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Section A – Keynote Speakers

Industry 4.0

Prof. Lalith Gamage

Vice Chancellor & CEO of SLIIT

Managing Director & CEO of SLIIT Academy

Chairman of ICTA

Prof. Lalith Gamage is the Vice Chancellor & CEO of SLIIT and Managing Director & CEO of SLIIT Academy.

Professor Gamage is an Electronic and Telecommunication Engineering graduate from the University of Moratuwa and holds a PhD from the University of British Columbia, Canada. His research areas include Computer Vision, Artificial Intelligence, Robotics and Evolutionary Computing. He has published numerous research papers and has won the prestigious Japanese Space Agency research award.

He is also an adjunct professor at university of British Columbia, Canada and Curtin university, Australia where he supervises several PhD projects.

Professor Lalith Gamage played a prominent role in establishing Sri Lanka Institute of Information Technology (SLIIT) in 1999. In the year 2000 he won The Outstanding Young Person of the year (TOYP) award for Academic Leadership.

Apart from his academic contribution he has also served the IT industry and the Government of Sri Lanka in many capacities. These include the Chairman of Lanka Software Foundation (LSF), Chairman of Arthur C. Clarke Institute for Modern Technologies (ACCIMT), Chairman of the ICT Cluster and the Executive Director of Trade Information Network of Sri Lanka Export Development Board. Prof. Gamage also took the lead in establishing Sri Lanka's first technology incubator, Conceptnursery which has produced a large number of successful technology companies.

Currently he is serving as the Chairman of Information and Communication Technology Agency of Sri Lanka (ICTA) and is also the Chairman of the Technical Committee for the Sri Lanka Unique Digital Identity project.

Prof. Gamage is an Advisory Board Member of Sri Lanka Association of Software and Service Companies (SLASSCOM) and is the Founding President of Sri Lanka Association of Non-State Higher Education Institutes (SLANSHEI).

Data: The New Form of Wealth

Haritha Thilakarathne

Haritha Thilakarathne is a Microsoft Most Valuable Professional (MVP) in Artificial Intelligence. He is well experienced in Machine Learning, Deep Learning, Azure AI stack and developing intelligent applications.

He commenced his professional career as an Intern at Microsoft and was employed by TechOne Global as a data science and analytics engineer. Currently he serves for various startups and enterprises as an independent consultant in AI.

Haritha completed his BSc in ICT with a first-class honors from Rajarata University, Sri Lanka. Currently he is working as a research scholar at La Trobe University, Australia while reading for his PhD on Deep Learning with the collaboration of Australian Institute of Sport.

One step at a time

Ishara Wickramasinghe

Ishara Wickramasinghe is the founder and CEO of Creative Tribe, which deliver bespoke software primarily for clients in New Zealand and Australia. He graduated with a BSc in Computer Science and Software Engineering from the University of Bedfordshire, in 2016 as the Best Performing Student.

Soon after the graduation he received a job offer from Invenco Group Ltd, which is the world's leading outdoor payment terminal manufacturer headquartered in Auckland, New Zealand and joined as a Frontend/UI/UX Developer. Later he was promoted as the UX Architect at Invenco Group Ltd, New Zealand

Ishara has been a freelance branding consultant, designer and a developer since a very young age. He has consulted various companies including Pringles, Emirates Airline and Formula 1.While he was reading for his Bachelors he worked fulltime as a software engineer.

Moderator

Suwan Fernando

Senior News Presenter – Sun FM & GOLD FM. He also serve as a Senior Officer – Implementation at Deutsche Bank. Suwan studied at SLIIT Academy and graduated with a BSc in Information Technology form Sri Lanka Institute of Information Technology

Section B – Proceedings

A Computational Model using Artificial Neural Networking for Predicting Astigmatism following Corneal Surgery

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***Abstract*- Keratoconus is an eye condition where the cornea thins and starts to bulge. Corneal cross linking is the only available accepted treatment to prevent or decrease the progression of Keratoconus. Although this treatment is considered a successful intervention, numerically it has a 7.6% failure rate and 2.9% complication rate according to the post-operative statistics. Corneal stability and the astigmatism after the corneal crosslinking can only be measured using pre-operative and post-operative patients' records. When counselling and selecting patients for this procedure corneal surgeons lack a definitive prognosticating aid to discuss with the patients. The aim of the research is to develop an artificial neural network model to predict the post-operative astigmatism for the patients undergoing corneal cross-linking surgery. The researchers were able to discover a higher success rate of best corrected vision in patients of the age group 18 to 20. Male patients had a 66% success rate compared to the female patients. A correlation between postoperative keratometry and the age for the predicted astigmatism was also found.**

***.Keywords*- Neural Networks, Keratoconus, Corneal Ectasia**

I. INTRODUCTION

According to [1], corneal cross-linking is one of the most attained treatment for progressive corneal ectasia. Further, [1] states this treatment can stabilize the progression of corneal ectasia while delaying the requirement of corneal surgeries. Although this treatment named as a successful treatment for corneal ectasia [2] mentioned there is a 7.6% of failure rate and 2.9% of complication

rate with the patient post-operative results. Further [2] mentioned the reasons for the failure and complication rates as interaction of factors mechanisms behind the treatment. Further [3] evidenced

current studies of corneal collagen cross-linking is insufficient/ to determine the postoperative results.

Number of researches [7][8][2][9][10] studies categorized the factors which affect to the corneal cross-linking treatment into four aspects as follows.

1. Refractive Variables [7] [8]
2. Bio-mechanical Variables [2]
3. Surgical Variables [7][8]
4. Temporal Time Duration Variables [9][10]

[4] has discussed on the modern technical solutions to which use to diagnose on clinical decisions. In the discussion [4] states that machine learning is the optimum solution for clinical diagnoses which disrupted by higher input of factors and their correlations. Further [4] mentioned the main barrier of technological diagnosis is overloaded information which affect to the final clinical diagnosis.

A. *Artificial Neural Networking (ANN)*

Artificial Neural Networks are mathematical processes stimulated in certain aspects of bio-logical neurons through the acquired knowledge of learning process and stored data which called synaptic Weight [5]. [5] evidenced ANN (Artificial Neural Networks) are the optimum mathematical algorithm which inspired in certain aspects of biological neurons. Further [6] mentioned ANN has been widely using for medical applications in last two decades due to its learning and predicting relationship ability. Further [6] proved corneal surgery predictions didn't follow any linear behavior and ANN is the optimum non-linear analyzing tool which obtain best results. According [6] the error which occurred in ANN application was 0.98D and further he mentioned ANN method is more reliable since it provided the lowest error rate.

[6] mentioned the multi-layer perception (MLP) is the most widely used ANN in many studies and situation analysis. Further he mentioned MLP has several non-linear elements which arranged in layers. The first and last layers called as input and output layers and rest layers named as hidden layers.

The closest application build using ANN for the keratoconus-based prediction is [6]. According to the ANN

model they have designed [6], the prediction of post-operative astigmatism is 0.93 diopter of error for the INTACTS surgery. Further they have approached the problem with 288 keratoconus patients' eyes preoperative factors feed to the ANN using multilayer perceptron, implemented in MATLAB. One of the limitations the author of the proposed research see is, they have only considered surgical and refractive variables in their model with different corneal surgery than the surgery the proposed research authors are going to address. They haven considered the biomechanical aspect of the cornea into the model.

When finding preoperative and post-operative variables for the input of the neural networking model

The past research papers conducted can be categorized into following sections

Epithelium-on vs Epithelium-off surgeries factors. [10]

Factors affecting to the cross-linking surgeries.[11] Further Statistical models also being developed. [12] .The issue with the [10][11][12] is that they address the factors in the statistical method which address the problem in a linear behavior.[6] suggest that the usage of ANN in Corneal surgery can be used to solve the non-linearity of the problem.

The biomechanical aspect of corneal cross linking is vital when determining the success rate of the corneal cross-linking surgery.[2] proposed an algorithm to predict the corneal stiffening effects' have not predicted the CXl efficacy in human patients but used data in porcine, murine, and lapine corneas. apart from [2] model designed a biomechanical corneal model using surgical factors.[2] also stated the demarcation line after CXL which a biomechanical perspective of the cornea is. they also support the idea of to date, the effectiveness of treatment could be monitored only indirectly by postoperative follow-up corneal topographies or using corneal confocal microscopy.by conducting the proposed research using ANN the researchers can open new possibilities using ANN rather than traditional follow-up corneal topographies after the surgery.

B. *Possible Solution and Limitations according to the past Researches*

According to [6] ANN provides a predictive model for surgeons, when the classical data is insufficient on the patients who have progressive keratoconus. Further he suggests a user-friendly prediction module using ANN to predict aid ophthalmologists ok K1 and astigmatism for KC corneas. Surgical variables (Incision and depth) and ring characteristics should input to find out the optimum position which give the highest level of vision. However, this research bounds to a limited number of considered variables where there are more reasons which improve the KC but not considered to this module. [6] ends up with an opportunity to develop a new module by considering more factors which affect the K1. Further [1] proved that ANN is adequate technique to predict pre- and post-operative keratoconus levels. However, [12] implement a mathematical model using multiple regression model to astigmatism prediction. In that, he mentioned number of incisions and incision length is the surgical factor which effect for the astigmatism level after the required surgeries. But still he proved that age and gender also have a strong affective power over the astigmatism level. Further he explained the implemented mathematical model cannot predict the astigmatism as the result can be change due to the age and gender.

C. *Limitations*

5. Bio mechanical factors can be changed according to the region or the country. But for this research, researcher select the sample as only three hospitals which located in Sri Lanka.
6. Since this research only focus on one specific treatment, the subjected treatment can be outdated due to the technical development.
7. This module limits to one specific eye disease. Since this is only based on the past records of patients`, actual result can be different.

There exist researches [3],[4][5][6],[7] which shows several factors affects the astigmatism of keratoconus and their conclusion was to test the dataset with the more geographical data since the problem behavior nonlinear. The artificial neural networking models are the novel idea given by the past researchers [1] [2] shows promising results in corneal surgeries .The identified research gap is there is no neural network model designed to predict the astigmatism in the corneal cross linking surgery before doing the surgery. This will make the researcher move towards developing the neural network that can connect the doctor and patients using the past data and the machine learning algorithms to predict the outcome of the surgery

II. METHODOLOGY

According to the literature researcher identified four main factors which have higher effect for the pre and post operational astigmatism level.

The researchers collected the dataset from national eye hospital cornea clinic from 01.01.2017 to 31.12.2019 31.12.2019 period, among the target population of Keratoconus patients. By nature, this study can be grouped as quantitative as more quantitative data and areas to be focus on. Hence the required data is collected through the past records of patient diagnosis reports. Sample for this study is the patients who

visits below three hospitals for cross linking. during 01.01.2017 to 31.12.2019 period, among the target population of Keratoconus patients.

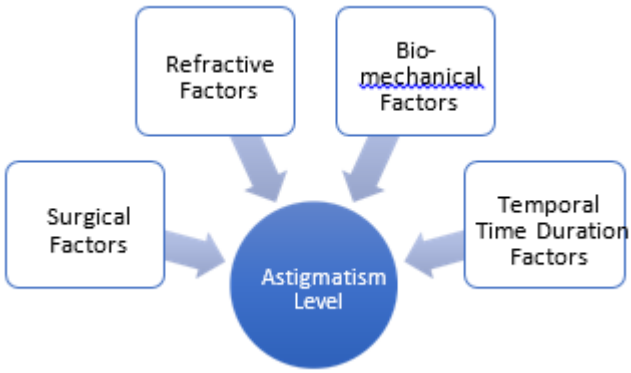

Figure 1

A. *Refractive Factors*

Variables collected by refractive eye examination related to keratoconus will be collected before and after conducting cross linking surgeries by examining the past literature related to factors affecting astigmatism will be considered when choosing variables to make the input layer of the neural networking model.

Following variables has been used from the corneal clinic dataset.

- Age.
- Sex.
- Eye.
- Keratometry Values (K1, K2).
- flat keratometry-K1
- steep keratometry k2
- Cylinder.
- Best corrected vision acuity.
- Pachymetry values-Related to the corneal thickness
- Spherical Equivalent.

B. *Bio-mechanical Factors*

The biomechanical factors from the past literature will be collected. Factors related to corneal cross-linking surgeries and the treatment protocol needed to be collected. But during the outbreak of covid019 in sri lanka the researchers was not able to collect bio mechanical factors of the cornea.

C. *Surgical Factors*

Data set recorded during the cross-linking procedure needed to be be recorded by the research team. Because of the covid-19 outbreak the access to the surgical and biomechanical Factors could not be obtained because of the quarantine restrictions. The researcher had to use the initial dataset given by the cornea clinic of the eye hospital to conduct the research in the limited amount of time and limited amount of data quantity.

D. *Regression Analysis with the Deep Neural Networks*

The objective of the research is to predict the astigmatism value follows the surgery. Which maps inputs variables into output variables to determine a Based on the previous researches, it is suitable to use multivariable regression models to develop the deep neural network model.

E. *Implementation stages in the Neural Network Design (Knowledge discovery process).*

The supervised learning approach is used in the proposed research. The neural network which is implemented in the research uses a learning a function that maps an input to an output based on example input-output pairs. It infers a function from labeled training data consisting of a set of training examples.

The research is step by step divided in to the seven steps as mentioned in the below figure, in each step the raw data set obtained from the cornea clinic will be analyzed by the researcher to extract the meaningful contents to develop the model. Under the preparation stage the data set can be transformed into one of the following data categories.

- Categorical Data
- Nominal Data

The processing steps of above two categories is discuss under the analysis of the neural network implementation. Creation of the neural network model is the next step that research follows.in this section the researcher maps inputs layers and hidden layers along with the output layer to create the unknown relationship between the dataset. After learning throw the iterations and the learning rates to map the objective in the research. Once the layers neurons and the learning rate is identified the research can compile and fit the dataset with the testing datasets. Once the training has been done the research. The researcher can use evaluation approach to evaluate the model to investigate the anomalies. The evaluation techniques used in the research is as of follows.

- Predicted astigmatism values against real values(scatterplots).
- Confusion matrix for false and true positive predictions

F. *Development of artificial Neural network*

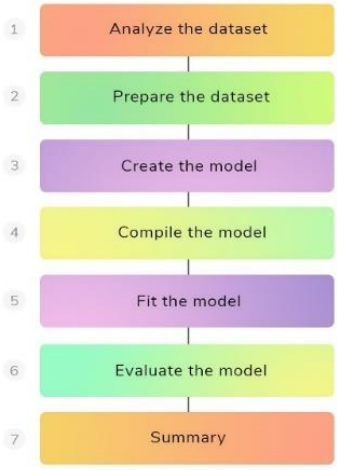

Figure 2

The cases indicated by the cornea consultant of the national eye hospitals which has keratoconus with cornea cross linking is approximately 500 cases. According to the morgens table of sample size estimation there needs to be at least 300 cases to conduct a proper Artificial neural network model design. The dataset contained several issues that needs to be address before feeds into the neural network model.

1) Missing values

- Table is not normalized
- Categorical data cannot be applied to some neural network models
- Patients id and the name which can be sensitive to the patients

The preprocessing stage in the knowledge discovery process can address the mentioned issues.

2) Pre-processing

The initial step when developing the artificial neural network is to pre-process the data that will be feed to the neural network. pre-processing step involve handling missing dataset, check for categorical values and mainly the researcher must split the data set into testing data set and training data set. The final stage of the data pre-processing is Feature Scaling. For the data pre-processing stages python panda's library is recommended based on the features and statistical capability to handle missing values. Principal component analysis should be conducted to find the correlation between the features of the dataset.

3) Dealing with the Missing values.

Problem with the missing data is that it reduces the statistical power of a study Most statistical procedures automatically eliminate cases with missing data. This means that in the end, you may not have enough data to perform the analysis

The researcher observed following types of missing data in the raw dataset.

- Accidentally skip

Where Several items of the data cell are missing. The researchers used to assign missing values with mean values where the values cannot be obtained by revisiting or calculating. Following equation is used when missing values can be replaced with the calculated value.

$$\text{Spherical Equivalent}=\frac{\boldsymbol{Cylinder}}{\mathbf{2}}+\boldsymbol{Spher}$$

4) Data Transformation.

The purpose of the data transformation stage is converting the data rows or column from one format into a desired format. The main reason for the data transformation is because of the existing format the data cannot be feed into the input layers of the neural networking model.the main example for the data transformation that the researcher as to do was that best

Distance Visual Acuity Conversion Chart

UK	Decimal	5m	US
6/3	2.0	5/3	20/10
6/4	1.5		20/13
6/5	1.2		20/17
6/6	1.0	5/5	20/20
6/9	0.7	5/7.5	20/30
6/12	0.5	5/10	20/40
6/18	0.3	5/15	20/60
6/24	0.25	5/20	20/80
6/36	0.2	5/30	20/120
6/60	0.1	5/50	20/200

Figure 3

corrected vision acuity was in the fraction format. The fraction format cannot be feed into the deep learning network. The chart that was used to record the best corrected visual acuity was in meter scale.by referring to the notation charts described by UK

Civil Aviation Authority, Medical Department the researcher had to convert them into the decimal format indicated by figure 3.

5) Creating the Neural Network model

After the pre-process stage the researcher need to specify number of hidden layers and neurons in each layers and transfer function of each layers along with training function and the weight learning functions. After obtaining the data set and feature extraction only the researcher can indicate the exact configuration of the neural network. Following attributes were taken into consideration when developing the neural network.

- Input Layers
- Optimizer
- Batch Size
- How many Hidden Layers
- Activation Function to be used
- No of Epochs
- Early Stopping Monitors (Callbacks)
- Accuracy Metrix
- Fully Connected Neurons (Dense)

6) Hidden Layers Calculation

The initial accuracy was very low due to the parameters set in the neural network model.the researchers used trial and error technique to set the parameters to get a accuracy of 60% with the following settings.

- Nh = Ns/(α∗ (Ni + No))
- Ni = number of input neurons.
- No = number of output neurons.
- Ns = number of samples in training data set.
- α = an arbitrary scaling factor usually 2-10
- Activation Function used
- Relu
- Tanh
- Radial basis function
- Early Stopping Monitors (Callbacks)

III. Results and Discussion

The researchers were able to discover a higher success rate of best corrected vision in patients of the age group 18 to 20. Male patients had a 66% success rate compared to the female patients as indicated by Figure 4.A correlation between postoperative keratometry and the age for the predicted astigmatism was also found

Figure 4

	eye	bcva	k1	k2	se	cylinder	pachymetry
eye	1						
bcva	0.146853	1					
k1	0.270821	0.002892	1				
k2	0.079063	-0.13231	-0.43815	1			
se	-0.08608	-0.38226	-0.02376	0.513699	1		
cylinder	-0.20569	-0.33603	-0.54748	0.64585	0.850331	1	
pachymetry	0.035281	0.318673	0.334681	0.003066	-0.34636	-0.47621	1

Figure 5 Pre-Operative

	eye	bcva	k1	k2	se	cylinder	pachymetry
eye	1						
bcva	-0.376996588	1					
k1	0.364957322	0.101257	1				
k2	0.006324697	0.065335	-0.16473	1			
se	-0.024025267	-0.15986	-0.17358	-0.14831	1		
cylinder	-0.210589968	0.000892	0.213597	-0.27107	-0.18919	1	
pachymetry	-0.053303543	-0.06934	-0.15061	0.089352	0.292877	0.170832	1

Figure 6 Post-Operative

The researchers were able to apply the neural network with the correlation of the age and the person. The initial neural network developed contained an accuracy less than 50%. The neural network was then fine-tuned using the radial basis activation function the accuracy was improved

Without transformation and without Calculated parameters

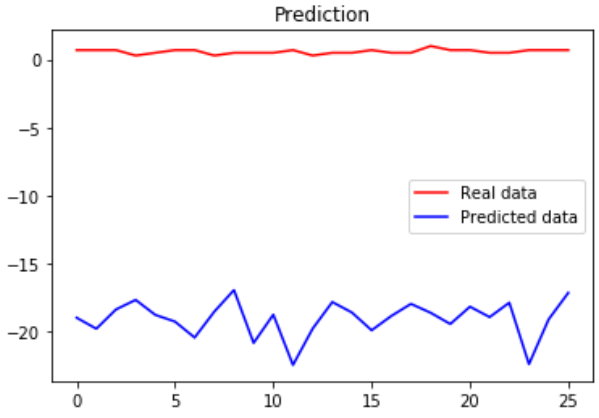

Figure 7

With transformed without calculated parameters and with calculated parameters

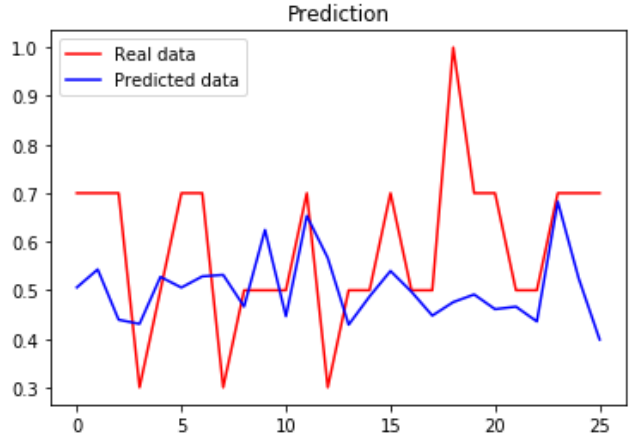

Figure 8

Model with radial basis activation

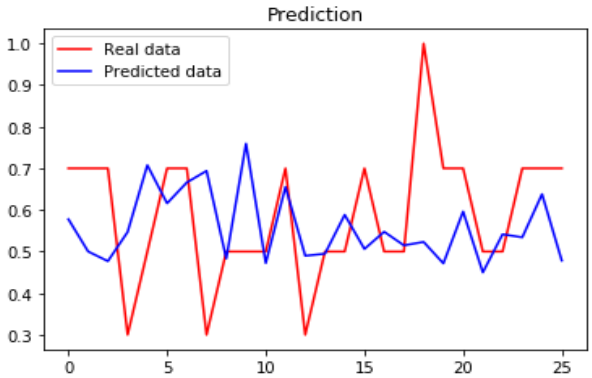

Figure 9

IV. Conclusion and Future Work

The preliminary data visualization techniques and statistics showed that results of Cornea Cross linking can be predicted by a computational model using artificial neural networking. Radial basis function activator improves an emerging accuracy. Larger dataset is needed to improve the accuracy. With a dataset of larger patient base and with the parameters of Surgical and bio mechanical factors the neural network can be further improved for future work.

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Plantina: The Plant Suggestion System According to Soil Type Based on Internet of Things (IOT)

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***Abstract* - The soil is the life of plants and a major element needed for farming and gardening. Most of the farmers and gardeners are facing frequent problems such as failed to find the reasons for not having good growing health, failure to identify plant types, and unable to determine the best soil type for different plants. The main aim of this project is to develop an Internet of Things (IoT) based application that is capable of suggesting crops and plants according to the soil type. The objectives of this research are to identify and evaluate existing soil type detector systems and sensors, design a sensor network to detect the moisture level and pH level, develop soil type detecting sensor, develop a mobile application using Android to get crop and plant suggestions, and to evaluate the performance of the new IoT based plant and crop suggestion system. The classification of the soil parameters of the soil model in the Plantina mobile application was done by the Gradient boosting classifier which was based on machine learning techniques. Training and testing accuracy of the soil model was 98% and 88.88% respectively. Furthermore, plant lovers can get knowledge about the most suitable soil types for the plants by selecting a leaf image of the plant from the mobile gallery. CNN (Convolutional Neutral Network) was used to train this model. The training and testing accuracy of this plant model was 98.74% and 89.2% respectively. Additionally, farmers can receive new news alerts regarding plant diseases, new trends and new inventions through this Plantina mobile application. Since this a complete system with a mobile application and an IoT sensor that is relevant to agriculture, farmers have the complete facility for real-time soil monitoring and plant leaf recognition.**

***Keywords* – CNN, Machine Learning, Mobile Application, IoT, Gradient Boost**

I. INTRODUCTION

Agricultural development is one of the most important approaches for ending hunger and poverty, increasing mutual prosperity, and feeding an estimated 9.7 billion people by 2050. Agricultural growth is two to four times more successful in increasing incomes among the lowest income compared to other industries. Analyzes conducted in 2016 showed that 65% of poor working adults make a living from agriculture [1]. Agriculture has been a part of human culture since ancient times. The economy of a given region relied indirectly on agriculture, which was a major driving force behind the industrial revolution [2]. Scientific and technical developments have led to the increased yield in the agriculture sector.

There is a strong need to provide farmers with real-time details such as temperature, humidity, carbon dioxide (CO2), soil moisture, and soil potential of Hydrogen (pH) which may be identified as the essential conditions need for optimal plant growth. These are important information that could decide the cycle of plant life that affects crop growth and farm productions. Effective use of these parameters increases plant production and reduces crop losses [3]. Soil parameters are currently evaluated using satellites and non-invasive techniques that are sophisticated and produce accurate real-time data. Agricultural areas are now bound up with these new age technologies. Agriculture facilities have discovered new data monitoring methods and programs to help farmers produce more production. Incorporating different sensors that are reliable and can produce hard data in real-time [2] and multisensory mobile phones with Internet connectivity which helped to reduce the barriers for associating mobile computing [4] will facilitate further evaluation. The application of electronic monitoring systems is one of the technologies needed for the analysis of essential conditions for optimal plant growth. In the present context, real-time monitoring systems have the benefit of being fast and time-saving. Besides, making it user-friendly enables the farmer to act quickly and take precautions.

Surveillance of soil moisture in different areas of a farm may help regulate irrigation overall. Different crops need various irrigation strategies, and a farmer can increase productivity by maintaining optimum soil moisture for a particular crop using real-time soil moisture data [5]. Soil moisture is one of the most important parameters influencing crop yields [6]. It plays a key role in the efficient photosynthesis, respiration, transpiration, and transport of minerals and other nutrients through the plant. Proper irrigation strategies are very essential for plant growth. Soil water dissolves the salts and constitutes the soil solution, which is crucial as a source for nutrient supply to growing plants [2]. Soil

temperature on its own is another important factor to determine crop growth. The temperature affects the rate of photosynthesis, respiration, and other processes related to plant metabolism.

Since this research was conducted in Sri Lanka, the main focus of this study was given to the Sri Lankan soil types. Reddish-brown earth, Noncalcic brown soils, Reddish-brown lateritic soils, Red yellow podzolic soils, Red-yellow latosols, Immature brown loams, Rendzina soils, Grumusols, Solodized solonetz, Low-humic gley soils, Meadow podzolic soils, Bog and half-bog soils, Alluvial soils and Regosols can be identified as the most common soil types in Sri Lanka. The pH levels were typically varied between 6 and 7 in reddish-brown earth with a generalized preference to rise with deeper. In regions with increased rainfall, the surface pH appears to be significantly smaller but rarely drops under 5.5. To a degree, the reddish-brown earth are Ceylon's most significant soils. They inhabit by far the majority of the dry lowland region in the northern, northern-central, eastern, and southern provinces. Yearly average temperatures range between 79 and 82 ° F. In Ceylon, the noncalcic brown soils are one of the least significant categories. They exist predominantly in the 'Batticaloa and its neighboring districts and are located distributed in the region of the reddish-brown earth, particularly in the transition regions to the lowland wet zone [7]. The reddish-brown lateritic soils have pH values Typically around 5.5 and 6 with the surface horizon values moderately greater. The pH does not seem to raise in the depth horizons. The reddish-brown lateritic soils are the prevalent soils of most of the districts of Kandy and Kegalle. Red-yellow podzolic soils are the prevalent soils of Ceylon's wet zone and even of the intermediate zones at altitudes greater than 2,000 ft. including the Badulla-Bandarawela Half-Dry Enclave. The pH levels in these soils are usually less than 6 and sometimes less than 5.5, with no likelihood to escalate with depth. Red latosols and yellow latosols are found in the near connection among Mannar and Puttalam in the western parts of the north-central province [8]. Calcic subgroup soils are more concentrated with pH values around 7 and 8 and often with secondary lime. The wet zone of immature brown loams can be seen in the districts of Kandy and Kegalle, where they exist in near connection with the reddish-brown laterite soils. Rendzina soils are minimal and only certain such soils have been found in the districts of Matale and Polonnaruwa. Grumusols are ideally represented to a small scale near Tunnukkai (districts of Jaffna and Mannar), and a lesser degree near Kottukachiya (district of Puttalam). Infrequently they can exist all over the dry zone. Solodized solonetz exists in all dry zone provinces throughout the seacoast and can thus occupy a large scale. The low-humic gley soils are generally located in the lower topographical areas in the Ceylon lowlands. They can exist in the uplands, particularly in the plateau regions, but are not prevalent in hilly terrains or in mountain relief areas [7].

The main aim of this project is to develop an Internet of Things (IoT) based application that is capable of suggesting crops and plants according to the soil type. The objectives of this research are to identify and evaluate existing soil type detector systems and sensors, design a sensor network to detect the moisture level and pH level, develop soil type detecting sensor, develop a mobile application using Android to get crop and plant suggestions, and to evaluate the performance of the new IoT based plant and crop suggestion system.

II. Literature Review

A. *Section 01: The Internet of Things (IoT)*

The Internet of Things was innovated by Ashton (1999). The IoT describes the connectivity of devices, sensors, and the Internet anytime and anywhere. The Internet of Things (IoT) is becoming a fact, because everyday physical entities are calibrated with sensors and actuators, uniquely addressable and interconnected, enabling communication with them via the internet [4]. Na et al. (2017) stated that developing an IoT-based infrastructure that promotes precision agriculture is one of those applications that has gained considerable attention. A farmer must optimize the yield per acre, limit spoilage from insufficient or overuse of fertilizers, reduce the likelihood of crop failure, and decrease operating costs to be effective. Our study has recently analyzed IoT application in agriculture and agriculture to address current issues such as unnecessary human interactions leading to higher labor costs, unnecessary water consumption and future water-saving measures, higher energy consumption, future energy-saving measures, and crop-monitoring difficulties [9].

B. *Section 02: Sensors*

Sensor technology is one of the emerging fields of physics, electronics and biotechnology and has made the best of the advances in the individual technologies of microelectronics, optical and computer sciences. Sensors have recently been considered a highly promising area of scientific study. In agriculture sector, the IoT combines with sensors to predict the real-time data accurately [10]. Electromagnetic, optical, mechanical, electrochemical, airflow and acoustic are the sensor types that used in the agricultural field to detect the soil characteristics. Most of the sensor used in agriculture sector provide services such as Irrigation, Pesticides, Fungicides, Herbicides, Fertilization, Soil Preparation, Yield Condition and Yield Storage [11]. Biswal et al. (2015) were built a smart

houseplant watering and monitoring system named as Greeves. The sensor of the Greeves application was capable to monitor the changing weather and soil moisture condition. Once the data were analyzed by the sensor it connected to the Android phone. The system was designed using .Net application and can be run on Microsoft windows computers. Pre-set sprinklers, control water system according to collected data and update the user with alert are the major parts of this system.

C. *Section 03: Image Processing*

Mouine et al. (2013) were invented an Android application for leaf-based plant identification. This system stores images of leaves. Then it provides the user to select characteristics of a leaf and analyzed the details according to selection. Pl@ntNet was founded by Goëau et al. (2013). It is explained that this system was designed for image sharing and retrieval applications for the identification of plants, available on iPhone and iPad devices. This application can work with several parts of a plant such as flowers, leaves, fruits, and bark. Kapoor (2016) was implemented a smart agriculture system using IoT and image processing techniques. The real-time AR program was introduced utilizing the OpenCV library, the ARToolKitPlus, and the VRToolKit on a smartphone. Face identification and recognition approaches on mobile platforms have become progressively popular in the literature as many of them include the OpenCV library. Although the efficient acceleration of some image processing algorithms demonstrating a high degree of parallelism, using the OpenGL ES 2.0 and OpenCL frameworks, the evolving frameworks need more speed-ups [12].

D. *Section 04: Machine Learning*

Chen (2017) was introduced a mobile application in agriculture for the image to object count estimation which is named “Estimage”. This system was estimated crops on a bush and a tree from an image using an Android mobile application with the help of a cloud-based machine learning technique. Crane-Droesch (2018) was discussed machine learning methods for crop yield prediction and climate change impact assessment in agriculture. The author of this article described a method to approach the yield modeling that uses a semi-parametric variant of a deep neural network, which can simultaneously account for complex nonlinear relationships in high-dimensional datasets and also known parametric structure and unobserved cross-sectional heterogeneity. Liakos et al. (2017) were implemented as a system for production in agriculture. Crop management, including applications in yield prediction, disease detection, weed detection crop quality, and species recognition, livestock management, including applications on animal welfare and livestock production, water management, and soil management were the fields that focus on this production system. The researchers from Columbia University, the University of Maryland and the Smithsonian Institution have developed a mobile application that is capable of identifying tree species from a photograph of leaves. This application was implemented using face recognition techniques. Ashley et al. (2014) were introduced a new iOS mobile application that is superior to the Leafsnap application. Ashley and his colleagues have identified an issue such as failing to deal with cluttered background and within-class variance. As a solution for that removing edge convolutional neural network was implemented in an application called “WhatPlant”. Deep learning was used as a major technology to implement this WhatPlant application. Eric Ralls was introduced a mobile application to recognize over 600,000 plants 250 million images were stored in their database. Machine learning and artificial intelligence are used to design this application. iOS version of the PlantSnap application has more features like auto-detect technology to say the best moment to take the photo to increase the quality of the photo [13]. Plant.id application was introduced as a web application. This application used cutting-edge methods of machine learning (AKA artificial intelligence) and train customized deep convolutional neural networks to predict the best results. According to Chlingaryan, Sukkarieh, and Whelan (2018), one of the key benefits of ML approaches is that they can solve massive nonlinear issues independently using information from multiple potentially interrelated origins. ML allows effective judgment-making and reasonable practice despite or with minimal human interference in real-world scenarios. ML offers a strong and versatile platform not just for data-driven decision-making but also for the integration of expertise into the framework.

Classification in machine learning is the problem of determining which among a collection of divisions (classes) a novel situation refers to. Binary classification issues suggested, by assessing a set of features, appointing an entity to one of two classes. Binary classifiers are excellent at distinguishing between classes but do not work as great when there are more classes associated. if there are greater than two separate labels in the groups, the issue is characterized as multiclass classification. In the typical multi-class classification situation, it is presumed that exactly one class label is allocated to each situation (i.e., this is a single-class classification as opposed to multi-label classification, allowing several class labels for each situation), and the class labels are unique (i.e., no class label association as opposed to hierarchical classification directed at

classification concerns where classes are grouped into hierarchical frameworks) [14]. Wang et al, (2017) were built binary classifiers focused on Naïve Bayes, Logistic Regression, and Support Vector Machines (SVM), and ultimately demonstrated that extreme risk incidents could be detected using a related strategy. It is concluded that Compositions of binary classifiers tend to be a viable approach for defining events by nature and severity. Automated recognition should allow the detection and timely resolving of safety issues. Multi-label classifiers may be needed for reports relating to more than one form of event.

E. *Section 05: Soils*

Moormann and Panabokke (1961) have done a study focused on a soil classification morphological framework in which the intrinsic morphological properties of the soil groups are defined and analyzed in the field, whereas their chemical and physicochemical characteristics are evaluated in the laboratory in Sri Lanka. They have studied 14 soil types including reddish-brown earth, Noncalcic brown soils, reddish-brown lateritic soils, Red yellow podzolic soils, Red-yellow latosols, Immature brown loams, Rendzina soils, Grumusols, Solodized solonetz, Low-Humic Gley soils, Meadow podzolic soils, Bog and half-bog soils, Alluvial soils and Regosols in Sri Lanka. But they have provided descriptions and analytical data such as temperatures and pH levels only for 10 soil types. They have included pH levels according to soil chemical analysis using a pH meter with a glass electrode with a soil suspension of 1:1 soil: water was used for different depths in the soil and they showed that pH level changes with depth of the soil. It is stated that the same soil type can be found in various areas of Sri Lanka with different pH and temperature levels.

III. METHODOLOGY

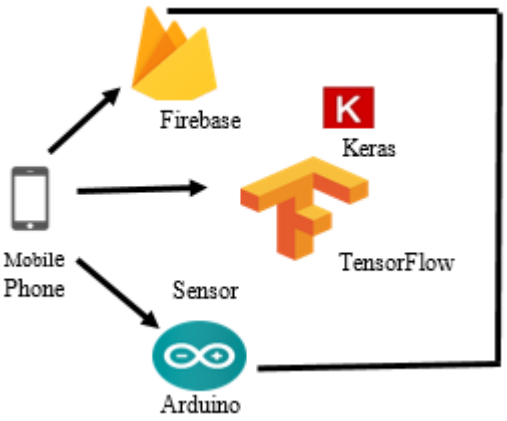
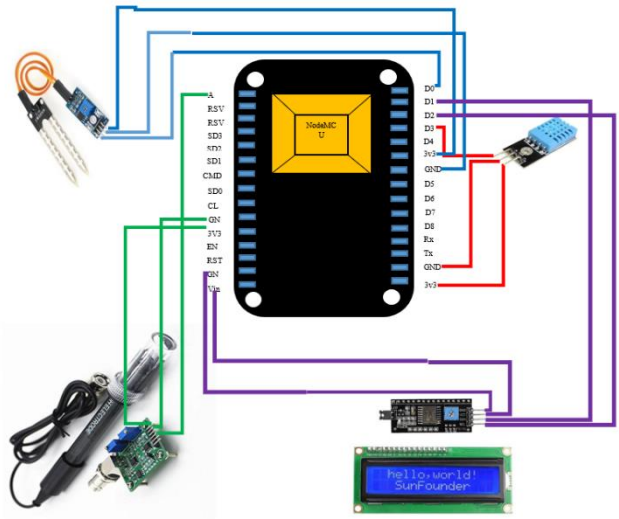


Figure 9:Architecture Diagram

that needed new technological implementations. Have found that industries such as Health, agriculture, transportation, and e-commerce sectors were urged new technological upgrades. Among those sectors, have recognized that the agriculture sector had very few new implementations that can provide knowledge to the farmers. Identified that most of the new technological agricultural implementations were very complex and not user-friendly to handle by the ordinary farmers. After thoroughly went through the sources, have found that more research is needed for soil type recognition, soil irrigation, and real-time monitoring of the soil. Ultimately, build a system to predict the best soil type based on the pH and temperature of the tested soil using a sensor and implemented a mobile application to select the image of the plant leaf from the gallery and identify the type of the plant or the crop with the help of ML technology to provide the most suitable soil types for the selected plant leaf from the database. Features such as prediction of the soil type based on pH and temperature of soil detected by a sensor, prediction of the plant related to tested soil type, prediction of the type of the soil relevant to the selected plant leaf via a mobile application and a news section relevant to agriculture which can add and view the news were determined as the overall features of this system. Figure 2 shows a full diagram of how each sensor is connected to the



NodeMCU module.

Figure 10:Sensor architecture

The plant model was implemented via Keras and TensorFlow by avoiding overfitting and underfitting and adding layers tried to get accurate predictions. Jupiter notebook which is an online tool was used to train both models. For the plant model, PIP is used to download libraries such as

TensorFlow, Keras, NumPy, and Matplotlb.Pyplot to build the models. For the training of the plant model, the batch size was ranged between 1-50 and

epochs ranged between 5-15. From the 10,000 plant leaf images, 80% were used as a training data set and 20% testing data set. CNN (Convolution Neural Network) was used as the classifier because it is one of the best methods to classify

	Classifier	Mean	Variance
0	Knn	0.993761	0.000016
1	Logistic Regeression	0.946881	0.000407
2	Naive Bayesian	0.484688	0.000006
3	Random Forest	0.999245	0.000002
4	Gradient Boost	0.999246	0.000009

Figure 11:Comparision of the Classifiers

different types of images. The plant leaf images were captured using a mobile phone, but the size and the capacity of the images were too high. Due to its larger size and high capacity, the code for the plant model could not run. Therefore, images were resized to [350x350].

5290 soil data were included in a CSV file to build the soil model. Included pH values ranged between 4-9 and temperature values ranged between 23°-36° for 4 soil types. During the training, multiclass classification methods were used. Figure 3 shows the comparison between Multiclass classifiers such as logistic regression (LR), random forest (RF), k-Nearest Neighbors (KNN), naive bayes (NB), and the gradient boosting (GB) which used to test best optimal accuracy for this soil model.

RF, KNN, showed a good training accuracy but GB showed the best accuracy during testing using test values. After the GB model was tuned, received the best learning rate as 01, best n_estimates as 20, best min_sample_splitt as 10, best max_ depth as 01, and best max_features as 01 after training the data set. Then performed training after tuning and the test accuracy was increased than previous test accuracy.

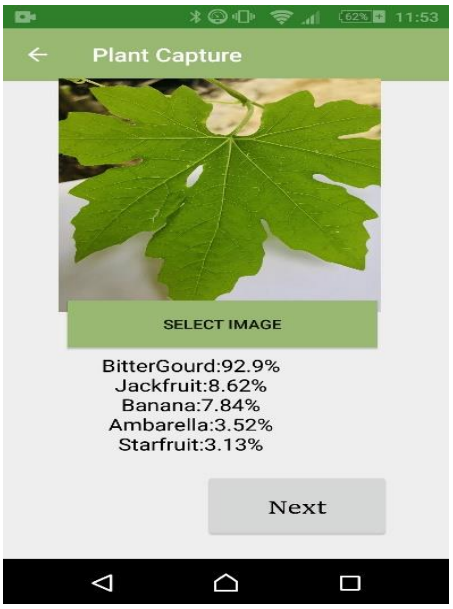
This “Plantina” mobile application is based on android. Android studio directly supports Java libraries other than the native code applications. With my experience based on android studio, it is the best IDE (Integrated Development Environment) for mobile applications. The functions of the sensors are based on the Arduino. All the written codes and calculations of pH and temperature were stored in the Arduino. All these codes and calculations are uploaded from Arduino to node MCU via a USB cable. So, the node MCU knows the correct pathway to operate the sensor functions according to written codes.

IV. Results and Discussion

Plantina: The plant suggestion system according to soil type based on the internet of things is developed. A sensor is developed to measure the temperature, pH, humidity, and moisture level of the soil. The main aim of this project is to develop an Internet of Things (IoT) based application that is capable of suggesting crops and plants according to the soil type.

A method to recognize a given plant leaf after selecting a picture and to predict the best soil types for the recognized plant through a mobile application was developed. To predict the selected plant leaf from the gallery of the mobile phone, a ML model was implemented. Five plant types were selected to build the model. 80% of 10,000 plant leaf images were used as the training data set and 20% were used as the testing data set. This plant model was implemented using Keras and TensorFlow. The batch size was ranged between 1-50 and epochs ranged between 5-15 to train the plant model. Figures 4 and 5 show the results of the bitter gourd plant identification and results of the reddish-brown earth soil identification. Figure 6 shows how the result of the trained plant model. The training accuracy of the plant model was received as 98.74%.

Figure 12: results of plant identification



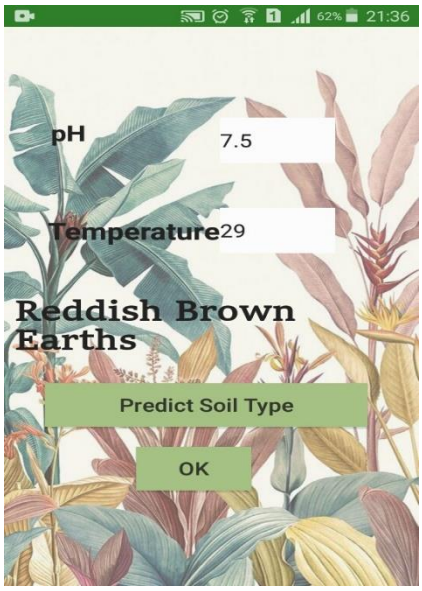


Figure 13: result of the soil identification

```
history = model.fit(X_train, y_train, batch_size=1, epochs=10)

Epoch 1/10
8000/8000 [==============================] - 2170s 271ms/step - loss: 1.1426 - accuracy: 0.5229
Epoch 2/10
8000/8000 [==============================] - 2210s 276ms/step - loss: 0.5439 - accuracy: 0.7989
Epoch 3/10
8000/8000 [==============================] - 2148s 268ms/step - loss: 0.2614 - accuracy: 0.9140
Epoch 4/10
8000/8000 [==============================] - 2214s 277ms/step - loss: 0.1523 - accuracy: 0.9542
Epoch 5/10
8000/8000 [==============================] - 2161s 270ms/step - loss: 0.0921 - accuracy: 0.9732
Epoch 6/10
8000/8000 [==============================] - 2175s 272ms/step - loss: 0.0843 - accuracy: 0.9797
Epoch 7/10
8000/8000 [==============================] - 2354s 294ms/step - loss: 0.0808 - accuracy: 0.9819
Epoch 8/10
8000/8000 [==============================] - 2291s 286ms/step - loss: 0.0797 - accuracy: 0.9869
Epoch 9/10
8000/8000 [==============================] - 2228s 278ms/step - loss: 0.0584 - accuracy: 0.9869
Epoch 10/10
8000/8000 [==============================] - 2232s 279ms/step - loss: 0.0710 - accuracy: 0.9874
```

Figure 6: Training accuracy of the plant model

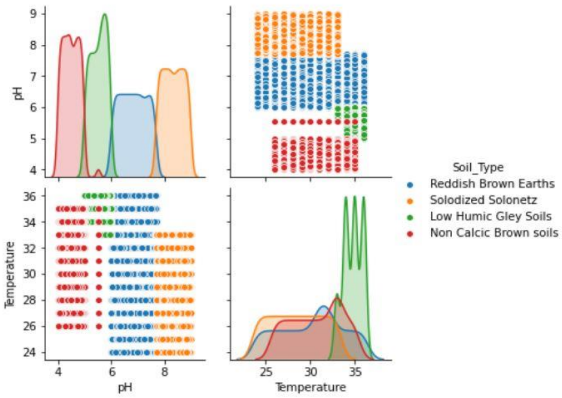
After training the model, figure 7 shows the comparison which was done between the actual digit and predicted digit to check whether both outputs were same between actual digit and predicted digit.

5290 soil data including pH values ranged between 4-9 and temperature values ranged between 23°-36° for 4 soil types were used to build the soil model. Distributions of the soil data were obtained to determine the spread of pH, temperature, and pH and temperature spread between soil types. The graphs showed a better distribution of soil parameters. Then evaluated the quantity of soil data for each soil type in the CSV file. The distribution of the pH and temperature values is shown in figure 8. The quantity was received as for RBE (48.2%), Solodized Solonetz (24.6%), Low Humic Glay Soils (20.8%), and Non-CalcicBrown (6.4%) in a pie chart (figure 9). Performed heat mapping to see the correlations of soil parameters that are shown in figure 10. The correlation between pH and temperature was -0.27. Then performed an accuracy test to determine the best classifier from multiclass classifications suitable for the test and train the soil model based on the above findings. KNN received accuracy as 0.993761, LR received as 0.946881, NB received as 0.484688, RF received as 0.999245 and GB received accuracy as 0.999246.

```
Actual digit is [0. 0. 0. 1. 0.], predicted 3
Actual digit is [0. 1. 0. 0. 0.], predicted 1
Actual digit is [0. 0. 0. 1. 0.], predicted 3
Actual digit is [0. 0. 0. 1. 0.], predicted 3
Actual digit is [1. 0. 0. 0. 0.], predicted 0
Actual digit is [0. 1. 0. 0. 0.], predicted 1
Actual digit is [0. 0. 0. 1. 0.], predicted 3
Actual digit is [0. 0. 0. 0. 1.], predicted 4
Actual digit is [0. 0. 1. 0. 0.], predicted 2
Actual digit is [0. 1. 0. 0. 0.], predicted 1
Actual digit is [0. 1. 0. 0. 0.], predicted 1
Actual digit is [1. 0. 0. 0. 0.], predicted 0
Actual digit is [0. 0. 0. 0. 1.], predicted 2
Actual digit is [1. 0. 0. 0. 0.], predicted 0
Actual digit is [0. 0. 1. 0. 0.], predicted 2
Actual digit is [1. 0. 0. 0. 0.], predicted 0
Actual digit is [0. 1. 0. 0. 0.], predicted 1
Actual digit is [0. 0. 0. 1. 0.], predicted 3
Actual digit is [1. 0. 0. 0. 0.], predicted 0
Actual digit is [0. 0. 0. 0. 1.], predicted 4
```

Figure 14: Prediction accuracy of the plant model

Figure 15:Soil distribution



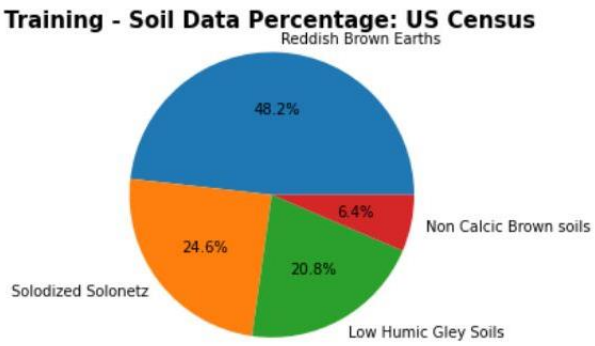


Figure 16:US Census

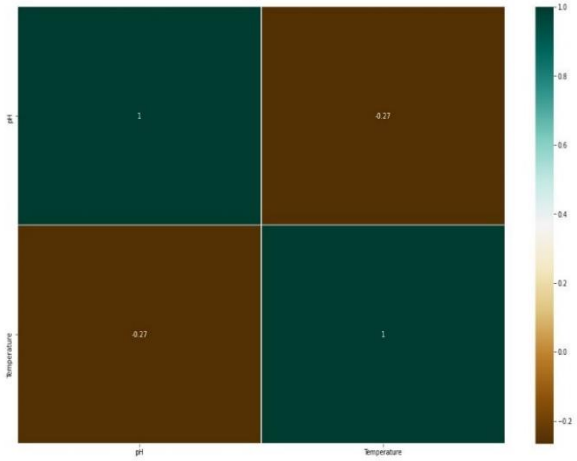


Figure 17:Heatmap

V. Conclusion and Future Work

Since ancient times, agriculture was employed by manual methods. Agricultural technological developments aid in improving the efficiency and quality of agricultural products, because output must be equivalent to supply and requirement. The "Plantina" mobile application which is a plant suggestion system according to soil type based on the internet of things, improves the efficiency and quality in agriculture. This mobile application along with the sensor is very comprehensive for farmers and gardeners. It is a fast, user-friendly system with an accurate portable sensor. This mobile application was designed to predict the soil type by receiving pH and temperature of the soil, give plant suggestions relevant to the determined soil, predict plant-based on the selected image of a plant leaf in the gallery through the mobile camera, and provide soil suggestions to determined plant. All the predictions were very accurate in both soil and plant models. The plant model received the test accuracy as 89.20% and the soil model received the test accuracy as 88.88%. Since there are very few researches based on soil type prediction based on soil pH and temperature, this mobile application will be very useful for the users.

In this research, the number of plan types and soil types was limited. Ambarella, banana, bitter gourd, jackfruit, and star fruit were the plants that the system can recognize. The most common four soil types in Sri Lanka were selected in this research. These selections will limit user requirements. If the user test dried soil, then the pH value will not be accurate. They need to add a small amount of water before they test the soil. Finally, the user needs to have a Wi-Fi facility to become a part of this application.

F. *Future Work*

In the future, the accuracy of the system can further increase if the number of soil types and plant types are increased. This mobile application also can be developed as an IOS-compatible application. This system can be developed to provide the success rate of plant growth in the ground soil. Along with that, if the suggested plants or crops are not available with the user or if the user does not want to grow the suggested plants in their soil, the user can enter the name of the plant that he wants to grow in that soil in the mobile application. Then the will provide how the plant will grow within this soil as a growth rate. This system can be developed to suggest the most commonly occurring areas of the soil that the user has already tested.

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Mobile Application for Police To Detect Traffic [Allegro]

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Abstract: **This paper provides a way to help traffic police in controlling traffic congestion. One of the major problems encountered in large cities is that of traffic congestion. Calming the traffic blockage in urban street arranges has been an urgent issue for both the exploration and viable activity. Because of quick urbanization, there is a quick reaction of clearing traffic blockage has become a difficult circumstance these days. Monitoring traffic systems utilized until now, are designed for the general public who suffer due to traffic congestion. They use these applications or systems to get to know the congested area and to use alternative routes. Advances to those mobile applications a real-time traffic detection system for traffic police who control and regular traffic conditions is what Allegro is basically for. A key component of the system is the camera with a sensor that gathers the traffic position and through image processing, the information is passed to a mobile application which will give feedback to traffic police. This paper elaborates on the procedure of how the system works.**

Keywords**: Allegro; background subtraction; Mobile application;**

I. INTRODUCTION

Unlike other countries, roads are the spine of the transport sector of our country. They are important in the movement of people and goods among the country and they integrate the country as well. A facility of smooth traffic movement is an asset to a country. But the capital city of Sri Lanka which is Colombo is facing a big problem with the traffic problem. Fast urbanization with populace development and vehicle extension over the previous decades resulted in a serious problem in clearing traffic blockage. For traffic control policies, it is extremely useful that a route guidance system can provide the shortest or an alternative path during an incident condition.

Usually, vehicles will be stuck especially at the traffic light junction, during a traffic jam on special events time, protests, public meetings, or any accidental incidents. This is because the road users are waiting for the traffic light to turn green or blinking as yellow. It can cause more congestion in the same path which has much traffic, these situations need traffic police to clear the traffic and divert the vehicles through the easiest paths [1]. Currently, traffic control and management are done by traffic police with or without the help of traffic lights. This system (Allegro) would help the traffic police to detect traffic conditions with the help of camera and video processing techniques.

The main research problem is helping traffic police with managing and controlling traffic conditions in peak traffic time by clearing traffic in another alternative way which is less congested. The main objective of this project is to develop a mobile application for traffic police to help them in supporting to detect of traffic congestion with the help of a camera which is fixed on the streets. Further user can view the current traffic condition in the particular area and can communicate the situation to the other traffic police who is in some other are which can be the alternative way to minimize the traffic in the first area.

II. RELATED WORK

One of the major problems encountered in large cities is that of traffic congestion. In ongoing decades in an urban area has quickly expanded alongside the development of financial action and populace anyway framework transportation has gradually extended because of constrained space accessible. Calming the traffic blockage in urban street arranges has been an urgent issue for both the exploration and viable activity. Because of quick urbanization, there is a quick reaction of clearing traffic blockage has become a difficult circumstance these days. Because of the fast urbanization with populace development and vehicle extension over the previous decades, powerful roadway system consisting of freeways, arterials, sub-arterials, branches, and nearby lanes, is normally evolved in an urban region to give the everyday travel administration.

Be that as it may, extreme clog much of the time occurs on turnpikes and certain arterials while different streets are delicately stacked, in light of the fact that no constant traffic message is guided for conceivable backup ways to go. Clearly, such an uneven conveyance of vehicle stream diminishes the system limit and activity productivity. For traffic control policies, it is extremely useful that a route guidance system can provide the shortest or an alternative path during an incident condition. Usually, vehicles will be stuck especially at the traffic light junction, during a traffic jam on special events time, protests, public meetings, or any accidental incidents. This is because the road users are waiting for the traffic light to turn green or blinking as yellow. It can cause more congestion in the same path which has much traffic, these situations need traffic police to clear the traffic and divert the vehicles through the easiest paths [1].

Figure 18: Traffic Flow

The author states that the ITMS (Intelligence Traffic monitoring system) uses a smart - box to trace and manage traffic by receiving data from satellite/ telecom towers through the help of a Number plate aided with a GPS tracker. Traffic density, theft detection can be controlled by ITMS easily because the E-number plate has more details and it can be traceable. In emergency situations, ITMS can play a great role in intimating the gravity of the situation to the nearest police station/ hospital. Through this system, if someone crosses the road rules and police could not find him by chasing him, an automatic fine would be imposed on him. For emergency vehicles such as ambulances, VIP vehicles, etc. this system helps by showing alternative paths to drivers. The journal of this system can be updated with a vehicle Driver assistance tool in the future to the smart traffic management system. [2]

In the journal An Intelligent Transportation System (ITS) based marking the alternative path to go direction framework for traffic redirection procedures assists with guaranteeing similarity among subsystems and sharing of information between suitable institutions. The ITS based marking route direction system is additionally explicitly tended to: ongoing traffic information is gathered, absorbed, and circulated in an incorporated way, occurrences just as alternative routes are detected and assessed by embedded algorithms, and route guiding controlling messages are given by emergency management techniques. Further in the future, the system can be implemented how the system could be utilized in an emergency incident or a disaster as the author stated. [1]

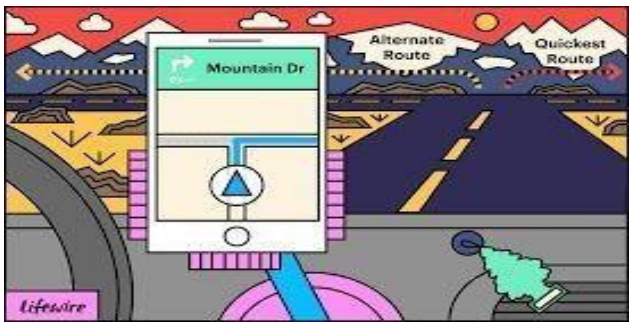

Figure 2: Route Direction (ITS)

The report presents how three sensors (EIS- RTMS) radar, (SmarTek- SAS 1) a passive Acoustic and (Wavetronix- smart sensor) Digital radar detect the traffic accurately. The system is intended to append to different kinds of signposts along freeways and arterials, and bolster a traffic sensor to direct temporary traffic data collection. The results of this traffic detection system showed that the sensor accurately detected traffic in both heavy traffic levels and free flow. Even in High-occupancy Vehicle lanes, the results error was between 1.0% to 9.0% in both volume and speed detection. The author said the system provided a reasonable measure. [3]

As Jie Zhou states at night times, vehicle headlights and bad illumination can also cause many difficulties for the detection task and that is why a video-based traffic monitoring system is more suitable to detect moving vehicles. The video-based camera system is more powerful because the information content associated with image sequences allows precise vehicle tracking. The author said comparing with some previous works the algorithm they have used here has no modelling or criteria establishment issues and in the future, they will improve the algorithm to be more and more precise by applying more data such as colour into that algorithm and other classifiers. [4] Authors exhibit different methodologies made to improve the traffic system over the globe. The writer states especially one of the primary drivers of traffic blockage is enormous red-light delays, In response to the journal there are many existing types of research are about ITS (Intelligence traffic system) but Aside from looking over different research chips away at ITS, the journal proposes a model which follows a straightforward calculation dependent on the length of traffic on every path. The author hopes that they can improve the system by developing better algorithms in the future. [5]

Unlike other countries, roads are the spine of the transport sector of our country. They are important in the movement of people and goods among the country and they integrate the country as well. A facility of smooth traffic movement is an asset to a country. But the capital city of Sri Lanka which is Colombo is facing a big problem with the traffic problem. The city of Colombo attracts millions of floating population on a working day and with the addition to the resident population of the city. The total population of the city increases during the daytime due of the population arrives at the city for employment or to connect to commercial activities and or to attend educational institutions. Many roundabouts that have no traffic signals are famous places for traffic blocks because many motorists and pedestrians do not follow the prevalent rules. Pedestrians used to crossroads in irregular intervals using hand signals. This makes the roads get congested and a need for traffic police arises to clear the traffic jam and to divert the vehicles where there is less congestion. OIS (Optical Information System) for road traffic Observation and Management uses optical and informational enabling technologies for automatic traffic data generation with an image processing approach. Its main purpose is to detect traffic image sequences from roadside cameras. [6]

Figure 3: Traffic Image of Dense Road

To meet these requirements many image processing algorithms have been developed. Another technology is used based on the idea that moving vehicles transmit information about their position and velocity via mobile communication. (E.g. GSM to a traffic management system.) Hardware concepts the system has designed in a way to work 7 days 24 hours to observe the whole junctions.

This report also states how data and image processing has been done. In the image processing session, systematic errors noise is removed and determination of space and time coordination of observed objects which is important for data fusion is done. OIS gives an overview over a whole intersection however the research team states that in the future it is possible to calculate the time intervals between vehicles which would help in detecting information about the real-time traffic situation. [6] Received signal strength indicator (RSSI) technology is used to collect data in the selected area. The smartphone is placed in the road surrounding to be used for traffic monitoring. This method uses Bluetooth bacon for road traffic monitoring. This method is suitable for crowd monitoring, reducing travel time in real traffic congestion. [7]

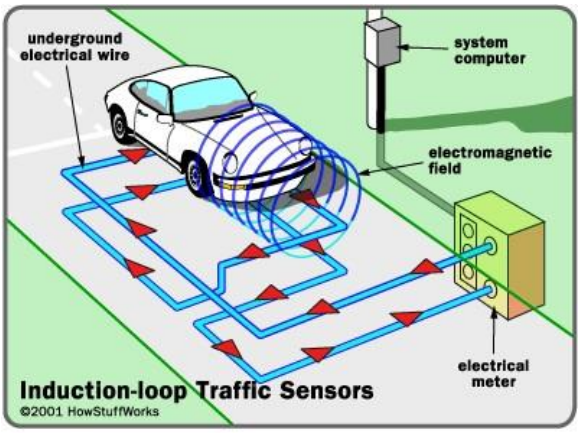

Figure 4: Induction of Loop Traffic Sensors

Inductive loop detectors are presently the most commonly used devices for vehicle detection, although microwave radar detection is also common. Their main uses are at a crossing in conjunction with developed signal traffic control systems, and on freeways for traffic monitoring and incident detection purposes. More than this Microwave radar detector, Infrared sensors are Ultrasonic Detectors are being used to detect traffic on roads. [8] (Figure 5)

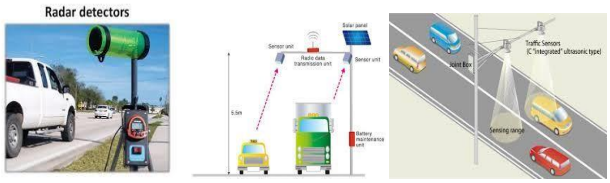

Figure 5: Radio Frequency Identification

An intelligent traffic management system (ITMS) with the use of RFID (Radio-frequency identification) and intelligent beacon sensing technologies is designed. Traffic detection is done using a video camera. And they are mounted on poles or structures above or adjacent to roadways.

Processing is done which is analysing the video images as vehicles pass by. Roadside fixed microphones pick up the audio that consists of vehicle noise and audio signal processing techniques are applied to estimate the density of traffic. [9]

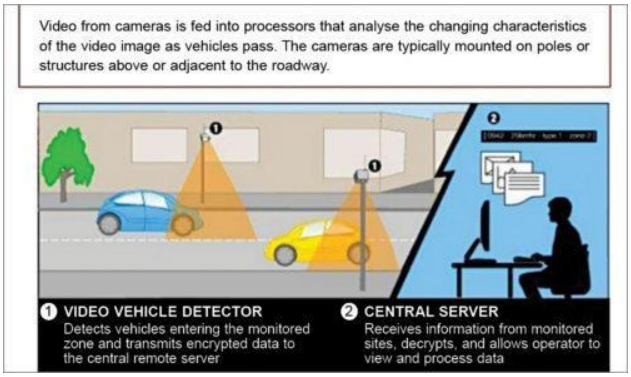

Figure 6: GSM and Vibration Sensor

The controller which is fixed in the user's vehicle will efficiently receive the traffic density information from a combined model of GSM and vibration sensor. The information about the congestion on the road and possible alternate routes also informed to drivers. Infrared light-emitting diode (IRLED) receiver and transmitter are used to measure the traffic flow. This is a real-time, GSM enabled, and intelligent Traffic Light controller. [10]

In many fields, there is a need to detect the specific object and also track those effectively when handling blockages and other complexities. Researchers attempted many approaches for tracking objects. The character of the techniques largely depends on the appliance domain. Few research works which made the natural selection to proposed work in the field of the object. The aim of object detection is to detect all instances of objects from a known class, like people, cars, or faces in a picture.

Generally, only a little number of instances of the thing are present within the image, but there's a sizable amount of possible locations and scales at which they will occur and that need to somehow be explored. Each detection of the image is reported with some sort of pose information. This is often as simple because of the location of the thing, a location, and scale, or the extent of the object defined in terms of a bounding box. [18]

III. METHODOLOGY

This proposed system contains three main components such as capturing videos of traffic condition, processing the video and getting the number of vehicles and detecting the actual traffic condition under three categories (high, Average, Low), and displaying the traffic condition on mobile application based on the image which is captured. The count of the number of vehicles in that input (recorded video) comes with the basic concept of background subtraction. Background subtraction is the way to eliminate the background from an image. By extracting the moving foreground from the static background it can be achieved. OpenCV for standard computer vision/image processing function has algorithms to do this operation.

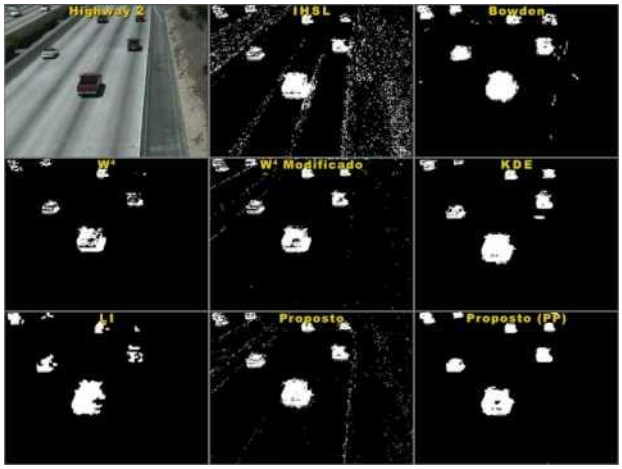

Figure 7: OpenCV Vision/Image processing

Morphological transformation is used to remove the noises in the resultant image. There are some tasks performed in object detection such as counting the number of vehicles, finding the relative size of the object, or finding the related distance between them. The objective is to capture the coordinates of the moving objects and mark that in the video as the following frame. (Figure 8)

Figure 8: Capture the Moving Object as Frame

The moving vehicle is detected and a box is created surrounding it. Frame differencing is used here, a video has a set of frames with a sequence in which an object is moving in that video. The object is at a different location at each consecutive frame. Then image dilation is applied over this, which is a convolution operation on an image where a matrix is passed over the image. By creating a detection zone (Figure 9) on the video it can detect any movement that happens in that particular zone only. Since the system has to find a counter of only those present in the zone. The x and y coordinates are set here as the counter area.

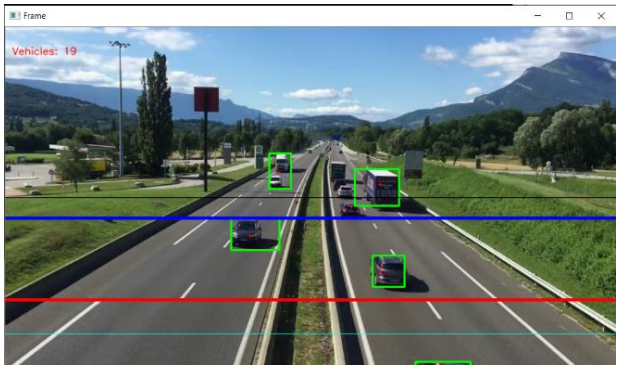

Figure 9: Creating Detection Zone on the Video

The count of the vehicles is given as 2 parts, one is the count of vehicles moving upwards and the other one is the count of vehicles moving downwards. From both this output the total count of the video will be displayed when the python files run successfully as well as it will be stored in the real-time database (firebase) as data.

The final outcome of the mobile application Allegro will be displaying the situation traffic from the count which will be taken as an input for the android studio mobile application. The final result displays traffic conditions such as less traffic, Average traffic, or heavy traffic. This differentiation from the number of vehicle ranges for categories can be changed according to our needs.

IV. RESULTS AND DISCUSSIONS

As mentioned, the system contains three main components input as recorded video, vehicle counting process, and the final output the mobile application Allegro. And this is fully based on background subtraction, so accuracy is very important since the system's initial input is the recorded video. It must be very clear and effective. Within the collected recorded videos, 30% of them taken for testing the validation and prevent from duplicate value errors.

As mentioned in the methodology to count the number of the vehicle in a particular traffic-congested road with the prefixed hardware component which was able to collect the field data as an mp4 file.

This was the main input while running the python files and the results we got in the command prompt is the count of vehicles in that particular video.

Figure 10: Command Prompt for Particular Video

Based on the collected vehicle count which was saved in the database and the output acts as an input for the mobile application. Then the mobile application will generate the traffic condition for the particular location as shown below. Based on the number of vehicles counts the traffic condition was categorized into 3 stages such as less traffic, average traffic, and heavy traffic.

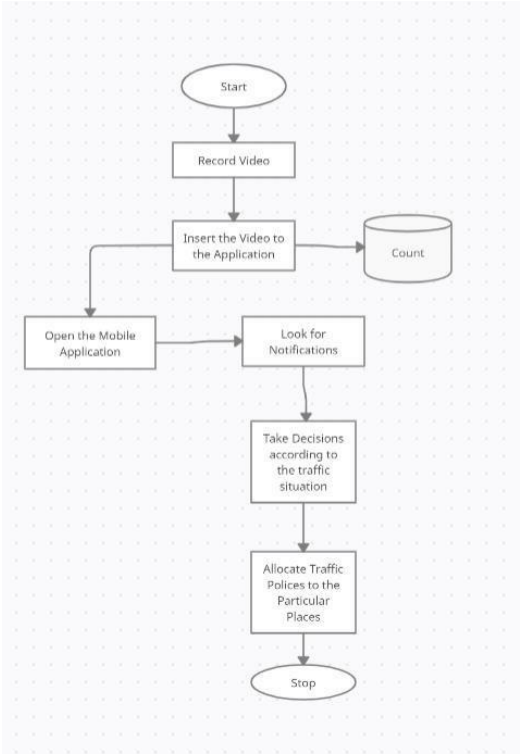

Figure 11: flow Chart of Allegro

Figure 11 shows the how the application works here. Based on the ranges of vehicle count the android studio displays the condition of traffic as follows, if the count is below 30 it considers as it has no traffic, if it is between 30 and 70, it considers as the video is having average traffic if the count is above 70 that has a heavy traffic situation in that particular location.

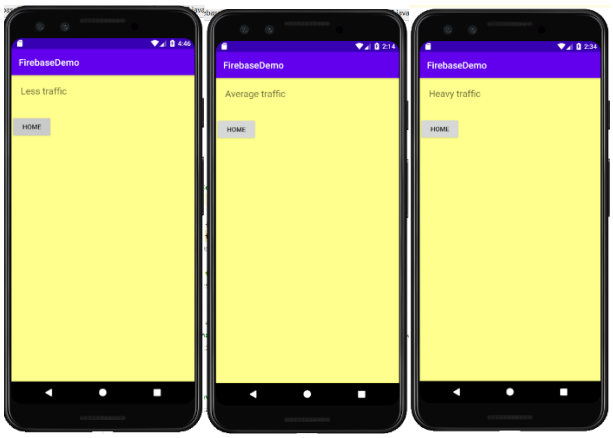

Figure 12: Traffic Conditions

For testing the python files to get an effective output as expected many numbers of recorded videos have been tested. While doing testing some misbehaviours were found in video processing. At night times vehicle's headlights will be on if the video is recorded at night time vehicle's headlights make a clear shadow on roads. That shadow is taken as an object by the system for background subtraction. So the result gives near to double the amount of count as the output.

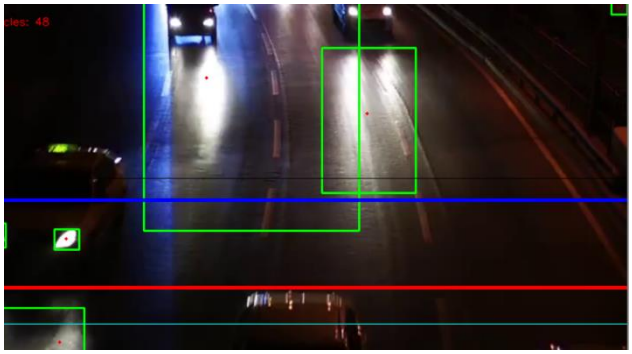

Figure 13: Misbehaviour Due to Vehicle's Headlights

As shown in this figure that the count as the output will be double the actual amount.

Another misbehaviour found while doing the testing was if the recorded video is closer to the object (vehicle) it takes the parts of the vehicle such as lights, windows, side mirrors, and door as an object. It gave uneven count as the output since the actual number of the vehicle is multiplying by a considerable instant. This might cause an unwanted panic about the traffic condition for the user.

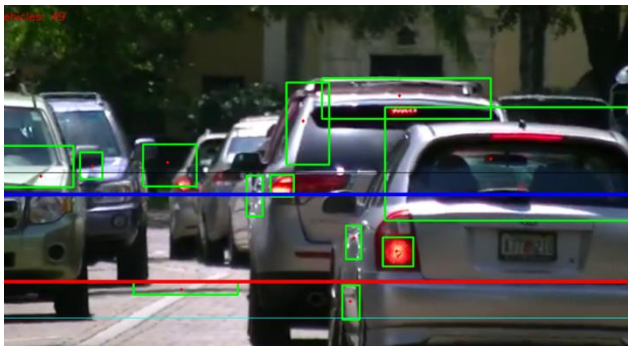

Figure 14: Misbehaviour Due to Closer Objects

This can be solved by fixing the camera in a suitable location like the top of the highways or roadsides without any disturbance.

Another misbehaviour found is the system takes unwanted objects to the count such as the other object moving in the road or roadsides. It might give some considerable extra numbers to the output.

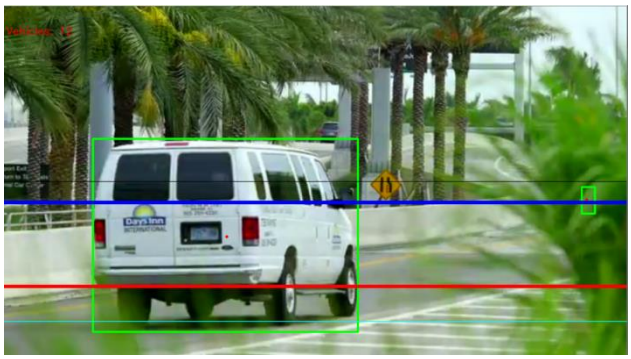

Figure 15: Misbehaviour Due to Unwanted Objects

As this figure is shown in the video has recorded from a roadside it may have some other moving objects such as roadside digital advertisements, plants, trees, or even it can be human. The effective output we expected cannot contain another moving object for the count. It might only contain the total vehicle count to process the rest system. According to this, it can be taken a decision that this is suitable for highways than other normal roads.

V. CONCLUSION & FUTURE WORK

Summarize our work, Mobile Application for police to detect traffic in any situations; the manual effort to detect traffic on the part of the traffic policeman is saved. As the entire system is automated, it requires very little human intervention. Usually, vehicles will be stuck especially at the traffic light

junction, during a traffic jam on special events time, protests, public meetings, or any accidental incidents. This is because the road users are waiting for the traffic light to turn green or blinking as yellow. It can cause more congestion in the same path which has much traffic, these situations need traffic police to clear the traffic and divert the vehicles through the easiest paths, this system design to control these incidents. For traffic control policies, it is extremely useful that a route guidance system can provide the shortest or an alternative path during an incident condition. The Mobile Application shows enough effective traffic conditions. It is designed to suit intersections in Sri Lanka.

Allegro can be taken as a sample of how to get to know the traffic situation without a man power in roads. There are some traffic polices who waste their duty time and service in normal ways which has no traffic. To avoid this this system is helpful to get the count of vehicles in a particular road through the recorded video. This Allegro can be implemented in future in many ways to get an effective results.

The application now is like it gives the count when a video is inserted manually. It can be implemented automatically or from a live video. And also the videos can be taken from different roads (next by roads) to get a clear idea about the movements of vehicles. It helps to police to allocate and control traffic polices in all situations. The mobile application can be implemented in various ways which makes user friendly, such as login and updates for every user, user can send complaints or feedbacks about the situation or application. Especially user can update the situation of that particular road or junction to other traffic polices as an information. This help to trace a vehicle in any needed situation too which is happening via walkie talkie. Through all these a user will get a clear idea of the city about the traffic conditions.

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LIASA: Live Activity Survey Application

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***Abstract*— LIASA is an android based application to conduct live surveys for live user events using real-time user data. The application is focused only on conducting surveys for live user events. LIASA will conduct any live activity survey with customizable questioners and geographical location. Currently available survey applications do not provide real-time reports using text mining technologies and real-time user's geographical information. The combination of the above-mentioned technologies will make the ultimate real-time live activity survey application. LIASA can collect data only within a pre-defined geographical area, ensuring only the event participants able to provide feedback. Text mining techniques will ensure the most effective way of collecting feedback. The application will validate and process feedback instantly after the event is over. Capturing the users' geographical location will be a part of the data validation mechanism. A detailed final report will present at the end of the event and survey in a short time. Applications are endless from live concerts, exhibitions, lectures, sports events, party, exams to a vast list of live events. The ability to customize the questioner will increase the above list. LIASA will be a new start of live activity survey applications.**

I. INTRODUCTION

LIASA- Live Activity Survey Application, a survey application for live activities to boost event productivity based on participant's feedback. As a huge fan of live events, the chances of providing feedback to the event organisers are very low and getting a feedback from the event participants is almost impossible due to the number of participants count and other many reasons. The organisers may receive feedback from the participants physically like a rain of tomatoes, but there must be a method to collect feedback from the participants in a systematic order. So, the researcher came up with a better solution where the participants and both organisers needs are well pleased. A solution which provides an opportunity to provide feedback and get a summary of the participant's feedback for the organisers.

A. *Background*

Surveying is the main method of collecting information from society. The first recorded survey is reported by the Egyptians. Then the Romans used surveying as a professional field. From there the surveying became a major part of the social studies. The world depends on the thoughts of the people affecting the economy, society, nature and other major sections of the world. One of the very best examples of a survey is the presidential election of a country. Therefore, surveying is a very powerful tool that we can use for the wellbeing of society.

Methods of conducting a survey may vary from the culture and the nations but there are few basic methods to survey are face to face questioners, polls, written questions papers etc. With the development of the technologies, surveying also developed accordingly. In the early steps, surveying was done using papers and the collected data was processed manually and the proceeded information is collected in paper-based media. Therefore, the vulnerability of information is high. With the development of the computers surveying became easy to manage and analyse.

B. *Scope of the project*

LIASA gather responses from the attendees and analyse the submissions. Then generate reports based on the responses. To analyse the responses LIASA uses text mining techniques. Event's organizers can add events and create surveys, then view reports. Event participants can see events and attend surveys. LIASA is a fully customizable application based on organizers needs.

II. LITERATURE REVIEW

LIASA is an application to conduct live surveys for live user events using real-time user data. The application is focused only on conducting surveys for live user events. Live users get the true experience of an event, therefor collecting feedback from live users will ensure the accuracy and quality of feedback. LIASA will conduct any live activity survey with customisable questioners and geographical location. Currently available survey applications do not provide real-time reports using text mining technologies and real-time user's geographical information. The combination of the above-mentioned technologies will make the ultimate real-time live activity survey application. Text mining techniques will ensure the most effective way of collecting feedback. A detailed final report will present at the end of the event and survey in a short time. In the following few pages, all the application related background information is discussed.

A. *Survey*

A method of collecting information using a set of questions and get different answers to the same questions and analyse them in a systematic order is known as a survey. The history of surveying goes back to ancient Egypt in 3000BC [1]. As a profession under the Romans, land surveying was established by around 300AD [1]. Over the evaluation of surveys, the paper-based method was the major media of keeping data and information. Ancient Egyptians used Papyrus to keep their records. However, surveying needs a lot of data to generate reliable information. Therefore, it needed a vast amount of paper to collect data, analyse and store. Entire libraries served as storage units. Surveying was a very difficult task back then.

Fortunately, for the professionals after the industrial revolution, many technologies were invented making surveying much easier than before. But it was same as before when comes to storage. So, after the invention of the computer, everything changed from conducting surveys to analyse and storing. Nowadays most of the surveys are conducted via mobile devices and the internet. The new trend is in the surveying industry is to automate the data analysing using several technologies. One of several technologies, the project is based on text mining.

B. *Live User Event*

Live user events, where a group of people get to gather celebrating a moment in a specific location. There are many types of live user events and non-live user events. The non-live user event, where users can participate virtually via the internet and telephone conversations. An auction is a great example of the non-live user event. In an auction, the number of participants is hard to determine because it may have a vast number of participants all around the world participating in the event via different virtual methods. The main focus of the project is the live user event, where the users physically attending the event experiencing the event with all of their five basic senses, sight, hearing, smell, taste and touch. Even the latest technology like virtual reality is unable to fulfil the true experience yet [2]. The best and true results of a survey rely on true live user participation and experience.

C. *Data Mining*

Mining information from data: A present-day gold rush. Data Mining is a multidisciplinary field which supports knowledge workers who try to extract information in our “data rich, information poor” environment [3]. A method used to extract a pattern from a data source is called a data mining technique. The term Data mining was introduced in the 1990s and early mechanism of identifying data patterns was based on Bayes' theorem and regression analysis. The evolution of computers has extended data storage and complexity making data analysis more difficult. Indirect and automated data processing were introduced thereafter including data mining techniques to overcome the above-mentioned problems.

D. *Text Mining*

Text mining is a subpart of data mining. During the past few years, the immense development of social network and world wide web let increase the amount of text data added day by day. So, the need for advanced algorithms, which can learn interesting patterns from the data in a dynamic and scalable way is a must since the data is complex and enormous.

The most common and widespread technology of text mining technology is natural language processing (NPL) [4] The range of technologies used under NPL covers a wide array. All of them use a parser of some sort or another, morphological analysis and lexical resources, such as WordNet, FrameNet or VerbNet. Support Vector Machines (SVMs), a new role in text mining, namely relation extraction. SVMs widely used in text mining to perform text classification, treating a document or a text file as an unstructured set of words. Non-NLP techniques, Latent Semantic Analysis (LSA), a numerical method based on linear algebra and use discriminant analysis for classification. Another Non-NLP technique, Genetic Algorithms (GAs) used for solving problems where the features can be represented as binary vectors. [4]

E. *Existing Applications*

SurveyMonkey

A cloud-based online survey application service company founded in 1999 by Rayan Finley and Chirs Finley. The company provide surveys and paid back-end programs. SurveyMonkey has acquired survey tools including Precision Polling, Wufoo, Zoomerang, and 49.9% stake in UK-based Clocktool [5](SurveyMonkey, 2020). SurveyMonkey software is written using .NET and Python. Applications provide automatic charts and summaries, analyse text responses with the Word Cloud and Sentiment Analysis, filters, and crosstab reports. [5]

Fynzo-Survey

A Cloud-based solution provider with a range of products from point-of-sale application to flagship survey and feedback application. The company headquarters located in New Delhi India and founded by Vibhuti Kumar, Rohit Raj and Nagendra KumarInvalid sources specified. Fynzo survey application provides offline data collection, multi-lingual support, complex

question design, real-time feedback and CSV and XL data. [6] Data analysis methods not revealed to the public. The assumption, data mining or text-mining is not used in Fynzo [6].

III. Methodology and Design

A. *Requirements for LIASA*

LIASA is an online survey application, therefore the use used an active internet connection and an android device to test the application. The application is developed using the Android studio and other applications.

User requirements

- An internet connection
- Mobile device (Android)

Developer requirements

- Android Studio
- Adobe XD
- A Windows PC
- An android device

B. *Architecture Diagram*

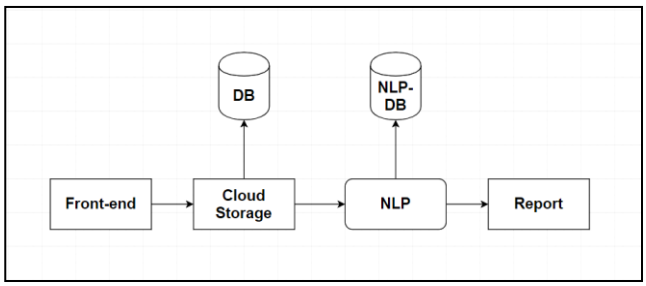

Fig. 1. Architecture Diagram

C. *User account structure*

Each user in LIASA needs to have an account to attend an event and survey. The user account is the key to an event. Events are added by the application owner, which is the event organizer. The owner is provided with an account to login the application in the time of purchase. User account and owner accounts are two different types of accounts, and each of them offers different functions and controls. Only the owner accounts are capable of viewing reports, add events, change event, delete an event, add a survey, change survey and delete the survey. In the meantime, user accounts are only capable of attending an event, submit a survey and view events.

D. *Event structure*

The event is managed by the owner of the application. The owner can insert an event, changing an event and deleting an event. The user must include the location, the radius of the event location, time of the event and description. Users are only capable of attending an event and view details of the event.

A. Survey Structure

A survey can be added by the owner or organizer in their favour. And the survey can be edited by the owner any time unless the surveying period. The owner of the event can specify a location and a radius around the event location. Then the owner can delete a survey. The survey will conduct in a form of simple questioner and comments. User can participate in a survey if the user's GPS location is within the predefined radius which is provided by the owner, the user must have an account on LIASA application and must have applied for the event before the event time. Those are the three simple requirements for the user to attend a survey.

IV. Testing strategy and Evaluation strategy

The unit test occurred in each spiral accordingly. The test is conducted by the researcher. Tests conducted using AppiumInvalid [1] source specified. For application automation test, EspressoInvalid source specified. for UI test and test database, the researcher used the sqlite3 database tool which is included in the Android SDKInvalid source specified. The security of the application tested according to the Mobile Security Testing Guide (MSTG) Invalid source specified.

V. . INTERFACES

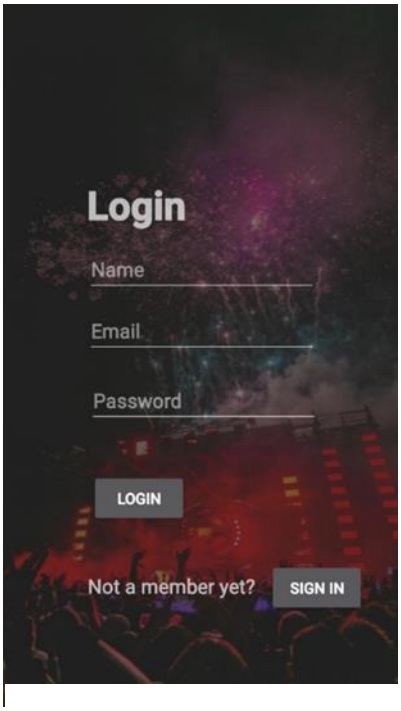

Fig. 2. Login interface

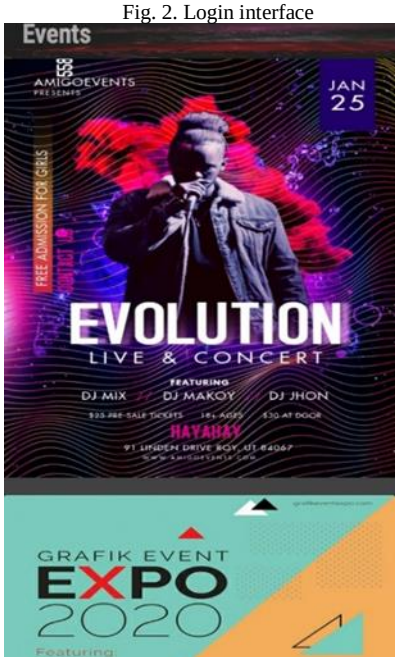

Fig. 3. Event Browse interface

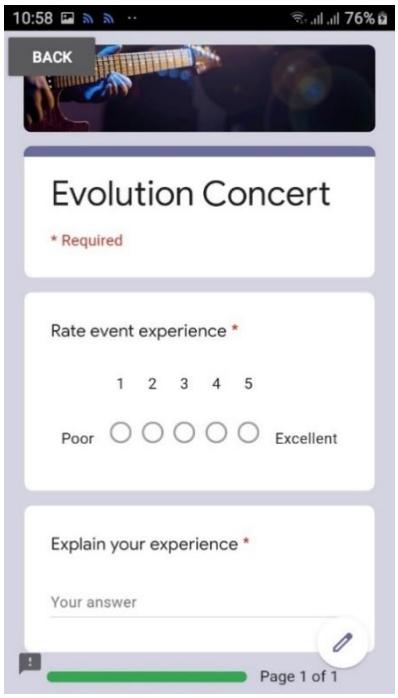

Fig. 4. Questioner interface

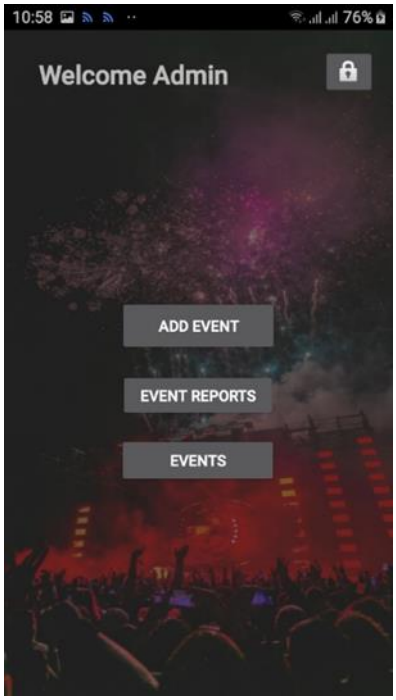

Fig. 5. Admin interface

Fig. 6. Add Event interface

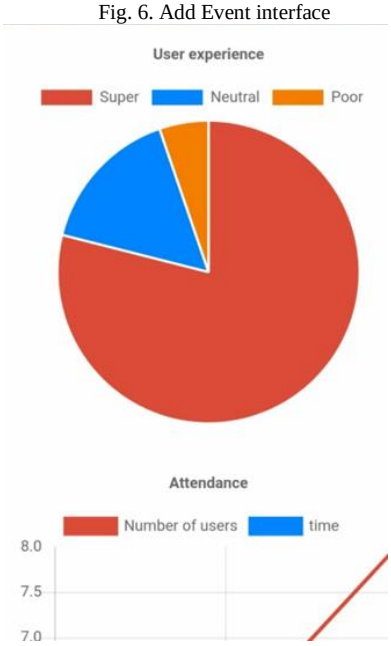

Fig. 7. Event Results interface

VI. . EVALUATION

Evaluation for LIASA is conducted though the Google forms, the application is given to a selected group of thirty-five people and collected feedback. The selected group of people are from different entities representing society.

Questionnaire

- Do you like the interfaces?
- Does the application cover the needs?
- Did the application crash?
- Rate the speed of the applications.
- Rate the application.

Results

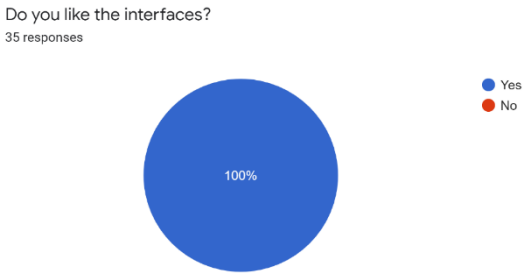

Fig. 8. Results 01

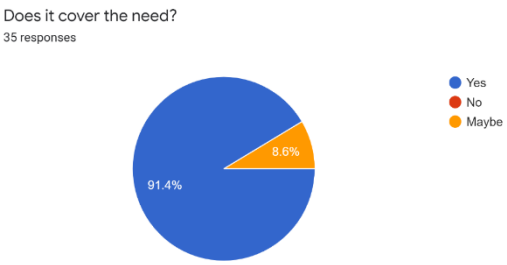

Fig. 9. Results 02

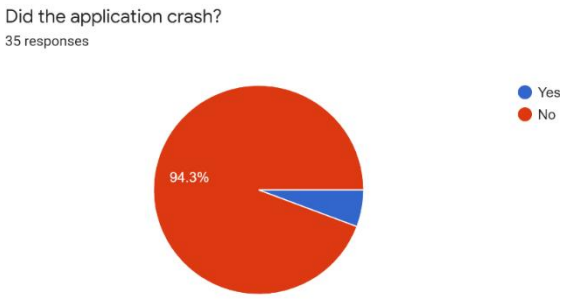

Fig. 10. Results 03

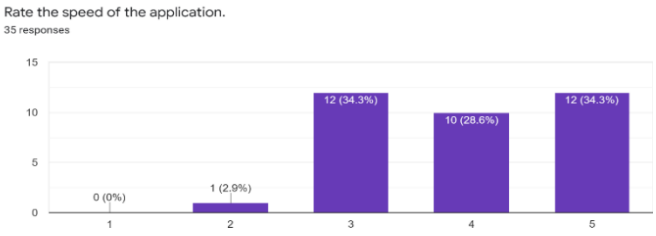

Fig. 11. Results 04

Table 1. Comparison between LIASA and other applications

Feature	**LIASA**	**SurveyMonkey**	**Fynzo Survey**
Text-mining	Featured	Featured	Does not support
Offline data availability	Featured	Featured	Featured
Real-time feedback	Featured	Featured	Featured
Charts	Featured	Featured	Does not support
Use of GPS technology	Featured	Does not support	Does not support
Collect answers based on the user's location	Featured	Does not support	Does not support
Multi-lingual support	Featured	Does not support	Featured

VII. Conclusions

LIASA, live activity survey application. Main points of the application LIASA are survey, live user event, data mining and text mining. The survey, basic operation of the application and the main function which provide survey questions with expected answers. Then the live user event, where the application will use in action. All the users should be within the predefined area to provide survey answers. Data mining and text mining used to conduct the data analysis operation. Which provides user feedbacks in the form of a chart or report. SurveyMonkey and Fynzo-Survey are similar systems to the LIASA with bit differences. Geo-location data is not used by both applications and data mining technologies are not used in Fynzo-Survey. By overcoming all the differences, LIASA provides the ultimate solution for live activity surveys.

VIII. Future Work

The current project covers only the basic requirements. So, in the future, the aim is to add more features and functionalities to the application like a social media platform for live events. Which includes posts, comments, event map and every feature other social media platform includes. As a result, the reliability and accuracy of the application can be improved. Therefore, in the future LIASA will be a dedicated social media platform which includes surveys for live activities. In the future, the LIASA will the leading live activity social media applications extending the capabilities of the current survey application. LIASA will be able to show live events all over the world and sell tickets online to the event participants. Therefore, the number of users will increase making the text mining process even accurate.

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Aviantra: An Aircraft Inventory Management Software with Stock Prediction, Integrated with Inventory Pick Mobile Application

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***Abstract*— Aviation industry is having an exponential growth with the increase of passengers travelling each year; therefore, the airline industries tend to purchase aircrafts to solve these needs. With the increase in aircrafts it is quite challenging to do a maintenance operation without having a proper inventory management system, in addition to this, controlling the inventory supply in a warehouse by understanding the demand for different aircraft spare parts was also an issue. The mismanagement of inventories, lengthens the ground time of the aircraft causing a revenue loss to the airline. The aim of this research project is to implement an aircraft inventory management system which uses a sophisticated artificial intelligence technique to mitigate these issues, in addition to this, the system carries other additional features like Baseline Configuration, Part Request and Mobile Pick solution. By doing thorough research onto modern technologies and deep learning algorithms used in existing systems, two algorithms were chosen for testing. The traditional Auto Regressive Integrated Moving Average algorithm and the more sophisticated Long-Short Term Memory algorithm. By executing tests on both algorithms using historical data from Industrial and Financial Systems, it was concluded that LSTM performed better, therefore it was chosen on the implementation of the system. The project was executed using the robust agile development methodology with scrum technique which influenced the iterative development of the phases in Software Development Life Cycle, ensuring the quality of the system. The final system test was executed, and the results showed that the LSTM algorithm gave a low Mean Absolute Percentage Error which tends to be a good value for time-series regression models. In addition, the baseline configuration, part request and mobile pick features also had a positive test result. Feedbacks from the technician who tested the system concluded that, although the system needs improvements in the future, it is highly effective, providing a great value to the aviation industry.**

***Keywords*— Long-Short Term Memory, Aircraft Inventory Management, Inventory Stock Forecasting, Integration with Rest APIs, Future of Technology in Aviation Industry.**

I. . INTRODUCTION

A. Project Background

Aviation industries are growing in a massive rate with huge number of aircrafts being produced every year, therefore there is a high demand for aircraft parts. Similarly, the number of passengers using commercial airlines are expected to increase in the coming years. It is unbelievable to run an efficient aircraft maintenance process without having an automated system to manage the parts which are being used during the maintenance execution, and also when a part is requested, a proper inventory picking system should be available where a technician can request for a part and the requested part can be viewed and delivered by the storeroom clerk. In this project, an aircraft inventory management system is developed to fulfill these requirements ensuring an efficient maintenance is executed. Besides, effectively controlling and managing the inventory stock being supplied from an original equipment manufacturer has been a difficult task for most of the industries, therefore in this project the main research component is to use deep learning techniques to use the historical sales information of a particular part and predict the future usage of it. In this way the airline can preemptively purchase and stock only the required parts before a maintenance program rather than having to blindly purchase additional amount of parts causing a loss to the airline or insufficiently purchasing parts which will increase the ground time of an aircraft until the required parts arrive. These scenarios repeatedly occurring will cause a massive revenue loss to the airline. However, with the use of Aviantra this problem will be mitigated.

B. Inventory Stock Forecasting

Inventory control is the art of managing the amount of inventory or stock held in an industry to encounter the demand placed economically, it is clearly required to predict the level of future demand (Lewis, 2012).

The benefits of holding stock are the customer are shielded from the suppliers constantly renewing orders to the stock holding process, therefore the holding of stock is managed economically. Managing stock can act as an effective way to protect against disturbance to the supply (Lewis, 2012).

There are different types of inventory predicting or forecasting methods.

1) Short-term forecasting: This type of prediction will be normally associated with many product items which typically happens in inventory control systems. The demand patterns analyzed are comparatively fast in this method. The prediction models used when operating in short-term prediction must be simple and cheap to manage (Lewis, 2012).

Few advantages of short-term forecasting model:

- Cheap computation in relative to processing time and storage requirement.
- Robust, and the predicting process can be clearly monitored so that situations that go out of control can be exposed.
- Easy to start up with new items that had no demand previously. For an example serial parts of an aircraft.
- Flexible when demand patterns change with seasons and growth of the industry (Lewis, 2012).

2) Medium term forecasting: Since computational power is increasing throughout the decades and getting cheaper, more complicated forecasting or prediction models which require complex calculations can be analyzed and performed on many stocked items since they are becoming financially cheaper.

Following forecasting or prediction models which are highly advanced are used in some of the software systems for inventory management (Lewis, 2012).

- Curve fitting and regression
- Linear regression
- Fourier analysis
- Bayesian forecasting

However, in a predicting approach, use of historical data is challenging due to Sparsity, Assortment variation and heterogeneous data.

Choosing the best forecasting or predicting model depends on: (Zhu and Laptev, 2017)

- Volume of historical data.
- Connection with explanatory variables.
- Computational complexity.

B. Existing research or systems on stock forecasting

1) Application of machine learning techniques for supply chain demand forecasting: The researcher believes that industries have started understanding the importance of sharing information across the stakeholders in the supply chain. The objective of this research is to understand the feasibility and analysis of forecasting the distorted demand signals in the extended supply chain using non-linear machine learning techniques (Carbonneau, Laframboise and Vahidov, 2008).

However, the collaboration between stakeholders and retailers were challenging. (Premkumar, 2000) lists down some key factors that needs to be addressed in order to permit successful supply chain collaboration. These are:

- Positioning of business interests.
- Managing long-term relationship.
- Reluctance to share information.
- Complexity of supply chain management.
- Performance measurement and incentive systems to support supply chain.
- Competence of people supporting supply chain.

In most of the industries these factors have not been addressed to enable effective supply chain management, However, now with the advance of e-business and increased tendency towards agile, enables the supply chain to be more flexible and adaptive.

With this advancement, investigation of the feasibility of forecasting methods can be executed on supply chain management (Carbonneau, Laframboise and Vahidov, 2008).

Following advanced Machine learning techniques to predict manufacturer's demand has been used in this research:

- Neural Networks (NN).
- Recurrent Neural Networks (RNN).
- Support Vector Machines (SVM).

These machine learning techniques are compared against traditional techniques such as naive foresting, moving average, linear regression and time series models.

Two kinds of test data have been used in this research, one is from a simulation of the extended supply chain and the second is from the estimated values of new orders received by Canadian Foundries (Carbonneau, Laframboise and Vahidov, 2008).

The results of the experiment had proven that Recurrent Neural Networks and Support Vector Machines are the most accurate forecasting techniques. The worst performers are Move Average, Naïve and Trend forecasting, However, the statistics of the results have shown that there is no significant difference in term of accuracy of forecast between Recurrent Neural Networks, Support Vector Machines and Neural Networks. With the analytics and test results the researcher

concludes that even though advanced machine learning techniques show better results, they did not provide a huge improvement over more traditional techniques, However for the dataset used in this research, the more advanced machine learning techniques like Recurrent Neural Networks and Support Vector Machines have shown larger improvements compared to traditional techniques (Carbonneau, Laframboise and Vahidov, 2008).

3) Forecasting for The Ordering and Stockholding of Consumable Spare Parts: The objective of this research is to identify and analyze the value of models designed to improve demand prediction or forecasting in relation to ordering and stoking spare parts for an aircraft and to produce a meaningful result for the real world scenarios (Charles Eaves, 2002).

The researcher believes, to consider a model useful, they should adhere to the following criteria:

- They should not be too complex and require unrealistic processing power.
- The models should not be too specialized that they carry destructive effects if the demand changes with the specified pattern.

Demand for aircraft spare parts are categorized into two different types erratic which are infrequent transactions with variable demand sizes and slow-moving which are also infrequent transactions but with low demand sizes.

Figure 3 shows the frequency of demand transactions over a six-year period for aircraft spare parts (Charles Eaves, 2002).

Many measures must be taken to compare between forecast accuracy, two methods of implementation for consideration are:

- Measuring errors observed at every point.
- Only measuring errors after a demand has occurred.

The first method is suitable for stock replacing systems with a forecasting method that updates often at any stage of the inventory cycle.

Whereas the second method suits where an order will be placed only when a demand occurs.

The testing data used to identify properties of spare parts of an aircraft are examined using Royal Air Force (RAF) consumable inventory.

(Charles Eaves, 2002) concludes that cost-effective management of spare parts is a problem faced by many aviation industries and is an area that has received many attentions throughout the years.

Although this research is performed for doctorate level and vague to understand fully ,within the context of Aviantra project, this research has helped to identify the problems faced in Aviation industries when it comes to managing inventory control for spare parts of an aircraft, and analyzing their attributes to find factors to consider when choosing a proper model to train.

4) Time series forecasting using a hybrid ARIMA and neural network mode: The researcher believes that the Autoregressive integrated moving average (ARIMA) is one of the popular linear models intime series forecasting during the past three decade. In this research the researcher elaborates on a hybrid ARIMA and neural network model. By testing the hybrid model using actual dataset, the researcher concludes that the combined model can be an effective way to improve forecasting accuracy achieved by either of the models separately (Zhang, 2003).

The reason to use a hybrid model is because, it is often difficult practically to determine whether a time series is generated from a linear or nonlinear process or whether one particular method is more effective than the other in out-of-sample forecasting, therefore it is difficult to choose the right forecasting technique for the proper situations. By combining different models, it is easier to select the proper model with little effort.

Real-world time series are rarely pure linear or nonlinear. If this is the problem then both ARIMA or NN alone is not efficient, since ARIMA model cannot deal with non-linear situations an NN model alone cannot deal with both linear and non-linear situations well (Zhang, 2003).

The ARIMA Model

In an autoregressive integrated moving average model, the future value of a variable is assumed to be a linear function of several past observations and random errors. That is, the underlying process that generate the time series has the form (Zhang, 2003).

$$\text{yt} = \theta_0 + \phi_1 y_{t-1} + \phi_2 y_{t-2} + \cdots + \phi_p y_{t-\text{p}} + \varepsilon_t - \theta_1 \varepsilon_{t-1} - \theta_2 \varepsilon_{t-2} - \cdots - \theta_q \varepsilon_{t-\text{q}};$$

where yt and Et are the actual value and random error at time period t.

In the identification step it is often required to make the time series stationary for the input dataset. “A stationary time series has the property that its statistical characteristics such as the mean and the autocorrelation structure are constant overtime”.

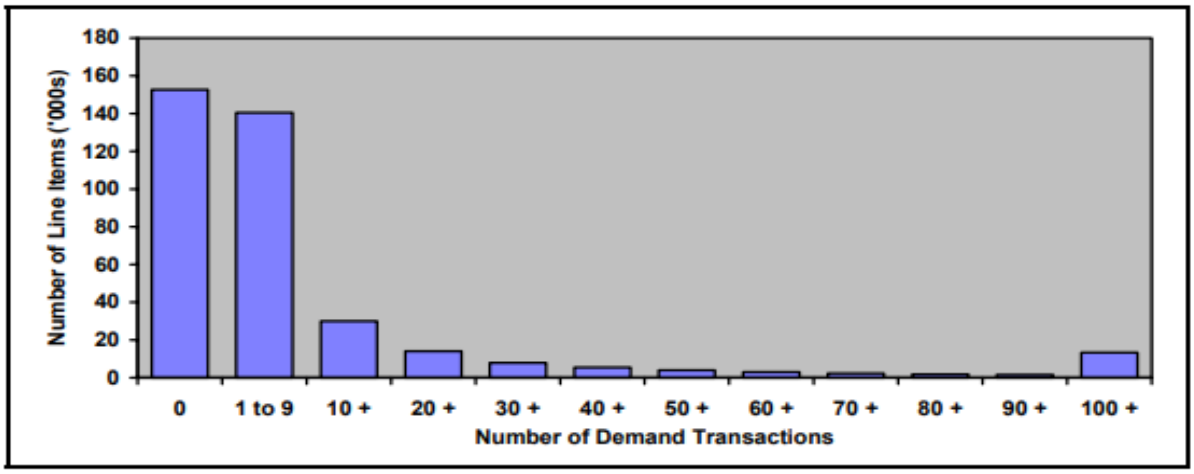

Fig. 19. No of demand transactions over a 6 years. (Charles Eaves, 2002)

Once the model is specified, identifying the model parameters is straight forward. The parameters are chosen in such a way that an overall measure of errors is minimized.

The last step of defining the model is to check whether the assumptions about the errors are satisfied.

The above steps are repeated several times until a satisfactory model is selected, and this model can then be used for predictions (Zhang, 2003).

The Artificial Neural Networks Model

Artificial neural networks model is one such model that can approximate nonlinear values in the data. ANNs are often used for broad non-linear problems. Their strength comes from the concurrent processing of the information from the data. No pre-assumptions of the model form are required in the model building. The neural network model is largely determined by the characteristics of the data.

There are similarities between the ARIMA and the ANN model. In both model’s data transformation is required to get the best results. A large sample of data is also required for better results (Zhang, 2003).

The Hybrid Model.

Both ARIMA and ANN are successful in linear and non-linear functions, however neither of them are suitable for all circumstances. Using ARIMA for non-linear problems and ANN for linear problems may not be satisfactory.

In this hybrid model the system consists of two steps.

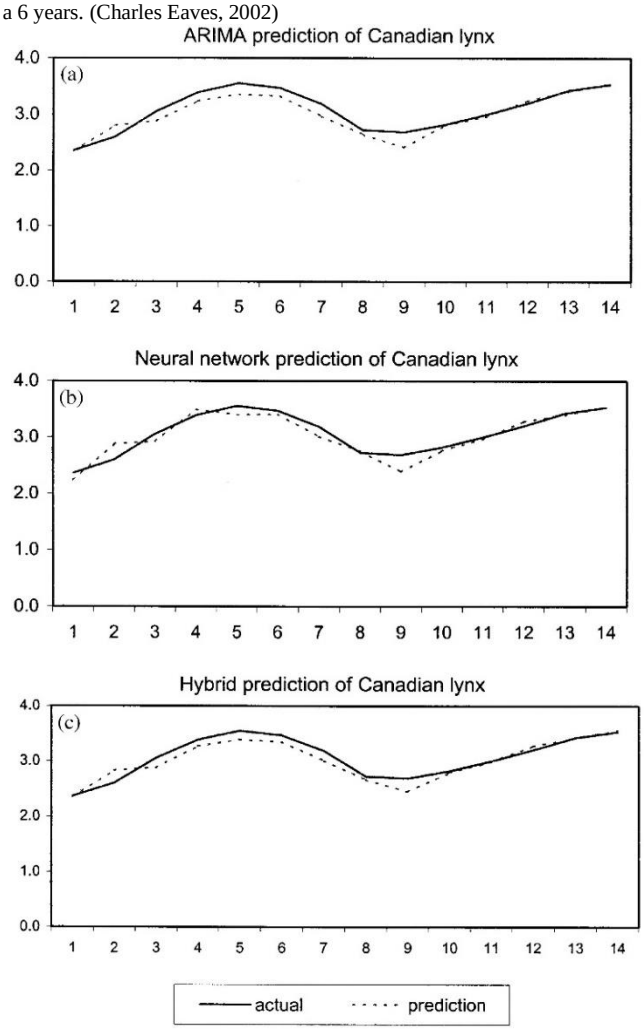

Fig. 20 . (a) ARIMA prediction of Canadian lynx. (b) Neural network prediction of Canadian lynx. (c) Hybrid prediction of Canadian lynx.

At first the ARIMA model is used to analyze the linear part of the data, and then the Neural network model is used to model the residual data from the ARIMA model, since the ARIMA model cannot capture the non-linear part of the problem. The hybrid model utilizes the unique feature of ARIMA model as well as ANN model in determining different patterns, therefore the combination of the forecast can be used to get an overall effective forecasting result (Zhang, 2003).

By testing the model with three well-known data sets—the Wolf's sunspot data, the Canadian lynx data, and the British pound=US dollar exchange rate data the researcher concludes that hybrid model can outperform each model used in isolation.

The figure shows the Mean Square Error and Mean Absolute Deviation for the prediction using the three models for Canadian Lynx data (Zhang, 2003).

TABLE I - LYNX FORECASTING RESULTS

	MSE	MAD
ARIMA	0.020486	0.112255
ANN	0.020466	0.112109
Hybrid	0.017233	0.103972

5) A Comparison of ARIMA and LSTM in Forecasting Time Series: The main objective of this research is to compare the performance of the traditional time series forecasting algorithms such as ARIMA against the newly developed more advanced deep learning algorithms such as Long-Short Term Memory (LSTM) (Sima 2018).

When it comes to time-series forecasting, it is quite challenging since the economic trends change and insufficient information on the other hand, therefore critically analyzing the accuracy of the forecasting algorithms is important, since each model have their own limitations. The main focus of this research is to investigate which forecasting algorithms produce best predictions with respect to lower errors and high accuracy.

Time series forecasting is traditionally done using the ARIMA model, it has been the standard for the time-series forecasting for a long period of time, However they have major limitations like it is hard to model the non-linear relationships between variables, and also it is assumed that ARIMA model has a constant deviation errors.

But with time advanced deep learning techniques such as LSTM have been implemented to overcome these errors in the traditional forecasting algorithms.

LSTM is a kind of Recurrent Neural Network with the ability to remember the values of earlier stage for the purpose of future forecasting.

In the following section the researcher critically tests and evaluates the two algorithms ARIMA and LSTM (Sima 2018).

The researcher extracted historical monthly financial time series from Jan 1985 to Aug 2018 from the Yahoo finance Website.

The following rolling models have been developed for the test scenario.

```
# Rolling ARIMA
Inputs: series
Outputs: RMSE of the forecasted data
#  Split data into:
#     70% training and 30% testing data
1. size ← length(series) * 0.70
2. train ← series[0...size]
3. test ← series[size...length(size)]
#  Data structure preparation
4. history ← train
5. predictions ← empty
# Forecast
6. for each t in range(length(test)) do
7.     model ← ARIMA(history, order=(5, 1, 0))
8.         model fit ← model.fit()
9.         hat ← model_fit.forecast()
10.        predictions.append(hat)
11.        observed ← test[t]
12.        history.append(observed)
13. end for
14. MSE = mean_squared_error(test, predictions)
15. RMSE = sqrt(MSE)
16. Return RMSE
```

Fig. 22. The developed rolling ARIMA algorithm

The following table shows the Root Mean Squared Error for both models using the test data for predictions.

TABLE II THE RMSES OF ARIMA AND LSTM MODELS

Stock	RMSE		% Reduction in RMSE
	ARIMA	LSTM	
N225	766.45	105.315	-86.259
IXIC	135.607	22.211	-83.621
HSI	1,306.954	141.686	-89.159
GSPC	55.3	7.814	-85.869
DJI-Monthly	516.979	77.643	84.981
DJI-Weekly	287.6	30.61	-89.356
Average	511.481	64.213	-87.445
MC	0.81	0.801	-1.111
HO	0.522	0.43	-17.624
ER	1.286	0.251	-80.482
FB	0.478	0.397	-16.945
MS	30.231	3.17	-89.514
TR	2.672	0.569	-78.705
Average	5.999	0.936	-84.394

The test results show that the average Root Mean Square Error using Rolling ARIMA and Rolling LSTM models are 511.481 and 64.213, respectively, yielding an average of 87.445 reductions in error rates achieved by LSTM (Sima 2018).

The research finally concludes that LSTM algorithms are more efficient when comparing the accuracy with the traditional ARIMA model. Specifically improving the prediction accuracy by 85% (Sima 2018).

```
# Rolling LSTM
Inputs: Time series
Outputs: RMSE of the forecasted data
# Split data into:
# 70\% training and 30\% testing data
1. size ← length(series) * 0.70
2. train ← series[0...size]
3. test ← series[size...length(size)]
# Set the random seed to a fixed value
4. set random.seed(7)

# Fit an LSTM model to training data
Procedure fit_lstm(train, epoch, neurons)
5. X ← train
6. y ← train - X
7. model = Sequential()
8. model.add(LSTM(neurons), stateful=True))
9. model.compile(loss='mean_squared_error',
                 optimizer='adam')
10.for each i in range(epoch) do
11.  model.fit(X, y, epochs=1, shuffle=False)
12.  model.reset_states()
13.end for
return model

# Make a one-step forecast
Procedure forecast_lstm(model, X)
14. yhat ← model.predict(X)
return yhat

15. epoch ← 1
16. neurons ← 4
17. predictions ← empty
# Fit the lstm model
18. lstm_model = fit_lstm(train,epoch,neurons)
# Forecast the training dataset
19. lstm_model.predict(train)

# Walk-forward validation on the test data
20. for each i in range(length(test)) do
21.    # make one-step forecast
22.    X ← test[i]
23.    yhat ← forecast_lstm(lstm_model, X)
24.    # record forecast
25.    predictions.append(yhat)
26.    expected ← test[i]
27. end for

28. MSE ← mean_squared_error(expected,
                             predictions)
29. Return (RMSE ← sqrt(MSE))
```

Fig. 23. The developed rolling LSTM algorithm.

II. SYSTEM TESTING

1) ARIMA Algorithm Testing: The ARIMA model was tested using the test dataset for an OEM part with 10 years of historical data grouped by months provided by Industrial and Financial Systems Aviation and Defense sector.

Test data plot

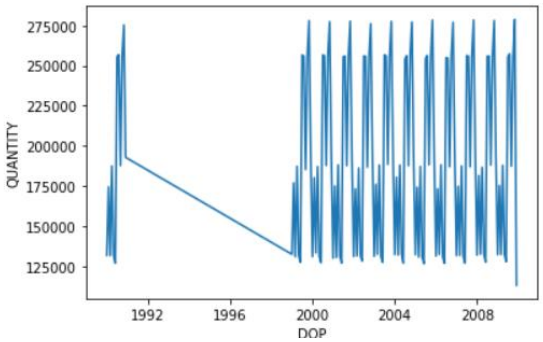

Fig. 7. Test Data Plot

The predictions for ARIMA model gave a Mean Absolute Percentage Error of 30.82663492898793, which was comparatively high, therefore the LSTM model had to be tested.

2) LSTM Algorithm Testing: The deep learning LSTM algorithm tend to perform better than traditional algorithms like ARIMA, therefore this algorithm was tested with the above dataset to see the accuracy to find out whether this is suitable for the implementation in the system.

Prediction plot for test data using LSTM algorithm

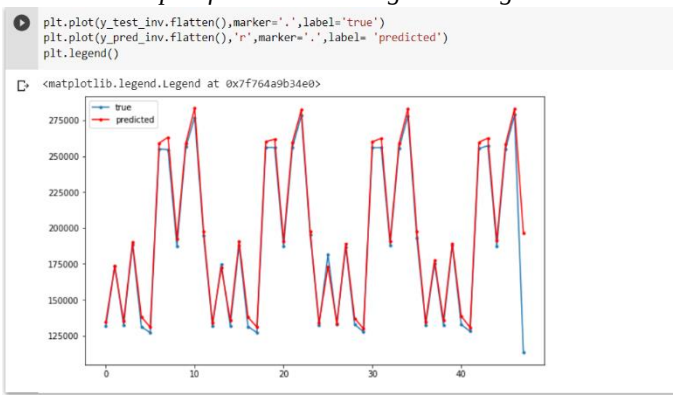

Fig. 8. Prediction Plot for LSTM

The test results for the LSTM Algorithm are as follows.

Mean Absolute Percentage Error	Mean Squared Error
3.5327587	12706.63866912565

Compared to the ARIMA algorithm the LSTM algorithm gave a low MAPE, therefore LSTM was chosen as the regression algorithm to be used in the Aviantra system for time-series prediction of part sales.

Test Results for Aviantra stock forecasting

Aviation industry is a highly regulated area and accessing data is quite a challenge.

The following test is executed for sales data of a close tolerance bolt for the year of 2018.

TABLE 2 LSTM Test Results

Month	Actual Value	Prediction Value	Error
January	131464	135017	3553
February	173325	174374	1049
March	132536	136325	3789
April	188202	187111	1091
May	131156	135356	4200
June	127109	130533	3424
July	254934	255925	991
August	254566	257143	2577
September	187095	189006	1911
October	256354	257032	678
November	276871	278281	1410
December	194558	193918	640

TABLE 3 MSE and MAPE

Mean Squared Error	Mean Absolute Percentage Error
11749.944	2.667057

III. EVALUATION & DISCUSSION

E. *Evaluation*

During the end of the project the system should be tested by an end user and an acceptance from him/her stating that the system serves the mentioned requirements and fulfills the problems stated is highly necessary to ensure a quality product is being released to the market.

Since this is a dedicated project based on aviation industries, it is necessary to identify a user who understands the domain and its problems. Therefore, this final Aviantra product was tested by an Aircraft Maintenance Technician of SriLankan Airlines, and his feedbacks are as follows.

- The biggest advantage in the software he sees is the part request feature being able to execute in a mobile device. In his perspective it seems very useful and user friendly.
- The stock forecasting feature is quite fancy and is very useful theoretically, however when it comes to time-series predictions he believes that the information of the future is always limited and can be only estimated with the past information, though the numbers seem accurate, practically there can be many sudden factors effecting the ground time of an aircraft therefore definitely this is an advantage but practically an additional margin of error count should be inclusive. ” But, having numbers in place is always an advantage than blindly purchasing parts which is costly.”
- The baseline configuration feature is pretty straight forward, which is similarly to other inventory management systems, however the responsive user interface, and the ability to see error messages and data being updated on real time without page reloads is impressive.

F. *Discussion*

1) Outcome: Walking back through the objectives of this research project, the first objective was to lay down a proper architecture to the system since there are several components to it, therefore a proper technical investigation is executed and a software architecture diagram is drawn during the design phase of the system to ensure the components can communicate between one another without any impediments. The next objective was to develop the aircraft inventory management system to address the research requirements which has been fulfilled by Aviranta with the inclusion of key features into the system. The next objective was to implement a standalone REST API, the REST API developed using spring boot which contains the business logic can also act as a standalone API where other software could retrieve useful information such as available parts, sales data etc. One key objective was to train the stock forecasting model and use for predictions, as a solution to this the LSTM model is trained with historical data and is used for stock predictions in the inventory management system. The final objective was to deploy the application into the cloud environment, to complete the final objective the components of the Aviantra aircraft inventory management system is hosted in Amazon Web Services, allowing the entire web-application to run in a cloud environment. Having said

that, the research concludes fulfilling all objectives initially planned.

2) Limitations: The Aviantra system is deployed onto a cloud environment where internet connectivity at all time is a must to access the web-application, also it interacts with several other API services which require internet connectivity to work efficiently.

The application is an aircraft inventory management system and it does not carry any sales data of parts, this information must be loaded into the system using a csv file from other systems used in the industry to manage sales information. The initial plan to load this historical sales data into the Aviantra application was to provide a user interface to upload the csv file, However this was unable to be implemented in the system , therefore the data must be pre-loaded into the environment during installation by an IT admin, this is a limitation which needs to be addressed for better user experience.

Angular supports latest browsers, therefore older mobile devices with non-updatable browsers will not support this application, therefore hardware upgrade is also necessary.

IV. CONCLUSION & FUTURE WORK

A. *Conclusion*

Aviation industries have an exponential growth in number of passengers travelling every year, therefore airlines are often purchasing new aircrafts. Maintenance operations increase with new aircraft coming in, therefore efficiently managing the inventory that comes in and out of the maintenance operation is quite challenging to Aviation industries. To overcomes this issue a proper aircraft inventory management system is needed.

Like aviation industries, technology is also improving and getting cheaper. In this project an aircraft inventory management system is implemented with features using of modern advanced deep learning techniques to forecast inventory stock. The project began with gathering requirements from experts from the aviation domain and analyzed to provide an effective solution to mitigate the problems. To properly plan and manage the project the most popular robust agile methodology is chosen to add value to the project. The initial design phase was carried out to lay out the user requirements in the form of use case diagrams, process models and use case diagrams along with it the technical architecture was put down as well. The focus of the project was the stock forecasting system using LSTM algorithm, alongside other features such as baseline configuration and mobile picking. The development of the features was done in an iterative method. Coming to the end the system was tested by an expert technician from SriLankan Airlines and the feedbacks were evaluated. The overall objectives of the project are fulfilled. What signifies Aviantra from other aircraft inventory management systems is its ability to forecast inventory stock. Finally, the evaluation of the system concludes that Avianta is highly effective in use.

B. *Future Work*

A full-fledged inventory management system contains many features like fault management, warranty management, change ownership feature etc. However, Aviantra focuses mainly on three major features in this phase, which are the baseline configuration, part request and mobile pick, and the significant stock forecasting feature. The rest of the standard features mentioned can be developed as future enhancements.

In this research seasonality and trends are not considered when training the LSTM algorithm, as a future work these attributes can also be used to train the model for seasonality and trend variations, to provide more business value to the airline industry.

Currently the historical data which is retrieved from systems used to manage sales of an airline should be pre-loaded into the inventory management system during installation, this is a drawback to this system which should be improved in the future by allowing the user to load the csv data containing the historical data from the user interface itself.

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Apex: Next Generation Smart Helmet with Artificial Intelligence

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Abstract **- Helmet has been always associated with bike riding since the invention of motorcycle. However, it has always been about protecting riders head in event of a crash. In essence it is a plastic or metal shell shaped for human head, padded inside with some material for increased comfort. Till now it has remains as simple yet functional apparatus. Here goal was to create a smart helmet that integrate with the bike itself to create a multipurpose, sophisticated device that assists the driver in his task without being a distraction. It contains heads-up display that relay useful information to the driver, various sensors that constantly monitor driver and surround area, companion app that contain various extended features and integration with the bike. Also, machine learning has been integrated into the system which in turn enrich the data supply. Research was aimed at bringing common drive aid features on motor vehicles such as lane departure warning, to a smaller platform that can be integrated into the helmet without losing its core functionality or performance.**

Index Terms **- Smart Helmet, Machine Learning, IoT, Android, Arduino, Automatic annotation, Deep learning, Object Classification, Object Detection, Lane Detection, and Object Tracking**

I. INTRODUCTION

Today, motorcycle is a very common mode of transport for individual riders. Motorcycle gives the freedom and flexibility for the riders to move anywhere they want and at any time. Riders do not have to be dependent on the public transportation services, which in many cities and countries are extremely unreliable. A motorcyclist's helmet, also called safety helmet, acts as a protective headgear to prevents any fatal head injury.

Rapid increase in motorcycle usage has led to significant increase in the motorcycle related accidents and fatalities. This has resulted in motorcycle riders being among the most vulnerable road users on roads as they have lack of protection in case of crash. The number of registered motorcycles in Sri Lanka in year 2016 was 3,699,630 which is 55% of the total registered vehicle population for the year [1]. From 2012 to 2016, the number of registered motorcycles increased by 45% with the growth rate of 11% per year, which shows the significant growth of motorcycle population in the country. There are 355 motorcycles per 1,000 households and 911 per 10,000 population available in Sri Lanka [2]. As the number of motorcycles increase so does the probability of their being involve in crashes also increases.

Helmets for riders are extremely important and many lives can be saved by the use of these Helmets in the event of accidents. Motorcyclists have a perception that wearing a helmet causes discomfort and they do not appreciate its importance, especially the youth. Perhaps the most misleading idea is that short trips do not involve any risk. Smart helmet helps the driver by supplying him with useful information and ensuring that he can be arrived at the destination safely. Larger vehicles contain driver aid features that helps toward safer driving experience. However, on two-wheelers there has been no attempt at implementing these features. One aspect this will focus on will be bringing these features to smaller vehicle without losing functionality or usefulness.

Scope of this research was to create a smart helmet that also integrate with the bike to create a multipurpose, sophisticated device that assists the driver in his task without being a distraction. It will have heads-up display that will relay useful information to the driver, various sensors constantly monitor driver and surround area, companion app that contain various extended features and integration with the bike.

A. *Benefits*

Benefits of "Apex: Next Generation Smart Helmet with Artificial Intelligence" System :

- ✓ Can track alertness level of the driver
- ✓ Can show navigation information on HUD
- ✓ Can aid in detecting traffic signs, traffic lights and speed limits
- ✓ Can take necessary actions if driver is falling sleep.
- ✓ Wake up driver by vibrations of a small motor.
- ✓ Can detect if driver is drunk or not.

- ✓ Can prevent bike from starting if driver is not in a suitable condition to drive.
- ✓ Can detect air quality, temperature and humidity in surrounding environment.
- ✓ Companion application can be used to extend features.

B. *Objectives and Goals*

Objectives and Goals of "Apex: Next Generation Smart Helmet with Artificial Intelligence" System :

- ✓ To transform an ordinary helmet to a feature rich, more usable, sophisticated device.
- ✓ Encourage helmet waring by make it more usable.
- ✓ To bringing features that are only available in larger vehicles to small scale in more user-friendly package.
- ✓ Keep price point low.

II. Literature Review

Helmet has been always associated with bike riding since the invention of motorcycle. But it has always been about protecting riders head in event of a crash. In essence it is a plastic or metal shell shaped for human head, padded inside with some material for increased comfort.

Functionality of the helmet always remained the same. But throughout the times there has been attempts at changing this simple yet functional device to a multipurpose, sophisticated device. Most of the attempts were made at monitoring wearer's vitals and act accordingly and supply rider with information which can be hard to access while riding a motorcycle. This section explains various undertaking that were done to improve helmet's status and usability while also remain a useful and approachable apparatus.

A. *Similar Applications*

There have been few attempts at implementing a fully functional, commercial smart helmet for masses. Frontrunners for this are LiveMap[3], CrossHelmet[4], Jarvish[5] and Skully[6]. One important thing is that all of these are still in development stage. Not even one of them has been made available to the public. All of these products are funded through crowdfunding platforms and one can pre-order them without knowing when they will be available if ever.

All of them have usual features like head-up display, sound control, rear-view camera, safety light, touch panel for operation and connectivity options. These were implemented at very basic level and only as a proof of concept since none of them has been released to the market. With this it is safe to assume that all these products are in very early development stage and possibility of coming to the market is very slim. Even if they came to the market it will be hard to deliver all the promised features. Another point is price. All these products are priced between $499 - $1500. Which is very high price for such a device specially for country like Sri Lanka. Proposed research is focused on integrating all these features and more into one integrated system that is more affordable and more accessible to the end user.

B. *Deep Learning Based Automatic Video Annotation*

Machine learning based video annotation tools are essential in building driver information systems. Through these processes it is possible to annotate and identify surroundings objects and inform and warn user about them.

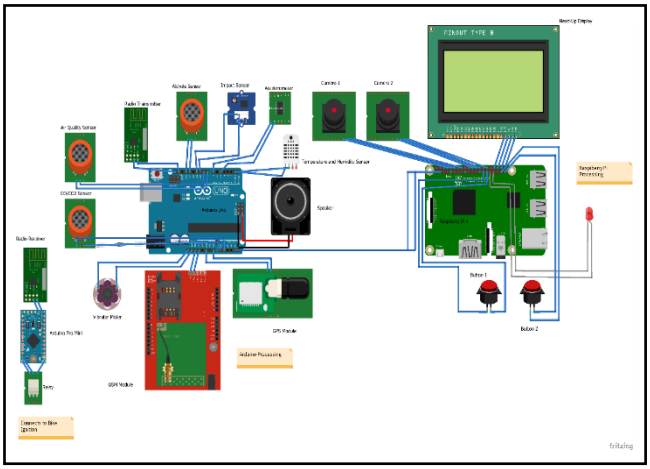

Figure -24 - Architecture Diagram

Manikandan et al. [7] compare and contrast which are the best algorithms for video annotation and also compare it to the full manual - done by humans by hand - process. In deep learning-based video annotation object detection, object classification, lane detection, and object tracking are considered to be the crucial modules.

In object detection, algorithm detect object as vehicles, two-wheelers, and pedestrians. If the detected object is a vehicle it further classifies it as car, bus, truck, other-vehicle, and non-descript. For the object detection YOLO and Retinant-50 were used.

With this model it is possible to detect objects, classify them in to their respective categories and also detect lane markings. Using this method is faster and more accurate than manual method which researchers also tried. But disadvantages can be

taken as it can be very resource intensive and impractical to implement with real-time data.

C. *Anti-theft System*

Agarwal et al. [17] have laid emphasis on the security of the two-wheeler and the rider. A prototype system is being proposed in which provides more security to two-wheeler systems with the help of biometrics system. This has been ensured by providing two layers of anti-theft protection. First access to the vehicle is limited only to authorized personals and at the time of entry person's fingerprints are cross checked with an authorized list. The second layer of protection is consisting of GSM (Global System for Mobile Communication) technology which sends SMS (Short Message services) to the owner in case of anomaly. If vehicle was moved without owner's prior knowledge, the current location of the vehicle is tracked by a GPS tracker. Then owner can track it through SMS and take appropriate actions. The system also consists of a rider safety system ensuring that the vehicle cannot be started if the driver is drunk or not wearing a helmet.

D. *Reduce Drunk Driving*

Reddy et al. [10] have laid emphasis on reducing the number of accidents caused by the carelessness of the riders such as driving in a drunken condition or not wearing a helmet while riding. The authors have tried to implement a system which does not allow operation when intoxicated and make it mandatory to wear a helmet while riding. A system is proposed which is an intelligent two-wheeler ignition system with an additional intelligent helmet for the safety of the rider. First access to the vehicle is limited only to authorized personals and at the time of entry person's fingerprints are cross checked with an authorized list. A module on the helmet synchronizes with a module fixed on the vehicle's ignition and if the rider is not wearing the helmed while turning on the ignition, vehicle will not be started.

III. METHODOLOGY

A. *System Design*

System consists of a helmet containing control modules, two cameras, a screen, and various sensors, control unit which fitted to the motorcycle that in charge of ignition and companion mobile application which extends various functionalities. In figure 3.1, block diagram demonstrates the overall architecture of the system.

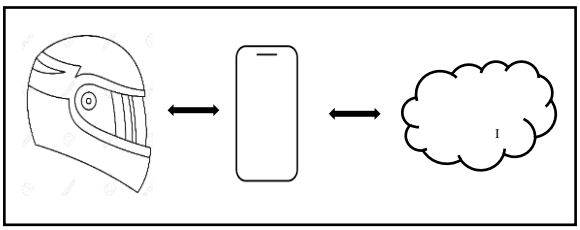

Figure 0-25 - Block Diagram

Figure 3.2 shows first part of the circuit. .This part contains a screen and two cameras which is controlled by raspberry pi. Screen is used as a heads-us display which relay various useful information to the rider throughout the ride. System contains two cameras, one is aimed toward oncoming traffic tasked with aid in driver-aid features and other one is aimed toward riders' eye tasked with detecting rider's alertness level. Two buttons are used for interacting with the screen and, LED acts as status light.

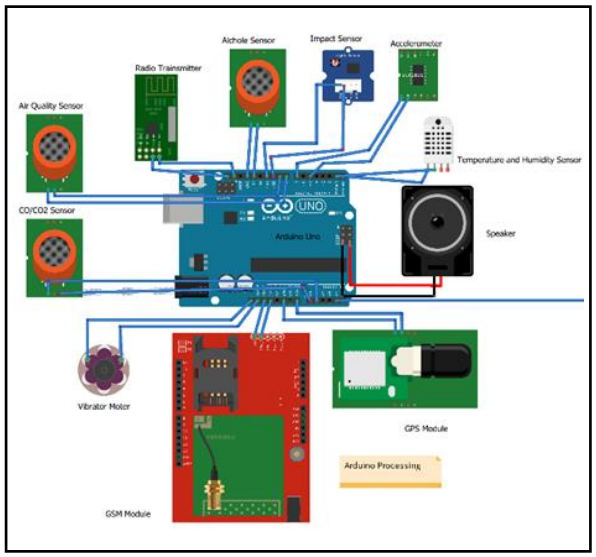

Figure 0-26 - Architecture Diagram - Arduino

Figure 3.3 shows second part. .This part contains arduino as controller unit and, other sensors and equipments getting controlled by it.

- ✓ Arduino Uno act as the main controller for sensors.
- ✓ Accelerometer and Impact sensor task with detection of falling and impact forces.
- ✓ Alcohol sensor tasked with continuously measuring rider's alcohol level.
- ✓ Small speaker act as a hearing aid for the rider.

- ✓ Temperature and Humidity sensors for continuously measuring ambient temperature and humidity both inside and outside the helmet.
- ✓ GPS module for continuously tracking current location.
- ✓ Air quality sensor, CO2 sensor and, CO sensor for tracking air quality in surrounding area.
- ✓ Vibrator motor for wake-up rider if he is falling sleep.
- ✓ Radio transmitter for connecting with ignition control unit.

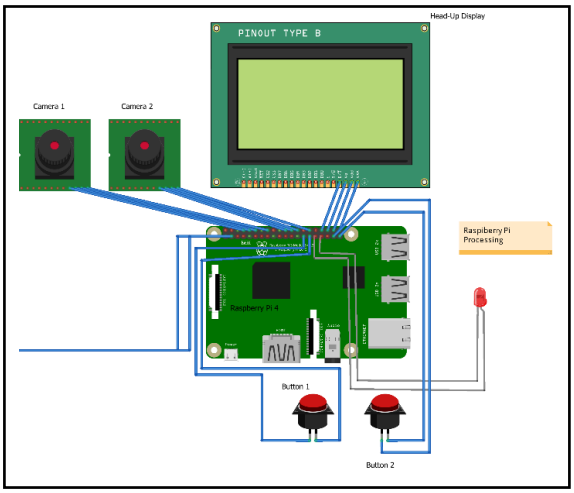

Figure 0-27 - Architecture Diagram - Raspberry Pi

Figure 3.4 shows last part of the circuit. This is the part that is fitted to the motorcycle. This controls the ignition. This communicate with main system through radio transmission.

- ✓ Arduino Pro Mini acts as controller unit for ignition control unit which is connect to bike ignition and communicate wireless with main unit. Task of this unit is to cut-off ignition if driver is too drunk to drive.
- ✓ Radio receiver is tasked with maintaining contact with main unit.
- ✓ Relay is directly connected to ignition.

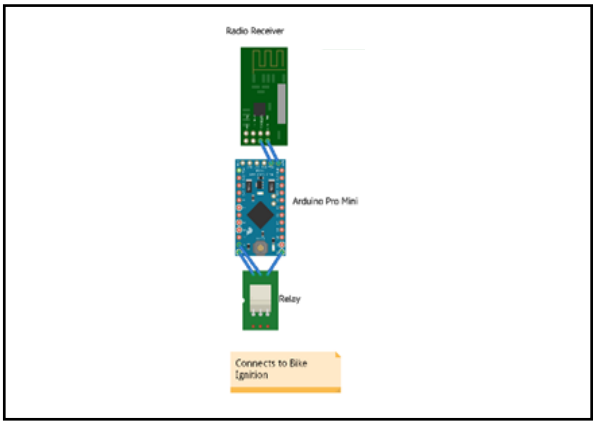

Figure 0-29 - Architecture Diagram - Arduino Pro Mini

B. *Interface Design*

First interface (Figure 3.5) appears when the user opens the application and logged in successfully. This interface is responsible for showing navigation information and weather conditions along the way.

User first enters their intended destination and then most optimal route from user's current location to their destination is shown in the map. Optimal route is calculated based on the traffic conditions and weather forecast. Also, when

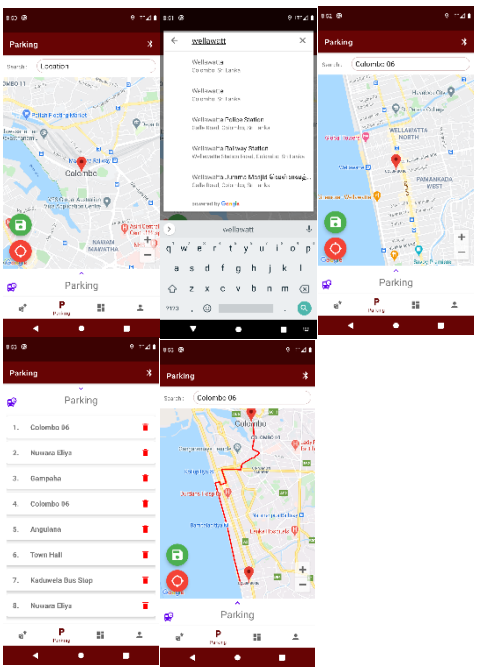

Figure 0-28 - Interfaces - Parking

user entering their destination automatic locations suggestions are given based on their current location.

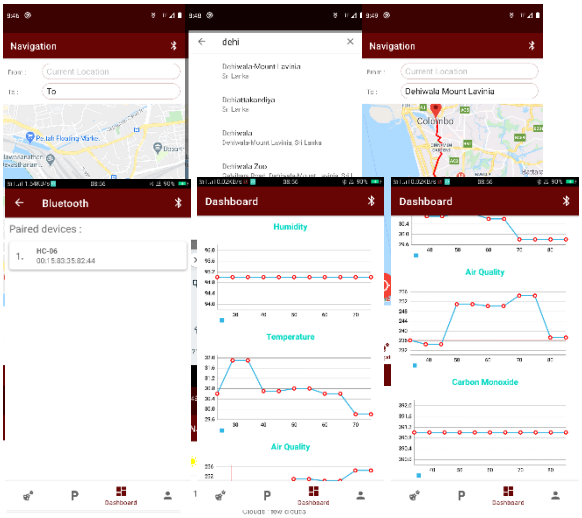

Figure 0-31 - Interfaces - Dashboard

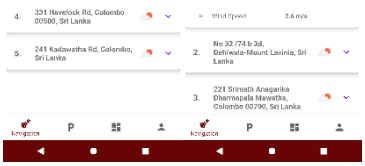

Figure 0-30 - Interface - Navigation

On the bottom of the screen there is a bottom sheet that can be slide up. In this panel weather information for five location which represents whole route weather details are shown. When clicked on one of the list items more details about that particular location is reveled.

Second screen (Figure 3.6) is responsible for handling parking location details. Parking location can be saved and later recalled from the bottom menu.

Third screen (Figure 3.7) is devoted to dashboard. Connection with the helmet can be initiated by clicking on the Bluetooth button on the top upper corner. Here it shows list of all the Bluetooth devices currently connected to the smartphone. When clicked on one of the listed devices, connection is initiated. Then in the dashboard screen real-time data collected from the sensors in the helmet are shown in graph. There are four data streams. Humidity, Temperature, Air Quality and Carbon Monoxide Level. Also, warnings are shown if Carbon Monoxide level or Air Quality level went above dangerous level.

C. *System integration*

- ✓ Software and hardware integration
- ✓ Unit testing
- ✓ Testing methodology

IV. Results & Discussion

A. *Accuracy rate and reasons*

The accuracy and the reliability of the system are expected to be at the utmost level due to the reason that the system as a whole was unit tested early in development stages in order to pinpoint and spot any kind of complications that could occur in the system. The team had to tackle a few problems, in particular, earlier on the designing phase. The complications being:

Figure 0-32 - End Product

1. How the android application is connected with the helmet?

The android application is connected with the robot via Bluetooth. No communication between the application and the robot can be conducted without it.

2. How to determine which locations are selected for showing weather details?

Five to eight locations are selected based on the selected route to represent the weather conditions along the way.

3. Calculate the most optimal route?

Most optimal path between locations are calculated based on weather conditions and traffic situation.

4. Communication system between helmet and android application

Communication between helmet and android smartphone is done through Bluetooth. Every message is sent with an identifiable character followed by the actual message. This way both devices can identify what the message actually about.

5. Communication between helmet and motorcycle

Communication between helmet and motorcycle is done through RF communication. Devices get connected with each other when they are nearby starts the communication process.

V. Conclusion

Helmet has been always associated with bike riding since the invention of motorcycle. However, till now it has remains as simple yet functional apparatus. Here the goal was to create a smart helmet that integrate with the bike itself to create a multipurpose, sophisticated device that assists the driver in his/her task without being a distraction. It contains heads-up display that relay useful information to the driver, various sensors constantly monitor driver and surround area, companion app that contain various extended features and integration with the bike. Also, machine learning has been integrated into the system which in turn enrich the data supply. Also, it was aimed at bringing now common drive aid features on motor vehicles such as lane departure warning, to a smaller platform that can be integrated into the helmet without losing functionality or performance.

System was developed which has embedded systems which will monitor whether the rider is wearing a helmet and if the rider has consumed alcohol. In either of the cases the bike would not start and the rider would not be able to use it. This is a preventive method to reduce accidents and fatalities on the road. This system also has a mechanism which will send a message and the location of the bike to the family members of the bike rider in the unfortunate event of an accident. This will help in providing timely help to the rider and reduce the fatalities. Through the smart helmet, the data of acceleration sensor, ultrasonic sensor, and carbon monoxide sensor were collected, and the data were analyzed to detect the specific situations.

VI. Limitations

The limitations of the current system as follows, An android device is essential to run the application. As such, user(s) must have an android device to install and run the application. Internet connection should present at all times due to the fact the android application is connected to database via internet. Also, for map related items to work, internet connection is necessary. Without an interconnection loss of transmission would occur resulting in the overall system not working. Due to the system being powered with a battery unit it is essential that the battery is recharged regularly. Lack of battery would result in system not working. Also, system running time is short due to battery limitations. Hardware components being overheat would result in system failure.

VII. Future Works

The future work for the current system as follows, To make circuit more simple, small and efficient. Next iteration will be on the flexible PCB so as to perfectly adjust the circuit inside the helmet and ultimately get a fully furnished complete market ready product. Next iteration will standardize the data by collecting and analyzing various data through more complex experimental tests.

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DID-Damsel in Distress Safety App

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***Abstract*-This research relates to an android application where the main purpose is to create a safe environment for the women who are in need of help. The uniqueness of this system is, when the user is in a harmful situation the user can take a SOS call and the current GPS location of the user to the guardian and also if the user is in a harm or has faced a trouble the system will provide direction to the nearest police station or to the nearest hospital. And there is a function which is, where the user can select an option to start counting the footstep and if the footstep starts to increase and the application will detect the frequency of the increment of the foot step and ask if the user is facing a harmful full situation if the user click on yes a SOS call and the current location will be sent to the guardian. And another major problem is to be unsafe is unknowingness of the people and about the area, this system has another feature where to mark the most popular crime areas related to harassment and notify the user when they enter the area. Damsel in Distress will provide a safe environment to the user.**

***Keywords*: Safe environment, SOS, GPS location, Direction, Harassment, Alert**

I. INTRODUCTION

Safety is a major question to the women in our society now a days. Women are being abused and harassed in many ways now a days. And there are harassed in many ways by verbal like derogatory comments, request for sexual favors and offensive jokes and by non-verbal like staring, throwing kisses and winking. And by Visual, it means by drawing offensive pictures photos. And the most common and most done around the world is the physical sexual abuse or harassment.

Women are being abused almost anywhere and there is no age limit in that. In schools and when you use the public transportation or it can be in a workplace or in the university it can happen. The normal procedure is to call the police and some women are shy to tell about it or they are scared to take an action

According to the police division island-wide from 2012 to 15th January 2020 that 11,998 incidents of rape, 4,806 of serious sexual abuse and 5,891 of child abuse were reported. And for the first 15 days of 2020 there has been 78 incidents of rape, 21 of serious sexual abuse and 34 child abuse cases.

A study was contacted by the United Nation Population Fund (UNFPA) in 2017 confirm that 90% of women in Sri Lanka have experienced sexual harassment in public transportation. And a study which included 2,500 individuals between ages of 15 and 35, stated that woman report experiencing abuse and harassment widely in transportation services, verbal and unwelcome abuse, but more likely physical abuse. It is estimated that 35% women worldwide have experienced physical and/or sexual violence by their partners or by a stranger at least once in their lifetime.

As a solution to the above-mentioned reasons, designing and implementing an android application will help the user to be safe and be aware in the surrounding area which is not safe. And also it will help the user to inform their guardian if any trouble occurs by from just a click. And to navigate themselves to the nearest hospital or to the nearest police station. Through this application the user will always be prepared and will be aware of the surrounding which is very important in order to be safe.

II. BACKGROUND

A. *SAFE APP*

According to Dr.Sridhar Mandapati and Sravya Pamidi and Sriharitha Ambati a lot of unfortunate situation have taken place when it comes to the safety of women. And problems can come in any direction. Such as when walking on the road after work, when going to the super market or many other reasons for which they go alone. According to the research paper in 2013 there happened an incident which is a gag rape in New Delhi a 23 year old woman was raped in a moving bus. Another incident was taken place in Mumbai in this case of woman who was leaving her native place after Christmas holidays has been kidnapped and killed. According to the researchers in order to overcome such problems faced by women the I Safety (women security app) mobile based application is not only necessary to use but also plays a pivotal role with android software. In the

system the user will be able to add the number of the guardian and send the current location though a SMS and inform the guardian. The system has an option to make a fake call when the user is in an unnecessary conversation and to get off from it [1].

According to Ravi Sekhar Yarrabothu and Bramarambika Thota in today's world people using smart phones have increased rapidly and hence, a Smart phone can be used effectively for personal security or various other security purposes. According to the researchers the uniqueness of the system is to send the current location to a registered number and inform them of user's location [2].

According to Ms. Najme Zehra Naqvi this paper presents the performance of a new step detection algorithm that utilizes the accelerometer of a waist-mounted smartphone. . Nowadays this kind of technology has become more successful rather than we think. Because people always think about their health to move into the real world. Literally in this paper shows that it's easy to combine with the technological world using these exercise measurements. And also this is only a navigation system. Basically in this paper it considers the step counter , that accessing through smart phone .step counting with a smartphone are still challenging due to many different walking behaviors and mobile phone positions .step counting means automatically detecting and counting steps taken by a human . In addition to this paper if the user shakes the phone while the user uses the phone when running or walking it automatically calculates the steps. It is easy to use and maintain and also more user friendly. When counting the steps have to reflect on the starting point and also recognition of each point that the user follows. An algorithm can also be used for estimating the distance. And also sometimes these step counters can be different from one phone to another because of the sensors .The advantage of this paper is to move with new technologies while using this step counter and live healthy [3].

B. *WALKSAFE: COLLEGE CAMPUS SAFETYAPP*

According to Saloni. J.D.Vaghela this paper introduces a location based emergency notification system with the records of past incidents along with the type of emergency with respect to the user's location. This paper considerably says that most of the school children and colleagues are facing such kind of incidents in the United States, and also Seung - Hui Cho shot and killed thirty two students and wounded seventeen others on the campus of Virginia polytechnic institute and state university in Blacksburg on April 16, 2007. After 10 months Steven Kozmierczak killed five and wounded eighteen from a mass shooting that occurred at Northern Illinois University. In 2014 it counted the crimes such as Burglary constituted 42% of crime , motor vehicle theft 9% , arson 2% and sexual of sensors 32%. This paper presents that mass shootings and violence have increased day by day to recognize illegal acts. And also in the campus related crimes. Because of that lots of campus studies are becoming of these incidents majorly. This can affect males and females on these campuses. Some researchers show that some groups, especially elders and women, are more hesitant about crime. Use of mobile technology to notify the campus crimes has increased in the passing years. So that safe lines have been developed. Even the social media apps also used to inform these emergencies that they are facing. Walk safe means that the user of that while using it, it will track the GPS location and show the crimes that are reported on the campus and provide a geographical view of the situation and saying that it is a dangerous area. And also it shows the time and the date of the incident that happened before. The app already keeps details about previous incidents that happen on campus. The advantage of this paper is that people can maintain their safety with this app and can also inform it to another person manually using the app [4].

III. METHODOLOGY

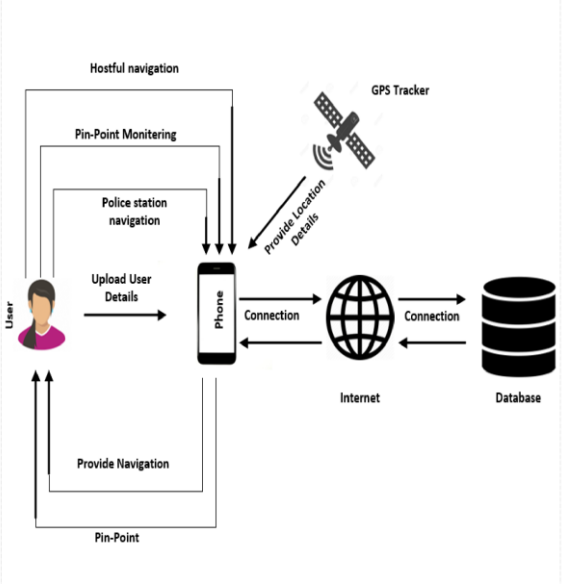
The primary data gathering for the research was done through a questionnaire. The target population for the study was women in the society. Quota sampling is used respectively where quotas of the population is selected to respond to the questionnaires. The analysis of the data gathered reveled as the conclusion of the data gathering the following needs for a "Damsel in Distress safety application" application were highlighted through the responses collected from the survey carried out. According to the responses received on the questionnaire, a considerable number of women have gone through abuse or harassment in public spaces or even at places they would consider safe. Due to the commonness of such abuse or harassment, a need for such an application to help protect women in need of an emergency arises. A majority of 95.8% individuals from the sample preferred to have access to a safety application on the mobile in case of an emergency. According to the data collected, 50.6% of the sample have not sought for help when faced with such a situation. In reference to question 10, 78.6% of the individuals in the sample have not reached out to the Police for help due to several reasons. Majority of the responses have mentioned their fear, shyness to speak up and ask for help, or reluctance due to the long procedure to make a complain to the police. The proposed application addresses such issues through implementing a SOS button to notify the selected guardian with your location other information if user is faced with an emergency, a button to indicate the directions to the closest police station or hospital, and an additional button to educate the user on how to defend themselves if they are faced with such 61.1% of the sample are Android users, 34.7% of the sample are iPhone users and the

rest are windows users. Thus, the proposed application will be developed for Android mobile phones.

IV. DESIGN

A. *Overall Design*

The Damsel in Distress is a safety application which provide a service to the user to handle the unexpected abusive incident which happens to the user. The Damsel In Distress will store the details which the user inputs and when the user is in a trouble and press the SOS button immediately a distress call, message and the GPS location will be sent to the guardian. And also, if the user has faced an unexpected incident and need to find direction the Damsel in Distress- safety Application will full fill the needs of the user in the navigation component in the safety application. The Damsel in Distress will monitor the location of the user and will provide the pinpoints of the abusive places which the user should be alert off.



B. *SOS Function – Algorithm design*

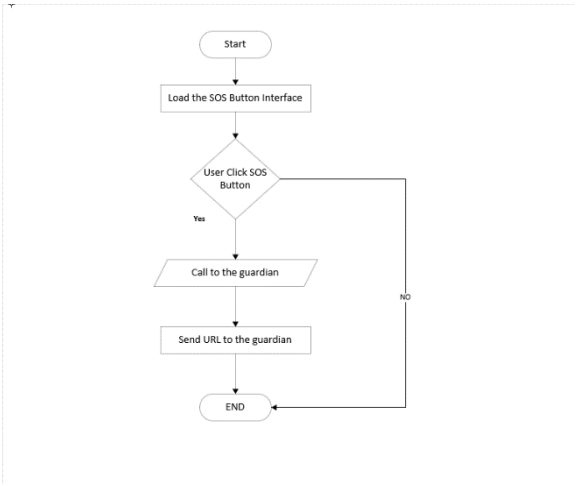


Figure 12 Algorithm design for SOS Button

When user is traveling alone or coming home after work in the night and when the user face a troublesome situation and need to contact the guardian the user is able to do so from one click in the Damsel in Distress by clicking on the SOS button. At the very beginning when the user downloads the safety application from the play store the user needs to enter a guardian's phone number when clicking on the SOS button a call will be taken and SMS with the current location will be sent as a URL to the guardian

C. *Foot Step Count –Algorithm Design*

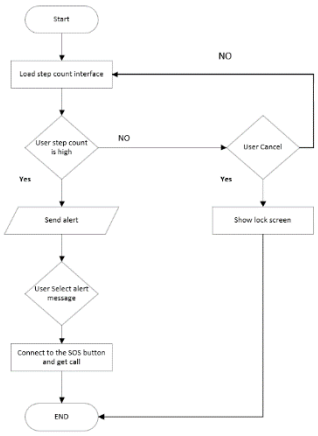


Figure 13 Algorithm design for footstep count

In the Footstep Count function is when the user is followed by some stranger and the user starts running away from it an alter message will pop asking if the user is in a trouble and if the user clicks "yes" a call and SMS will be sent to the guardian

V. RESULTS

A. *SOS - Function*

Figure 1 SOS Call

Figure 2 SOS Call

In the above figure 1 and figure 2 it shows the functionalities when the user clicks on the SOS button where an immediate call and a message will be sent to the guardian from the users phone which includes the GPS location of the user.

B. *Navigation*

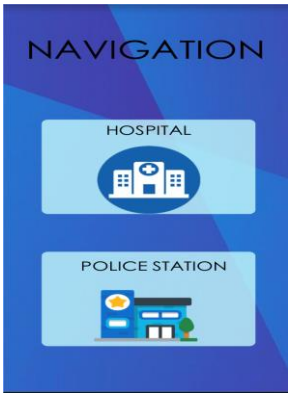


Figure 3 Navigation

Figure 3 will be displayed when the user clicks on the "Navigation" button. When the user needs direction to the nearest hospital or to the nearest police station.

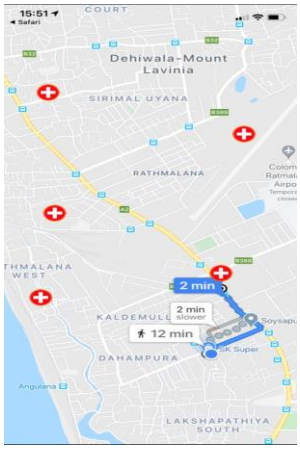


Figure 4 nearby Hospitals

In the above figure 4 shows when the user clicks on the hospital option and how it will be showing and giving direction to the user for the nearest hospital.

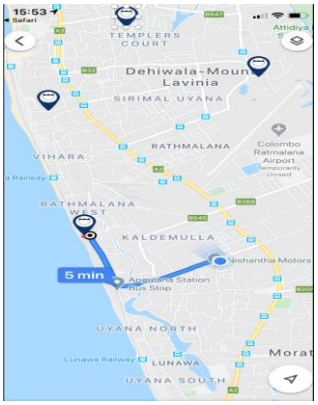


Figure 5 nearby Police station

In the above figure 5 shows when the user clicks on the police station option and how it will be showing and giving direction to the user for the nearest police station.

C. *Foot step counter*

In the above figure 6 shows the interface of the when the user clicks on the "Foot Count Detection" option where it asks permission from the user to "Allow" or "Deny" the functionality. When the user allows the option, it will start counting the users step count and if the user is in trouble and running away from the incident a notification will be popping up to ask if the user in a trouble and need help. When the user taps on the notification a call and a message will be sent to the guardian.

Figure 6 Footstep count

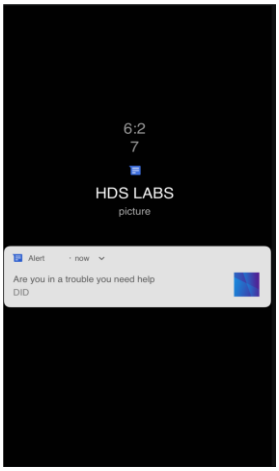


Figure 7 Notification

D. *Pin-point Monitoring*

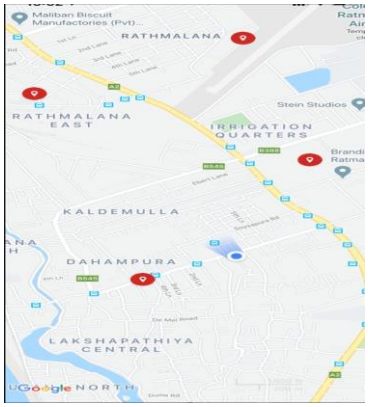


Figure 8 Pin Point Monitoring

In above figure 8 interface it shows when the user clicks on the "Pinpoint Monitoring" It will be providing the user pinpoints of abusive and areas to be alert to be careful which is to the user's current location.

VI. EVALUATION

After the completion of the implementations, the Step count functionality was evaluated under real situation. The evaluation criterion was same person using the application in different speeds. Recorded the actual counts of foot step per second to evaluate the output generated by the application. Table 1 lists the recorded result of the study.

TABLE 1
FIRST USER

User	Step Per second	Actual Number of steps	Expected	Actual Result
1	3	5	Not Running	Not Running
2	7	8	Running	Running
3	2	2	Not Running	Running

According to the results listed in the Table 2 it could be clearly seen that the foot step counting algorithm runs with much higher accuracy where under each evaluation session the algorithm generated the expected result.

The second evaluation setting was using the same parameters as the setting 1, with a change of the user. Three different users were selected for the evaluation to check the accuracy of the algorithm. According the results listed under Table 2, it is clearly visible that the algorithm generates the expected result.

TABLE 2
SECOND USER

User	Step Per second	Actual Number of steps	Expected	Actual Result
1	3	4	Not Running	Not Running
2	5	7	Running	Running
3	6	6	Running	Running

VII. CONCLUTION

When you're in are traveling alone anywhere in the society now a days many face different type of problems. The main goal is to provide to the user and kept them informed about their surroundings.

A treat can come to anyone at any unexpected time and we might not be able to inform our love ones on time and inform them our current location. When such incident occurs by

clicking on the SOS button an immediate call and a SMS will be sent to the love ones the current location with the URL. More often women are being followed by Sangers in many occasions and when the user starts to run by measuring the footstep and it's frequency an alter message will be popped asking if "Are you in a Trouble Do you need help" if the user selects "yes" then an immediate call will be taken and the location will be sent as a message. Another important is to know the direction when you have faced a troublesome situation by selecting the navigation the user will be directed to the nearest police station and to the nearest hospital. In the Pin point monitoring option the user will be notified by when they enter to a dangerous area by sending an alert message. It is very important to know how to defend yourself in the motivation feature the users will thought how to do by demonstration of self-defense techniques.

VIII. LIMITATIONS AND FUTURE WORK

There are few limitations in the Damsel in Distress mobile based safety application.

- When the user is facing a life threatening situation without accessing the phone the user will not be able do any functionalities.
- When the user is not connected to the internet or have mobile data the user will not be able to access the functionalities.
- When the user is in a trouble and try to reach the guardian and if the guardian does not pick up the phone the user will be facing a huge problem.

This application can be further modified with other new extra features addressing few limitations. Research team has identified few areas which might attract potential researches in near future.

- To develop a Voice command system to make calls and to give commands.
- To make a button to call 119 or to an ambulance
- To build an option to contact to a call center when the guardian does not answer the mobile phone.

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Expenses Handling and Budget Planning Android Mobile Application

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Abstract— Today's the most frequent question among the humans are "How can we maintain or manage money",how ever it is not that much of complicated problem. Due to the fact financial administration is the key to that problem. The Other main question is "How can we saving money". The majority of the countries are developing countries and many of them are middle-class people and those people face common financial troubles in there course of their lives. The major reason is those people have an awful lot less understanding of monetary administration for a proper investment. Details of the income and expenses are key to success and keep away from economic issues. This research is aimed to determine the monetary troubles and grant ideal facts-based solutions in the path of issues. This mobile application would perhaps be very beneficial to those people who face financial problems in their life. As a solution, this task offers a lot of overall performance to overcome these matters. Nowadays most of them are used smart-phones and applications are developed beneath the android platform as a budget assistant. The system consists of six major performances consisting of a individual, family ,event , record profits and expenses, notifications, and history. The most fundamental characteristic among these functionalities is the budgeting process. To enhance the finances method a new algorithm was once developed and the fire-base database was used as records storage. However, it used to be once a huge task to extend new functions for financial management. It is indispensable to do trials and testing as soon as the system is developed and for that special testing methods had been used such as unit testing, acceptance testing, usability testing, and integration testing. After the checking out section identified key issues of the system via wondering about feedback's from the clients and experts tend to make some changes to improve this gadget higher accurately. The main goal of this project is to help the community address new financial challenges and provide IT support to address financial challenges.

Index Terms- Budget friend (BD), Android application(AA), Service Oriented Architecture (SOA)

I. I.INTRODUCTION

The idea of this mission used to be born at the same time as inspecting an article on the newspaper and, the article turns into in reality referred to that the root purpose for most of the monetary troubles rose due to lack of know-how in monetary management. Hence this publication focuses to make particular interest in budgeting and administration experience a quantity of the people. Development of the technological know-how has influenced the growth of people wishes and people's expenses have grown up dramatically. Compared to a decade ago, the fee of dwelling has been increased day by using day. Money makes a important position in people lives and there can't survive without money. Money offers the energy to be self-dependent and peoples can fulfill their aspirations on their own. Money is the key to restore peoples' monetary complications. Money administration helps to gain lengthy time period dreams and approves humans to stay except stress even with much less salary. Notebook and the worksheet have been used to manipulate cash waft on many events so some distance then again now a day's most of them used to have a smartphones with the improvement of the technology.

There are many who earn a lot of cash however negative in managing their money. As a end result of poor cash management people confronted challenging troubles throughout their life. The essential weakness of the people is a lack of consciousness of economic administration and inadequate document keeping. In many cases, humans don't have a clear thought about how ought to they spend cash on a particular event. Other than these weaknesses humans are no longer keeping data of earnings and expenses for similarly evaluation inside a particular time period. Not solely that, most have to pay some pre-defined repayments on constant dates however regularly overlook to pay on or earlier than the constant date. These are the principal problems of the chosen subject matter and answer is given to overcome the problems. The purpose of this project is to identify an existing application for cost management and planning. Second is the development of an algorithm for managing expenses according to user income and other obligations. The third is to develop an algorithm for proposing future plans in terms of revenue and expenditure and finally an Android application for predicting future expenditure based on current expenditure.

This research paper gives a whole description of the "Budget Friend Android application".First Section of the this paper describes introduction of the research, research problem to be addressed, research questions, research objectives, scope of research and research contribution and structure of paper. Second Section offers a literature review of the system. Background context and This is the major section of the document. This describes literature related to the research problem. It addresses the literature and research findings with an explanation of the research gap.

II. .BACKGROUND

At a time of huge advancement to the human race where we have gained a vast pool of knowledge, engineered many solutions to many problems and at a time of better quality of life for each individual as compared to the 18th century we still face the issue of handling our most important asset - money. It is generally said money cannot buy happiness and while that is generally true, mishandling of it can lead to unhappiness, worrisome and bother. At a time of never before reached technoigical peak like this, it is only natural to propose a mobile application dedicated to aid the smart use and handling of finances to govern the way for a better life. Below mentioned will be related research papers and projects that studied .

Expenses Tracker delineates the utilization of income and expenses tracking system, the appearance of their system and how it records income and expenses[1].The income and expenses tracking system is used to manage out income and expenses on a daily basis or a custom set time. The application in question uses a trivial message storing method combined with a reminder to notify on a set date. It has a set purpose to assist with making a note of things the user has to do at a set date.

Intelligent Online Budget Tracker is a working online budget tracker [2].This system will help track and plan ordinary domestic budget issues[3]. Each user of the system is able to access the system securely from anywhere and real-time via the Internet. It can also provide analyzing functions by using graphs and charts and finally predicting future budgets or even issues like the possibility of bankruptcy.

*Expenses tracking system's development proces*s help derive a better understanding of current techniques and tools for Budget Friend (BD) mobile application [4]. It explains about web service and architecture of the application using Unified Modeling Language diagrams. The mobile application is completed based on Service Oriented Architecture (SOA) where Android Phones are used as clients. The goal of this project is to show features, design and architecture via supporting Google Android Mobile platform.

Background of problems identification about maintain budgeting [5]. It means importance of having saving goals, general education, financial knowledge, time orientation and financial situation. Mental budgeting is also positively associated with having an overview of expenses and current accounts, and household financial management. Budgeting varies from one family to another according to this document but it is the best way to reach financial goals.

The event budget website shines light about event planning and provides details about event budgets [6]. It talks about the importance of financial control of an event, adjustment of the event, budget and basic event budget rules among other things.

Expenses tracker mobile application highlights the limitations of the new product, issues faced and the solutions to these problems [7]. This application is a full detailed expenses tracker tool that will help to track expenses and cut down on unrequited expenses. It mainly focuses on IOS users and display application's interfaces with functionality of each section. Even though my mobile application is targeted towards phones using Android Operating System it still provides invaluable knowledge about expenses tracking process.

Budgeting system in the strategic management accounting talks of the budgeting process and the problems with budget implementing at the industrial enterprises of Kazakhstan and suggested ways of solving the issues [8]. It also investigates the direction of development of budgeting along with identifying problems and solutions.

Importance of budgeting tells how to plan a budget, reviewing overall progress, achieving goals and how to avoid financial troubles [9].

Algorithm Designs shows three important characteristics of data structures [10]. Firstly, there is a strong emphasis on the relationship between data structures and their algorithms, including the complexity of analyzing algorithms. Secondly, data structures are shown to be object-oriented setting in accordance with the current design and implementation criterion. Specifically, the information-hiding principle to further capture and decomposition is stressed.

A. *Research Ga*

As a conclusion of the literature review, it is convenient to come up with a evaluation between existing systems and the proposed system. The new system gives a higher possibility to get some clear concept about the research gap. Following is the evaluation of the current structures and proposed system.

1) Product Perspective

A. Can record profits and expenses.
B. Display history of earnings and expenses
C. Calculate whole earnings and expenses.
D. Produce price range format for individual person, family and event.
E. Budget plan accordance to allocated amount which consist of precise quantity for every fees type.
F. When allocated amount exceeds from the budget amount all the calculation will be displayed.
G. Provide reminder facility with pop up notices .
H. Show pie chart view what are the most useless habits and things.
I. Can have a good idea about future plans with your current saving amount.

Names of the Systems	A	B	C	D	E	F	G	H	I	J
I. Technology budget manager for mobile employees.	✓	✓	✓	✗	✗	✗	✗	✗	✗	✗
II. Income and Expense Tracker.	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
III. Easy App for Expense Manager Using Android.	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗
IV. Expense Manager Mobile Application	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
V. Family Expense Manager Application in Android.	✓	✓	✓	✓	✓	✗	✗	✗	✗	✗
VI. Handling Employee Expenses.	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗
VII. Budget Plan to Manage Income and Expenses in College Students.	✓	✓	✓	✓	✗	✗	✗	✗	✗	✗
VIII. Budget planning	✓	✓	✓	✓	✓	✓	✗	✗	✗	✗
BUDGET FRIEND (Expenses handling & Budget planning mobile application)	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓

Figure 1: Product Perspective

III. METHODOLOGY

In developing this Android application(AA), has used the prototype methodology as the software program life cycle model.When the data analyzing used googel form and have some interview with people.This model gives me flexibility in design. Errors are very easily noticed. It is a prototype that flows very easily to find lost functionality. There is one for improvement, which means that The methodology includes the strategies and approaches, the steps had taken in the method of develop the application.

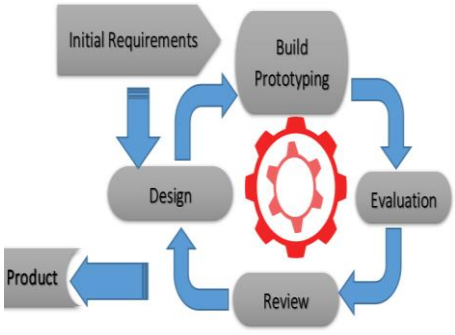

Fig. 2. Prototype methodology

A. *Planning*

Project planning is an extensive concept to be an essential contributor to task success. If the planning is terrible it may also lead to a failed undertaking and if the planning is exceptional usually lead to a successful project. However, the planning segment makes the most necessary task in this project implementation. After the evaluation of the task background, an initial project format was once made to estimate the time duration. Many difficulties encountered at some stage in the planning phase such as useful resource management, project allocation with the right time duration, and missing some key activities. It is key to become aware of all the workable problems at the planning stage in order to meet the expected results. As a solution, it used to be determined to create task design as nicely as make a motion plan using a Gantt chart.

During the planning phase, many features of the task will be covered such as describing the advantageous impacts to the project implementation, gathering findings, and sources to apply to the Budget Friend (BF) Android application. Planning - Initial Stage of the Project At this stage, the budget friend completed, and the problem is determined by the correct search. Another search is now underway to select the available comparable options.

B. *Analysis*

As mentioned in researcher theory, can authenticate that most financial problems are caused by poor money management. Since then, it has been common to find answers to financial problems, in addition to methods and experiments. As if it did not support the adoption of this theory. During this project, faced many challenges and made previous attempts to overcome these challenges. However, these challenges help me to improve my attitudes and skills and improve my knowledge of how to deal with price ranges and how to deal with problems. At the beginning of the ventures, it was very difficult to do this job due to few exits, but it may be a great experience for future operators. Anyway, one of the most valuable things learned from this mission was working hard, and it leads to anything we need. Finally, throughout this application “Budget friend ”, set up something unique for financial management, which made me happy.

The requirements had been accrued and analyzed in the second step of the prototype lifestyles cycle model. In this case, some steps are taken to recognize them. Conditions are summarized in three main ways;

- Questionnaires
- Interviews
- Studying the current systems that have .

The Google Forms Requirement Questionnaire and Result Results are set out in Appendix C, and many of the financial difficulties that come with administrative management skills are

that their requirements cannot be accurately identified. Budgeting and Record Income and Expenditure are the best way to keep these things at bay. People are accustomed to a variety of traditional and modern methods of financial management and budgeting. Nowadays, many people have a tendency to manipulate their earnings and fees using smart-phone objectives. So because of the budget Freud bones it will also help middle class people as an Android app. In Budget Friend some details can be updated / added to new ones Some parts can be removed due to unforeseen reasons. As we run the project, these additions / updates / deletions will be shown in the final document.

C. *Design*

In the Budget Friend, the design phase team will format the user interface of the android application. All the data with grasp to the system hardware and the functionalities ought to be received by using this phase. The system model and strategies will be selected. Then the subsequent step will be to justify the gathered requirements accompanied by way of producing diagrams to visualize the layout of a system. Finally, the format will be produced. During software architecture, a appropriate programming language and database are identified. The closing design will be examined with the aid of a prototype.

Fig. 3. High Level Architecture

Software architecture used to be helped to this project because it used to be a described structured solution to meet all the technical and operational requirements whilst optimizing the frequent first-rate attributes like overall performance and security. This software program architecture diagram helped in special methods to address the requirement of the various stockholders and provide each functional and best requirement. Unfortunately, the architecture plan can also consist of some drawbacks. The following sketch demonstrates the thought in the back of the software program architecture of the mobile application and this concept was used for the proposed application .

System diagram is a great way to create a Budget Friend . Technology helps to map the structure of a demo system. It

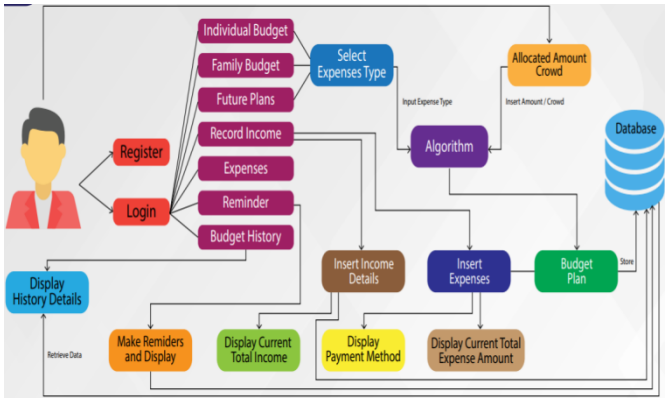

Fig. 4. System Diagram

introduces key factors and metrics and helps you calculate the relationship well.Acceding to the above System diagrams is about the full system and the flow that the system going on first user have the register with valid mail and phone number after that user can caret a new account .when user caret the a account and after that user can go to the main UI and easily maintain with the system and this is how the System and the main function connect with the Fire base DB.

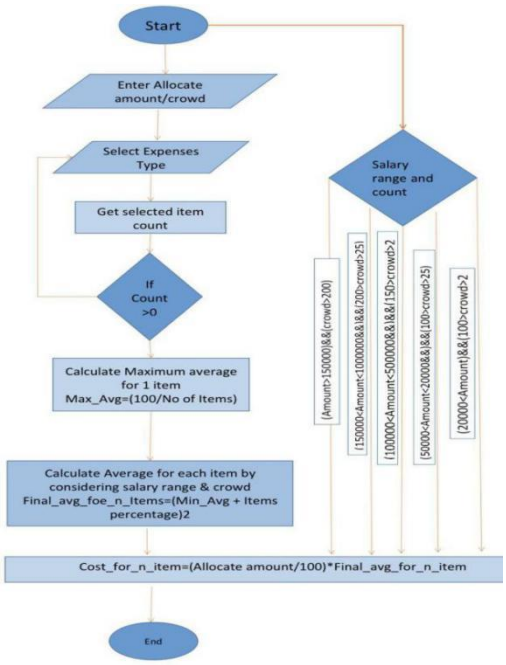

Fig. 5. Budget plan flow

The main function of this system is a budget plan, which varies depending on the amount the user spends for a particular month. This feature works for a single user or group of users. If the user is only one, the system offers a budget plan for the individual only, but if it is a group of people, the system offers a budget plan based on the number of people. An algorithm was used to set the program budget. A new algorithm for creating a

mobile application and including all components was developed, as the existing algorithm was not budgeted. The following diagram describes the sequence that further developed the algorithm.It used to be easy to create a new algorithm based totally on the steps in the go with the flow chart. As a Flow chart conducts the sequence of special movements to clear up a problem at every stage.

D. *Implementation*

During the implementation, a suitable programming language and database will be selected and used for coding. Java programming language is decided the optimal programming language since it is official language of android development. For database, Fire-base database will be used. During software development, Android Studio will be used which provides basic tools such as source code editors (IDE), compilers and interpreters. To gain access to advanced features of the android platform Android SDK, Java JDK and AVD manager tools are used. Hardware vice Budget friend need Android mobile or Tablet But In a Software vice The person does not need any kind of special software devices. The person only needs a device that has an android operating system. The said system however must use Google so user have to know how to login to system only. The system store the data in fire base so user do not need any memory capacity in there mobile phone and other special rearmament is the Communication, the user need good Internet connection otherwise user can not log in to the system as well as if the connection is poor it might be a issue to load data or view data.

IV. RESULTS

Few interfaces of the mobile application are given below.

Fig. 6. Home

Planning budget user have to give the expenses

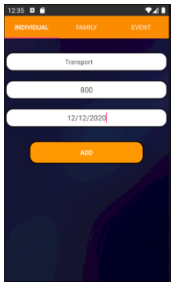

Fig. 7. Adding Expenses

After giving the expenses user can selecting that expense and after click add button user can view the budget balances and the list view of budge

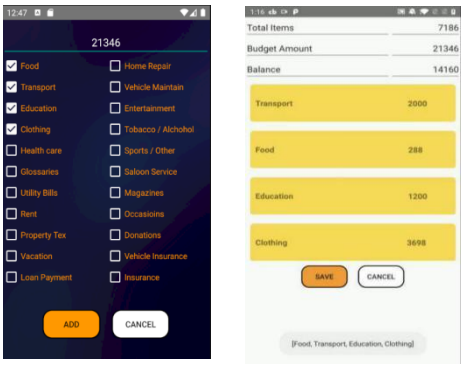

Fig. 8. Individual Budget plan

User can view the Budget History as Line chart and list view.

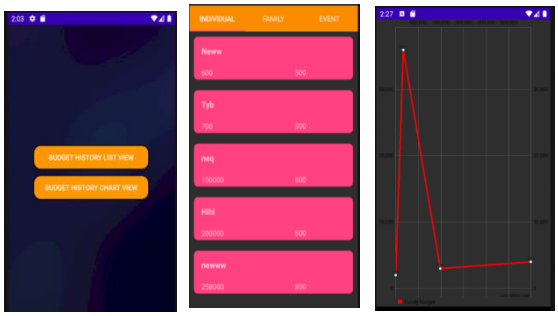

Fig. 9. Individual Budget History views

User can planning Future events from events

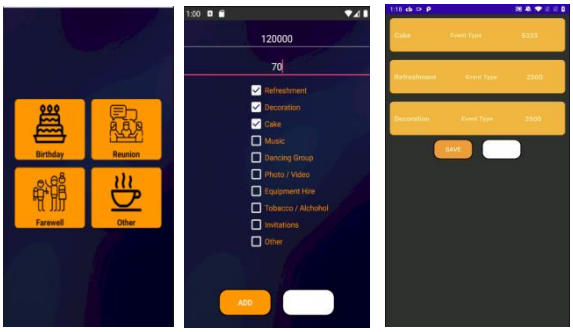

Fig. 10. Events Planing

User can add reminder notices

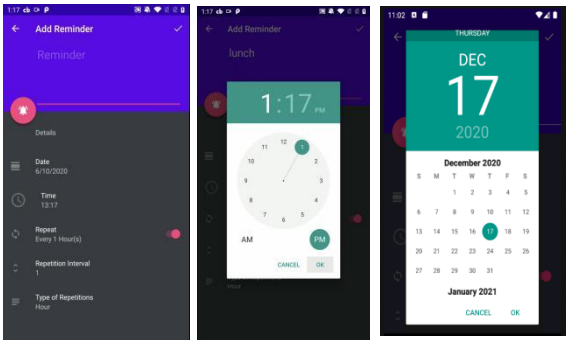

Fig.11.Reminder

User can Add there Additional income and handling as well.

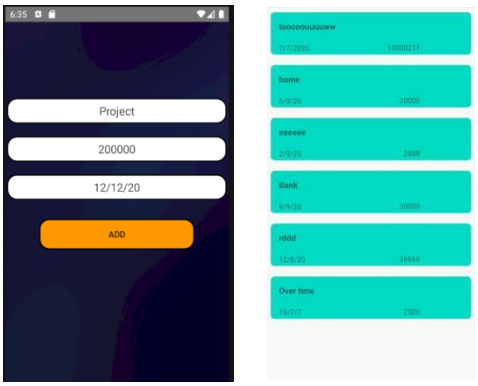

Fig. 12 .Income Handling

V. COUNCLUSION

This challenge has to turned out to be a very interesting and necessary gaining knowledge of experience for me. Selecting this subject matter used to be honestly an excellent decision. From this project, it used to be in a position to enhance my technical knowledge associated with algorithms and android development. Obviously deciding on to develop a cell utility on the android platform makes a big cost for this software as an alternative than creating an internet application.

Due to a lack of know-how in android improvement at the beginning, it was once difficult to introduce this concept to the users. Not only that I have discovered many algorithms and analyze why optimization is necessary when a product launched to the market. Another important studying effect is how mission planning is necessary earlier than the mission started out due to the fact besides accurate planning there is no success product. This task was once provided a possibility to talk with professionals of the area and humans who confronted economic issues. It was once a very true chance for as a student to get a concept about how to manage economic troubles and what variety of financial problems will be confronted in the future. Moreover, this research improves my expertise in fixing economic associated problems.

Despite the brief length of time, it supplied a massive ride for me. As nicely as this project made me realized that as a girl what I can do. Finally, I realized that I have done everything to my satisfaction for this project.

VI. FUTURE RESEARCH CHANGES AND FUTURE WORK

Up to now, it is viable to talk about related to the presently developed device however now it's better to discuss about how we can develop this software in the future. This proposed android application was to enhance only android customers properly now. But when we assume about the future improvement we can develop this android application for IOS users as well. Because today, the majority of human beings in the world used android smart phones however IOS customers additionally unexpectedly growing day with the aid of day. So it may be beneficial for IOS customers as well. Other than that there are some different features that can be developed as future improvement and these are referred to below.

a) Using AI technological know-how it is viable to create a web bot that acts as a digital assistant and can reply questions and assist the person to get things finished quicker besides desiring to speak to any other human.

b) Getting access from financial institution so that the app can be used through an individual's personal account. Then one can enter personal/ financial information which will be saved and can be handled via the app

c) The contemporary application supply consumers to report profits and complete earnings additionally displayed, so the user can test their whole profits via this application. But this quantity would now not be the specific quantity due to the fact they insert this amount in accordance with their memory. But if there any interconnection with the financial institution this all file may additionally be extra accurate. Because whenever customers make any transaction this utility will realize and update the app details also. So in the future, we can create a connection with the financial institution and can grant more service for the user.

d) This Android Application there are 6 important features consisting of event budgeting. Event administration has a large scope and in the future, it is viable to provide event administration journeys As well as Can provide budgeting tips also.

e) Using this budget friend application device all the expenses are inserted manually, however in the future, it is feasible to develop this budget faster via usage of photo processing to perceive amounts. Whenever the user provides an invoice and software want to become aware of the quantity interior the invoice and deduct that amount from the whole income.

A. *Limitations:*

when developing the Budget Friend (BD), certain limitations or insecurities of the system were encountered such as:

- Android Operating System tailors to a multitude of smart phone brands each with different phones having different resolutions and screen sizes therefore making app design and creating the User Interface unnecessarily complicated.
- Real time data delivering from client side to server side.
- The current mobile application produce solely one budget design for one unique revenue range.

B. *Recommendations:*

The work around to above mentioned issues are as follows respectively:

- The mobile application will require a certain OS requirement (better than/or Oreo version) and hardware requirements in order to narrow the devices that can run it effectively instead of letting all devices running and ending up with a multitude of crashes and more time needed to debug.
- Use fire base for a real time data access
- Produce alternative finance plans on every occasion customers so that users no longer be given a given budget plan.

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“SMART FARMER” -Mobile Application for Agricultural-Based Logistic Management and Consultant Service

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Sri Lanka Institute of Information Technology

***Abstract* - Mobile applications and services make things easier and simpler for the daily needs of the people. Although Sri Lanka is an agricultural country, there is a lack of applications, which can be useful for the farmers as well as customers. In this paper, the research team proposed one such mobile application “SMART FARMER” for agricultural-based logistics management and consulting service. In Sri Lanka farmers faced many problems because they do not have a suitable market for selling their products, they cannot find the actual reasons for some crop diseases and they faced problems in waste management processes. This application will help to the farmers working with the motive of the high profitability of direct communication between the farmers-to customer, farmer-to-farmer and also farmer-to-agricultural consultants. Therefore, this system is an effort to fill the gap between farmers and merchants. The system uses the Global Positioning System (GPS) and a system bidding.**

***Keywords*- Mobile Application, agricultural, logistic management, consultant service, system bidding, GPS.**

I. INTRODUCTION

Agriculture is important to everyone because it organizes the basic requirements of food security and also it has been an important portion of the economic system for thousands of years. In Sri Lanka farmers faced many challenges because they do not know such technical skills. Currently, mobile phones have become more familiar with the people and as a result, a lot of research is happening with the use of mobiles. Hence, the research team decided to introduce a mobile application to the farmers. There is no similar mobile application in Sri Lanka to help farmers, for their sales and other agricultural issues they faced.

“SMART FARMER” for agricultural-based logistics management and consulting service mobile application helps the farmers to direct communication with consumers, farmers and consultants. This service is also offering new technology features to build up productivity. It provides an option of login to farmers and do their sales. Using this system, farmers can provide inputs related to the products being cultivated or manufactured and customers can bid for the products and purchase. The developed system uses the Global Positioning System (GPS) for location tracking. It provides detailed information about the waste removed from the farms and notifies it to the nearest registered consumers. This system has a direct chat box with agricultural consultants and farmers able to discuss the issues they faced with crop diseases or farming-related issues.

The system has a lot of benefits to the user. That is separate login areas with appropriate functionality for farmers, customers and consultants and there are effective graphical user interfaces (GUI) to understand easily how the system working. As a result, the system is to be developed mainly for medium-scale farmers. However, the main reason for developing such as application is to make the farming environment more efficient and productive.

II. RELATED WORKS

A. *Bidding system for dairy products selling.*

According to Popa Cosmin and Chiran Aurel research to identify the logical structure of data and the particularities of developing and testing a website designed for selling farm products through online auctions. The technology that researches used for developed the project was PHP, Java and SQL database. In that online environment usually, the seller establishes a fixed date as the time for every auction and the software automatically decides the winner at the finish date, based on the highest bid. A valid bid must fulfil the following requirements to be accepted by the system [1].

- The user placing the bid is not the same user who started the auction.
- The first bid must be at least as high as the starting price and the next bid must be at least 1% higher than the previous one.

Another research was an android application for online Agri-auction. Authors of this research paper were Nirali A.Kannsagara, Trupti M. Khurape, Jyoti S. Kamble and Manasi M. Kulkarni. In methodology, the aim was developed an android application to provide a user-friendly application for the buyers and sellers/farmers to auction their products easily. For online users there is a secure registration of all users including personal profile administrators would authorize the product to auction, set auction dates and minimum auction amount for that product. The administrator can take a backup of the database for every auction that is happening periodically. The technologies used were Android studio and (OLTP) database model [2].

Online bidding application for farmers to increase agricultural productivity is one of the other research done by Shreekara S.S, Kumar Ayush, Vishalayya S and Sharath A.U. Cloud platform and the Model View Controller (MVC) design pattern was the technologies that they were applied to develop the research. This auction model website is hosted in the amazon elastic cloud compute server which could be reliable but also provide so many advantages such as scalability and cost-effectiveness. Bidding moves from low price to progressively higher price and auction is closed when the highest bid for the item is made. The seller sets a margin price [3].

Above mention, the researches used bidding systems for the transaction. In the developed system, there is a system bidding function and customers able to get the products easily.

B. *Harvested crops selling and payment method.*

According to Shrikant Waghulkar, Kumardtt Ganjre, Nitesh Behare and Niranjan Diwan research of a feasibility study of online marketing of agriculture greenhouse products, the system design for the only sale the greenhouse products through the online platform. In this platform implements the wholesale markets for the farmers [4].

Online agriculture products sales in Taiwan is another research done by the Seiichi Fujita, Hideo Hohgi and Shigeru Nishiyama. The main objective of the research is to create an online business model for online vegetable sales. The online system introduces several benefits:

- Provide the complete certification and verification report.
- Provide the purchase history record.
- Save the shopping time.

The users can read thousands of agricultural products descriptions and can compare the different products at the same time. It helps customers to trace the purchases easily [5].

E-commerce site for agriculture products is a research done by the Megha Nayak, Pinky Wankhede, Neha Khapekar and Komal Dhote. The website is built the online platform for the farmers, admin as well as the customers for buying and selling the agricultural products. Farmers get a unique interface where they can sell the products, get the rates on the market, get in touch with SMS and E-mail and gather the knowledge about different schemes. Farmers get the benefits of selling the products at the best price online. It supports the different business models such as multi-suppliers, e-sales and several types of auctions [6].

C. *Disease recognition and consultant service.*

Diseases in plants cause major production and economic losses as well as the reduction in both the quality and quantity of agricultural product. According to K.S. Usharani, B. Surendranath and S.M. Paul Khurana, several leaf curl diseases have been observed since 1999 in potato crops. The affected plants were severely stunted by apical leaf dizziness and crushed leaves and prominent mosaics. This is the first case of a begomovirus causing potato disease in India. According to nucleotide sequencing data, the cause is a virus closely related to ToLCNDV [7].

Another research was Effector Genomics Accelerates Discovery and Functional Profiling of Potato Disease by Hendrik Rietman et.al. According to research the world's fourth-largest food crop yet it continues to endure a devastating disease caused by the Irish famine pathogen Phytophthora infestans. According to their findings, efficient genetics allow for the detection and functionalization of late-onset R&D genes at an unprecedented rate [8].

Adoption of computers and consultant services by New York dairy farmers is another research done by W.F. Lazarus and T.R. Smith. According to the research, it shows the rate of adoption of computers and consultant service by New York dairy farmers and data was from form business summery program. [9].

D. *Waste disposal management and delivery system*

According to Agriculture waste management case study of a waste treatment plant for animal manure. The problem of agricultural waste management is studied in the Northern Agricultural Region of the Galilee. This article aims to present

a method for evaluating the comprehensive solution for agricultural waste treatment, including choosing the suitable technology relating to economic aspects, to agricultural needs, and complying with environmental regulations and acts of the region. The following methods and tools were implemented: data questionnaire was conducted by surveying the region [10].

Another research was the Agriculture waste concept, generation, utilization and management is a system for utilization and managing waste. Agricultural wastes are non-product outputs of production and processing of agricultural products that may contain material that can benefit man but whose economic values are less than the cost of collection, transportation, and processing for beneficial use. [11].

Implementation of GPS Based Object Location and Route Tracking on Android Device. Location-based services have enabled people to locate and track the location of other people, objects, machinery, vehicles and resources, from the comfort of their home as long as they have the required gadget such as smartphone, PDA's, and others (Adusei, et al, 2004). [12].

TABLE 1: RESEARCH GAP

	Portal to connect farmers & customers	**Consultant service**	**Bidding system**
Agri app	X	√	√
Seed co:	X	√	√
Market yard	X	X	X
SMART FARMER	√	√	√
	Waste management	**Fully automated payment method**	**Delivery system**
Agri app	X	X	X
Seed co:	X	X	X
Market yard	X	X	√
SMART FARMER	√	√	√

III. METHODOLOGY

To implement the Smart Farmer mobile application the research team is selected prototype methodology. When executing the methodology there is a process to follow. Identify the basic requirements, develop the initial prototype, review, revise and enhance the prototype. This process repeatedly happens until the product has achieved its final goals. First, the initial prototype is developed with minimum functionalities.

During the second prototype implemented all the essential functionalities. At the final prototype included all the other functionalities to view the final version of the final working application.

In the requirements gathering and analysis stage, the research team gather requirements used in two techniques.

To gather the primary data the research team, create a questionnaire using the google form and distributed among the users. This questionnaire was distributed to get ideas about the development application.

To gather the secondary data the research team studied the literature reviews of the similar applications. Studying similar applications through literature reviews the research team identify what has already been done, the scope of the particular component and identify the research gap.

In the designing stage research team divided the application into several parts according to the prototype methodology and implemented the main components according to the methodology.

A. *Bidding system for dairy products selling*

The online auctions consist of an auctioneer providing an internet-based platform to match the seller with buyers. In this, the seller will post the product and bid accordingly, and the bidding will have a specific time limit which will be set by a seller of the product. The buyer with the highest bid, the product will be sold to the bidder.

B. *Harvested crops selling and payment method*

This part implemented the online platform to the farmers and customers. Farmers can be posted their products to the application. And customers can compare the different products at the same time and purchase. The customers can add their purchased products into the virtual cart and if the does not want to buy it they can remove the products from the cart. Customers can pay the bills using the online payment gateway via credit cards.

C. *Disease recognition and consultant service*

The system has already added some common crop diseases to the application. Referring to those diseases farmers can get the basic knowledge about the diseases. To get more information about the issues farmers can use the consultant service. This part includes the chatbox to chat with consultants.

D. *Waste disposal management and delivery system*

Farmers can advertise their waste, and the notification is sent to the nearest consumers via GPS technology through an application. Customers can be brought their purchased items right at the door.

The following figure illustrates the software architecture diagram of the Smart Farmer application. The application is built on the react-native framework and the application communicates with the firebase server. The application is also able to connect to the Google Maps API using the API key in the google cloud platform.

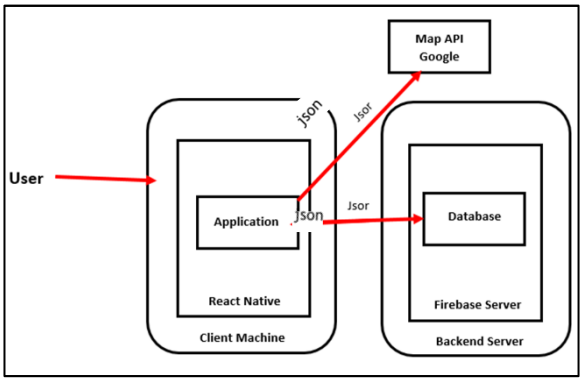

Figure 1: Architecture diagram

When it comes to the testing phase, testing is a very critical part and plays a major before releasing an application to the end-user. Once the coding is completed testing is started and released all the modules for testing. Testing ensures that all the functions of the entire application are working correctly and properly according to the user requirements. During the testing phase, the research team identify the bugs and checked the entire application is working according to the user requirements.

The research team used testing techniques to test each and every component of the application. The research team has done all the functional testing like unit testing, integration testing, system testing and acceptance testing. Non-functional testing is also done during the testing phase. After finding all the bugs redeveloped the code again and retested all the units. And user acceptance testing is the last part of the testing, and it is done by the end users.

IV. RESULTS AND FINDINGS

A. *Chat with consultant Interface.*

This is interface allows farmers to directly chat with the consultant and get the information about cultivation and disease issues.

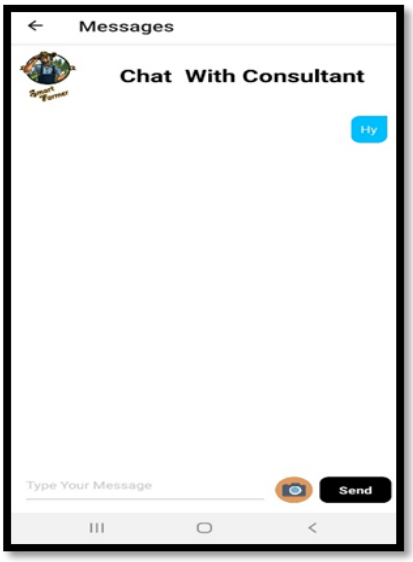

Figure 2: Chat with consultant interface

A. *Harvest Interface.*

This interface allows farmers to add their harvest into the application. All the included products can purchase on the customer lateral.

Figure 3: Harvest Interface

B. *Sell Dairy Products interface.*

This interface allows farmers to add the dairy products onto the application. And the farmer can also set the bid price.

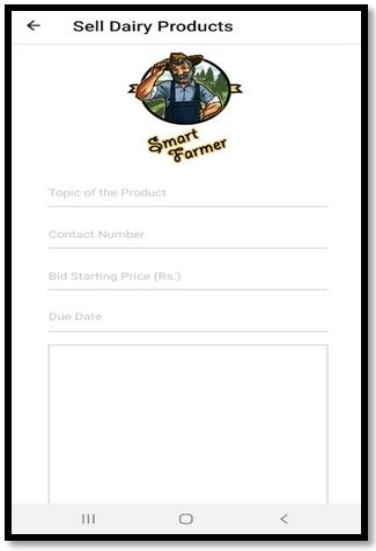

Figure 4: Sell Dairy Products interface.

C. *Sell Your Waste Food Interface.*

This interface publishes an advertisement about the fertilizer. The advertisement appears on the nearest consumers through GPS technology. The map is shown in the application.

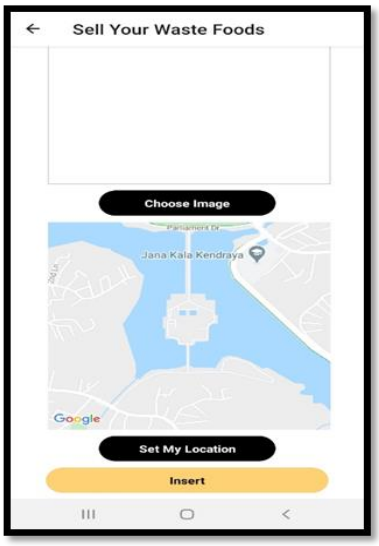

Figure 5: Sell Your Waste Food Interface.

V. DISCUSSION

"SMART FARMER: Mobile application for agricultural based logistics management and consulting service" This application will provide useful help for farmers as well as customers. The research has been accomplished by developing an android application. The system is implemented by using the prototype methodology.

Above mentioned statements are the aspiration of our research. The project team faced a few problems while implementing the SMART FARMER mobile application system.

VI. CONCLUSION

"SMART FARMER" agricultural based logistics management and consulting service mobile application, help the farmers working with more profitability by direct communication between farmer-to-customer, farmer-to-farmer, and farmer-to-consumers. In addition to that farmers can chat their problems related to crop diseases, agricultural consultants. The developed system is tracking the GPS of the current location of the farmer and it connects to the most suitable customers or consumers.

The "SMART FARMER" application will improve the cultivation and agricultural products in Sri Lanka.

VII. FUTURE WORKS

As the research team selected a research topic with a broad area, the team hopes to improve the system by adding more features. Such as, rated the service of consultants, developing the image processing segment for disease recognition fields and In addition to potato and tomato leaf diseases, our system hopes to include details on the symptoms and treatment of other crop diseases.

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“MumCare”: An Artificial Intelligence Based Assistant

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***Abstract*— Bringing a new life to the world is a wonder to every mother. Experience from each pregnancy can be vary from one pregnancy to another pregnancy, problems are made guiltier when information passed down is mixed with cultural taboos. There are normally plenty of details commonly accessible in papers, this knowledge is too complex and lengthy. One of the easiest places to obtain prenatal information is via the internet. Hence, this research-based project is about helping pregnant mothers by using a mobile application which includes artificial intelligence-based chatbot to guides them in a way that creates the illusion as if they were talking to their unborn child. The rapid development of the Internet and mobile devices in the world has changed people's lifestyles. People living in rural and metropolitan areas can have equitable access to communication technology via mobile devices and can enhance education, health and economy using these devices. The Spiral Model used as a development methodology and the application was developed in an environment of continuous integration and deployment with Git personal repository, this application was implemented using React Native and the Node.js. Created a Dialogflow agent and integrated it with the firebase through the Google cloud functions. Some existing applications have been used to evaluate the capabilities that mobile applications for pregnancy care currently provide and those that they are lacking. The solution is realistic, successful in this study and it has an upgradable model of growth.**

***Keywords*— Pregnancy; Artificial Intelligence; Chatbot; Natural Language Processing; Mobile Health; Maternity Records;**

I. INTRODUCTION

It can be very difficult for mothers to be pregnant particularly when they expecting it first. Most rely on information from one pregnancy to another that may not be accurate as experience may vary from pregnancy to pregnancy, and from person to person. Therefore, the problems are made guiltier when information passed down is mixed with cultural taboos [14].

Humans are not the most honorable creatures; they can do nothing without any profit. Therefore, mobile pregnancy applications have become a popular way to easily get pregnant at the push of a button at a very low cost. As smartphones become more and more popular today, pregnant women can use them as a way to monitor their pregnancy through computerized maternity records. This would be a simple and convenient way to access knowledge about pregnancy because mHealth is the innovative use of new electronic technology to provide and improve health care services. The computerized pregnancy reports consist of eating schedules, routines and all the things to be performed regularly by pregnant women before their due date.

Providing good mobile network coverage and mobile applications can help reduce pregnancy-related depression and distress and its symptoms by means of a support infrastructure that is available anytime and everywhere. The framework will allow the pregnant woman to be aware of changes during pregnancy and take the appropriate steps to prevent unintended changes.

A. *Aim and Objectives*

The main aim of this project is to develop an artificial intelligence-based assistant to guide pregnant mothers through the childbearing.

The Objectives are:

- To identify and evaluate existing artificial-intelligence based chatbot systems and pregnancy care applications.
- To design and develop artificial intelligence-based chatbot suitable for pregnancy care application.
- To design and develop more user-friendly pregnancy care application.
- To deploy a pregnancy care application includes artificial intelligence-based chatbot.

B. *Project Realisation*

The motivation to do this project was that the developer wanted to bring something valuable to society and solve their problems. The target audience was pregnant women because it is a joy for a mother to bring a new life to the planet.

Then the idea was to create a mobile application including the chatbot to guide mothers through the course of pregnancy. It has been discovered that none of the existing applications on offer has artificial intelligence-based chatbots achieved by conducting thorough research on this type of mobile apps and evaluating the most common applications for maternity care, and obtaining a better understanding of their characteristics. MumCare can promote this functionality making it more user-friendly and beneficial for pregnant mothers by providing them practical knowledge and advice throughout.

It would be tedious and needs a great deal of expertise to get the whole project to a standard with certain implementations that already exist. Although the chatbot is the distinctive aspect of this application, it was not only the chatbot itself that centred the development. Other than that, daily reminders and pop-up notifications, emergency dialing feature, kick counter, pregnancy tips, and this mobile application also support pregnant women by small activities during their pregnancy that will also improve maternal mental wellbeing based on computerized maternity records. This application provides various benefits including improved quality of treatment, greater performance, lower costs and reduced cases of malpractice and access to health-related information from around the world.

II. Literature Review

This section will explore the major research topics related to this project and the researcher would summarises previous researches on Artificial Intelligence, Artificial Intelligence-based Chatbots, Mobile Health (mHealth) and Mobile Phone-Based Pregnancy Support Systems.

A. *Artificial Intelligence*

Human toyed with the idea in the early centuries that computers could achieve the same stages of thought as the human brain. The robots' thoughts and renderings can be traced back to the Greek myths and Chinese and Egyptian history. Flasinski's "Introduction to Artificial Intelligence" book shows that since ancient times, certain basic philosophical questions in artificial intelligence have been of considerable significance in philosophy, and thinkers such as Aristotle, St. Thomas Aquinas, William of Ockham, etc., have asked certain questions that could not be answered until the first computers were invented in the twentieth century. Allen Newell and Harbert A. Simon were designed, the first artificial intelligence system which named as 'Logic Theorist' at the Carnegie Mellon University in 1955 [1].

The world has been making several technical strides in AI since the first AI system was built and now it brings to mind robots that can behave like a human [2]. These are more complex and complicated structures that have been designed to tackle situations where problem solving without human intervention could be needed. There were two parts in the artificial intelligence: weak artificial intelligence and strong artificial intelligence [3]. Weak artificial intelligence includes a machine programmed to execute a specific purpose, and strong artificial intelligence-based systems execute the tasks encountered as a human being [3].

Artificial intelligence has drawn interest in developing countries as a key to development, and is growing rapidly. Artificial intelligence is rapidly changing as technology progresses to support several diverse sectors. The technologies can be extended to numerous fields; thus, the artificial intelligence implementations are infinite.

1) Natural Language Processing: Natural language processing, commonly simplified as NLP, is a branch of artificial intelligence that uses the natural language to deal with the contact between machines and humans. NLP 's overall goal is to learn, translate, understand, and make sense of the human languages in a meaningful way. Most NLP strategies are based on learning the computer to infer meaning from human languages [4]. NLP will support you with a lot of activities and the areas of use appear to only grow every day. In the healthcare sector NLP is especially booming. This technology increases the quality of treatment, the diagnosis of illness and lowers costs as healthcare institutions are rapidly embracing electronic health records. The idea that clinical reporting can be enhanced implies more comprehension and helping people by quality treatment.

A difficult challenge is designing a technology that knows the natural language. There are large a number of natural languages, they contain infinitely many sentences. There's still a lot of doubt about the natural language [5]. Also, many words have several meanings and several times the same phrases have different meanings in various ways. Because of this it is a difficult challenge to develop applications that comprehend a natural language. Importance of NLP is due to the fact that there is a massive volume of data in the world wide web, at least 20 billion pages, that can be used as a major resource, as long as useful information can be retrieved by NLP from this [4].

B. *Chatbot systems*

As a human-computer interface, Chatbots have played a major role in the last few years. A chatterbot or chatbot is a computer program that mimics human conversation spoken and written. Chatbots are currently leading the market and bringing it into the era of Artificial Intelligence. The chatbots do human jobs, practice it and master human strategies as well [5]. Chatbots conduct conversations with people, and developers typically hope that users will not realize they're talking to a robot [6]

Generally, the chatbot was written in three modules: the user interface, an interpreter, and a knowledge base [7]. There are two types of chatbots: one whose functions are based on a set of rules and another one which uses artificial intelligence and

this is the more advanced version. When artificial intelligence used in a chatbot, the chatbot always gets smarter as it can learn new things from the conversations with the human. Doshi, S. V., Pawar, S. B., Shelar, A. G. & Kulkarni, S. S (2017) define that as a program, chatbots are an attempt to simulate typed conversations and they have been deployed on the internet for the educational, guidance, customer service, and entertainment purposes.

The first chatbot in the world is ELIZA which works on the pattern matching system developed by the German scientist, Joseph Weizenbaum in 1966 [8], [6]. Human users could chat with ELIZA and this chatbot was initially created to respond as a psychotherapist, and users can have a meaning full conversation [6]. Since ELIZA was created by J. Weinbaum, the world has been headway in the development of intelligent chatbots. As a result, in 1972, PARRY was created by Kenneth Colby, Richard Wallace created ALICE which was considerably complex in 1995, and there was a range of new chatbot architectures have been deployed [9].

ALICE was a rule-based chatbot based on Artificial Intelligence Mark-up Language (AILM). The AILM based chatbots are easy to implement, those are lightweight and efficient to handle and AILM still uses today [10]. Jack's research shows [8], an Artificial Intelligence Mark-up Language is obtained from Extensible Mark-up Language (XML) which is used to build conversational virtual assistance and it has more than 40,000 categories, where each one has a combination of different patterns and its response. His paper gives detailed information about the architecture, design and development of chatbots.

Empowered by artificial intelligence, chatbots are rising as new technologies in business potential. In the market place, customers who used artificial intelligence-based applications were also reacting positively to chatbots as they use chatbots for sales, guidance, customer service, entertainment, health care, education, and more. The Marketing Science (2019, p.937) emphasise 'The market size of chatbots is expanding quickly, from $250 million in 2017 to more than $1.34 billion in 2024' and the use of this artificial intelligence-based applications span across individual services to commercial purposes. In the year 2020, over 85% of customer interactions will be handled by bots. Therefore, in the future customer supports jobs seems to replace by the chatbot and also, people find that have a chat conversation with a chatbot is well-being rather than making a phone call. However, the use of artificial intelligence-based chatbots is in its childhood, but the future is exciting.

In MumCare mobile application artificial intelligence-based chatbot technology is used to help pregnant mothers in a way that creates the illusion as if they were talking to their unborn child where this will help stabilise their mental as well as physical health.

C. *Mobile Phone-Based Pregnancy Care*

Being pregnant can be very challenging for mothers especially when they are first expecting it. Most depend on knowledge from one pregnancy to another that may not be reliable as experience from each pregnancy can vary from one pregnancy to another, and from one person to another. Mobile phone-based pregnancy support will position itself as a significant breakthrough method for educating women about pregnancy, tracking their own and child's growth, tracking medical check-ups, and stabilise their mental as well as physical health [14].

The current trend in the healthcare sector is to connect patients, doctor and hospitals to provide all patient with optimum treatment. Patients also say their physicians should be open to tacking a part in video conversations [13]. Mobile pregnancy applications have become a modern way of providing readily accessible maternity contents, simply by pressing a button, at little or no cost [15]. However, the main concern is over the quality of these developed applications, thus the accuracy of information received by mobile pregnancy applications needs to be tracked [15].

The provision of strong mobile network coverage and mobile phone technology will help minimize the stress and anxiety related to pregnancy and its complications through a support system that is available anytime and anywhere. The system should allow the pregnant women to be aware of changes during pregnancy and take the necessary actions to avoid unexpected changes.

D. *Similar Applications*

Pregnancy week by week by Amila [16], Pregnancy Tracker by Mobile Dimension LLC [17] and Pregnancy Tracker by What to Expect [18] is the highly-rated pregnancy care applications in Google play store and Apple Store. These applications have been used to understand the capabilities that mobile applications for pregnancy currently provide and those that they are lacking. These applications are very helpful and useful for the weekly tracking of their pregnancy and they have over one million downloads with average ratings of 4.7 to 4.9.

Get pregnancy tips, week by week pregnancy tracking, calculate due date, pregnancy calendar, weight tracking, kick counter and pregnancy diary can be considered as a common functionality in these three applications. However, none of these applications was used chat-bot. Therefore, chatbot is the major difference between existing applications and the MumCare. In addition, the application includes an emergency dialling system and it supports women by computerized maternal recoveries during their pregnancy.

E. *Conclusion*

This analysis is intended to reassure the reader that it is important for the mHealth and artificial intelligence assistants (chatbots) to use it to improve self-care for pregnant women. During this phase, it was discovered that the artefact created has a unique feature and with some additional features and added functionality. It will guide pregnant mothers in a way that creates the feeling they talk to their unborn child and help stabilize their physical and mental health.

III. III. Design and Implementation

A. *Planning*

This application was implemented using Spiral methodology that will certainly yield a release of the version by the potential implementation. Every spiral can be named as a loop in the spiral model and each loop is a different method of creation and there are four phases: Planning , Risk Analysis, Engineering and Evaluation. The tasks started with an initial process of preparation and collecting requirements to prepare the project proposal, the appropriate resources and the Gantt chart to assign and allocate the time and resources available. The engineering process took places with the application being tested, coded and deployed, using continuous integration and continuous deployment.

In addition, the version-based feature releases involved defining the threats in the project along with the supervisor and mitigating the post-release problems. With development, testing, and continuous integration and deployment will take place after the task engineering section within the version was developed. This creates a platform for effective pre and post-version review and assessment. Any bugs detected will be moved for fixing in the next release of the version.

B. *Architecture*

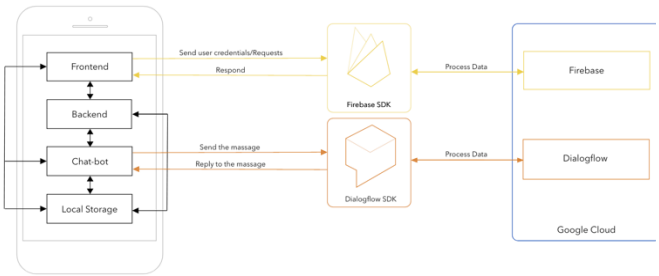


Fig.1. Architecture Diagram

Above architecture diagram (Fig.1) outline the description and interconnectivity of this application and also describe how the chatbot communicates with users and how it transfers and receives data from local storage and cloud storage. There are two separate data stores for the MumCare; the Firebase Realtime Data Base handles user details and events, whereas the Local Storage used to store user profile picture. The Dialogflow and Firebase are connected together through the google cloud to share the data when the chatbot needs to retrieve user information. As in the mentioned in Fig 1, when user completed registration process their user credential will sent to the firebase authentication because it provides backend services and SDKs to authenticate user with the MumCare application. When user login to the application the user name and password will be sent to the firebase and validate to find whether the user has already registered.

The Firebase and the Dialogflow were connected through the Google Cloud Platform and the database of the MumCare should be registered in the Dialogflow in order to communicate among them. When users have conversations with the chatbot, the messages will be sent to the Dialogflow agent and for any data requests, the agent could access to the database and retrieve the necessary data and then send them to the backend of the application.

C. *Implementation*

MumCare offers numerous options such as kick counter, baby name list and reminder to make it more user friendly. These are the features of the MumCare mobile application.

- Baby Chatbot
- Kick Counter
- Pregnancy Calendar
- Reminder
- Baby Name List
- Mind Relaxing Game (Tic Tac Toe)
- Computerised Maternity Records
- Emergency Dialling System

1) *User Account Structure:* Every MumCare user needs to have an account that stores the data directly in local storage. React Native carries certain efficiencies, and when creating an authentication and handling user functions can often be difficult to deal with. Thus, MumCare was using Firebase Authentication to handle user accounts and authentication. Firebase Authentication tightly integrates with other Firebase applications, using industry standards such as OAuth 2.0 and OpenID Connect, making it easier to incorporate with any backend.

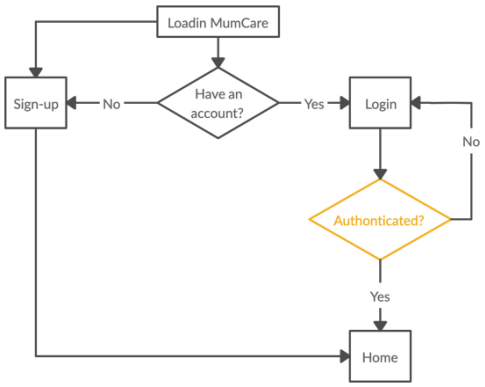


Fig.2. User Authentication with Firebase

Firebase Authenticate helps users to authenticate with their emails and passwords, it also manages resetting emails and passwords. The user has to provide their credentials to sign up to the system and these credentials will be the email address and password for the account. Then, the Firebase Authentication SDK sends those credentials to the Firebase (Fig.2).

2) *Pregnancy Calendar:* The pregnancy calendar is a detailed guide which illustrates the baby's growth with all the changes taking place and each week of pregnancy includes a description of the baby's development. The application would have an attractive user interface design to demonstrate baby's growth weekly with current week, day, how many days remained, the trimester, baby's measurements and photos.

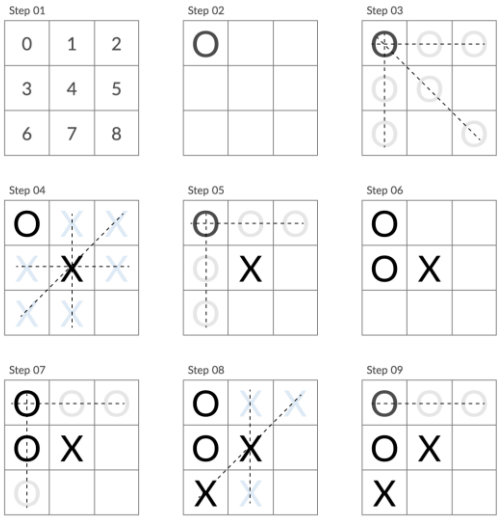
Moment.js was used to parse, validate, manipulate, and display dates and times in pregnancy calendar. This can be installed with a simple node command “npm install moment --save”. Using this library, the current week and day of the pregnancy will be calculated, and identified number of days left to delivery. Also, Moment.js is used to illustrate baby’s development by images based on the current week. Depending on the due date which is user entered when registering to the application the system will be customised.

3) Mind Relaxing Activities (Tic Tac Toe): Not all games for kids, sitting down with a board game will really get your mind off the pregnancy stresses. They are fun and take you back to the good old days of childhood when it all was much simpler. Similarly, board games are a fun way to connect and spend time with your other half, rather than pacing in front of a TV without talking. Board games initiate conversation, and while they are vintage and a little classic, they are more relaxing than video games that can put strain on eyes

Therefore, MumCare will provide Tic-Tac-Toe game which is a virtual Board/Strategy game using “tictactoe-agen” node module to determine the system’s next move. This can be installed with simple node command “npm install tictactoe-agent --save”.

Fig.3. Pregnancy Calendar (Home Page)

When click on the start game it will start to render game component. The board divided in to 9 tiles (3 x 3 grid). To play the game, the user must start by entering a circle, after the choice has been submitted, the tictactoe-agent will identify the index of the tile (index 0) which the user has selected. Then, the tictactoe-agent will reference the victory conditions ([0, 1, 2] / [0, 3, 6] / [0, 4, 8]) as shown in the array shown below Fig.4 and it will select index 04 as a suitable index which has most winning chances to the system, and which will reduce the users winning chances (Step 04). Then that index will be represented by a cross. The user will then enter a circle into index 3, at which point, the previous steps will be repeated until the game is won or drawn (as shown from steps 5 to 9).



Fg.4. How it works (example)

Fig.5. Game Screen

4) *Chatbot:* This is the unique component of this project, Artificial Intelligence-based chatbot. The Dialogflow is used to develop the chatbot which gives users to interact with their product by developing text and voice-based conversational interfaces such as chatbots and voice applications powered by NLP. Dialogflow is a natural language processing-based platform that makes it easy to design and integrate a conversational user interface into mobile applications, web applications etc. As mentioned in section 3.5.4, the front-end of the chatbot has been implemented in the application and the back-end was implemented in the Dialogflow. When the fulfilment for an intent was enabled, Dialogflow responds to that intent by calling a service that has been defined by the developer. There is an in-built code editor for Dialogflow called 'inline editor' which can be used to crate fulfilment code and deploy it to Cloud Functions.

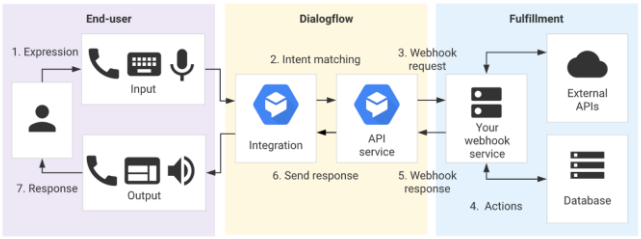


Fig.6. Processing Flow for Fulfilment

Above Fig.6 illustrates the processing flow for fulfilment. When the user enters their request, the Dialogflow matches the requirement with an intent to extract parameters. It will send a webhook request to the webhook service and this service message consists of the action, parameters and the response. The actions can be API calls or data retrieves from the database. Finally, as in step 5, the webhook response will be sent to the Dialogflow and the Dialogflow sends the response to the end-user.

The Dialogflow service for application can be installed in React Native environment with a simple node command "npm install --save react-native-dialogflow react-native-voice". When the user provides the information, the user input which could also contain entities must be handled by Dialogflow. Therefore, Dialogflow has to seek the details from the web-hook to fulfil the request of the users. The data provided by the user is then sent to the web-hook along with entities so that the necessary information can be retrieved. Once the Dialogflow receives the information from web-hook it sends the response back to the user in the desired manner.

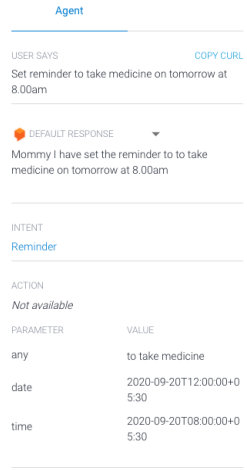


Fig.7. Snapshot of Dialogflow Agent

When developing the baby chatbot in application the React Native Gifted Chat was used to create front-end. There are three main functions implemented in the inline editor with three intents to make reminders through the chatbot, to get existing reminder details and get pregnancy information by week.

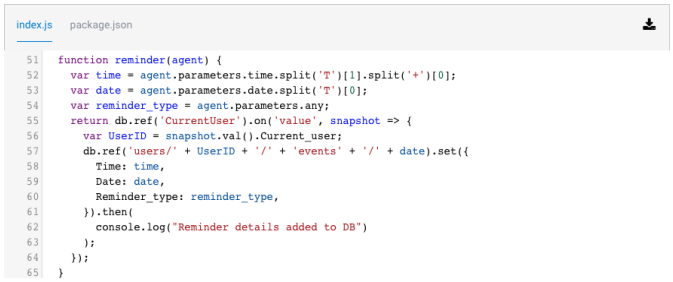


Fig.8. Reminder Function

The Fig.8 illustrates one of those three functions which were implemented by the developer. The users can make reminders through the application as well as the chatbot without using the calendar feature. The function will read the reminder details from the agent by providing a simple code segment: 'parameters.entity_name'. The 'time', 'date' and 'any' are the three entities used in this intent. To store the values in the database current users' ID should be identified first because there could be many users and each user has a separate database. Then the user ID will be initialised to the variable

called ‘UserID’ and the data should set the database using the user ID as a reference (line 57 in the Fig.8).

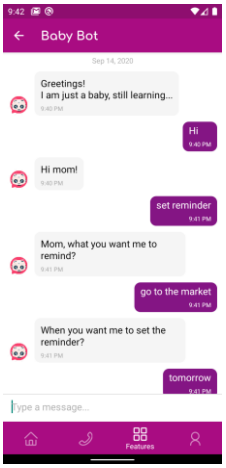


Fig.9. Sample Preview of the Baby Chatbot

IV. Results and Discussion

In this research, the researcher simulated multiple scenarios to check the performance and functionalities. The scenarios were divided into main 4 stages. One of the scenarios was used to check the Pregnancy Calendar by inserting different due dates and the second scenario was used to check the performance and reliability on chatbot by asking different questions and requirements. Then the third scenario was inclusive to test the emergency dialling system, accuracy of the tic-tac-toe game and accuracy of the reminder function. Finally, the last scenario has included testing the whole system, flow and integration of the all components. During the 4 simulation phases, all the scenarios turned out to deliver a good performance. Nevertheless, the researcher has found that the results in some areas need to be improved and in other areas, the results were more than expected.

The agent’s average response time is less than 5 seconds (time period from 2020/08/19 to 2020/09/19). The response time of the agent depends on the user’s request. For an example, for a small talk conversation, the agents' response time averages from 1-3 seconds and if the agent gathers data from the database, the average response time increases to 3-5 seconds and in some cases, more than 5 seconds. When evaluating the Firebase Performance test results, the average application start time is less 3-6 seconds.

When testing the reminder function with Firebase Cloud Messaging (FCM), pop-up notifications cannot be received if the device is offline. To overcome this problem an in-built function using react native was developed to send push notifications. This allows all notifications and reminders from the application to be received when the device is offline.

When creating the Chatbot the researcher faced some difficulties to get data from the database and since the time has been limited some of the functionalities could not be implemented. As the agent is hosted on the web, further development can be done in the future through Dialogflow.

Finally, after conducting experiments on the application many functionalities proved to be working as expected. To develop this system into a commercial product using the latest technologies such as artificial intelligence-based chatbot that uses a large database and more technical improvements are required. Further encouragements for additional improvements will be mentioned later in the report to create a better application based on the evaluation of existing systems and evaluation results.

V. Evaluation

Three methods were used to evaluate the artefact for the purpose of the system. First, the artefact was analysed at the start of the project and afterwards modifications were made according to personal preferences. Finally, the end users of the application were allowed to use the application and provide feedback to be assessed and evaluated. After combining the above techniques, MumCare can be considered as a successful project.

To evaluate the potential for the artefact, a group of 6 expecting mothers were gathered and asked to try the MumCare mobile application. After having a chance to try out the application they were asked to complete a survey about their opinions about the MumCare, what they liked and disliked about it, the drawbacks and then the features they willing to have in the future.

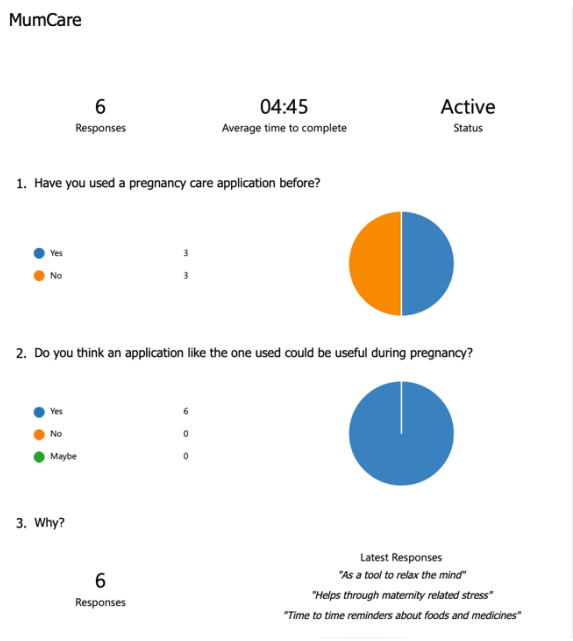


Fig.10. Evaluation Results – Part A

Fig.11. Evaluation Results – Part B

Fig.12. Evaluation Results – Part C

VI. Future Work

It would be tedious and needs a lot of experience to get the whole project to a stage with certain implementations that already exist. The focus will be based solely on the artificial intelligence-based chatbot, since this idea will be built independently and within a limited period of time. Hopefully, a couple of features can be added during the allocated time period with successful time management, but a completed product can be expected in future. Interactive 3D models will illustrate the development of the baby and track the mother's walking patterns by using the smart devices' built-in sensors which will provide useful alerts.

To increase the usefulness of the MumCare, additional features to interact with the current notification system could be added. The notification system should be developed further to send notifications to both mother and father. The weight tracking system to be developed as further implementation and this will help to keep track of mother's weight. At the outset and regularly during pregnancy, track your pregnancy weight gain and compare your progress with suggested ranges of safe weight gain.

VII. Conclusions

During the research the developer identified the possible needs for a new technique of guiding pregnant mothers through an artificial intelligence-based assistant, using both end-user surveys and analysing the existing applications. In this thesis, various functionalities of the pregnancy care application were researched and it was found that none of the existing applications have a chatbot.

Due to the unavailability of a pregnancy care application with an artificial intelligence based chatbot, MumCare demonstrates a working proof of concept to potential users and opens doors for further development to allow more features and functionalities. Furthermore, during the evaluation phase, the feedback from short survey given to expecting mothers after allowing them to gain first-hand experience of using the application has brought mainly positive feedback and other suggestions with good comments.

Acknowledgment

I would also like to thank Mr. N. Kalansuriya, Full-stack developer at Leafycode (Pvt) Ltd., for his valuable contribution in guiding me in using React Native successfully.

Finally, I would like to express my appreciation for my friends at the SLIIT Academy because the concept for this project would not have evolved without the invaluable contribution of them.

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Identified Research Gaps in Game Addiction: For Future Research Directions

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***Abstract* – Overall motive of this study is to explore current research gaps regarding game addiction, in order to support future research studies within the context of Sri Lanka. Desk research approach has been adopted for this study by reviewing past literature during the period between 1995 and2020. The reputed research databases such as Sage, Research gate, Google Scholar, Taylor and Francis Online, Springer link, Science Direct, JSTOR and Emerald were used/referred when searching journal articles, which were then shortlisted in order to collect data. Implemented desk study led to determine four research gaps concerning game addiction. First, is to operationalize game addiction and test the existence of the above concept using a valid scale within a segment of Sri Lankan society. It can be highlighted that, the above concept has been tested and operationalized globally. Hence, studies conducted in Sri Lanka lag behind for empirically testing the concept of game addiction. Second, is the existing knowledge gap within local studies in determining a relationship between game addiction and the psychological functioning of people. Moreover, developing a framework to identify the significance of the above relationship is the third research gap regarding the given subject. This process of configuring a proper framework can also be shown as an ice breaker/can also play the role of an ice breaker for future studies on the related topic/area of research. As the fourth gap, prior studies in global context have conveyed shortage of studies in local context proving the concept of game addiction. Therefore, findings of this study can be a value addition to this field of research. Also, the study can be a foundation for future investigations to further expand insights in this subject area by identifying the current research gaps in a broader perspective.**

***Keywords* - Game Addiction, Psychological Functioning, Research Gaps**

I. INTRODUCTION

Leisure time activities have derived to give people a break from the daily chores, for their own benefit. In society, various leisure time activities which have been implemented place to get over anxiety, stress etc. Main objective of these activities is to assist people for proper functioning of their day today activities. Video gaming can be identified as one which has become an extremely popular leisure time activity in recent times, with more than two million users worldwide[1]. According to Pew Research Center[2], "Video gaming is a very popular leisure activity among adults" where users of video games are not just limited to a certain age group as kids and teenagers, but also adults.

Exploratory study by Sălceanu[3], on influence of game play shows that, computer is mostly used for playing games (36.28%), rather than for Internet access (22.88%) and social networks (14.44%) etc. This higher relative footprint of video games on a person's use of computers elaborates the attraction towards playing video games by making it more than just a leisure time activity. As a result, video game industry has taken a leap forward in entertainment, providing a variety of game genres, platforms and other facilities to fulfil the existing demand. However, the question is, by considering the amount of attraction towards these games and the obsession for playing games created over time, what the consequences will be if such an activity designated for releasing stress leads to eradicate those terms.

In such a scenario, concept of game addiction becomes the topic of the discussion. This paper mainly focuses to address the following aspects.

1. Concept of gaming addiction
2. Key studies on game addiction
3. Current research gaps
4. Conclusion

II. METHOD

Main focus of this study has been to identify existing research gaps, regarding the concept of game addiction. Therefore, as the most appropriate method to achieve the main objective of the study, researchers implemented the Desk research strategy. Discussion regarding the concept of game addiction trails back to early 90's. Noticing this, a literature survey was carried out using a considerable number of articles from year 1995 to 2020 which were related to the topic of "Game addiction" and "Impact of game addiction". Out of these, a number of key articles were referred to collect secondary data in order to address the concept of game addiction. The four main focused areas were achieved through a critical review of referred literature. A number of renowned databases were accessed to shortlist previous research articles such as Science Direct, Google Scholar, Emerald, Research gate, Springer link etc.

III. .LITERATURE REVIEW

A. *Concept of Game Addiction*

Gaming addiction can be clarified as one of the most discussed psychological aspects recently, in particular to computer and mobile video games[4]. Although, there have been considerable discussions on the related topic, the term "Addiction" has not been tolerated by psychologists in clinical terms. As alternatives, clinical psychologists have used the terms excessive, obsessive and problematic on behalf of the term addiction in their respective studies [5], [6], [7]. According to the World Health Organization (WHO), these terms can be easily described through behavioral actions such as compulsion to engage in activity, trouble controlling intake, a physical withdrawal, tolerance, neglect of other activities and interests in favour of activity that causes addiction, and persistent on the related activity despite the harmful consequences [8].

Simply, this concept behind game addiction can be described as, playing computer/mobile video games continuously in a manner which is unable to control, reduce or stop playing by ignoring other activities, there by making his or her social relationships and interactions with people lesser [3], [9], [10], [11]. Therefore, excessive spending of time towards playing games and being obsessed with the video games beyond day today activities can be critically reviewed as gaming addiction. Furthermore, game addiction is described as "Many computers or digital equipment come equipped with pre-programed games and people become addicted to playing them at the cost of work performance or family obligations" [11]. As mentioned, the attraction towards playing games and the existing demand have forced game developing companies and digital accessory developers to introduce built-in games in such devices and also in more devices which mainly support playing video games. Introduction of gaming computers and laptops along with gaming consoles like XBOX, PlayStation etc., can be identified as a result of the above scenario. Not only this, but also using internet for playing videogames have become insanely popular among the users. Addiction to playing online games is the most addictive activity on the internet[9].Introduction of online platforms and online games also have played an important role in attracting more users towards spending time on video gaming. Over time, this process or the level of usage of internet for gaming activities has forced internet service providers even to introduce service packages specialised for online gaming. Kuss and Griffiths[12], suggested that some internet game players experience symptoms that relate to substance-related addiction, including mood swings, preference to excessive usage/spending of time on gaming which have caused some other activities to be disturbed/which have caused to interrupt certain other activities. These findings have guided the evolution of game addiction into the concept of online game addiction.

In the year 2007, the American Medical Association has encouraged the American Psychiatric Association to identify gaming addiction as a diagnostic mental disorder with the excessive behavioral changes of the gamers at that time[4].Findings of the studies, since then continued to have enforced the WHO to declare gaming disorder or the gaming addiction as an on-going health concern [13].

B. *Reasons for Game Addiction*

With regard to the researcher's interest on the concept of game addiction, this section focuses on the key reasons leading to game addiction on personnel. According to the Usman and Inam[14],an average video game player stays with the game for a long time without focusing on their day-today activities due to many reasons. These can be identified as game's attractiveness, ease of use, engagement, aesthetical appearance of video games, high-quality graphics, more realistic images, complex game strategies, use of artificial intelligence and human machine interaction[14]. The games are designed to be attractive and addictive. The purpose of these types of games designing are to ensure that players never stop/continue playing [15].Addictive or the attractive features of games tempt and attract individuals to immerse themselves in a virtual environment instead of the real world[16]. This may be supported by the features of the developed games with much enhanced graphics, sound systems, storyline as well as the gaming characters. Furthermore, they emphasize this nature of the developed games reveal people's deep feelings and desires that he or she has not attained in real life. Therefore, these kind of games create a separate virtual life for the player while in the

game, which is more tempting/appealing interesting to him or her involving expected fantasies in life [16].

Video game addiction has been described as the work of video effects in a game that create the imagination in the human mind to tolerate a fantasy life[17]. The above mentioned study further elaborates reasons for game play as relaxation, amusement and interesting storylines. Likewise, some game players stated that they have felt like individuals with much interest and fun in the virtual world and consequently, they tried to avoid and escape problems in the real world when playing games[15]. As discussed earlier, the objective of these games has been to provide entertainment to alleviate stress of the users. In order to achieve this, almost all the new digital devices come with built-in games accessories. Therefore, it leads as a reason for people to keep playing these games again and again.

Apart from the above circumstances, a person's network of friends was found as a reason for being addictive to video games. When frequented by friends who seem to play games and extensively talk about games, in time lead people to become curious about games and create hopes to play it soon as possible[15]. Among other reasons to play video games were associated with a positive impact from game and social interactions. Game users seemed to create powerful association with the players who played the same game stimulating their imagination and curiosity. Due to relaxation and storyline, it is very interesting for players who have played video games[17].Additionally, some previous researchers suggest that males are the most excessive users of video games [17], [18]. There are few reasons for the males to play video games than females such as content of the game, social behavior and gender difference. Usually, males perform better in competitive video games and they would be more likely to score higher than an average female player. Therefore, Griffiths and Hunt[19], state that gender difference matters on the types of games played. Therefore, males prefer more violent, competitive games and puzzlers while females prefer platform games and simulations[20].

C. *3.3 Effects of Game Addiction*

An exploratory study on the attitudes of parents of children who constantly play games shows that gaming addiction can affect both positively and negatively for children's development. On the one hand, "Playing games promotes a wide range of cognitive skills, such as: faster and more accurate attention allocation, higher spatial resolution in visual processing and enhanced mental rotation abilities" [21], [22].

On the other hand, most of the studies discuss a vast area of negative aspects. Lack of physical movement, sight disorders, agitation, nervousness and lack of socialization are few of these factors [3]. Moreover, respective study discusses that spending considerable percentage of time playing computer games causes physical inactiveness. Lack of sleep and changing the active hours of a human body mainly affect a human body physically. Hence, tiredness, sleepiness during the daytime and lack of concentration cause the mind to be retarded within, thus making it hard to focus.

Saputra, Marjohan and Safrizal[9]have stated that online game play has an adverse relationship with the mental health of adolescents, which has a direct effect on violent behavior, anxiety, depression and isolation from others. This study further reviews on the mental impacts that gaming addiction causes in a persons' mind and reactions. The researchers have also observed the inability to process emotions of the gamers due to defeat while playing a game. Experimental studies conducted by Anderson and Bushman[23]show that high video-game violence is associated with aggression in males and females, children as well as adults. Furthermore, it derives that there is a negative correlation between violent game play and positive behaviour in the real world. As mentioned earlier, efforts taken by the American Medical Association encouraging the American Psychiatric Association to identify gaming addiction even as a diagnostic mental disorder, reflect that the effects of game addiction are more critical than one could imagine/predict[4].

IV. 4. KEY SUDIES ON GAME ADDICTION

Among the past literature referred for this study, several key studies have been identified. These are presented in Table 1.

TABLE 4 KEY LITERATURE ON GAME ADDICTION (*SOURCE: AUTHOR COMPILATION*)

S/N	Author	Year	Description/Findings
1	Saputra, Marjohan and Safrizal[9]	2020	The behavior of additive games among youths has been reflected. Most visible impacts were difficulty in moving back from the aspiration to play online games and lack of patience for the use of current time. So, people spend a lot hours just to fulfill the aspiration to play games in as a result of difficulties in detaining sleep plans even games are willing to stay up late at night to reach the desired topic peak.
2	Kanat, S [24]	2019	Result of this study illustrated there is significant difference between the levels of digital game addiction according to the gender as well as this study founded there is statistically significant difference between communication skills among males and females. Further there statistically significant difference between the level of digital game addiction of students participating in the study according to the class the enrolled.
3	Quwaider, Alabed and Duwairi[25]	2019	The result of this study showed how video games affected the behaviors and emotions of the players. The researchers conclude that video games affected the player's personality, and the behavior.
4	Wani, M.A [26]	2019	Result of this study illustrated boys had most addicted behaviors than girls, so girls have better mental health than boys. Furthermore, the researchers founded the significant relationship between playing hours and mobile game addiction.
5	von der Heiden et al [17]	2019	Video games used has related to various psychological working variables such as the existence of psychological symptoms including unhappiness, nervous and aggression. For the analysis psychological scales such as COPE, Affect, and General psychopathology have been used.
6	Saquib et al [27]	2017	Dependence to video games was strongly related with the psychological grief and other important associates were female gender, higher screen time and shorter sleep hours.
7	Taquet et al [16]	2017	The purpose of the study is assessing cognitive, emotional, and behavioral aspects of video game addiction. Further this study emphasizes importance of avoiding the cognitive of reality and immersion into the game. Results of this study showed that video game addiction is close to addictive behavior.
8	Sălceanu, C [3]	2014	The result show that the access of the children and youngest generation to computer, children have accessed a computer lesser than youngest. This research even refers to the program of the children to the computer, which the result show that more of parent are discussing with their children about the access to the program in the computer, while some of the parent forced the hard program and few of children may access the computer anytime that they want.
9	Reshadat et al. [28]	2014	The result of these study showed computer and video games may not be threat to the mental health as well as it is courses to lead depression. Further it discusses the proper use of games will deliver positive effect on person's life.
10	Usman and Inam[14]	2013	The feedback and variation of behavior among young people who are addicted in playing video games pointers to anger and obstruction, even though it as an entertaining act and some as an indoor journey. Further it discusses the relationship between playing games and emotions.
11	Wang and Zhu [15]	2011	Findings of the research show that the online game addiction among university students caused foremost many students to drop self-control and face social separation. Simply people with a problem of hang out or joining in social assemblies and missing self-control would be most subjected to becoming an addicted person. Online gaming effects increase body weight strangely due to reduce eating habits, socially it slowed down the enlargement of their social kills and can also loose personal relationships, also the academic occupation had been suffered considerably since they started playing.

12	Lemmens, Valkenburg and Peter [4]	2009	Study is about developing and validate a scale to measure the computer and video game addiction. This scale consists of seven sub factors (salience, tolerance, mood modification, relapse, withdrawal, conflict and problems) and 3 items were created for each seven factors.
13	Griffiths and Davis [6]	2005	Study have introduced DSM criteria model to operationalize game addiction as a valid scale. Further it discusses about the reasons that may have affected to cause game addiction in the first place.
14	Anderson and Bushman [23]	2001	The assumptions of these outcomes are that, contact with violent video game poses a threat to children and youths with increased levels of aggression, with prosaically manners, long term effects on the expansion of aggressive behavior and understanding.
15	Anderson and Dill [29]	2000	Aim of the study is to examine the relationship between long-term exposure to violent video games and several outcome variables as well as aggressive behavior, delinquency, academic achievements. Positively related aggressive as well as nonaggressive delinquent behaviors with the trait aggressiveness and video game violence.

V. Existing Research Gaps

Based on the comprehensive literature review and previous studies regarding game addiction, following gaps were identified.

Gap 01: The gap related to operationalizing game addiction and testing the existence of game addiction within a segment of Sri Lankan society through a valid scale

.In global context, similar studies have been tested and operationalized game addiction through valid game addiction scales. Most of the previous researchers applied Lemmens's[4]Diagnostic and Statistical Manual (DSM) of Mental Disorders (DSM scale) for their studies [6], [24], [30], [31]. It can be mentioned that the DSM based scale for pathological gambling has been used to confirm the existence of gaming addiction within the society [4], [6]. According to Griffiths and Davies[6], this scale can benchmark the addiction where the components within the scale represent operationalized components of addiction. Further, it emphasises that if a certain behavior fulfils the criteria, from this point onwards it can be operationally defined as an addiction.

The DSM scale consists of seven sub factors such as salience, tolerance, mood modification, relapse, withdrawal, conflict and problems. Three items were included for each seven factors. According to previous research as well as their findings, DSM can be identified as the most suitable benchmark scale to measure and validate the existence of game addiction which can also be used to prove the concept in Sri Lankan context.

Moreover, another scale of Assessment of Internet and Computer game Addiction (AICA-S) is widely used to test participants' gaming behavior with regard to problematic video game use[32].Moreover, a study discussing about video game addiction and psychological distress among expatriate adolescents in Saudi Arabia have included a validated game addiction scale with 11 items to the survey; this is based on the theory for pathological gaming which implies that gaming harms an individual's social, professional, family, academic, as well as psychological functioning[27]. This particular scale is can be identified much similar to the DSM scale.

Depending on the above facts and lack of practical contribution in the local context on the related subject, it is evident that an empirical study is crucial to properly determine the existence of game addiction in Sri Lanka. Such a study would assist to bridge the existing research gap identified in terms of both the local and global context.

Gap 02:The existing knowledge gap within the local studies to determine a relationship between game addiction and psychological functioning of the users.

Several studies have indicated that there is a higher the tendency of being addicted to the internet and its creative components like online games, lead to negatively impact on a person's social life by making them less sociable [33], [34]. Similarly, Lo, Wang and Fang[35]and Roe and Muijs[36]have investigate the relationship between social competence and excessive game play. Results indicate that heavy playing of computer games is negatively associated with sociability. Another study conducted by Loytsker and Aiello[37], mentioned that the gaming addiction paves the way to social distancing, reduce the active participation in studies due to the spending of time within the computer and mobile games.

Strengthening the above opinion, Kuss and Griffiths[12]suggested that some internet game players experience symptoms that relate to substance-related addiction, including mood swings, preference to excessive time spend on gaming which have caused some other activities to be disturbed. A negative correlation between problematic video gaming and psychological functioning has been configured using real world examples [17].

Numerous research studies unveil findings relevant to behavioral trends of university students concerning play computer and mobile games[15]. Nevertheless, it is not rationale to accept that/it cannot be accepted that the impacts of gaming addiction are only limited to, and adversely impacting teenagers and adolescents. Furthermore, studies have been discussed and emphasised on the vast area of negative aspects of computer and mobile gaming towards the overall wellbeing of an individual. Taking an in depth perspective, some researchers assert that most adolescents engaging in such addictive practices lead to long-term ill effects within the society. Lack of physical movement, sight disorders, agitation, nervousness and lack of socialization are few of these adverse factors [3]. Visible harmful/severe impacts can be observed due to the habit of reversed day and night activity schedules causing many students or teenagers to fall asleep during class hours[9].Online game play has a negative relationship with the mental health of adolescents and has a direct effect on violent behavior, anxiety, depression and isolation from their associates [9]. This valuable finding is observed from one of the recent studies conducted regarding the proposed research area with respective to teenagers. It further reviews on the mental impacts that gaming addiction causes in a persons' mind and reactions. One of the main negative impacts which are discussed here is related to the behavior of obsessive gamers that occur when playing a game. All these empirical evidences proved of less empirical evidence in determining a relationship game addiction and psychological functioning of people as well as other related variables significant in the Sri Lankan and Asian context.

Gap 03: Developing a framework to identify the relationship between game addiction and psychological functioning.

Lemmens, Valkenburg and Peter[4]have applied correlation analysis to determine the relationship between game addiction and psychological functioning. Five factors such as time spent on games, loneliness, life satisfaction, aggression, and social competence have been tested through game addiction scales. Furthermore, this study shows strong correlations with time spent on games and significant moderate correlations with the psychosocial variables. As such, the time spent on video games will vary from one person to another depending on their desire or the requirement to play. Therefore, the researchers have revealed some benchmarks to measure and act as reference on the amount of time spent on video games. Parker[38], states that spending over/more than 20 hours to play games can negatively impact health causing symptoms like negative emotional status, depressive syndrome and the inability to build good/sound social relationships.

Gap 04: There is a lack of studies, providing evidence to prove the existence of game addiction in local context within Sri Lanka.

In global context similar studies have progressed clarifying the existence of game addiction among people who belonged to different age groups yet rarity of such a study in local context will provide significance for the current study. Most of the global studies have focused on younger age category covering teenagers and adolescents [3], [7], [9], [40], [41]. Apart from that Wang and Zhu[15]have processed their study to determine the game addiction among university students further opening up the population for research. In order to determine the existence of game addiction previous researchers have used variety of variables. Time spent or screen time has been used as such an indicator of game addiction [4], [36]. Through those studies researchers have identified screen time has a strong positive correlation with problematic use of game. Furthermore, they have been able to determine level of addiction depending on the time spent on games. It has been highlighted that spending more than 20 hours per week for playing games can negatively impact to the health through negative emotional status, depressive syndrome and inability to build good social relationships[38].

On the other hand, previous researchers have developed scales to determine and prove the existence of game addiction among the selected population [4], [6], [17]. Those scales have been validated and future researchers have the comfort of using the same scales to prove the discussed concept. The uncontrolled use of these digital games has made digital game addiction at the same level as drug addiction[24]. This can be taken as an instance where this undergoing social concern taken to consideration as similar to another well-known problematic issue within the current society. Many studies based on Asian countries can be identified among the previous studies on this concept on global context [9], [7], [15], [24], [40], [41]. Yet there is no evidence about convenient studies done locally compared to existing global studies. Munasinghe and Dodanwala[42]have done a descriptive study by selecting a sample of 100 respondents on factors influencing video game addiction. Recent exploratory study discussing impacts of mobile game addiction on teenagers by Karunanayake, Perera and Vimukthi[39]can be identified as the most similar study in local context to the existing studies in global and Asian context.

Therefore, an empirical study to determine and test the existence of game addiction within Sri Lanka would help to narrow this existing research gap.

VI. Conclusion

As mentioned above, game addiction can be identified as a most discussed psychological area of research related to online video games. Main objective of this study has been to identify the existing gaps where four gaps were determined using the past literature. Among those gaps, first three gaps can be identified as empirical gaps in the research area while fourth gap can be stated as a theoretical gap. By identifying these gaps, this study will provide guidance to the researchers who are willing to do further research on the discussed concept of game addiction.

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SURGE – Early Flood Detection & Avoidance System

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***Abstract* - In Sri Lanka Early Flood Detection and Avoidance System is rarely few people know. Since there are have so many existing flood detection and recovery systems but the existing systems are not good in performance and functions. In the implemented system can save people using the android application and unfortunately, Researchers could face immediate flood situations and disasters. At that time, the implemented system shows the safe places and send them to safe places and who are the people affected by flood situations, they can get the donations or other helps from this implemented system. There is no function like this in other existing systems. It is felt that notification system such as flood warning system should be carried a step further is notifying the public. The implemented system able to send information in real-time. The architecture of this system can be expanded further to a fully functioning system in alerting the public of an impending disasters caused by flood. The implemented system will be designed using programming tools and database models. Implemented system is a good opportunity to make operations more efficient and synchronize. The aim is to focus on evaluating and improving the use of Early Flood Detection and Recovery System among public.**

I. INTRODUCTION

In this world developing countries like Sri Lanka, Bangladesh, Pakistan, India etc. In these countries natural disasters are a big problem to them. One of the natural disasters is a flooding. Some people may be dead, or some people are going to be displaced. It effects their lifecycle also examples for like farmers they can't farm no longer transporters are faced with the problem of flooding of routes in the are concerned. Peoples are faced different problems example for they have no place to go to protect their lives, their important documents, certificates will misplace so it's will be a huge problem. If they have warned about flood in earlier, they can prepare for it. Natural disaster is a huge problem to people who live in this society and this era now. One of natural disaster is a flooding. When flood coming people have no idea its coming. Some people do not care about what it takes. It can be taking life or important document, property there are many lots of things. In Sri Lanka have 103 rivers. To the record of google 2017 flood affected by 15 districts killed at least 208 people and left a further 78 people missing 2,093 houses fully and 11,056 houses partially destroyed [1]. The Implemented system send alert about the flood in earlier with SMS technology. Before the flood they can go to the safe places looking through the android application about the safe places bye near location in the map & donation system to people can donate goods or they can look what are the safe places looking through map and give it to there for displaced people. If people want to inform or contact the nearest police offices or hospitals about the flood the all contact information will have there. Then after flood came people can help the displaced people using the donation collection and the donation distribution system. People can send current flood affect situation images to the admin so they can share it with the relevant department and notify and warn people about that area.

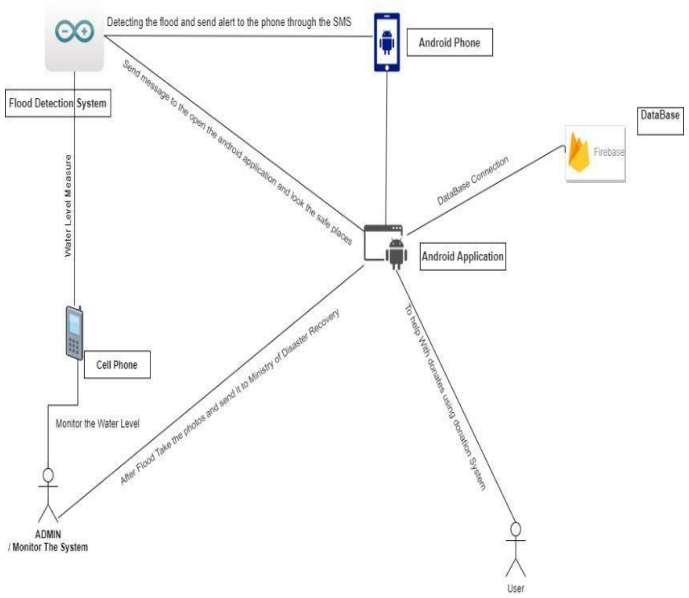


Figure 1: Architecture of the System

This above diagram explains the basic structure of the system. In here Main component is the Hardware. It is handling by the admin after measured water level data will upload to firebase. And Android application and the mobile device communicate through the using firebase. Android Application developed by android studio and the hardware component developed by a Arduino IDE.

II. RELATED WORK

The research team was found by some other researches that used ultra-sonic sensors to detect the flood getting out of the bed, emergency button system to notify guardian and an alarm system.

Early Flood Detection System

A. Flood alert and Donation System

B. Water level Monitoring System

A. *Early Flood Detection System*

Early flood detection existing system is used to monitor the flood situation and the danger is send by alert in the form of text messages. Arduino, water level sensors, GSM module, web monitoring and SMS are the parts the early warning system mainly consists. The water level sensor is used to measure the water level. So that the flood can be monitored. The solar panel operated microcontroller relates to water level sensor and GSM module. All the sensor data is transmitted to the server by using GSM. It takes 10-15 seconds to send the data to server for the sensor. The speed of this delivery time is influenced by several factors, including sensor response, server to SAFE response and the cellular network used. The EFDe system is equipped with an alarm around the location and has 10-15 seconds response when the indicator shows FLOOD POTENTILAL and it will not stop until the signal changed.

Early warning flood detection system mainly consists of 4 operations as sensing, computation, government and office interface, and community interface. By measure river level, rainfall and air temperature and solar panels powered different nodes are used to get information. In here water pressure measurement system is used to get the river level instead of water level water level sensors which fails due to corrosion issues and wind effects [2].

A real time sensor network for early flood detection and control monitoring system, design with a function of real time monitoring with contracting connectivity in low cost. This system is consists of CMOS image sensor to capture image for monitoring. Zigbee network and the GSM network is used to transmit the images in this system. If the alerts danger, alarm will be beeped. In here mainly three sensors are used to detect the water level, when water touched the first sensor indicator indicates the water level and so on. And the average sensing time and sending time are 1.14 sec and 2 sec respectively.

The hardware consists of this system are NodeMcu, WiFIESP8266 and several sensors. The HCSR04 sensor is used in this equipment. Ultra-sonic sensor works by sending certain waves and calculating the time it is received back by the sensor. The EFDe system testing is carried out by conducting a connection test which include sending the data to the server. Data is in the form of analogue signals and it provide by sensors, which are send to the server nodemcu. After sending the data it will display in a webpage that can be acceded via desktop or smartphone. The location of the placement of the EFDe system and the indicator table that real-time displays the reading of the water level. There are components that are presented in the table are; The sensor reading sequence number and this number also represent the delivery that EFDe system had made to the server, The time

column describes the local time data which is received on the server, The year, month, date, hour, minute and the seconds are displays in the time column and the description column is and indicator column that explains the safe condition or potential flood base on water level data read by the sensor[3].

When the water level is rinsing up it will send signal to the PIC. In this situation the accurate sensor needs to give information to the whole people in the area about the water level. The sensor is based on NAND gate. The most significant of this sensor are small size, inexpensive, easy to use and available in the market. In flood monitoring and detection system using wireless sensor network. In which can measure four parameters like rainfalls, temperature, water level and humidity to detect the flood situation. PIC24 microcontroller with the ZIGBBEE radio module is used in this system for communication. Also, they are using JAVA programming to develop a flood maintaining. And also, other components of the flood detection systems are PIC16F877A, Radio frequency and Global system communication mobile (GSM). In peripheral interface controller (PIC) all the code which has been programmed in C language is installed inside to the PIC. Additionally, PIC16F877A consider the main control of this system. It has the ability to identify the functions. Receive the signals from the three sensors and it will process the data know about the current level of water is the one of the function of PIC. The data which has been processed will display at computer personal (PC) as the output. In radio frequency the transmission medium is used. The transmission medium that is used in this system must be connected to the encoder. It make sure if the data is transmitted to the receiver. Change the signal or data in to code is the function of the encoder. When the information is send through RBO-RB3, the same information is received by decoder [4].

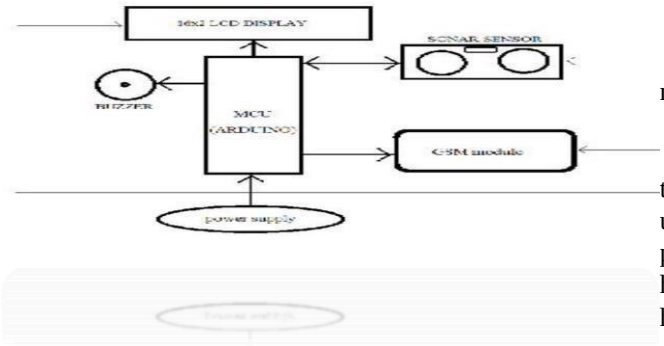


Figure 2 Design of the System

B. *Flood alert and Donation System*

Internet of things (IoT) is a technology that connects anything and everything to the Internet. IoT is the newest technology rapidly widen in its usage. This technology brings new products such as disaster monitoring. Flood disaster is one of the main concerns in Sri Lanka as it affects Sri Lankan economy, health and agriculture. This technology monitors the situation 24/7 and informs the user once it reaches the critical point. In this, we propose IoT approach that is known as flood alerts system with Android application. This system will monitor the potential drainage usually occur flooding and share the info in real time to people nearby. **[5].**

The main objective of this is to introduce a system of flood detection which is operated via an android application. The water level will be measured by ultrasonic sensors which are connected to solar panel operated microcontrollers and GSM module. This system will monitor the potential hazardous drainage and will share the information and updates to the users of the application via SMS and warning alerts. **[6]**

The proposed disaster preparedness system consists of a GPS supported android mobile phones with our proposed application installed on it and users having national identity. The user of our proposed android application can also register the number of family members, relatives, friends to send message for help. Through network provider or GPS provider, mobile phone gets the current location. **[7]** A SMS alert is sent to all the users of the application including information about the water level, and the potential possibility of flood. The SMS alert informs people evacuate from the hazardous area to safe places indicated in the application. It also provides contact information of Sri Lanka Ministry of Disaster Management. Alerts generated by the application are also sent along with the SMS alerts to ensure the user is informed about the situation. Alerts can be sent either in Sinhalese or English to avoid any language barriers in communication. **[8]**

C. Water Level Monitoring System

Dalibor Purkovic and team, introduces a smart river monitoring and early flood detection system in japan.

They used different range sensor technology & techniques for this system. However they used ultrasonic sensor adapted to the EnOcean solar-powers long range sensors for the system. This system have 10 meter measuring range. The ultrasonic sensor has two modes.

- Monitoring mode

In this mode the measurement will be taken by default every 10 minutes but only transmitted every 2 hours. If the water level rises and the measured distance drops below a certain level enter critical mode.

- Critical mode

In this module measurement are taken by default every 5 minute and every measurement transmitted. [9]

Figure 3:Enocean self-powerd sensor module with attached generic ultrasonic sensor

Herman Yuliandoko , Subono, Vivien Arief Invented the Design of flooding Detection system based Velocity and water Level Dam . In here Velocity and water level are main aspect to know and predict flooding of river. This system monitoring on dam, dam officer have to standby 24 hours to monitor water condition on dam and inform the result to the main office. To inform dam water status is needed communication network which can carry the data from the sensor to the users. This system represented real time water level and velocity graph.[10]

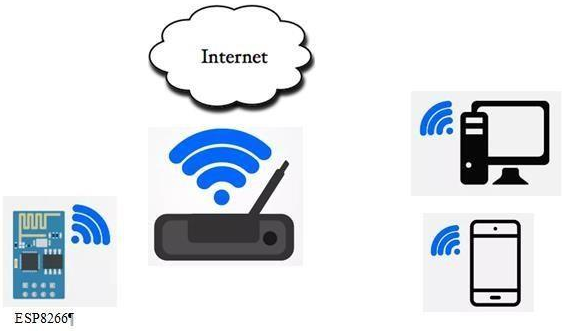


Figure 4: The system design

III. METHODOLOGY

Research team selected the Prototyping methodology to implement the System Surge. The earlier works done before other researchers are helpful to implemented a prototype of the system. The System implemented with real time processing of the data. Therefore, used firebase with connected server. Firebase data used as a dynamic source.

In the second phase is about the Requirement gathering, and data analysis. In this stage research team gathered requirement by two types

• Primary Data Gathering – Questioner Research Team questioned people by send a google form among the people. That form included 21 questions and it's about asking how important implementing system to this society will be and what are the now developed system for early flood detection.

A. • *Secondary Data Gathering – Literature Review*

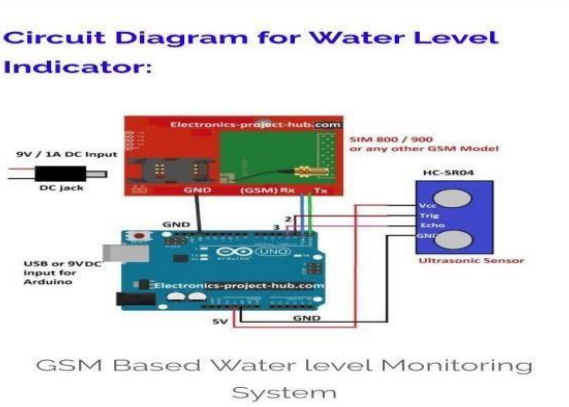
In the Literature review research team gather what are the existing system to get knowledge about early flood detection systems and analyzed what are the main strengths and weakness of this existing system.

After the Requirement and data gathering research team divided the system in to two main parts, Hardware part and the Software Application. After that Designed and implemented the system according to prototype software development life cycle.

B. • *Hardware Component*

This hardware part detects the flood then after in certain level it sends the warning message to the user through SMS also when maximum level reaches it rings alarm to find the risk. In also this component measured water level time by time and it send to the user with SMS and the output of measured water level uploading to the firebase.

In the Software part the android application divided in to four main parts.



Here Above diagram shows the design of the hardware system and how it works. The Arduino, Ultra-sonic water level sensors, GSM module, Buzzers and SMS are the parts the early warning system mainly consists. The Arduino is used to read the input coming from sensor and calculates the height water of water level whereas the text SMS is sent to the user by using GSM module. The ultra-sonic water level sensor is used to measure the water level. So that the flood can be monitored. The solar panel operated microcontroller relates to water level sensor and GSM module. All the sensor data is transmitted to the server by using GSM. It takes 10-15 seconds to send the results to server for the sensor. Other part buzzer is a mechanical, electromechanical, magnetic, electromagnetic, electro-acoustic or piezoelectric audio signaling device, when the water level increases to the maximum level the buzzer starts to work and give alarm to the system. A real-time sensor network for early flood detection and control monitoring system, design with a function of real-time monitoring with contracting connectivity in low-cost.

C. • *Safe places & Emergency Contacts*

In this function first user will locate the current location. Then after user can search near any safe places with limited area already defined. When flood is coming people can search locations near and they can go that places and can be safe. In also users can contact any emergency for police or hospital to relevant area.

D. • *Donation Distribution & Collecting*

In this part purpose is when after affect people by flood to help them by other people. Who monitoring this application they will put donation notices about where the places, time descriptions about donations goods will be collect and the locations will be display

where the places are by location. If anyone want to contact them their contact details will be display and also if failed to contact them in case users can send their details to them by fill some fields.

In this part admin will handle all this data through different login no need to check the database again and again.

E. • *Uploading Images of current situation*

In this function for share picture among the system. When after the flood the flood will be occur at least one or two days so using system people can notify there's flood in this are do not go like wise. Users or who monitoring this app they can take or select already captured pictures and send it to the database. So it will be check admin and notify relevant departments or give it to media to warn people about it.

F. • *Water level Measurement check*

In this function for check the water level measured at the last moment it will display with time and the measured water level. So, if anyone need that check data can be uploaded for the database for admins future purpose.

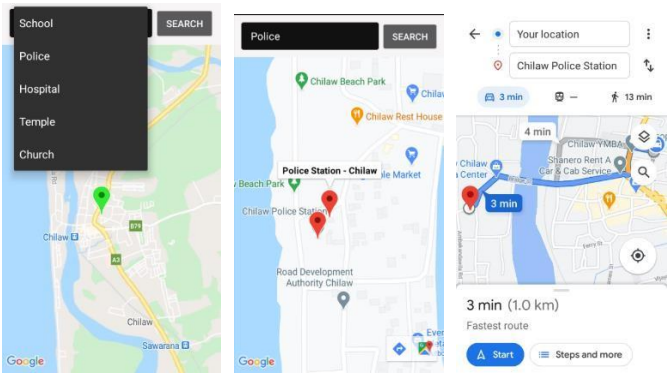
IV. RESEARCH FINDINGS AND EVIDENCE

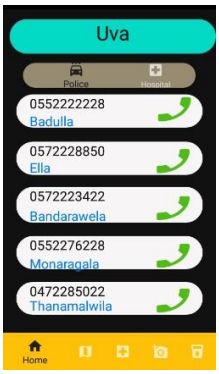
In the evidence described the all component research team did with the user interfaces and the important code fragment of functionalities.

A. *Checking the safe places or Emergency Contact Details*

When the flood is coming after warning by SMS people can check what are the safe places through the Map Implemented in there. When entering the map first it identified the current location of user then after user can select what are the places user want to go. After select type and search then it will display all near places user can select one place and it can be open with google maps so user can get the direction details directly. In here implemented with couple of place types.

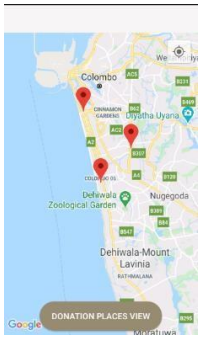
In the Emergency contact details user can select the province and get the details of nearest police department or nearest hospital contact numbers for any kind of emergency.

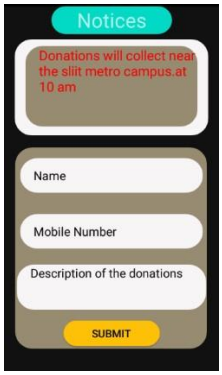


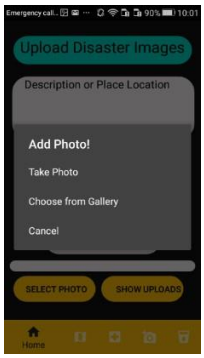


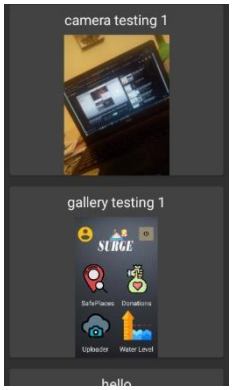
B. *Donation Collecting System*

This function when the flood came for the people get displaced or affected by the flood. In here other people can help for them. In here separated with three main parts. First one is to see donation locations, second one is for the see the details about donation notices and the third one is for the contact details about the donation collectors if they cannot contact them user can their details to the admin through the second option after they will contact the user.







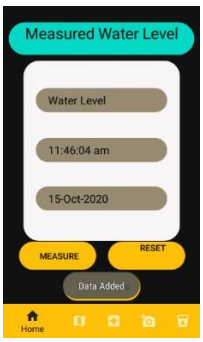


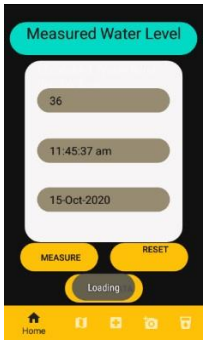
C. *Uploading the Disaster Images*

This function also can use to warn the people. When the flood is coming who is monitoring this app or users can take or select pictures from camera and they can upload it so admin can warn the people by saying this area is affected by flood or can give it to media and the relevant departments. Also, users can see the earlier users uploaded pictures and can share with them or distribute among people and can be safe.

D. *Measured Water level check and Adding*

In here Users can check the water level of the last time measured with hardware component. In here data will retrieve through the firebase database. Time by time its automatically measured the water level and send it to the database. For any future purpose of admin user can add measure data with current time to the database.

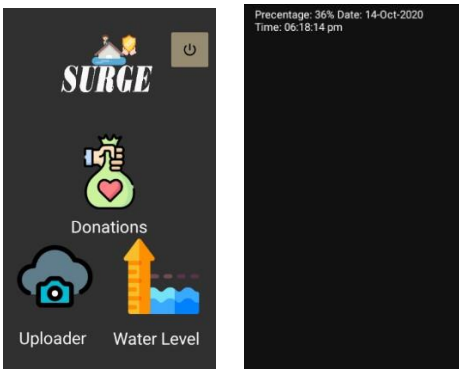




E. *Admin Perspective for Manage All Data*

In here Research team Admin Login Manually to the Firebase. In here Important is Who is monitoring them do not want to check the firebase to manage the data using admin login

they can change the data of Upload Image, Donation System Data & the Water level measurement Data. The All Data Retrieve Through List views.



V. DISCUSSIONS

This system helps the people who will affected by flood every day. Before the flood when warn the people, flood is coming in developing country like Sri Lanka it is rare. So, for that research team we think problems and implemented a solution for that problems. First need to be warn the people flood is coming and then want to think about what will be happens after the flood is coming. To get the knowledge about this problems research team did a literature review for get analyze about the existing systems for this problem and what are the strengths and weakness of this systems. Research team developed solution for that and finally implemented hardware component for detect and measure the water level and warn people by sending warning messages through the component to and make people notify about the flood, so they can prepare for itself.

Then after developed an android application for other problems peoples occur when flood is coming and after. When flood is coming some people do not know where to go may be there's home not be safe for them so for that research team find a solution showing safe places trough the android application by near location then also people have, and emergency then can contact nearest police or hospitals through the emergency contact details. Also, people can check latest measured water level through the android application and decide we will want to move on to any safe places or this situation will end. Then after flood people can help who affected by the flood they can give good for displaced people from using the donation collecting and distribution system. Uploading image of the current situation so admin can check it and give to the relevant department or media and notify the people there's area is affected by flood. This all function data will be handled with firebase database. In order to work with the system user, need a android mobile phone with internet connection. For use emergency contact there's no need an internet connection.

VI. CONCLUSION AND FUTURE WORKS

This system helps the system (Hardware, Application) to connect with the users constantly. Furthermore, the android application can do their own work without going to the hardware system all the time because all the hardware information and updates will retrieve in the application via firebase at the time. Any emergency situations or when water level reached the maximum level, that hardware system quickly does the processes and give the Alert Messages with ring alarms to the users. Some additional functions (Visit Safe Places, Uploader and Donation Systems) also helped to do this whole system successfully

This Application is limited to the android device in future works this system can be implement in different platforms in IOS and Windows. This System implemented with only English Language in the future works can do with select the language with use it, so it will be easy to use every people who don't' English also. Can add Whether situation and check how it's gone an effect for the flood and it will be high or low likewise can check in the future works.

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Academic Pulse – Institute Management System with AI Chat Assistant

Paskuwelge Don S. S, D. K. T. R. Karangoda, M. N. L. Costa, H, K Imalka and G. Fernando

SLIIT Academy

***Abstract*- Institute management system with AI (Artificial Intelligence) based chat assistant with Machine Learning. Main purpose of this system is to implement a system which related to academic based business entities and equip the system with advance chat assistant also known as "chat-bot". A "chat-bot" expects to make a discussion between both human and machine. The machine has been installed information to distinguish the sentences and settling on a choice itself as a reaction to address an inquiry. It can be referred as intelligent systems that understand user's natural language questions of the consumer and respond accordingly in a conversation, which is the main focus of this study. Main purpose of this system is to provide an efficient system for Schools, Institutes, and Colleges and provide an Artificial intelligent based chat assistant and reduce human interaction regarding consumer support. A Chat-Bot on a college system will enable all the users to discover the required data in few snaps and questions. The chat-bot distinguishes the intent of the questions or queries received from the client and parses the system accordingly to find the related information. The chat-bot technology can deliver the simplicity and human like collaboration to students, parents and academic staff as well. This document contains the detailed description of the device and the solution.**

***Keywords* – Artificial Intelligence, Machine Learning, NPL, Institute Management System, PHP Web Application, Chat bot**

I. INTRODUCTION

A Chatbot additionally alluded to as "Bot" it is a computer framework which can be communicated through audio or textual format. The first ever Chatbot was made by Joseph Weizenbaum in 1966 and it utilizes design coordinating and substitution strategy to recreate conversation. The program was planned such that it mirrors human conversation [1]. Essentially Chatbot can be referred as virtual conversation in which one party is an automated online talking robot that can handle a defined task or give automated structured replies to the user queries. Bots can discover from client's conduct and furthermore give much increasingly customized answers. It's assessed that approximately 80 % of organizations are intending to consolidate chatbots by the whole year of 2020. Due to the advancement of the technology every institutes are tending to use systems in order to ease their work. When it comes to institutes and colleges it is the only industry where the use of technology is at a very low percentage and very slow speed compared to other business entities that are available around the globe. More than 90% of colleges, institutes and all academic related business entities uses systems in order to ease their business process. Some business entities have a central system and some have fragmented system. If education institutes begin utilizing the innovation of Chatbots it will be extremely advantageous for them to relate with their students, academic staff.

Academic pulse is an institute management system, which will be an enterprise grade system with all basic and non-basic features that exist in a regular information system. The main feature that will be unique from other systems is having an in-built chat assistant known as the chatbot in order to maintain good user interaction with the system. The system will consist of multiple areas such as Student, Academic affairs, Administrator and Finance these are the main parties related to the system. Each and every area has a different role to handle as an example, the student will be able to enroll for courses, view lecture materials and even view the results of the completed modules. The uniqueness will arise when the chatbot is implemented. Chatbot will be a virtual assistant to all the given parties separately. Each and every entity that is mentioned above will get a separate dashboard to handle their tasks.

II. BACKGROUND

In this section covers all the main research areas which inspired our Academic Pulse Institute management system research. The main research component is the Chatbot. In this section point outs the other various implementations of the chatbots around the globe. Various chatbots were used in different systems by various business entities. These days' institute management systems have become a vital aspect in education systems. Institutes now uses institute management

system to make the process flow much easier. Academic pulse is an institute management system which has an in built AI based chat bot or so called as chatbot. Every institute must be equipped with an institute management system and mostly building an institute management system will be costly. Academic pulse is an easy and cost effective and reliable system which has an AI based chat assistant running inside the system providing and giving the user more interaction between the system. AI chat bot will reduce the cost on maintaining a separate call center or help desk agent for system issues. The uniqueness of Academic pulse with other institute management is having the chatbot within the system. Most systems that are available in the marketplace does not contain a chat bot. Most common reason is most people does not have a proper knowledge or idea on this matter. When considering the entire globe. Each and every business entity now tends to use the technology of AI based chat bots. This technology will bring the system into a whole new level and it's easy to maintain and handle customers or users. The availability of an assistance 24/7 is the most convenient option or a feature that any business entity must adhere. Solving system problems and automating the process for a system is a great feature for any system. So our research team came up with the idea of implementing the chat bot into an institute management system and help the related users. Lecturer can interact with the chat bot. cancellation or postponing lectures, viewing time tables are some of the functionalities that can be achieved using a chatbot. A student can get help regarding enrolling into a course, view results of his modules and view time tables and lectures are some features that will be implemented to the Student module. Not even students and lecturers even administrators or finance department can also have separate features regarding their workload. We assumed that chat bot option will be a good replacement for a human agent. Most common features of an institute management system are covered by the scope of Academic pulse.

In order to achieve the research goal new innovative ideas were involved, these ideas laid the foundation on building a reliable system that equipped with a chat assistant. This section will cover and focus on major systems that used chat assistants. Other related innovations were likewise evaluated. In spite of the fact that the research shows these inventive thoughts in an assortment of settings this writing will fundamentally concentrate on the current existing technologies.

Chaitrali S. Kulkarni.et.al published "BANK CHAT BOT" on May 2017 it provides smart solution to solve these queries, provide information as and when required, improve service and increase number of customers. It was a web based chat-bot which could be available on any hand-held devices. Customers can mention their queries in natural language and the chat bot can respond to them with correct answer. Furthermore, it states that chat bot application is easily accessible to customer thereby solving redundant queries anywhere anytime. As there will be fast response for inquiry, this will be time saving for both bank and customers [2].

Namita Mhatre .et.al published "Donna Interactive Chat-bot" on April 2016. Donna is a web based personal assistant chatbot which has the ability to simulate mundane conversation with a human either via textual or auditory methods [3].

Jash Thakkar.et.al published "ERASMUS" an AI based chat-bot on October 2018. ERASMUS is a chat bot on Facebook which is used to answer the queries related to the college information. It has artificial intelligence algorithms that analyses user's queries and understand the user's messages. Students must query through the bot which is used for chatting and the interface is same as any other chat box. The system interprets the question and analyses it further to generate answer for the user [4].

TABLE 1. FEATURE COMPARISON WITH SIMILAR SOLUTIONS

Project / Functions	**HD**	**AI**	**FH**	**RG**	**AC**	**RC**
PowerSchool	✔	×	×	✔	✔	×
Infinity Campus	✔	×	✔	✔	✔	✔
Chatbot based college information system	✔	×	×	✔	✔	✔
Cluster	✔	×	×	✔	✔	✔
Snappi	✔	×	×	×	✔	✔
veracross	✔	×	×	✔	✔	×
Academic Pulse	✔	✔	✔	✔	✔	✔

- HD = History Data
- AI = Artificial Intelligence Chat bot
- FH = Finance Handling
- RG = Report Generation
- AC = Admin Controls
- RC = Results Checking

Above table is a comparison of our System and other systems which are available in the market.

III. System Implementation

Deployment of Academic Pulse web-based system follow limitation constraints, which should be got into consideration. The limitations are the web based system does not support any platform other than PHP, the system does not work when the computer has no internet connection, all users should have XAMP or WAMP for using the system. We decided to develop our system in Laravel framework of php. Laravel was a complete new framework to the team members. We selected laravel because of the wide usage from the entire globe and laravel has in built security authentications so that the team did not have to spend more time on the security of the system. Miss communication within the team members caused failure in identifying the assigned tasks. Lack of up-to-date technology caused too complexity to implement the application. The team had to overcome these challenges in order to deliver a reliable system which will bring a unique product to the market. The chat bot was developed using python. So python language was a new experience for the team. Team has to go through many resources in order to build a successful chat bot algorithm.

Providing a good Institute management system with a chat bot is the main focus of our research. PHP is a widely used language for building web based system. Python and Laravel can be a good combination and derive a good system with an advanced chatbot into the market. All the roles in the system such as Administrator, Student, Lecturer and Finance user will be able to interact with the system more and get things done using the inbuilt chat bot in the system.

The system consists of four main roles associated such as Admin, Student, Finance User, Lecturer

A. *Admin Dashboard*

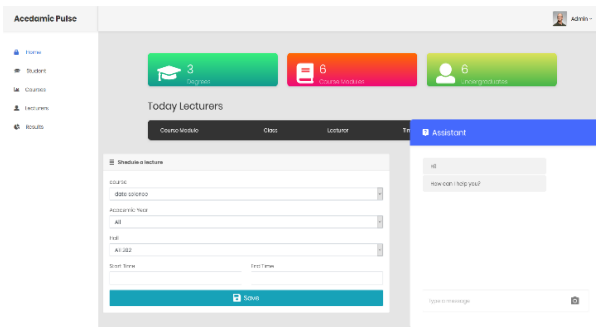


Fig 2. Admin Dashboard

This is the dashboard of the administrator. In the dashboard the admin user can see the current semester of the system. Administrator can view the Courses, Degrees and number of undergraduates who are registered in this system. In the main dashboard the admin can also view the scheduled lectures. Scheduling a lecture can be done in the form that is available in the bottom. Chatbot text is available and the admin can pass queries to the chatbot from this interface as well. Admin is the super user of this system. Most of the functionalities can be done in the admin panel.

B. *Student Dashboard*

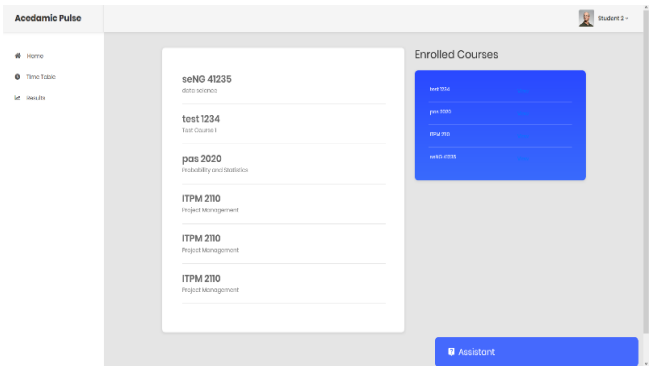


Fig 3. Student Dashboard

In this interface the student user will be able to see all the subjects which is relevant to his/her academic year. In the right side of the interface the user will be able to see the subjects which the user is currently enrolled.

C. *Lecturer Dashboard*

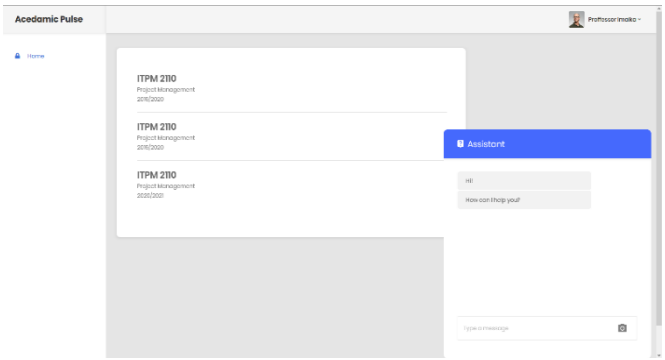


Fig 4. Lecturer Dashboard

In this page the lecturer user will be able to see all the courses that enrolled by the administrator. All the details regarding the course will be shown in the screen. Chat bot message box will be available in this interface. The user can interact with the chatbot in any given interface in this given role.

D. *Finance Dashboard*

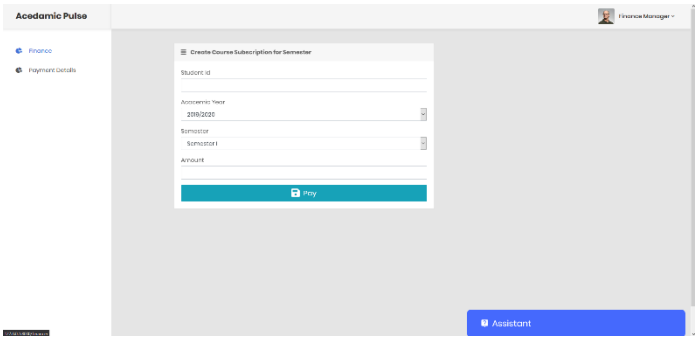


Fig 5. Finance Dashboard

This interface the finance user can add payments for students. The chatbot text box will be available in this interface so the finance user can interact with the system effectively

E. *Chatbot*

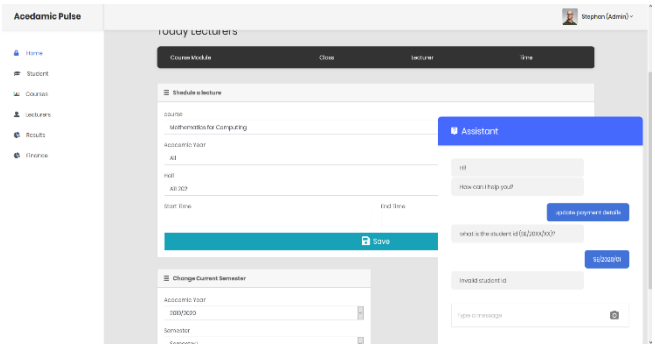
Chatbot is our main research component. The team had to conduct more research regarding chatbots. Team had to divide into individual groups in order to conduct the research fast. Main goal was to identify the methods of developing a chatbot. After finding the methodologies team focused on finding an algorithm to develop the chatbot. There are multiple algorithms on developing an AI based chatbot. Most commonly used chatbot algorithm is Naïve Bayes algorithm and in some occasions there were instances of using decision tree algorithm. As the selected methodology is prototype methodology by testing all the possible algorithms and finally decided to develop the algorithm using decision tree algorithm. The chosen algorithm showed significant success when comparing with the Naïve Bayes algorithm. In the Initial stage of the development the main target was to implement the system and then the focus was changed towards the development of the chatbot. The chat bot interface was added in the initial stage with dummy data and when the functionalities of the interface completed the development of the API was started. At first the system has to pass the query to the python powered chatbot for that the API will be the mode which will grant the user query and pass the value into the python. To keep the communication with two different platforms the API plays a significant role in cross-platform development. In the Python code segment there is a function called “predict” that is the function that receives the values that have been passed by the API. There is an excel CSV file which is used to store all the possible queries and questions which a user might type. In that CSV file intents were defined in order to sort the query to get identified by the chatbot. Decision tree algorithm will start working in this phase by identifying the user query and the predict function will identify the query from the CSV file get the relevant intent for the particular query. Decision tree will partition the query similar to an array and assign an id for each word, by assigning the decision tree algorithm will identify the numbers and compare it with a probability score which is predefined in the code and generate the next query or answer based on the score which is received by identifying the data set. To improve the response of the chatbot more and more data should be added in order to get maximum accuracy from the chatbot.

```
def predict(text):



    guess_proba = classifier.predict_prob
a(prepare_text(text))

    max_value = max(guess_proba[0])

    print(max_value)

    if max_value > 0.2:

      return {'result': classifier.predic
t(prepare_text(text))[0]}

    else:

      return {'result' : "NOT_FOUND"}



##predict("hi, good morning")



if __name__ == '__main__':

app.run(debug=True)
```

This is the code segment of the API which connects to the Python Function.

```
function        mapIntent(text)        {
  $.ajax({
      type:                        "post",
      url:
"http://127.0.0.1:5000/api/v1/predict",
      data:              JSON.stringify({
          'text':                     text
      }),
      dataType:                    "json",
```

```
        contentType:    "application/json;
charset=utf-8",
        success:    function(result)    {

            if    (result["result"]    ==
"NOT_FOUND")                            {
                is_intent_identified    =
false;
                showDidNotGetIt();

            }           else            {
                is_intent_identified    =
true;
                intent = result["result"];

                reqObj['user_id']       =
userId;
                reqObj['intent'] = intent;


if(INTENT_LIST[intent].length   >   0)   {

getParamMsg(INTENT_LIST[intent][parameter
_index]);
                }         else          {

sendProcessedMsgToServer(reqObj);
                }
                parameter_index++;
            }


        },
        complete:       function()      {
            $(".au-input").val("");
        },
        error:          function()      {
            alert("error        occured");
        }
    });0
}
```



IV. Conclusion

Major goal of this system is to provide an institute management system with AI chatbot. In the final stage of chatbot development the team decided to use Decision Tree algorithm. It is a very good option for text classification and NLP. Using Latest technologies in the world such as chat bots in an institute management system is good approach to any institutes that are available in the market. There are many institute management systems that are present in the market. Our team will ensure Academic Pulse will stand unique with other institute managements that are present in the market. This web application will give many benefits for the users. Chat bot will ensure that the user and the system will have a good interaction and make the system more reliable and convenient for the market. There will be specified task which can performed by the chat bot in each and every role. The chat bot will be able to differentiate the user and identify the problem and provide solution for the relevant query entered by the user.

Deployment of the Academic Pulse system will follow some limitation constraints, which should be getting into the consideration. This system is developed using PHP Laravel framework and this system will not support any other languages or platforms rather than PHP. The computer which is using the system will also need internet connection to run the system smoothly. Chat bot was designed using decision tree algorithm this algorithm requires to be trained more and more using natural language in order to identify the query. There might be slight complications when identifying user queries in the chat bot.

Providing a good Institute management system with a chat bot is the main focus of our research. PHP is a widely used language for building web based system. Python and Laravel can be a good combination and derive a good system with an advanced chatbot into the market. All the roles in the system such as Administrator, Student, Lecturer and Finance user will be able to interact with the system more and get things done using the inbuilt chat bot in the system.

In the future the team wanted to develop an android application for this system. Both the system and the android application will be integrated and user will be able to use the laptop or the android application to do the tasks. The team also wanted to improve the chatbot as well. During this research time the team was highly concentrating on the time because the time was limited for developing system that has a wide scope. When the time is not a constrain the team can easily be focused on Machine learning and AI parts of chatbot in order to add further improvements.

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Section C : Abstracts
Electronic & Electrical Engineering

Smart Irrigation System for Large Scale Cultivation

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Abstract – Agriculture plays a significant role in the economic sector. Automation in agriculture is a main concern and an emerging subject across the world. The population is increasing tremendously and with that the increase in the demand for food and employment is also increasing. The traditional methods which were used by the farmers, are not sufficient to fulfill these requirements. Thus, new automated methods are introduced for agriculture. A microcontroller-based system is presented which is installed in a cultivation. It monitors the soil moisture and the nutrient content level of the cultivation and continuously modifies and controls the conditions in order to optimize them in order to achieve maximum plant growth for best yield.

Smart Greenhouse

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Abstract – Greenhouse farming is a practice of growing crops within sheltered structures covered by a transparent, or partially transparent, material. The main purpose of the greenhouse is to provide favorable growing conditions and to protect crops from unfavorable weather. This paper presents a solution to maintain favorable conditions within the greenhouse to grow plants all year through, even with unfavorable conditions. It is a smart greenhouse. It uses 4 sensors to maintain light, temperature, humidity and soil moisture inside the greenhouse within acceptable limits favorable for healthy growth of plants. Sensor data is saved on a regular basis in a mobile app and it is used by a closed loop control system to regulate greenhouse parameters and provide proper conditions for a healthy growth of crops throughout the year.

Vehicle Accident Analyser - Black Box

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Abstract – Every year thousands of human lives are lost due to vehicle accidents. This paper presents a warning system which can identify and minimize vehicle accidents. It is a wireless system that is located and fixed inside the vehicle similar to a Black Box in an aircraft. It is an accident prevention system followed by accident detection and reporting system. It can also ensure safety of the driver and the passengers by giving a warning signal. The system warns the driver if he is in an unsuitable condition to drive such as a situation when he is under the influence of alcohol. It also informs the relevant authority if needed. Should an accident occur, it can take necessary measures to limit the damages to the humans and the vehicle. All necessary readings such as time and speed are recorded after an accident occurred to use as forensic information.

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