I.5. Research outputs are published in refereed national and/or international journals.

List of Faculty who have conducted and/or are conducting research/es relevant to the Program

Name of Faculty	Title of Research	Duration of Implementation	Funding Source	Status (On-Going/Completed)
Cansino, Julius . De La Cruz, Arvin R. Tenerife Jr., Pedrito M.	Impact Assessment of the Computer Engineering Learning Management System Evaluation	2019 - 2020	Personal	On-Going
Ado, Remedios G. Cansino, Julius .S. Mahaguay, Rolito L. Tenerife, Pedrito Jr. M.	Industry Perception on the Computer Engineering Graduates of the Polytechnic University of the Philippines	2019 - 2020	Personal	On-Going
De La Cruz, Arvin R. Tenerife Jr., Pedrito M.	Design and Development of Banana Fiber Decorticator with Wringer	2018 – 2019	Personal	Completed
De La Cruz, Arvin R.	Optical Character Reader of a Braille Unicode System for the Blind	2018 – 2019	Personal	Completed
De La Cruz, Arvin R.	E-Teaching Assistance Management System (ETAMS) with Educator Stress Determination for K*12, Tertiary, Graduate School and Distance Education	2018 – 2019	Personal	Completed
De La Cruz, Arvin R.	Optical Character Reader for the Blind	2018 – 2019	Personal	Completed
De La Cruz, Arvin R. Tenerife Jr., Pedrito M.	Image-Based Microalgae Cell Identifier and Counter	2018 – 2019	Personal	Completed
Ado, Remedios G. Mahaguay, Rolito L.	Development of e-Bag Wireless Charger for Gadgets	2017 – 2018	Personal	Completed
De La Cruz, Arvin R. Tenerife Jr., Pedrito M.	Design and Development of a Hybrid Photobioreactor for Biomass Production of Spirulina Platensis Species	2017 – 2018	Personal	Completed
Tenerife Jr., Pedrito M. Tubola, Orland D.	The Development of a Hybrid Renewable Energy: Powered Light Bouy System Harnessing Sea Energy Potentials	2017 – 2018	Personal	Completed
Cansino, Julius S. Tenerife Jr., Pedrito M. Fernando, Ronald D. Mahaguay, Rolito L.	College of Engineering Online Class Record	2017 – 2018	Personal	Completed

Natividad, Ferdinand O. Oquindo, Florinda H.				
Dela Cruz, John R.	Design of a Fuzzy-based Automated Organic Irrigation system for Smart Farm	2016 – 2017	Personal	Completed
Dela Cruz, John R.	Fuzzy-based Decision Support for Smart Farm Water Tank Monitoring	2016 – 2017	Personal	Completed
Tubola, Orland D.	Lung Disease Identification and Classification through Neural Networks	2015 – 2016	**Grant in Aid (PUP)**	Completed
Remedios G. Ado	Evaluation of SMART Wireless Engineering Education Program (SWEEP): Basis for a Proposed Integrated Model of Collaboration Between Industry and Academe	2014 – 2015	Personal	Completed
Ferdinand O. Natividad	Computer Engineering Laboratory Equipment Reservation and Monitoring System with Mobile Application	2014 – 2015	Personal	Completed
Remedios G. Ado	Engineering Academe Industry Partnership Towards Learning Exploration	2014 – 2015	Personal	Completed
Remedios G. Ado	Mobile Emergency Response Application Using Geolocation for Command Center	2013 - 2014	Personal	Completed
Natividad, Ferdinand O.	Enhanced Voiced Based Cane For The Blind With Anti-Lost Feature For The Resources Of The Blind Inc.	2012-2013	Personal	Completed
Oquimdo, Florinda H.	Groundwater Treatment using Bio-sand Filter in Sitio Centro Brgy. Cogunan Nasugbu, Batangas	2012-2013	Personal	Completed

Prepared by

Pedrito M. Tenerife Jr.

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Image-Based Microalgae Cell Identifier and Counter

Pedrito M. Tenerife Jr.[1], Arvin R. De La Cruz[2], Wilgefortiz P. Catchillar[3], Dannah Louise L. Gabuni[4], Nathaniel Lewis Galang[5], Adrianne Paule M. Langit[6]

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***Abstract*— Microalgae have received considerable interest as a potential feedstock for biofuel production because of the useful quantities, like polysaccharides (sugar) and triacylglycerides (fats), they produce. Obtaining high yield and good quality of the said raw materials is must in optimizing biofuel production. Therefore, daily monitoring of algal growth is done manually by counting microalgae cells under the microscope that is time consuming and tedious. Thus, the proponents developed a system for automating the method of counting microalgae cells, specifically Dunaliella sp. cells and Chlorella sp. cells, using image processing and Haar Cascade as classifier implemented in Raspberry Pi to minimize the work and time of counting. Images of cells were taken under a low power objective of microscope. T-test was used to analyze the significant difference between the means of manual and automated counting and F1 score for the accuracy of the system. Based from the analyzed and computed results, average F1 score for identifying Dunaliella sp. is 66.14% while the average F1 score for Chlorella sp. is 19.74%., thus, there was no significant difference between the means of manual cell counting and automated cell counter, yet the performance of the system was accurate in counting and identifying Dunaliella sp. cells than Chlorella sp. cells.**

***Index Terms*— Image Processing, Haar Cascade, cell counting, classifier, Raspberry Pi**

I. Introduction

Microalgae cell counting is necessary in determining the number of cells in a millilitre of a liquid. It is done to estimate the size and population of the cultured algae, and to estimate the growth rate of a cell. [4]

The purpose of cell counting is for the management of cell cultures in biological research. [3] In addition, cell counting is important for the routine monitoring of cell health and proliferation rate. [5]

Hemocytometry is the manual way of counting cells that uses microscope and hemocytometer. This is the commonly used method in cell counting. A hemocytometer is a special type of microscopic slide consisting of two chambers, which is divided into nine (9) large squares with each area of 1mm^2. The central counting area contains 25 large squares and each large squares has 16 smaller squares. The chamber are 0.1 mm in height so that each square corresponds to a given volume, applied to count cells with a size of 2-30 micrometer and concentrations of 104-107 cells per mL.[4] The advantage of using this is that it includes the ability to make immediate judgments and decisions about the sample analysis. Cell viability is often accomplished using the trypan blue dye-exclusion method. This method is since viable cells exclude the dye and remain visually clear, whereas nonviable cells are stained blue. [6] But cell counting using hemocytometer suffers from a variety of shortcomings like, lack of statistical robustness at low sample concentration, poor count due to devise misuse, subjectivity of counts among users. In addition, it is very time consuming and tedious operation.

The current method for identifying, counting and measuring cells are at best semi-automatic but slow. This is due to the complex nature of the microscopic images. Also, algal cells are typically clustered and overlapping and a method is needed for accurately separating, identifying and counting individual cells in a sample, while ignoring noise. Overcoming these problems using image analysis is the first step in developing automatic methods of estimating biomass directly from the microscope image. [7]

Nowadays, several automated cell count systems are available that provides the possibility of analyzing number of samples in a shorter time and reduces the variability associated to human error. [3] Automated cell count instruments consist of a digital camera to obtain images and the analyses are performed through specialized software that requires minimal user involvement. The semi-automated Countess from Invitrogen and the fully automated ViCell XR from Beckman Coulter are two instruments currently employed in viable cell counts at many laboratories worldwide. Although automated instrument facilitates the process of analyzing samples, they are constrained by the availability of a few compatible staining options and may be imprecise in differentiating some types of cells due to technical limitations in their hardware and software. [7] But these automated cell counting systems are costly and internationally available only.

Thus, the researchers developed a cost-efficient system for automating the counting process of microalgae cells in order to lessen the time and effort of counting a pure cultured cell sample specifically Dunaliella sp. and Chlorella sp., that will help a lot for the observation of cell growth and cultivation inside a laboratory.

A. Objectives of the Study

General Objective

The researchers aim to develop an image-based microalgae cell identifier and counter implemented in raspberry pi.

Specific Objectives

It specifically aims to design a module for:

1. Calculating the cell density in a milliliter of sample to be used for monitoring the growth rate of microalgae cells,

2. Counting and recognizing microalgae cells using image processing and Haar cascade algorithm, and

3. Automating the counting process of microalgae cells developed in raspberry pi microcontroller.

II. SCOPE AND LIMITATIONS OF THE STUDY

Dunaliella salina and Chlorella sorokiniana are the two species of microalgae could be used for the system. The system can only process images that were taken by a monocular digital microscope that has 100x magnification that is available at the Polytechnic University of the Philippines – Institute of Science and Technology Research Laboratory. Furthermore, the researcher chose the PUP-ISTR to be the sole beneficiary of the project. The system did not cover the classification and counting of microalgae in uncultured environment. Growth monitored by the system was the quantity of microalgae cells per mL. Monitoring the growth size of microalgae cells was not part of the process. The schedule of conducting the cell count and interpretation of results will be done by domain experts from CLS-ISTR.

III. METHODOLOGY

A. Data Gathering

The researchers gathered data and information by using the following research instruments: using online journals and articles from research databases, document analysis for reviewing existing documentation of comparable processes and interview method. The researchers interviewed Prof. Armin S. Coronado, OIC Director of ISTR, related to the development of the system.

B. System Development

The system was implemented in Raspberry Pi 3 microcontroller, with Python language as the programming tool used in the development of the software. OpenCV was used, which is responsible for processing captured images and Haar Cascade Algorithm used as the classifier. HTML and CSS were used for the front-end development while PHP was used for the backend development.

C. Block Diagram

Figure 1 shows the block diagram composed of two processes, image processing using OpenCv and Haar Cascade Classifier. The input of the system is the image captured by the camera. These digital images undergo pre-processing and the processed images will serve as an input for the training and testing using the Classifier inside the Raspberry Pi. The system then identify the microalgae and computes the estimated cell density based from the total *counted cells in the image. Results are displayed in the Touch Screen LCD interfaced in Raspberry Pi.*

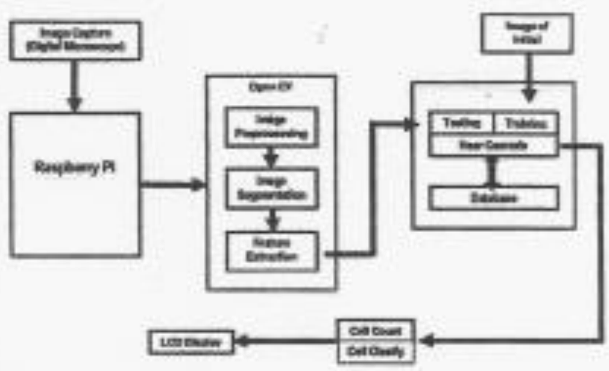

Fig. 1 Block Diagram of the Image-Based Microalgae Cell Identifier and Counter

D. Data Analysis

Microalgae samples were provided by the Polytechnic University of the Philippines Center for Life and Sciences, Institute for Science and Technology Research (CLS-ISTR). Counting the microalgae cells was done both manually and automated. Five (5) trials were done in comparing the manual and automated count, and ten (10) trials for identification process.

F1-Score was used to test the performance of the system in identifying Dunaliella sp. and Chlorella sp. The significant difference between the means of manual and automated counting was analyzed using t-Test.

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A. F1 Score

The performance of the system was tested using confusion matrix. Values obtained from confusion matrix were used in the computation of F1-score, precision and recall.

Figure 2 and Figure 3 shows the graphical representation of the system performance of identifying Dunaliella sp. and Chlorella sp., and the computed percentage of precision, recall and f1-score in each trial.

In Figure 2, precision, recall and f1-score does not differ significantly in each trial for Dunaliella sp. Since the system outputs a high precision and recall and the percentages reaches above 50%, the classifier for Dunaliella sp. returns a relevant result.

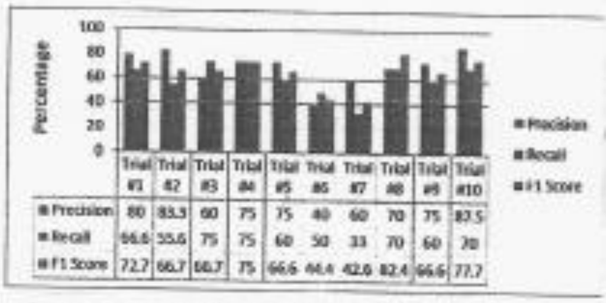

Fig. 2 A sample of the System Performance for Dunaliellasp.

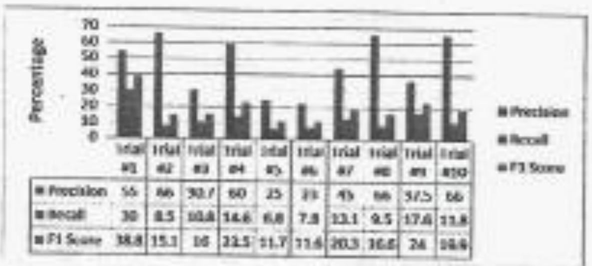

Fig. 3 A sample of the System Performance for Chlorella sp.

Figure 3 shows that the percentage of precision and recall for Chlorella sp. differs significantly in each trial. High ratio of precision and low ratio of recall means a low f1-score. Also, compared to Dunaliella sp. most of the trials for Chlorella sp. yields a percentage below 50%, hence, it means that the system has low performance when it comes to recognizing Chlorella sp.

B. T-Test

Results produced by the system were compared to results done in manual counting. The following table below shows the result of t-Test between the means of the manual and automated cell count.

t-Test was used to compare the means of the manual and automated process of the system, and to test the null microalgae cells t-test is 0.05.

As shown in Table 1, the computed p-value=0.6143790 is greater than the alpha level, therefore, null hypothesis cannot be rejected and the difference between the sample means of manual and automated process for Dunaliella sp. do not diffe significantly.

TABLE I
T-TEST BETWEEN the MEANS of AUTOMATED and MANUAL CELL COUNT for DUNALIELLA SP.

	Automated	Actual
Mean	86.8	83.4
Variance	145.2	62.8
df	7	
t Stat	0.52714762	
P(T<=t) one-tail	0.30718951	
t Critical one-tail	1.8945786	
P(T<=t) two-tail	0.61437903	
t Critical two-tail	2.36462425	

While in Table 2 shows that the computed p-value=0.003293807 of Chlorella sp. t-test is less than the alpha level, hence null hypothesis rejected. This means that the difference between the samples means of manual and automated process differs significantly.

TABLE III
T-TEST BETWEEN the MEANS of AUTOMATED and MANUAL CELL COUNT for CHLORELLA SP.

	Automated	Actual
Mean	499.4	589.8
Variance	1526.8	617.7
df	7	
t Stat	-4.365061906	
P(T<=t) one-tail	0.001646903	
t Critical one-tail	1.894578604	
P(T<=t) two-tail	0.003293807	
t Critical two-tail	2.364624251	

V. CONCLUSION

Based from the analyzed and computed results shown in the table and graphs, the proponents concluded that the system was indeed effective, that there was no significant difference between the manual and automated counting and can be utilized as an alternative for manual counting.

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Also, the system successfully managed to achieve the objectives of the study. The researchers were able to automate the counting process using Raspberry Pi, the system was able to calculate the cell density of the sample and able to count and identify Dunaliella sp. and Chlorella sp. using image processing and Haar Cascade Algorithm. However, the system was not able to return precisely results for Chlorella sp. due to its size and difficulty of processing images because of low resolution camera.

So, the proponents recommend using a high-resolution camera to acquire better quality of images. Using an updated and higher version of microcontroller other than Raspberry Pi 3 would also be better to enhance the performance of processing.

FIGURES/CAPTIONS

The following formulas were used in the computation of precision, recall and f1-score.

$$F1\ Score = \frac{2*(Recall*Precision)}{Recall + Precision}$$

$$Precision = \frac{True\ Positive}{True\ Positive + False\ Postive}$$

$$Recall = \frac{True\ Positive}{True\ Positive + False\ Negative}$$

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DEVELOPMENT OF E-BAG WIRELESS CHARGER FOR GADGETS

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Abstract

Engineers and technologist who go in the fieldwork every day are gadget dependent in monitoring the status of their projects, during outside team meetings and presentations. They use different portable devices such as mobile phones, tablets and laptops in the delivery of their tasks which need electric power sources to operate. This research focused on the development of readily wearable e-Bag as a way to power portable devices. The developed wearable e-Bag used the solar panels to generate power for the devices in times when gadgets are power-deficient. The solar panels collect the solar energy and store it in a lithium-ion battery inside the bag. The e-Bag was designed in a simple and creative way. It has wired charging ports to cater phones and devices that are not capable of wireless charging. A battery meter is provided as charging indicator status. The e-Bag has built-in battery that can supply 5V and 19 V. The stored voltage and power were calculated using Ohms Law. It was able to supply 5V and 19V to the devices such as Android, Nokia Lumia800 cellular phones with built-in wireless module, any modeland brand of laptops and tablets. The prototype was tested in an indoor and outdoor environment under the sunny and cloudy weather conditions. Continuous testing was done in two weeks from nine o'clock in the morning up to four o'clock in the afternoon with two hours' interval. The actual temperature ranges from 23° to 32° in the last two weeks of October 2017.

Keywords - solar energy; renewable energy; wearable technology; wireless charger; portable devices

DESIGN AND DEVELOPMENT OF A HYBRID PHOTOBIOREACTOR FOR BIOMASS PRODUCTION OF SPIRULINA PLATENSIS SPECIES

[1]Pedrito M. Tenerife Jr., [2]Arvin R. De La Cruz, [3]Jan Lennard A. Augusto,[4]Tracey C. Cabacaba,[5]Ann Maekylah N. Paiton, [6]Mary Margarette L. Velasquez
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Abstract

Microalgae, an organism that can grow in fresh, salt, brackish and waste water, provides promising capabilities to act as catalyst for variety of chemical and valuable agent to produce different commodities. Similar to plants, it consumes Carbon Dioxide (CO2) and yield oxygen during its photosynthetic stage. Nowadays, microalgae have attracted much interest in terms of its potentials for production of biofuel, cosmetic additive, food supplement, fish feed, and in agriculture. In order to further improve the potentials of microalgae for biomass production, a Hybrid Photobioreactor for Spirulina Platensis Sp. is developed for Polytechnic University of the Philippines-Institute of Science and Technology Research (PUP-ISTR). A hybrid photobioreactor was designed and developed by combining the tubular and helical structure design. An airlift mechanism is added that uses an air pump for the inoculum's circulation. In this paper, Spirulina platensis species was used to test the photobioreactor's efficiency.The device can also monitor the current state of the inoculum's power of hydrogen (pH) level and temperature to determine whether the specie's condition is within its optimal state through a microcontroller.A Light Emitting Diode (RGB LED) strips was also installed in the photobioreactor as light source for the microalgae's photosynthetic stage. The researchers used Zarrouk's medium in cultivating the microalgae. Data are saved in a micro secure digital card for retrieval and analysis. A sample of 5 mL is taken every day to be tested on a UV-1800 spectrophotometer to measure the sample inoculum's optical density. The validity of the data that the researchers observed proved to be acceptable through Linear Regression. The structural design supports the other modules such as the light, circulation and sensors which results to a more effective culturing process. The designed circulation using an airlift system was proven to be effective of the culture medium. The clumping of microalgae was prevented and the distribution of nutrients and light was optimized. The biomass production of Spirulina platensis by PUP-ISTR was increased through the photobioreactor.

Keywords - Algae culture, Biomass, Inoculum, Microalgae, Photobioreactor.

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IRP would like to express our gratitude towards all those who invested their time, energy and intellect to host and manage this conference. Specially, IRP thank the chairs, who were working on a voluntary basis for a whole year to make this Conference a success. IRP would also like to thank the 120+ presenters who presented their research and gave us overwhelming response. Finally, IRP would like to thank the management of NUS for their amazing support in this endeavour.

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Mobile Emergency Response Application Using Geolocation for Command Centers

Jethro B. de Guzman, Ritz Carlo C. de Guzman, and Engr. Remedios G. Ado

***Abstract*—This paper introduces Mobile Emergency Response Application using Geolocation for Command Centers. It is a combination of a mobile and web application for responding to emergency requests for ambulance, fire truck and police by people in a certain area or city. The mobile application would detect user's current location through geolocation and sends to the web application deployed to a command center the name, age, mobile number and location of the user for easily dispatching of emergency units.**

***Index Terms*—Command center, emergency response, geolocation.**

I. Introduction

The actions and responses taken in the initial minutes of an emergency are critical. These life threatening events may happen any moment. Being always prepared and ready can save lives. A call for help to public emergency services that provides full and accurate information will help the dispatcher send the right responders and equipment.

Environmental emergencies are incidents or events that threaten public safety, health, and welfare and include hurricanes, floods, wildfires, industrial plant explosions, chemical spills, acts of terrorism, and others [1]. Emergency response is the organizing, coordinating, and directing of available resources in order to respond to the event and bring the emergency under control. The goal of this coordinated response is to protect public health by minimizing the impact of the event on the community and the environment.

One of the most popular and well known emergency systems in the world is America's 911. The system was designed to provide a universal, easy-to-remember number for people to reach police, fire or emergency medical assistance from any phone in any location, without having to look up specific phone numbers [2]. The technology, regulations and funding that make the system possible are largely based on the technology that existed at the time 911 was first implemented during the late 1960s –i.e., wired phones in residences and businesses.

The Philippines created its version of 911 called PATROL 117. Patrol 117 is the national and official emergency hotline number of the Philippines [3]. It aims to provide an easy recall number that can be accessed by anyone, anytime, anywhere in the Philippines in cases of emergencies, as well as to monitor the efficiency of its emergency network. It however, does not compete with other locally established emergency numbers or with local responders, but complements their local operations.

There are also a number of mobile applications available in smart phones that are beneficial in disaster response [4]. Among these are GPS technology, which can be used in the tracking of rescuers and resources, the translator, which can be used for communication, and the field examiner, which can be used to send information to headquarters for assessment of damages. Indeed, the use of a smart phone in a disaster management system is advantageous.

Command Centers handle certain communities. The release of a smart phone app increases the participation and preparation of the community in certain disasters. Ref. [5] Community-based disaster risk management is a process in which at-risk communities are actively engaged in the identification, analysis, treatment, monitoring and evaluation of disaster risks in order to reduce their vulnerabilities and enhance their capacities. Ref. [6] internationally, the trend continues to build capacity in government disaster management capabilities and functions in developing nations and to promote community-based hazard mitigation planning and programs.

The use of new technologies like smart phones and web application play a big role in improving emergency system. Mobile devices have become increasingly important in the developing world, facilitating communication between locals, government officials and first responders [7]. Many applications provide important information in areas of health, agriculture, disaster relief, and crime.

The mass communications media not only quickly notifies the world of disastrous events, but many times their versions are greatly dramatized, if not distorted. In addition, news reports usually do not give specific information about the exact location of a disaster, or details to indicate who has or has not been involved. But with the use of geolocation, the location is plotted on the map and user's information will be sent to the command center [8].

Many of the emergency systems exists are landline-based. With the fast development in technology, especially the emergence of smartphones where almost many people hand carries these devices; we propose a system that would give people an alternative and added option or medium in calling for rescue. Providing the people a mobile application to be installed on their smart phones to send emergency requests and a web application to be deployed on command centers to receive and locate the mobile app users, this might be useful for easy and fast dispatching of emergency units.

II. Proposed System

A. Technologies Involved

The core concept of the researchers focuses on a mobile

Manuscript received December 5, 2013; revised March 12, 2014.
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and a web application. Our major goal is to provide information such as name, age, type of emergency response needed and location of a person using the mobile app and to be retrieved by a system on the web and plotting the equivalent latitude and longitude on a Google map in order to pinpoint the exact location of the person who uses the mobile app. To achieve it, the researchers also studied an extensive array of technologies focusing on computer engineering field.

For the mobile application, the researchers plan to use Phonegap instead of a native android language in order to maximize the user interface and to make it flexible and easy for other mobile platforms to adopt. Phonegap is a free and open source framework that allows you to create mobile apps using standardized web APIs for different mobile platforms. Basically it uses HTML, CSS and JavaScript, and wraps it with phonegap then deploy to different mobile operating systems like Android, iOS, Windows, Windows 8, Tizen, Blackberry, Blackberry 10.

QuoJS will be used as the main JavaScript Library for the mobile application. It is a micro, modular, Object-Oriented and concise JavaScript Library that simplifies HTML document traversing, event handling, and Ajax interactions for rapid mobile web development. It allows writing powerful, flexible and cross-browser code with its elegant, well documented and micro coherent API.

For getting the user's location, it requires to have a stable internet connection and an enabled GPS for more accurate reading of latitude and longitude points. Google Maps JavaScript API will be used to read user's geolocation. Reverse geocoding will also takes place in order to convert the geographic coordinates and display a human readable address to the user.

Since the researchers will focus more on running the mobile app on an android platform, Fries framework will be used. It is a mobile UI development framework that creates a native android-like feel using HTML, CSS and JavaScript.

For the web application, the researchers intend to use SailsJs. It is a MVC Framework for Node.js. Node.js is a platform built on Chrome's JavaScript runtime for easily building fast, scalable network applications. Node.js uses an event-driven, non-blocking I/O model that makes it lightweight and efficient, perfect for data-intensive real-time applications that run across distributed devices. We will also use Socket.io. Socket.IO aims to make real-time apps possible in every browser and mobile device, blurring the differences between the different transport mechanisms. It's care-free real-time 100% in JavaScript.

Tuktuk is the main UI framework for the web app. It is simple and a Responsive Web Design framework for creating websites and web applications. It contains HTML and CSS-based design templates for typography, forms, buttons, navigation and other interface components.

All the data will be stored on a MongoDB database. It is a NoSql and a document database that provides high performance, high availability, and easy scalability.

B. System Architecture

In the initialization of the mobile application, it detects the current position of the user through geolocation. The user can navigate in three tabs namely home, info and hotlines. The home tab contains the current location of the user. It is displayed on the map. Geographical points are converted into human-readable address. Three emergency buttons are present: ambulance, police and fire truck. The info tab contains details like name, age and mobile number of the user. He/She needs to input once and data will be save but he/she can edit if necessary. The hotlines tab contains other emergency hotlines. Since the application is internet dependent because of the geolocation, the emergency numbers are pre dialled enabling the user to call for emergency even without an internet. The system architecture for the mobile application is designed as described in Fig. 1.

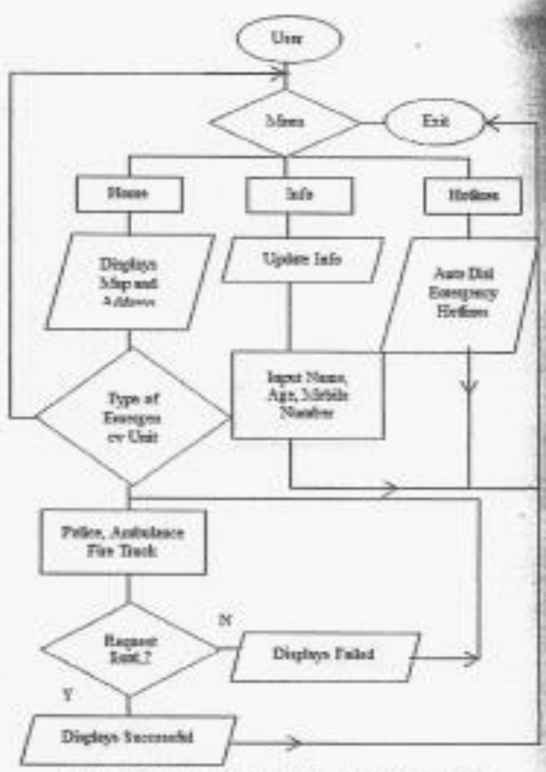

Fig. 1. System Architecture of the mobile application.

For the web application, the dashboard contains a map and a side bar where emergency reports are appended real time. The user can respond, decline and view the report on the map. The system architecture for the mobile application is designed as described in Fig. 2.

C. Graphical User Interface

The researchers provide graphical user interfaces for both mobile and web application where the users can interact with the emergency response system. Fig. 3 shows the prototype of the home tab of the mobile application where the users can select emergency request for ambulance, police and fire truck.

Fig. 4 shows the prototype of the info tab of the mobile application where the users can update their personal information that will be send to the command center.

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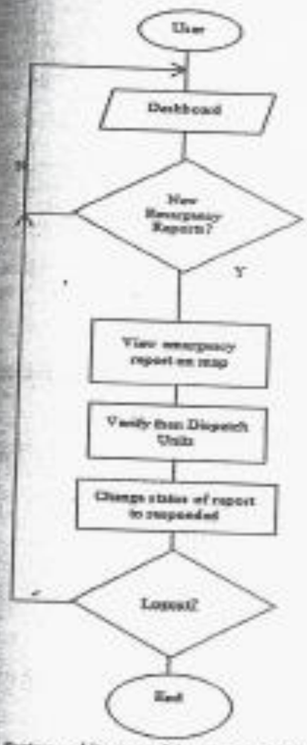

Fig. 2. System architecture of the web application.

Fig. 3. Home tab.

Fig. 4. Info tab.

Fig. 5. Hotlines tab.

Fig. 5 shows the prototype of the hotlines tab of the mobile application where it contains pre dialled hotline numbers that can be used when the application is not connected in the internet.

Fig. 6 shows the prototype of the dashboard of the web application where it retrieves the sent emergency request and plot on the map the location from the mobile app user.

Fig. 6. Web application dashboard.

III. Scope and Limitation

The study is mainly focused on the development of a mobile emergency application for the community and a web application for Command Centers.

The mobile application can only run on devices particularly smart phones that run on an Android Operating System version 2.3 Gingerbread or Higher for the meantime. But the app can be ported to other platform since it will be created using Phonegap. While the web application, it can be accessed through the internet.

The mobile app can be downloaded by the community from a webpage where the web application is also hosted. The application basically would detect the user's current location. The user needs to fill up some personal information for verification, such as name, age and mobile number. The application is only limited into three emergency units such as ambulance, police and fire truck.

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Once the user click to request a certain emergency unit, the application automatically send the user's geographical points using the phone's GPS together with the personal information. The Command Center's web application will retrieve the sent distress request from the mobile app and plot it in Google Maps real-time.

Since the mobile app needs to track the location of the user, it requires a stable internet connection. Without it, the application won't be able to send an emergency request. Because the application would rely to the IP address provided by the internet connection to locate the current position of the user in the map. The accuracy of the position's detection of the user also depend on the place and how stable the user's internet connectivity. The error of the GPS position is mainly determined by the interaction of the time varying constellation of the satellites and the built-up in the close vicinity [9]. The average position error ranges from 2 meters on an open square to 15 meters even in wide streets with four story houses on both sides. The built-up shades the satellites especially suitable for a positioning. The constellation of the satellites is periodic and the built-up constant, therefore a rudimentary database was used to reduce the positioning error by ~10%. We will also provide auto dialled links for other emergency hotlines in case the user won't have a chance to connect to the internet.

The mobile app cannot support location tracking for users on a moving vehicle. The app detects the last position of the user on the map, and that is the location to be sent to the command center.

IV. Conclusions

In this paper, we proposed the use of mobile and web technologies to add another option and medium for emergency response. The proposed method used the current trends in mobile and web technologies for fast and efficient dispatching of emergency units

Our goal is not to create a new protocol in emergency response, we have just maximize the use of smart phones to act as medium and to help people save their lives in case of disaster. Command centers will also benefit in a way that the location of the user are easily detected and plotted on a map.

Our porposed system supposed to lessen the response time it takes to respond to emergency events. It also provides reliable information that might help in identifying accidents.

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