UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF OCEAN CURRENT LEVEL AND RED TIDE MONITORING PORTABLE SYSTEM FOR BIG DATA APPLICATION

This report is submitted in accordance with the requirement of the Universiti Teknikal Malaysia Melaka (UTeM) for the Bachelor of Electronic Engineering Technology (Telecommunication) with Honours.

by

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DECLARATION

I hereby, declared this report entitled DEVELOPMENT OF OCEAN CURRENT LEVEL AND RED TIDE MONITORING PORTABLE SYSTEM FOR BIG DATA APPLICATION is the results of my own research except as cited in references.

Signature: .....

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APPROVAL

This report is submitted to the Faculty of Electric and Electronic Engineering Technology of Universiti Teknikal Malaysia Melaka (UTeM) as a partial fulfilment of the requirements for the degree of Bachelor of Electronic Engineering Technology (Telecommunication) with Honours. The member of the supervisory is as follow:

Signature: .....

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ABSTRAK

Projek ini menerangkan kajian tentang kepentingan mengesan air pasang merah dan nilai semasa paras pasang surut air laut menggunakan sensor seperti Gyroscope dan Colour Sensor. Alat pengesan ini mampu mengesan kehadiran air pasang merah pada peringkat awal dan mengukur paras ketinggian pasang surut air laut pada jarak yang jauh menggunakan aplikasi mudah alih. Selain itu, aplikasi ini juga mampu menghasilkan dan menganalisis data yang diterima daripada sensor dan memaparkan data melalui sistem Internet Perkara (IoT) yang menghantar maklumat secara terus ke aplikasi mudah alih.

ABSTRACT

This project describes the study of the importance of detecting red tide and the value of current tide levels using sensors such as Gyroscope and Color Sensors. This detector is able to detect the presence of red tides in the early stages and to measure the height level of tide in the distance using mobile applications. In addition, the application is also capable of generating and analyzing data received from sensors and displaying data through the Internet of Things (IoT) system that sends information directly to mobile applications.

DEDICATION

Alhamdulillah, praise to the Almighty Allah S.W.T

This thesis is dedicated to:

My beloved family,

My Parents,

My Supervisor,

My lecturers

And all my friends

Thanks for their encouragement and support

ACKNOWLEDGEMENTS

Alhamdulillah, thank you Allah for letting me finish with a great health so that my final year project ended successfully.

I would like to express my gratitude towards the following groups. Without them, this paper will not be completed in time. I would extend my deepest appreciation to my beloved parents that I treasured the most, Mohd Ariff Bin Ali and Noor Hajar Bt Zainal that giving me the endless supports throughout this entire project.

Not to forget, my supervisors Ts. Fakhrullah Bin Idris for his guidance and encouragement towards this project until I complete this report. Last but not least, to my friends who have always been there through my ups and downs, helped and motivated me in when I need the most. This paper would not be possible without all of them.

TABLE OF CONTENT

LIST OF TABLES

LIST OF FIGURES

LIST OF APENDICES

CHAPTER 1

INTRODUCTION

1.0 Background

One of the most prominent harmful algal blooms is the "red tide" from Florida caused by Karenia brevis, a form of algae that produces potent neurotoxins (Fleming *et al.*, 2011). The red tide is causing alga where the bacteria exist at the same time or in the same place in xenix cultures of Alexandrium tamarense (Wang et al., 2010). The toxins can be suspended in the air near beaches and cause respiratory disease in humans. These can also accumulate in shellfish and cause human neurotoxic shellfish poisoning, so impacted states track shellfish closely and may close the harvest to protect public health for a period of time. An algal bloom or algae bloom is a rapid increase or aggregation in the algae population in freshwater or marine water systems and is often identified from their pigments by discoloration in the water (Kirkpatrick *et al.*, 2004). Algal form a extracellular product into ocean environment in process of enlarge that release essential source of ocean organic element such as carbohydrates, sugars, vitamins, toxins, enxymes, polyalcohols, peptides and amino acids (Wang *et al.*, 2010). Paralytic shellfish poisoning (PSP) was reported first time in Sabah, Malaysia cause six persons warded including one casualty after contaminated benthic clams. In Tumpat, a massive blooms of marine dinoflagellate have been reported over the past decade cause shellfish intoxication (Teen, Gires and Pin, 2012).

Tidal is rise and fall of ocean level caused by the combined influence of the Moon and the Sun's tidal powers and the Earth's rotation. The best describe about tide is from the book Principia Mathematica by Newton(1687a) where there is relationship between lunar and solar gravitational force regarding to laws of mechanics. The theory proved that tides is produced by sun which modulated the lunar tides. The tidal level is rising at full or new moon while the tidal will decreasing when reach to half-moon than the average (Guzewich *et al.*, 2016). Although tides are typically the primary cause of short-term variations in the sea level, the sea level is often subject to factors such as changes in wind and barometric pressure, resulting in storm surges, especially in shallow seas and near coasts (Nicholls, 2011). Tides differ between hours and years due to a variety of reasons that decide the lunitidal time. Tide gauges at fixed stations monitor water levels over time and make accurate records. Tidal anomalies are not confined to oceans, but can exist in other environments if there is a gravitational force differing in time and space (McCarthy *et al.*, 2015).

1.1 Problem Statement

Red tide in ocean can cause terrible to marine life. This problem responsible for huge fish kills and cause endangered species to death such as dolphins, sea turtle, blue whale, sea lion and fin whale. Besides, this also causes lost millions of dollar to fisherman communities, hotel, restaurant and water based tourism attraction like boating, fishing, seafood supply and more. As human being, there can cause implication to respiratory system especially in sensitive population like asthma and skin irritation. This symptom can lead to Neurotoxic Shellfish

Poisoning (NSP) disease which caused by the consumption of molluscan shellfish contaminated with brevetoxins, these are a group of more than ten natural neurotoxins produced by the marine dinoflagellate (Watkins, 2008). First case documented with the effect of Paralytic shellfish poisoning (PSP) was at the U.S west coast where five staff crew of Captain George Vancouver's get sick and one of the member died after eating mussels that carries PSP poisoning. Then, second case where staff worker for Alexander Baranof died after eating mussels at Sitka, Alaska. This two cases was related to red tide problem after done a few investigation (Horner, Garrison and Plumley, 1997).

These present days, the major issue of ocean-level rise is caused by anthropogenic global warming that put future investigating development for ocean level. Ocean level rising is one of the dangerous effect from ongoing global warming, which can make some particular area easily exposed to flooding and land loss (Cazenave *et al.*, 2014). Another huge impact from ocean level rising including higher extreme sea levels, beach erosion, surface and ground waters pollution and destruction of beach habitats place such as wetlands. Without any monitoring or a good care of ocean level will affect a million of people and beach habitats land areas (Nicholls, 2011).

1.2 Objective

1. To design and develop a system that can detect the existence of red tide in the ocean water and measure tidal current of an ocean level.

2. To measure the tidal height and get the image of red tide current condition.

3. To analyze by comparing tidal current value using design of experiment method.

1.3 Scope

This project is focus on safety of fisherman community in Malaysia that use big data application to enable use of in gathering information regarding to the current ocean situation in Malaysia. There are certain places in Perak that focus into as an example, test will be done using sample of water from rivers and seas around Perak. A piece of red card will be added into water sample for red tide sample. This project will use NodeMCU as a microcontroller to collect all big data from body of water ocean around Perak and analyze to come out with the result. The hardware of this project will combine together and locate at certain ocean spotted. Generally, this system will put into every fisherman boat. This will easily get information needed.

1.4 Expected Project

As the outcome of this project, the report consists of five chapter which is introduction, literature review, methodology, result analysis and conclusion. All the details, process, concept, description and result will be discussed on the chapter specified.

For introduction, this chapter will be introducing the action or the beginning section to understanding the general knowledge about main element in this project. Basically, will describe and review the background of the project, problem statement of an issue to be addressed or to be improved upon, objective that need to achieved and scope of the project which the work that must be done to deliver the project.

In second chapter, a literature review is a comprehensive summary of surveying scholarly source such as articles, books and journal that relevant to particular area of red tide and tidal current level. This topic provides an overview of describing, summarize, current knowledge, objective evaluate, identify relevant theories and clarify of existing research. It also covers the effect of both situation red tide and tidal ocean current level.

For chapter 3, the methodology of the project will be conducted and discussed. The method of flowchart, procedure, data collection, calculation and description of design will briefly be enlightened in this chapter. Project methodology can be used as validation point by explain the process step by step to get the real condition of red tide or tidal ocean level at every device installed. Besides, the software development that use in this project will be describe.

In chapter 4, the result and analysis part aim at narrating the finding in orderly, meaningful and simple way. From the result that recorded, it will analyze using graph, detection colour and image of every device installed. The data will save and show in detail information to every software development created.

Lastly, the conclusion of this project will conclude the whole project process and development. The improvement or recommendation for incoming project development will discussed.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

This chapter discusses on writings by researchers on relevant study on the red tide phenomenon, the impact of red tides on people lives especially in Malaysia. Also discusses the tidal sea phenomena, its monitoring.

2.2 Red Tide

Red tide is one of the caused by algal blooms phenomenon which they discolor ocean water by become a lot of number. Algal blooms produce many bacteria growth stimulate by extracellular product into marine life which this term called “phycosphere”. In phycosphere area, bacteria interact with algae that form a dinoflagellates explodes then called red tide (Wang *et al.*, 2010). There is a mixotrophic dinoflagellate that form a red tide in ocean where it’s called ichthyotoxic dinoflagellate *Cochlodinium polykrikoides.* This mixotrophic dinoflagellate produce 4 red tide in sequence formed diatom without certain distinct pattern which is the phototrophic dinoflagellates Prorocentrum donghaiense, Ceratium furca, and Alexandrium fraterculus (Jeong *et al.*, 2017).

From the research, there are some situation that contribute to the growth of red tide or phytoplankton. The element is Ocean acidification (high pCO2/low pH), ratios, shifts in nutrient availability, and speciation, changing exposure to solar irradiance, greenhouse warming, and altered salinity (Fu, Tatters and Hutchins, 2012). From the research in human exposure and health, brevetoxins cannot easily identify or evacuate by food preparation procedure because this toxics are heat and acids stable, odorless and tasteless but the detection is in substrate environment such as seawater, seafood, air and human clinical specimen by applying new technology (Fleming et al., 2011b).

2.2.1 Red Tide Effect to Marine Life

The present state of awareness stems from a rich literature collectively classified as "harmful algae" on the taxonomy, growth patterns, and ecophysiology of freshwater and marine phytoplankton. This societally specified group involves toxic organisms that transmit toxicity to higher trophic levels, mainly fish, shellfish, marine mammals, or humans, which include members of the cyanobacteria, dinoflagellates, raphidophytes, haptophytes, which diatoms. High-biomass occurrences, which also involve non-toxic phytoplankton organisms, often significantly change habitats by hypoxia or anoxia, altered food web efficiencies, activation of pathogenic bacteria or other ecological effects, are often included under the HAB umbrella (Wells *et al.*, 2015).

During harmful algal bloom happen, the researcher collected a sample from juvenile lemon sharks near the Florida ocean and found mercury and selenium existence in their tissue

muscle. Generally, normal mercury toxic in tissue muscle is 0.34 µg/g. If the level exceed safe limit of mercury, it will hardly impact the aquatic system especially for the species classified as almost extinct such as lemon shark and other species (Nam *et al.*, 2011).

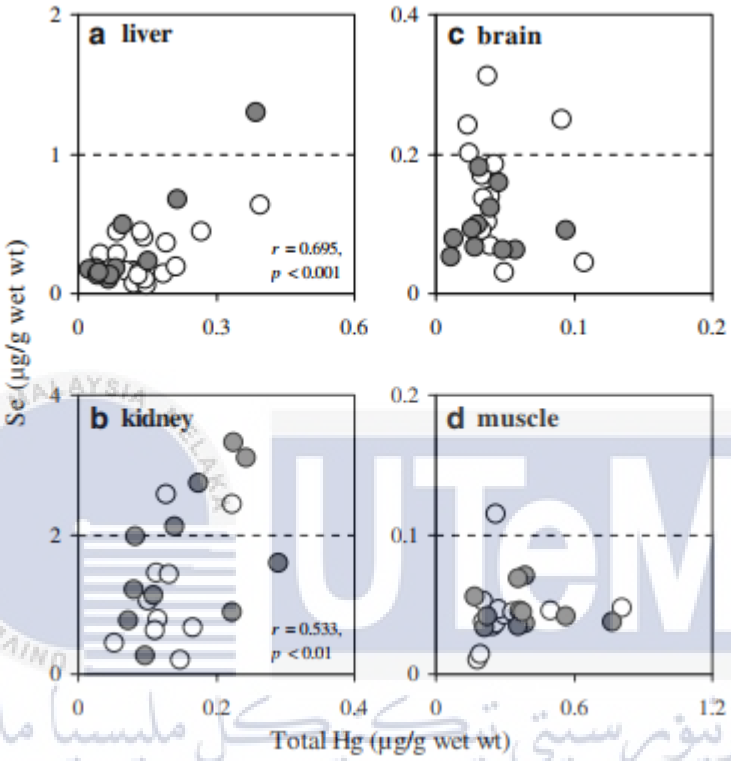

Figure 2.1 Spearman rank correlations between total Hg and Se concentrations in tissues of control (open circles) and HAB-exposed (shaded circles) juvenile lemon sharks (Nam *et al.*, 2011)

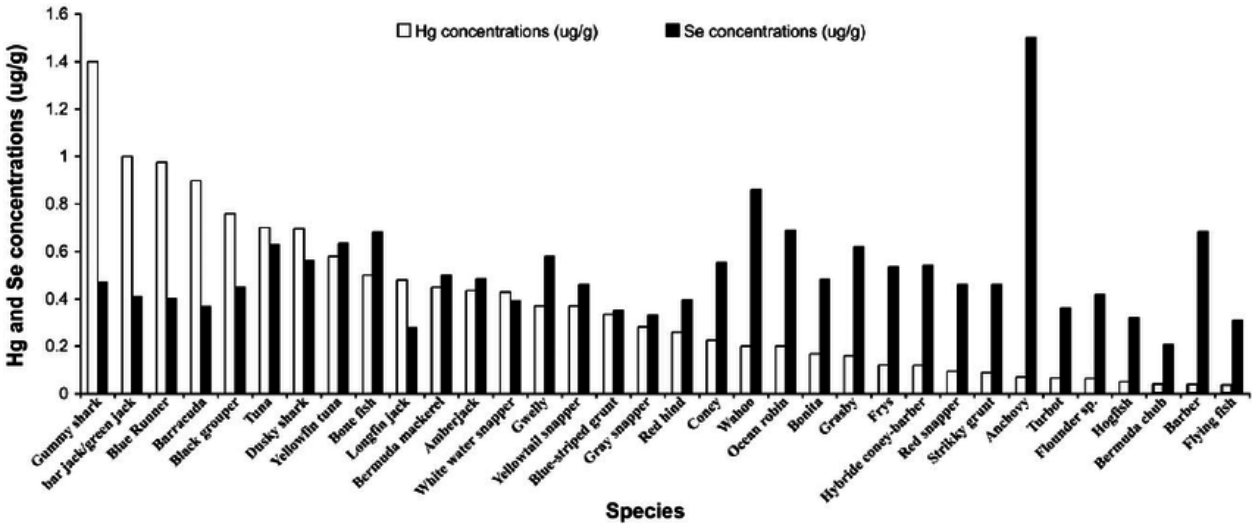

Figure 2.2 Mercury and selenium content in flesh of local fish species (Fang, Nam and Basu, 2011).

2.2.2 Red Tide Effect to Human Health

Pyrodnium bahamense, Gymnodinium catenatum and several species of *Alexandrium* are toxins produced by red tide dinoflagellates that carried to paralytic shellfish poisoning (PSP). This term comes from neurotoxin group named saxitonins (STXS) due to shellfish contamination that cause seafood poisoning to people. Hundreds of poisoning cases have been reported over the last three decades due to shellfish contamination (Teen, Gires and Pin, 2012). Therefore, red tide produces toxic dinoflagellate which is neurotoxins and brevetoxins that can harm to marine life and these toxins become marine aerosol that mixed with air environment and inhaled by human and animal. This toxin can be harmful to people that have chronic respiratory illnesses such as asthma because when people inhale brevetoxins, this toxins can

increase upper and lower airway and decrease lung function symptoms including bronchitis and pneumonia (Kirkpatrick *et al.*, 2010).

There is concern harmful algal carries over mercury pollution level in ocean that can affect the human health. Mercury in fish bodies is another pollution of water which contains methylmercury, a highly toxic organomercury compound. When mercury absorb into the human body can cause headaches, memory loss, insomnia, tremors, emotional instability, neuromuscular changes and can harm kidney and thyroid. This disease is in group of neurological and behavioral disorder (Nam *et al.*, 2011).

2.2.3 Red tide detection method

This subtopic will discuss red tide detection system model based on other project development.

2.2.3.1 CNN Detection Model

In China, there are system that high precision detection system based on a fully connected 8-layer deep CNN detection model for tracking red tide in hyperspectral remote sensing images, then discuss the glint reduction approach for enhancing the accuracy of red tide detection. The findings demonstrate that the hyperspectral detector model developed for the CNN will reliably and efficiently detect red tide. Hyperspectral image is captured from China Marine Surveillance aircraft that contains PushBroom Hyperspectral Imager (PHI). PHI

resolution size is 383.3 nm to 881.4 nm which has the potential to classify red tide from normal seawater (Hu, Ma and An, 2018).

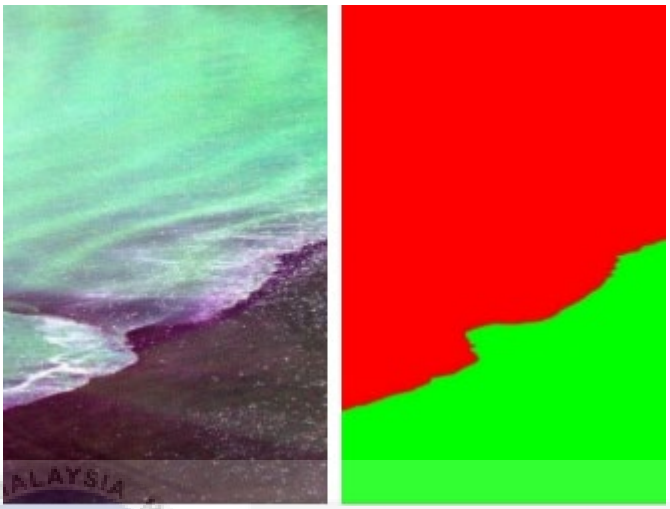

Figure 2.3 The map of PHI spectral remote sensing image (R:10, G:60, B:100) and the red tide validation map (red: red tide, green: seawater) (Hu, Ma and An, 2018).

Image from the CNN model contains details about the spectral function includes the initial spectra and the first derivative spectra. The first derivative spectra of the original spectral reflectance includes the slope value of the spectral curve, that reflect the rate of change of the original spectral curve, where the positive value is the band where the reflectance increases the most, and the negative value is the band where the reflectivity deceleration is the largest. The first derivative spectra can be expressed by the formula:

$$\frac{dL}{d\lambda} = T \cdot E \cdot \frac{d\rho}{d\lambda} + \rho \cdot T \cdot \frac{dE}{d\lambda} + E \cdot \rho \cdot \frac{dT}{d\lambda} + \frac{dLp}{d\lambda}$$

Where L is the energy of imaging spectral image

ρ is the ground object reflectivity

T is the atmospheric transmittance.

E represents the solar irradiance

Lp represents the process radiation

λ is the wavelength

Adaption of median filter algorithm to validate the influence of red tide detection from the glint image, the filter size is 3x3, and then detect red tide based on the denoise image. Instead used the red tide analysis chart to verify the red tide identification accuracy later. The feasibility of the new procedure is tested by contrasting it with the state-of-the-art SVM approach to classification. The findings of the identification are shown in Figure and Table below.

Figure 2.4 the red tide detection results (From left to right: SVM, CNN, Filter-SVM, Filter-CNN) (Hu, Ma and An, 2018)

Types	SVM	CNN	Filter-SVM	Filter-CNN
Red tide	83.41	95.71	92.91	96.80
Seawater	99.27	95.35	87.84	98.81
OA	88.83	95.58	95.20	97.45
Kappa	0.76	0.90	0.89	0.94

Table 2.1 The red tide detection accuracy (%) (Hu, Ma and An, 2018).

2.2.3.2 Satellite Remote Sensing

Other method used to detect red tide growth is using satellite radiometer developed to investigate the changes of colour in ocean water. This method has been used in Florida red tide water by surveillance the harmful algal blooms (HABs). A hybrid scheme was developed, which sequentially applies the streamlined variants of two pre-existing satellite-based algorithms: an empirical method (using water-leaving radiance as a function of chlorophyll concentration) and a bio-optical technique (using chlorophyll concentration with particulate backscatter). Scheme was introduced which applies the optimized versions of two sequentially. The methods used to assess the long-term detection capability of modified iterations of the Analytical Approach and the Bio-Optical Technique (Carvalho et al., submitted for publication) was observed. This included performing the same thorough quality assurance research to deliver the "true cloud-free match-ups' between satellite and in situ measurements. Measurements of the shipboard and satellite were compared in both space and time. The logic for using only satellite measurements from the pixel containing the point at which the sample was taken removes inconsistencies by using wider areas like adjacent pixels to field distance, although the use of this time-acceptance window was explained by the slow pace of growth (Carvalho *et al.*, 2010).

2.2.3.3 MODIS Imagery

MODIS Imagery stand for Moderate Resolution Imaging Spectroradiometer to detect and differentiate red tide within various ocean water using satellite remote sensing. This method analyze the image colour of ocean water from NASA Goddard Space Flight Center (GSFC) (http://oceancolor.gsfc.nasa.gov) and allow manipulation of fine differences in image contrast by means of image processing algorithms. First step is using SeaWiFS Data Analysis System

(SeaDAS) program, data were analyzed to produce Level-1b data for the "ocean color" spectral wavebands in the visible and near-infrared, and geolocation data. MODIS Level-1b data is atmospherically corrected using SeaDAS to produce spectral remote sensing reflection (Rrs(λ), sr−1) and uniform water-leaving radiance (nLw(λ), mW cm−2 μm−1 sr−1) using SeaDAS. Then, These products were georeferenced to a cylindrical equidistant projection for the area of interest by Rrs(λ), nLw(λ), Chl-a, bbp;QAA, bbp;Morel and FLH. This imge will composed to reach Enhanced RGB (Red Green Blue) image an show the detail on red tides (Moradi and Kabiri, 2012).

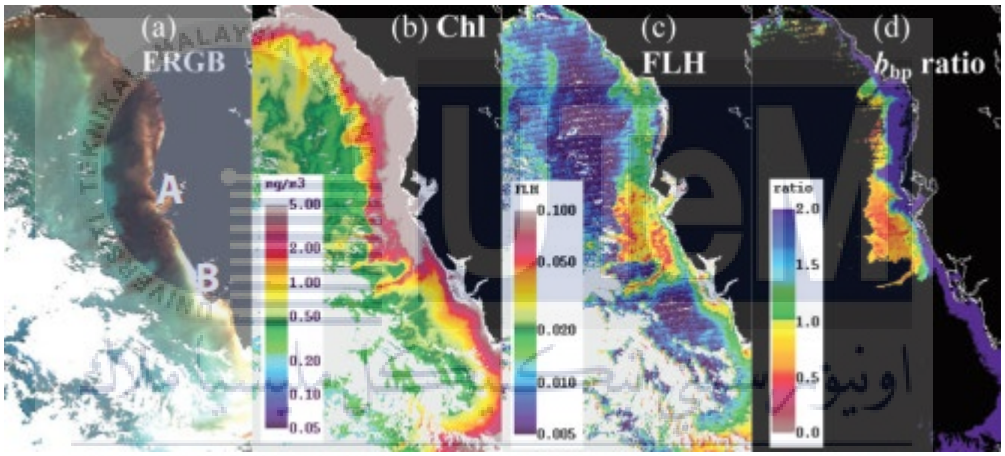

Figure 2.5 Example image from satellite remote sensing (Moradi and Kabiri, 2012).

2.2.3.4 GOCI

Geostationary Ocean Color Imager (GOCI) the world's first geostationary ocean-colored satellite produces photographs with a spatial resolution of 500 m at an hourly rate of up to 8 times a day, allowing short-term transition observations was used by Korea Institute of Ocean Science & Technology (KIOST) at Korea ocean to detect red tide using empirical algorithm method. With any one of two gains on board, GOCI tests radiance per pixel per band Switching

between the two benefits happens at the radiance of the saturation. Sensor accumulation should potentially exist over the full radiance of the air. For SNR measurement, the numerical radiance corresponds to each band's general signal (Oh *et al.*, 2013).

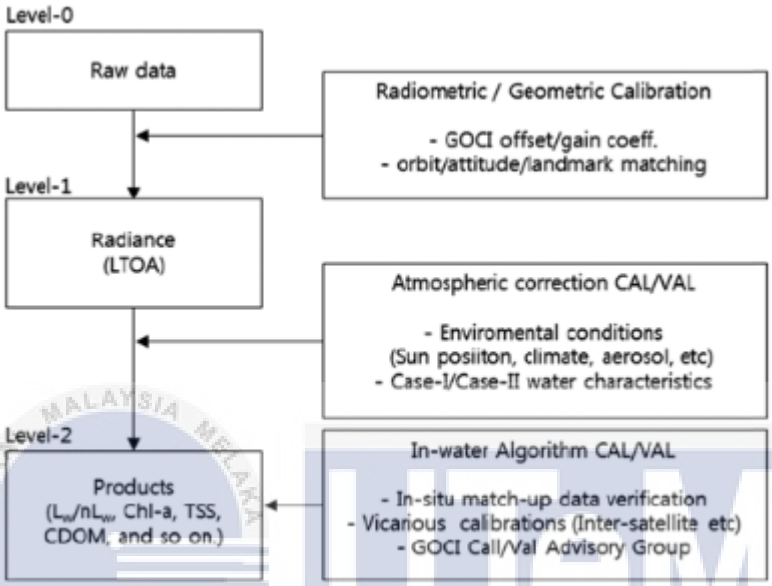

Figure 2.6 GOCI flow (Oh *et al.*, 2013).

2.2.3.5 Method Summary

Author	Title	Method	Software Development	Advantage	Disadvantage
(Hu, Ma and An, 2018)	Research on high accuracy detection of red tide hyperspecrral based on deep learning CNN	Convolutional Neural Networks (CNN)	Pushbroom Hyperspectral Imager	Little preprocessing.	Need aircraft to survey everyday.
(Carvalho *et al.*, 2010)	Satellite remote sensing of harmful algal blooms: A new multi-algorithm method for detecting the Florida Red Tide (Karenia brevis)	Satellite Remote Sensing	Image Processing	-Precise intensity data by establish the brightness -provide location, top height & optical thickness of cloud.	Expensive method to analyse repetitive photographs.
(Moradi and Kabiri, 2012)	Red tide detection in the Strait of Hormuz (east of the Persian Gulf) using MODIS fluorescence data	MODIS	SeaDas processing software	-Very fast image display and navigation. -can process giga-pixel image efficiently.	Differences from the accusrate location and area
(Oh *et al.*, 2013)	A Comparative Study for Red Tide Detection Methods Using GOCI and MODIS	GOCI	GOCI Data Processing System software	-can obtain data every hour. -test radiance per pixel per band switching between two benefit saturation.	Detect Water Leaving Radiance influence of cloud as a red tides.

Table 2.2 Difference between method used to detect red tide.

2.3 Ocean Level

Ocean level is depending on global warming, warm sea water and expand. This element makes ocean level index very sensitive to climate change that cause ocean level increase. As an example, glaciers mountain at Alaska, Arctic Canada and Himalaya getting to melt as the temperature increase. Ocean level increase as the glaciers mass input to the ocean (Cazenave and Llovel, 2010). There are natural ocean level such as tidal rise and fall is depending on influence of the Moon and the Sun's tidal powers and the Earth's rotation. The main issue that cause ocean level increase is anthropogenic global warming that threatening densely populated areas such as exposed to flooding and land loss (Cazenave *et al.*, 2014).

2.3.0 Ocean Tidal

Tides are a rising process and periodic sea level drops caused by the attractive force from celestial bodies, mainly caused by the pull of the Sun and the pull of the Moon against the mass of water on the surface of the Earth, as well the existence of gravitational force by the Earth. Based on the period and regularity, tides can be can be divided into three types(Indarto, 2015). Firstly, diurnal tide is a situation which happens one day tide times and one time low tide, period the average tides are 24 hours 50 minutes. Second is semidiurnal tide is a situation that happens in one day two times the tide and twice the water receded with almost the same height and ups and downs occur sequentially and regularly. Period the average tides are 12 hours 25 minutes

and lastly is tidal mixture, divided into two types, namely Tides of a single dominant mixture and Tides of a double dominant mixture.

Tides are also a factor for the process construction of a port and to obtain data later will be the foundation or basis in a study. Knowledge about tidal conditions in Indonesia is very important, meaning that Indonesia has a coastline of 80 thousand km, for various activities related to sea or coast such as inter-island shipping, sea pollution, processing of marine biological resources or national defense. In addition, tidal knowledge will also affect the way of life, work and even the culture of the people who live in the area (Quraisy, Zainuddin and Hasanuddin, 2019).

2.3.1 Ocean Level in Malaysia

One study has been conduct in 8 locations of tide gauge stations which is Pulau Langkawi, Geting, Cendering, Tanjung Gelang, Pulau Tioman, Kukup, Port Klang and Pulau Pinang. This study is to predict what the average level of ocean in 2050 and 2100. Ocean level will rising 10.79cm in 2050 and 32cm in 2100. The highest ocean level rise is Tanjung Gelang with rise 14.42cm and 32cm in 2050 and 2100. Intergovernmental Panel on Climate Change (IPCC) reported that estimated sea level rise 0.10 – 0.20m by 2100 higher that expected ice sheet melt and glacier dynamics (Jeofry and Rozainah, 2013).

Tidal Stations	Linear Trend Analysis (cm)/ month	Deterministic Seasonality (cm)/month
PulauLangkawi	0.0191	0.015451
Pulau Pinang	0.0242	0.020712
PortKlang	0.0274	0.023675
Kukup	0.0265	0.024291
PulauTioman	0.0211	0.020383
TanjungGelang	0.0299	0.029301
Cendering	0.0243	0.023918
Getting	0.0184	0.01762

Table 2.3 General *Observations about Rising Sea Levels in Peninsular Malaysia (*Jeofry and Rozainah, 2013)

2.3.2 Impact of Ocean Level Rising

The increase in sea levels will reduce the size of an island or state and its amenities such as airports, bridges, and capital cities that usually predominate in coastal areas; intensify floods, deforestation, and other coastal hazards; endanger critical assets, towns, and services, thus undermining the socio-economic well-being of island populations and States (Handmer et al., 2012). The increases in sea levels will lead to high impacts such as infrastructure degradation and economic damage, loss of human life, mental health consequences or loss on plants, animals and the environment, and their magnitude depends on their intensity, exposure and vulnerability (Sarkar *et al.*, 2014). Ocean surface warming will affect biodiversity and the growth levels of temperature sensitive species such as corals (Handmer et al., 2012). Thus, education, improved

governance, proper planning and preparedness are very critical in combating the impacts of climate change in developed countries (Handmer et al., 2012).

2.3.3 Method to measure tidal current ocean level.

This subtopic will discuss the method that was used to measure ocean water level in around the world.

2.3.3.1 Single Geodetic Receiver

This method use GNSS-R technique which stand for The Global Navigation Satellites System Reflectometry (GNSS) that offers autonomous, regional geospatial positioning that collect 50 satellite data collection from around the world. This method is based on the study of electromagnetic signals continuously produced by GNSS satellites and measured by the receiver after the Earth's surface reflections. The time gap between direct and reflected signal transmission is closely associated with the difference in height between the receiver and the reflecting surface. The data can be obtained by using code to study the temporal evolution of the reflected signal power known as waveforms. The main benefits of such a technique is the extensive spatial and temporal range of the reflection points, which is not limited to a single point of measurement or a non-repetitive transect as is usually achieved with GNSS-equipped buoys. The analysis of data obtained is based on Signal-to-Noise Ratio (SNR). Although much of the signal produced is received immediately in the antenna's zenith-looking region, a small portion of it arrives from below the horizon, through one or two reflections in the atmosphere surrounding it. Such so-called multipath signals interact with the direct wave, and by adding new frequencies influence the GNSS measurements reported by the receiver. Thus, the geodetic

GNSS antenna is designed to reduce the multipath contribution which degrades the location determination accuracy (Roussel *et al.*, 2015).

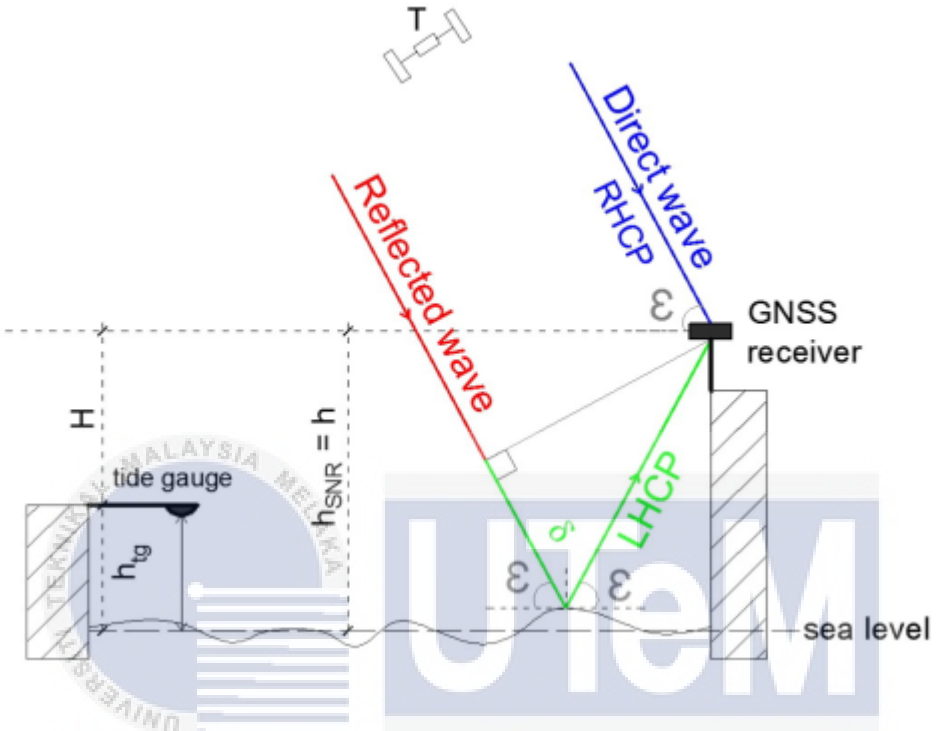

Figure 2.7 Principle of GNSS Method (Roussel *et al.*, 2015).

2.3.3.2 Atmega328 Microcontroller

A prototype tool has been built to measure the sea level height based on the ATMega328 microcontroller. The measurement system is based on the working principle of a buoy and infrared sensor so that it can measure sea level directly. This instrument can record the results of measurements to in Multi Media Card (MMC) data storage media. Stages of research include the process of designing, manufacturing and testing tools. To maintain the stability of the buoy from the influence of waves the sea is carried out by inserting a buoy into the Paralon. The measurement results can be taken from the recording process using data storage media in the form of Multi Media Card (MMC), so that the operator does not need to observe the measurement results directly. Furthermore the data that has been saved to MMC can be used to analyze the type of tides. This tool is designed to measure the height of sea water at a distance of 15 cm to 110 cm from the sensor. The experimental results show that the performance of the tool is affected by the stability of the buoy motion. The results of testing the tools have an average accuracy of 99.89% (Indarto, 2015).

2.3.3.3 LUWES

LUWES stand for (Live Uninterrupted Water Sensor) that is a water level monitoring equipment with a telemetry system that uses GPRS (General Packet Radio Service) signals for real time data transmission in data retrieval, which consists of data logger integration, ultrasonic sensors, GPS (Global Positioning System) timing, battery power supply systems and solar cells and wireless communication. This low-cost innovation is intended to close the existing water monitoring network so as to be able to significantly increase the number of sensors not only for specific disaster monitoring needs but can also serve multipurpose needs through integration in

one system displayed on the website. In LUWES data retrieval using an ultrasonic sensor where the tool is made easy to synchronize the reading device with height the water level as read on the attached tide palm. LUWES measurement tool in real time to get the wave data parameters sea level modified from the tool tidal measurements with observational data per second produces 6 (six) data. Tidal observations of 15 pigs using the LUWES tool, compared with secondary data from 3 (three) stations owned by Pushidrosal, BIG, and UNESCO / IOC (Pandiangan *et al.*, 2016).

2.4 Summary

Many method have been proposed or implement to detect red tide and ocean tidal level monitoring. Although the literature covers a wide variety of such theories, this reviews will focus on major method which emerge repeatedly throughout the literature reviewed. Both method of literature review more concentrated on using satellite image but in different image processing. However, the literature review present these themes in variety of context, the paper will primarily focus on how their characteristic identify instead of their method. The method that will use in this project will explain detail in chapter 3.

CHAPTER 3

METHODOLOGY

3.0 Introduction

This chapter will discuss about the method used in this project and the reason this project had been done to gain the objective of providing the best system to monitoring red tide and current tidal level. This explain the procedure that need to develop from starting until the project finish. It include the flowchart of developing monitoring application using AppInventor software development and Arduino IDE software.

3.1 Architecture

Smartphone is a mobile phone enabling you to do more than just make phone calls and send text messages. Smartphones can access the Internet and execute computer-like software programs. The use of smart phone is the must have device of everyone in the world. This device will easier the user to control everything in their finger. So, this project will use smart phone application to monitoring the tidal ocean level and red tide growth. The application will develop using AppInventor software based on multi-block programming and Application Programming Interface (API) of Blynk to enable the connection between microcontroller and smart phone. In the application will have three option to get the information from Arduino microcontroller which

is get the value of current tidal level, detect the ocean colour and capture the image of ocean water.

The initial step is to gather information on the normal tidal level and the characteristic of red tide algae from internet, books, newspaper and journal article. Then, Research on the basic concept of application of Arduino and coding of a system using gyroscope, colour sensor recognition module, ESP32 camera and NodeMCU Arduino microcontroller is carried out to understand and also the coding to be program on both AppInventor and Arduino device. In this project, Arduino NodeMCU will be use as the main computer to control all the activities that will be conduct. Precautionary action to be taken during hardware construction is established by performing a review of the facilities, resources and usefulness of the project that will be used. Next, the coding concerning C++ is written by using Arduino IDE and block based program language using AppInventor web browser.

This architecture is divided into three stages:

I. **The first stage** is involving the Arduino NodeMCU connected to all the sensor which is gyroscope to give the current tidal level information, colour sensor to detect the water colour and ESP32 to capture the image. The option is occur at different time according to user request.

II. **The second stage** is the Arduino NodeMCU will reply and receive the user request to API application which is Blynk. The API will specify the software component should interact regarding the instruction.

III. **The third stage** is the API should interact between user smart phone where the background contains AppInventor programming to display the user information needed on the application.

Lastly, a full report is prepared and submitted to the supervisor. Figure shows the flowchart of the methodology of this project.

Figure 3.0 Block Diagram of the project

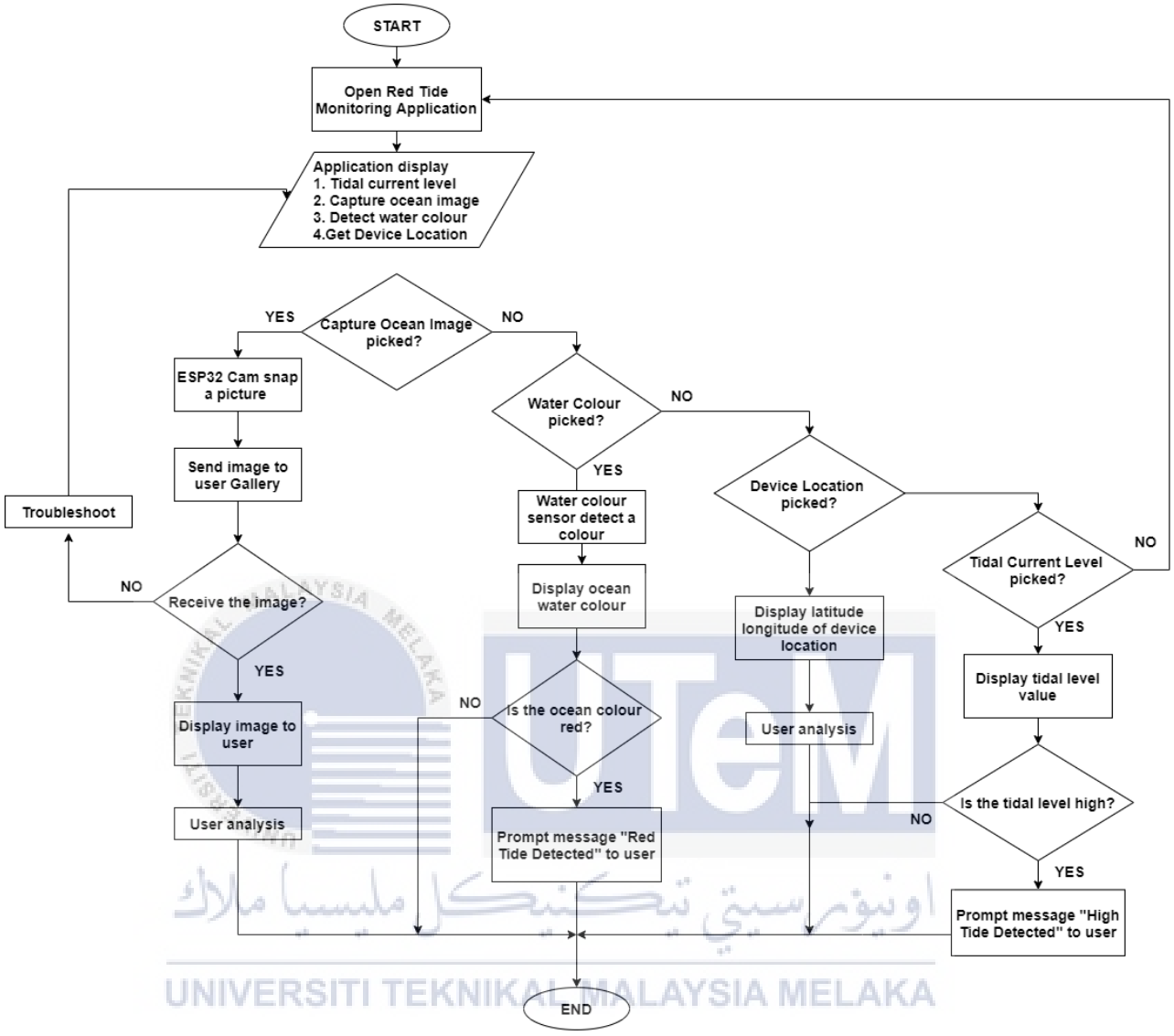

Figure 3.1 Flow Chart of the working project

The block diagram and flow chart displayed the process of red tide and ocean tidal level monitoring application system. This flow chat explain the working flow of using application to get the user input inquiries. Regarding the flow chart, when the user input the desire output, the application will go to each condition to check which the condition is true. When the condition is true, the application will run the statement to appear the outcome. If there is the problem in the application, the user will troubleshoot the application and return to application display.

3.2 Software Development

3.2.1 App Inventor

MIT App Inventor is an interactive, visual programming environment that lets anyone create mobile and tablet completely functioning applications. App Inventor is using C++ block based programming framework that requires visual objects to be dragged and dropped to create an application that can run on mobile devices. Also, to allows complex, high-impact applications to be produced in considerably less time than conventional programming environments. This application will work together with Blynk API to receive and send information regarding to user request. The application interface will be design using this visual programming that allow IoT environment runs along the device.

3.2.2 Blynk API

In Apps and Hardware, Blynk HTTP RESTful API will read and write values to or from Pins. Each PUT request will change the status of Pin in apps as well as on hardware. Any GET request on the specified pin will return the current state or value. This also gives simpler API, so updates can be done every GET requests.

The API will work behind App Inventor application software. As an example, the user wants the current tidal level and the application will request GET analog value from Blynk API to receive the information. Besides this two programming, there are many instruction such as get pin value, write pin value with PUT or GET, hardware and application network status send push notification and more.

3.2.3 Arduino IDE

Arduino IDE (Integrated Development Environment) is software used to program in arduino, in other words Arduino IDE as the medium for programming the Arduino board. In arduino the programming language used is C / C ++. This Arduino IDE is useful as a text editor for creating, editing, and validating program code. can also be used to upload to the Arduino board. The program code used on the Arduino is called the Arduino term "sketch" or also called the arduino source code, with the source code extension .ino.

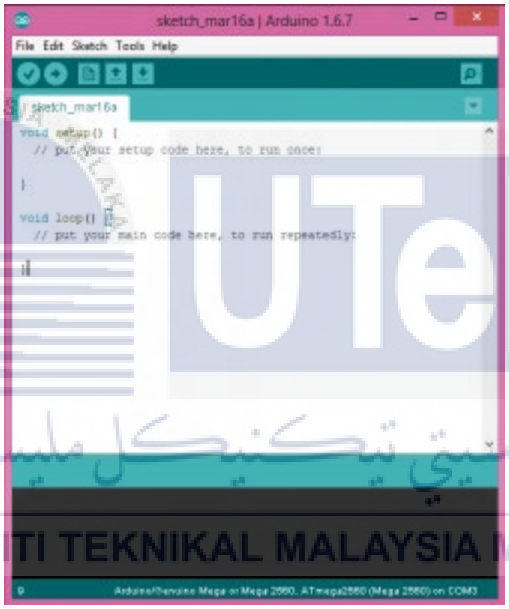

Figure 3.2 Arduino IDE interface

3.3 Hardware Development

3.3.1 NodeMCU

NodeMCU is an open-source software and development kit for prototyping or constructing IoT devices and includes software running Wi-Fi ESP8266. MCU stands for Microcontroller Unit which basically means it is a single chip computer used in this project to

automated the device. The ESP8266 WiFi Module is a self-contained system on chip with an embedded TCP / IP protocol stack that enables access to the WiFi network by any microcontroller. The ESP8266 will either host an application or offload all Wi-Fi networking features from a separate application processor.

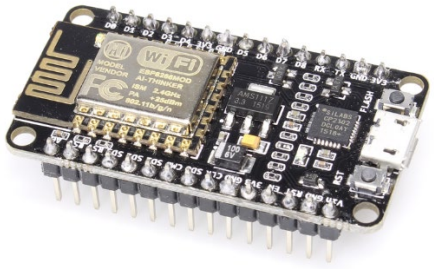

Figure 3.3 NodeMCU

3.3.2 Colour Sensor Recognition Module

Dependent on their wavelength, the color sensor can distinguish a wide variety of colours. This sensor is especially useful for projects for color recognition, such as color mixing, color sorting, test strip, and reading. This colour sensor with proper programming can sense any number of colours. The sensor includes microscopic level RGB (Red Green Blue) arrays where one can see the square boxes within the sensor's head. The square boxes are RGB matrix arrays. In this project, this colour sensor will detect the red colour of ocean water to identify whether there is presence of red tide algae.

Figure 3.4 Colour Sensor Recognition Module

3.3.3 Gyroscope

A gyroscope is an instrument that uses the gravity of Earth to help determine orientation. This configuration consists of a free-rotating disk called a rotor, placed in the middle of a larger and more powerful circle on a revolving axle to maintain its orientation regardless of any movement of the base. This gyroscope will float on the ocean water and return the calculation value of x,y,z of tidal level.

Figure 3.5 Gyroscope

3.3.4 ESP32 CAM

ESP32-CAM is a low cost development board with WiFi camera. It allows creating IP camera to take picture form ocean water with different resolutions. ESP32-CAM has build in PCB antenna. It also features a microSD card slot that can be useful to store camera shot images or to store client service files. After taking a picture of ocean water to analyze any possible red tide, ESP32 Cam will store the image on microSD card and send to application server.

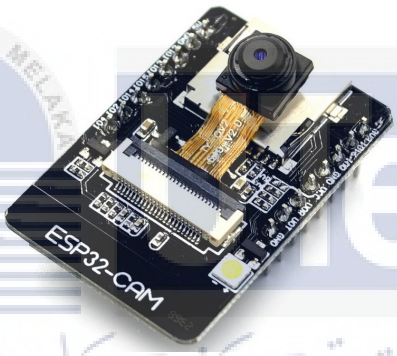

Figure 3.6 ESP32 CAM

3.4 Connection Design

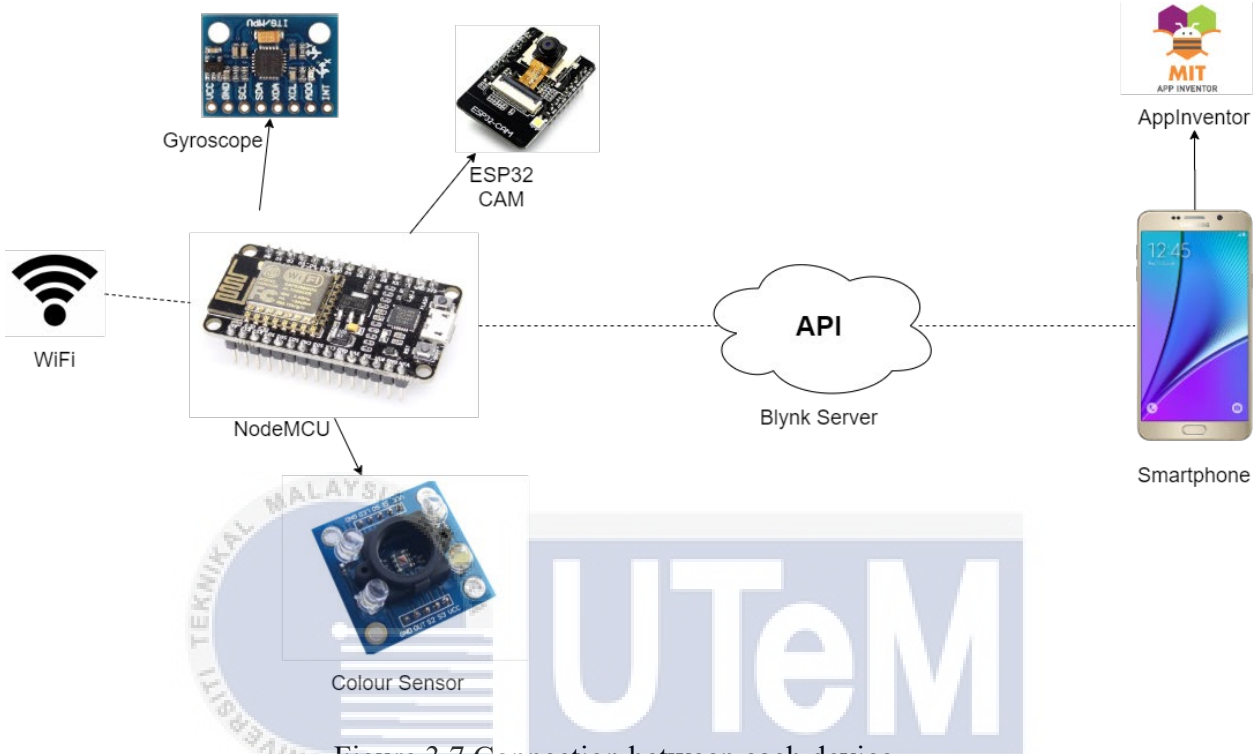

Figure 3.7 Connection between each device

Figure 3.7 above show connection that need to implement in this project. Gyroscope, Colour Sensor and ESP32 CAM will physically connected with NodeMCU. While, NodeMCU wirelessly connect with WiFi and Blynk server to get internet connection. NodeMCU using Arduino IDE as mediation to realizable connection to WiFi and work together with Blynk API. Smartphone use MIT AppInventor programming application to access Blynk server and get information through internet connection. Blynk server act as middle communication to send any digital or analog data between hardware device and smartphone application. All this connection realizable using both physical and wireless implementation.

3.5 Summary

The chapter summarized the part of the methodology consisting of the mechanism and the part used for the project. The project portion cited along with the features and advantage explained. Thus the process of the project approach explained the instructions to convey the concept of the project in the clear way in the flow chart diagram.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

This chapter will explain about the result and analysis from hardware and software in real situation including accuracy of the system in detail. This session will be divided into two part which the analysis coming from hardware and software part. The result will show the real output obtain from all the sensor testing.

4.2 Analysis of Hardware Part

For hardware part, it consists the functional of hardware implementation, which is NodeMcu, Colour Sensor, Gyroscope and ESP32-CAM. All the data and parameter output from this device will uploaded to NodeMcu that act as important role controlling system. The result will be shown at mobile software application development using MIT app inventor. The prototype will be using boat toy assemble with all hardware device to implement and presenting ocean current level and red tides monitoring system.

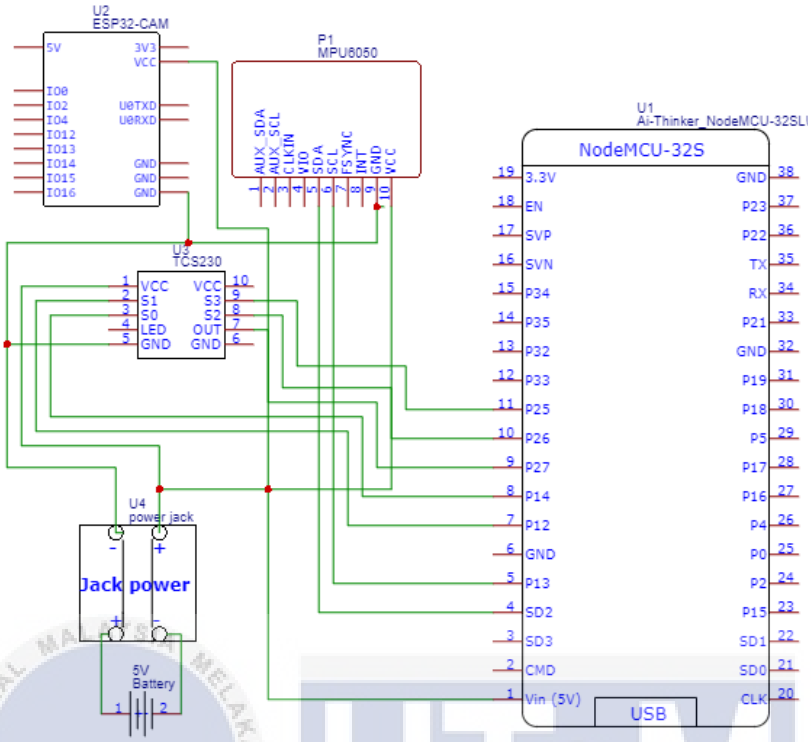

Figure 4.0 Schematic diagram for hardware system

Figure 4.1 Model Prototype for the system

4.2.1 Detect the Ocean Surface Colour

Colour sensor TCS230 was used to detect colour on ocean surface with help 8x8 array photodiode. Once colour sensor detect any surface, it will return the value of RGB (Red,Blue,Green) value differently. RGB value refers to three basic colour which is red, blue and green that can be mixed together to create different colour. There is a condition to detect red colour where the red value must bigger than the value of blue and green and must be 50% or above intensity value. It will directly send to mobile application to alert user existence of red ocean colour. The application will show "No Colour Detect" if the detection colour other than red.

Colour Detect	Condition	Intensity
Red	Red value must in between 25-77 and higher than green and blue.	50%
Green	Green value must in between 25 and 77 and higher than red and blue.	50%
Blue	Blue value must in between 25 and 77 and higher than green and red.	50%

Table 4.1: Colour sensor condition.

4.2.2 Monitoring Ocean Tides Level

MPU6050 is a part of component to reliable this function in the system. This device provide gyro sensor that return the value of x,y and z of sense angular velocity. It detects the motion of boat to maintain the orientation of its rotation. When boat, the acceleration magnitude, G, from tri-axial accelerometer is a constant and angular velocity is 0°/s. When the subject falls,

the acceleration is rapidly changing and the angular velocity produces a variety of signals along fall direction. Below formula show how to calculate value of angular velocity to identify the wave energy, where Gx, Gy, Gz the angular in the x, y, z axes, respectively:

$$a = \sqrt{(G_x)^2 + (G_y)^2 + (G_z)^2}$$

Figure 4.2 Formula to calculate angular velocity

Boat movement encouraged by the wave energy. If the tide is too high and rising, each successive wave will push higher, while if the tide is high and falling, the energy in the waves will decrease with each wave. As the tide approaches low tide, the waves will be less powerful and flat. The value then analyses to indicate whether the ocean tidal is high or low based on wave energy movement. The value can be analyse in condition below:

Tides Level	**|a|**
HIGH	Above 20000 & below 14000
LOW	20000 < a < 14000

Table 4.2: Tides level condition.

4.2.3 Observing Current Ocean Condition

User need to analyse or identify the existence of red tide by observing the situation occur at the ocean. ESP32-CAM is using local web server to capture ocean image from assemble boat and show through mobile application. The user can request image directly through mobile application. This device was program using HTML web language to save the last photo taken at Serial Peripheral Interface Flash File System (SPIFFS). SPIFFS is a flash memory that enable access user to read and write file or create folder on ESP32.

4.3 Analysis of Software Part

Red Tide and ocean level monitoring system develop using MIT AppInventor online software application. This system will control all activity whether to request data or sending data to NodeMCU using smartphone application. Behind this system, there is Blynk API (Application Programming Interface) that allows hardware to communicate with a project in the app by using token which assign to both hardware and software programming. All request or sending data to NodeMCU will go through Blynk cloud server before microcontroller can process the instruction.

4.3.1 Monitoring Current condition through Mobile Application

This application will provide four option to the user, which is Detect Red Colour, Monitor Tides Level, Take Ocean Image and Get Device Location. All four option will be given the data or output that user request. Before start to using this application, there are device status indicator at the bottom to make sure the device connection between application is establish. If there is no connection or the system might have some problem, the status will return 'Not Connected'. Figure 4.3 below show application homepage screen and device status indicator at bottom of the screen.

Figure 4.3 System Homepage Interface

4.3.1.1 Colour Detector

This part will show the value of RGB (Red Blue Green) return from NodeMCU. From the RGB value, the system will identify what colour its detect and show through this interface. This device will identify 3 colour only, which is red blue and green. Every colour detected will changed the background screen colour based on particular detected colour. If the red colour detected, the system will notify the user to analyze the red tide existence.

Figure 4.4 Colour Detector Interface

Figure 4.5 below show some part programming block for display detected red, blue and green colour with changing the background screen colour. JsonTextDecode command can convert JSON to list structure when receiving data from Blynk. Then, the receiving data will store to ‘global data9’ and analyze whether the colour is red, green or blue. If the colour detected

is red, ‘Notify_v31’ block will create a push notification through smartphone notification bar. This block command will notify the user and give option to take an action.

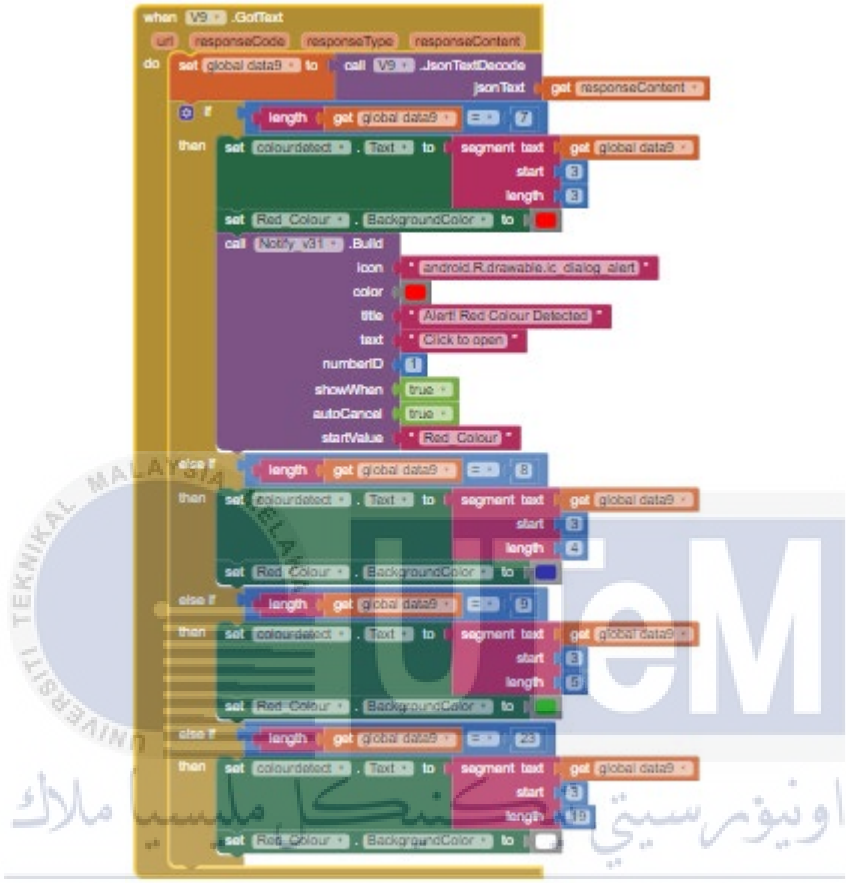

Figure 4.5 Programming block for detect red colour

4.3.1.2 Tides Situation

In this part, the interface will initialize to get the value of Gyroscope and Accelerometer from NodeMCU and display in this screen. ‘LOW’ tides status will display when there are low tidal and ‘HIGH’ tides will display when there is high tidal. The system will request the required value from main controller every 1 second and update the value into google sheet every 5 second. Google sheet will provide tides history from system to facilitate the user to analyse data

based on tides condition. Data history will saved x, y, z, tides level, time and date value. Below Figure 4.6 and 4.7 show the tides and tides history interface.

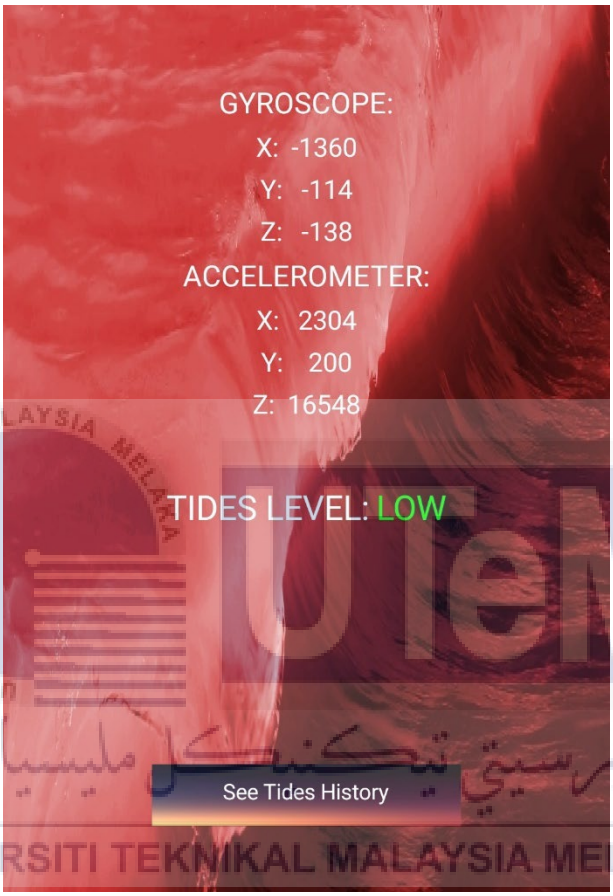

Figure 4.6 Tides Value Interface

Tides Level

Sheet1

	A	B	C	D
1	Time	Date	X	Y
2	0:09:16	1/11/2020	968	520
3	0:09:22	1/11/2020	968	520
4	0:09:27	1/11/2020	968	520
5	0:09:32	1/11/2020	968	520
6	0:09:37	1/11/2020	968	520
7	0:09:46	1/11/2020	968	520
8	0:09:42	1/11/2020	968	520
9	0:11:22	1/11/2020	968	520
10	0:11:27	1/11/2020	968	520
11	0:11:33	1/11/2020	968	520
12	0:11:38	1/11/2020	968	520
13	0:11:43	1/11/2020	968	520
14	0:11:48	1/11/2020	968	520
15	0:11:55	1/11/2020	968	520
16	0:12:00	1/11/2020	968	520
17	0:12:05	1/11/2020	968	520
18	0:12:10	1/11/2020	968	520
19	0:12:17	1/11/2020	968	520
20	0:12:24	1/11/2020	968	520
21	0:12:29	1/11/2020	968	520
22	19:54:18	6/11/2020	2304	200

Figure 4.7 Tides Data History

Behind Google Sheet that store all tides data history, there are Google Script that working as an API automation extend services and build web applications using javascript programming language. API in this task acts like a translator where it transfers communication between the user web server and the search database. This script will using GET and POST command to get and request data from system application. All data variable must be declared on both system application and Google Script to enable the system to recognize which data should be taken. After get the data, all data append to sheet in row with already set their variable.

Below Figure 4.8 show the programming that used in tides system along Google Sheet web server.

```
function doGet(e) {

var ss = SpreadsheetApp.openByUrl("https://docs.google.com/spreadsheets/d/1mxfynVwDhK7OzsKiNzI7nbXog6qK59LAnUxceZnry20/edit#gid=0");
var sheet = ss.getSheetByName("Sheet1");
addUser(e,sheet);
}

function doPost(e) {
  var ss = SpreadsheetApp.openByUrl("https://docs.google.com/spreadsheets/d/1mxfynVwDhK7OzsKiNzI7nbXog6qK59LAnUxceZnry20/edit#gid=0");
  var sheet = ss.getSheetByName("Sheet1");

  addUser(e,sheet);
}


function addUser(e,sheet) {
  var Time = e.parameter.Time ;
  var Date = e.parameter.Date ;
  var X = e.parameter.X ;
  var Y = e.parameter.Y ;
  var Z = e.parameter.Z ;
  var Tides = e.parameter.Tides ;

  sheet.appendRow([Time,Date,X,Y,Z,Tides]);
}
```

Figure 4.8 JavaScript programming for Google Script.

In Figure 4.9 below show programming block to get the value of Y-axis accelerometer from Blynk. JsonTextDecode command will parse the receiving data into structure and store to 'global data5'. The length command will measure the text length and go through the condition until the condition become true. Then, segment block extract selection part of the text by indicate the value starting position and continuing for length character. The data then display as a text value of Y-axis. There is 4 condition for data to meet, this because data comes from Blynk is a raw data and need to extract to get the real value. Purpose measure the length data is because accelerometer will return the value whether 2,3,4 or 5 digit and this does not include raw data from Blynk. So, the data can be analyzed by measured the length and display the real value.

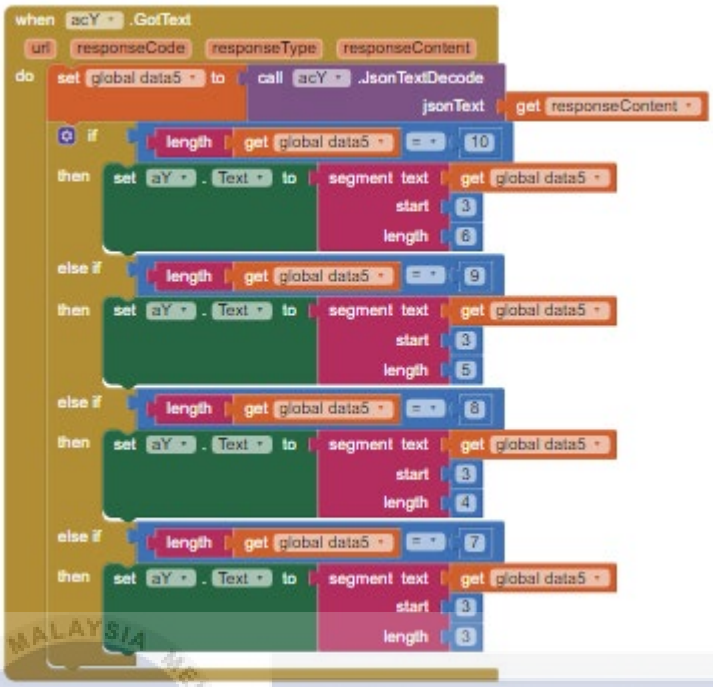

Figure 4.9 Programming block to get Y-axis accelerometer.

4.3.1.3 Taking Picture

App Inventor has a component called WebViewer. This function can load a webpage or website into an app using WebViewer component. ESP32-CAM has create their own local web server to display capture image. This screen will display webpage from ESP32-cam and control output from single interface. There are 3 button to configure this function. After click ‘Capture Photo”, user need to wait 5 second to let the system load the image through SPIFFS and click ‘Refresh Page’ to display the captured photo. The photo can be rotate their orientation to get clear and stable image. This function can be used by user to identify the existence of red tide on the ocean surface.

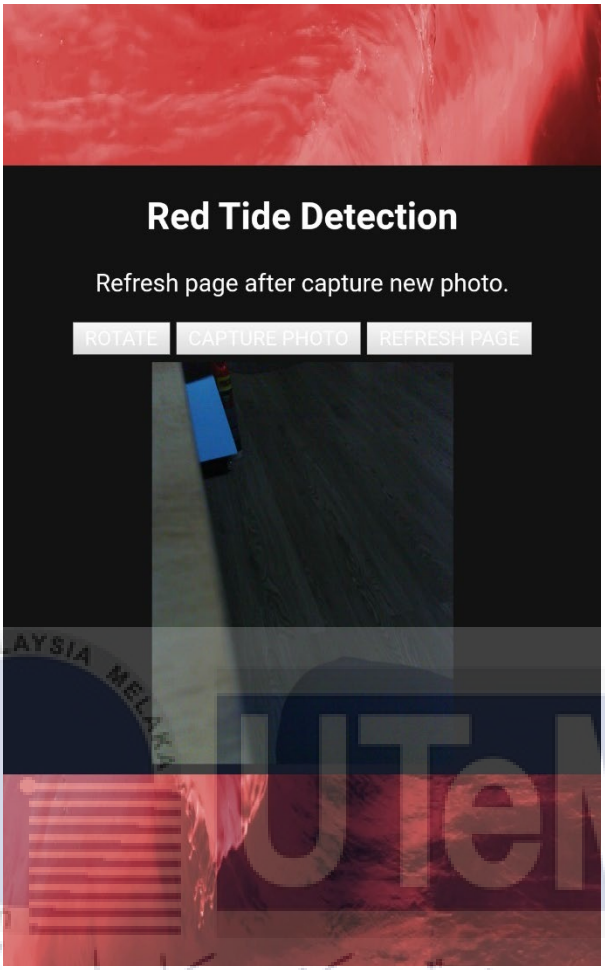

Figure 4.10 ESP32-CAM Local Webpage

4.3.1.4 Real-Time Location

Real-time locating system are used to automatically identify and track the location of objects or people in real time, usually within a building or other contained area to communicate with the global positioning satellite receiver (GPS). In this case, the system will track the location of device and provide the value of latitude and longitude. This accurate position able user to identify where data of the device taken. Ocean didn't come as a street with a name on every junction, they need latitude and longitude to know the location. There is no use if we take

data but we don’t know the exact location. This function really needed to focus or identify on harmness area or zone on the ocean.

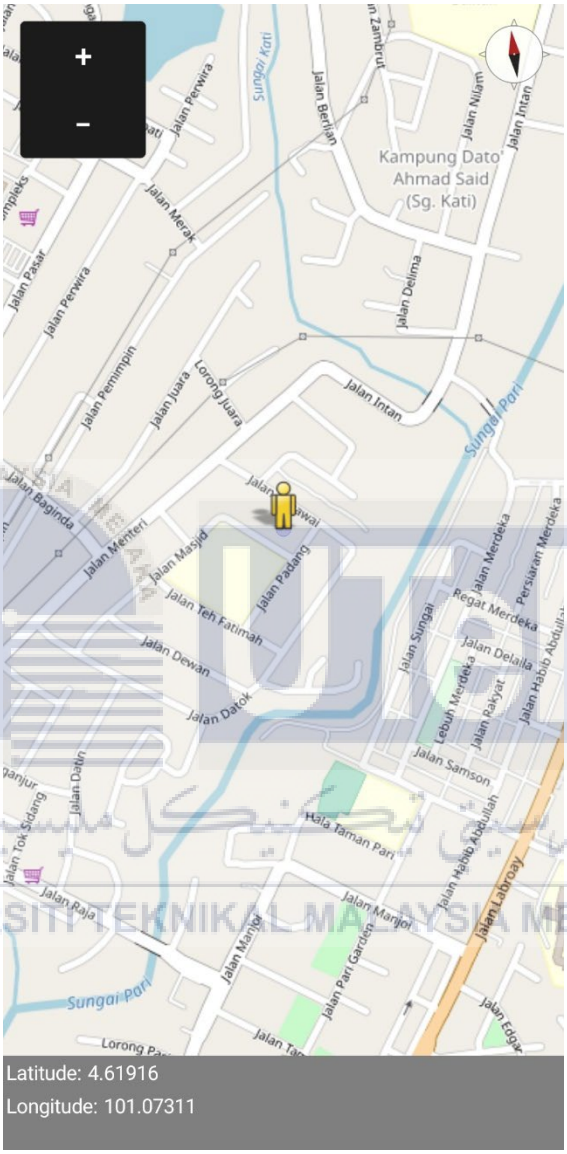

Figure 4.11 Real-Time Device Location Showing

4.4 Functionality Testing Based on Real Situation Simulation

This part will testing the functionality and realibility by simulation on real situation to make sure that the system is well operate and fully function before being used by the user. The test carried out by put the system prototype on aquarium box filling with normal water. In Figure 4.12 show on the application detect “NO COLOUR DETECTION” when there is no red colour on the water. While, Figure 4.13 show “RED COLOUR” when a piece of red card is put on the surface of the water. This testing assume that the normal water is ocean water and a piece of red card is existence of red tide. Red card can be replace as a red tide in this testing because its is a large concentrations of aquatic microorganisms, such as protozoans and unicellular algae that appear on surface of water. This testing prove that the system function very well and can be implement on real situation problem to detect the existence of red tide on the surface of ocean water.

Figure 4.12 Test with normal water

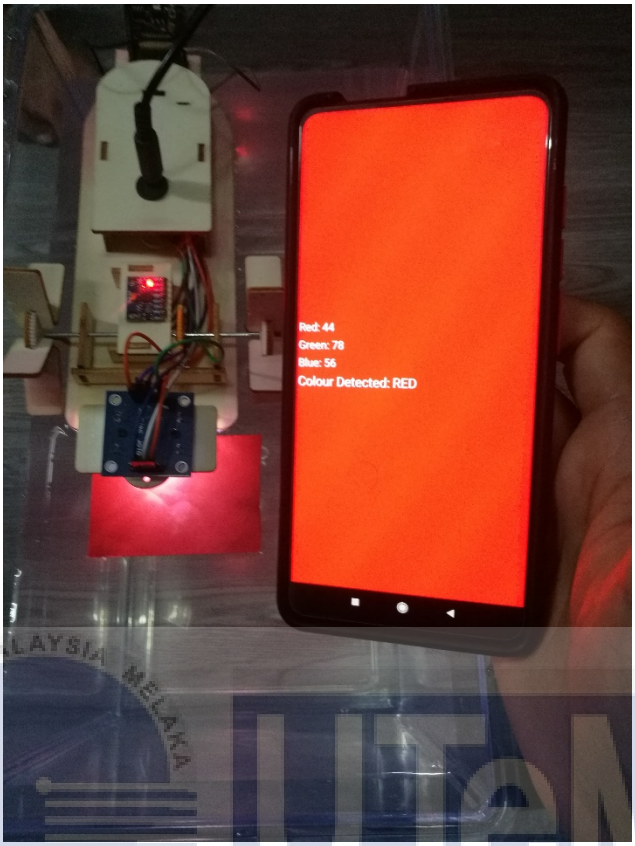

Figure 4.13 Test by putting red card on the water

The testing continues with the tides level function around the ocean in Lumut, Perak. The prototype was put in the resistance water box, tied on the buoy to avoid any unwanted situation such as the device sink into the ocean or drift by the ocean wave. The system prototype was left on the ocean water during low tides and high tide to get the date measured. Current and future tides level analysis or graph analysis can be monitor on website to compare the measured value and real value whether its match or not. Figure 4.14 show how the test experiment was carried out during low tide. The test was run at middle of the ocean rather than doing near the beach to get accurate data analysis.

Figure 4.14 The system was put into body of water during low tide at Lumut, Perak

The data was taken around 30 minutes for both low tide and high tide level to see the trend changes. Before start take data, tide forecast was monitored from https://tides4fishing.com/as/malaysia/lumut website to get exact time for tides level. The location to get data was monitored to avoid any danger situation such as high wave attack because the water location is deep and near to sharp rock. Below Table 4.3 show some of data taken for high tide and low tide level. The data contain time, date, x-axis, y-axis, z-axis and tide level situation. This data imported as excel file to analyse and create a graph for easy to understand and communicate the differences. Once have collected quantitative data, it will have a lot of numbers. The graph is created meant to represent data and to portray a relationship and for determining the general trend, relating the results of an experiment to the hypothesis and for formulating hypotheses for future experiments.

Time	Date	X	Y	Z	Tides
17:22:39	18/12/2020	1024	3080	16112	LOW
17:23:13	18/12/2020	4612	4996	14060	LOW
17:23:43	18/12/2020	2184	1820	15748	LOW
17:24:13	18/12/2020	1660	2656	15080	LOW
17:24:43	18/12/2020	2052	688	16060	LOW
17:25:13	18/12/2020	1852	1280	16156	LOW
17:25:43	18/12/2020	1924	1808	16044	LOW
17:26:12	18/12/2020	1104	748	17260	LOW
17:26:43	18/12/2020	1148	392	16116	LOW
17:27:13	18/12/2020	1752	1860	18104	LOW
17:27:43	18/12/2020	1836	532	16864	LOW
17:28:13	18/12/2020	2236	1436	16036	LOW
17:28:43	18/12/2020	-4064	-2944	19624	HIGH
17:29:13	18/12/2020	1848	1060	14592	LOW
17:29:43	18/12/2020	-1304	420	16440	LOW
17:30:13	18/12/2020	2024	1464	16856	LOW
17:30:43	18/12/2020	1532	1524	15700	LOW
17:31:13	18/12/2020	1472	776	14824	LOW
17:31:43	18/12/2020	1740	1504	14960	LOW
17:32:13	18/12/2020	1844	1704	16008	LOW
17:32:43	18/12/2020	1544	1164	16152	LOW
17:33:13	18/12/2020	1640	1092	15576	LOW
17:33:43	18/12/2020	1604	1168	17104	LOW
17:34:13	18/12/2020	2040	900	15068	LOW
17:34:43	18/12/2020	2492	2392	16544	LOW
17:35:13	18/12/2020	1756	1940	15016	LOW
17:35:43	18/12/2020	1732	2040	16168	LOW
17:36:13	18/12/2020	2296	956	16824	LOW
17:36:43	18/12/2020	2096	1312	15344	LOW

Time	Date	X	Y	Z	Tides
20:41:25	18/12/2020	-2892	-700	-4064	HIGH
20:41:55	18/12/2020	-2892	-700	-4064	HIGH
20:42:25	18/12/2020	16200	19532	29860	HIGH
20:42:55	18/12/2020	16200	19532	29860	HIGH
20:43:25	18/12/2020	16200	13536	32767	HIGH
20:43:55	18/12/2020	11580	6352	23372	HIGH
20:44:25	18/12/2020	11580	6352	23372	HIGH
20:44:55	18/12/2020	-304	4560	11412	HIGH
20:45:25	18/12/2020	-1344	4276	15444	HIGH
20:45:55	18/12/2020	-1344	4276	15444	LOW
20:46:25	18/12/2020	-624	2820	16180	LOW
20:46:55	18/12/2020	-624	2820	16180	LOW
20:47:25	18/12/2020	3588	2820	16180	LOW
20:47:55	18/12/2020	3588	2228	15536	LOW
20:48:25	18/12/2020	3588	2228	-5692	LOW
20:48:55	18/12/2020	1192	360	-6148	HIGH
20:49:25	18/12/2020	1192	360	-6148	HIGH
20:49:55	18/12/2020	29156	1484	32767	HIGH
20:50:25	18/12/2020	2412	960	1768	HIGH
20:51:11	18/12/2020	2412	960	1768	HIGH
20:51:41	18/12/2020	2412	960	1768	HIGH
20:52:11	18/12/2020	2412	960	1768	HIGH
20:52:41	18/12/2020	4408	1564	16120	LOW
20:53:11	18/12/2020	4472	1124	16672	LOW
20:53:41	18/12/2020	4472	1124	16672	LOW
20:54:11	18/12/2020	1920	1832	11540	HIGH
20:54:41	18/12/2020	1920	1832	11540	HIGH
20:55:11	18/12/2020	2112	3380	20160	HIGH
20:55:41	18/12/2020	3360	956	3884	HIGH

Table 4.3 Some of Data Taken during Experiment at Lumut for Low and High Tides

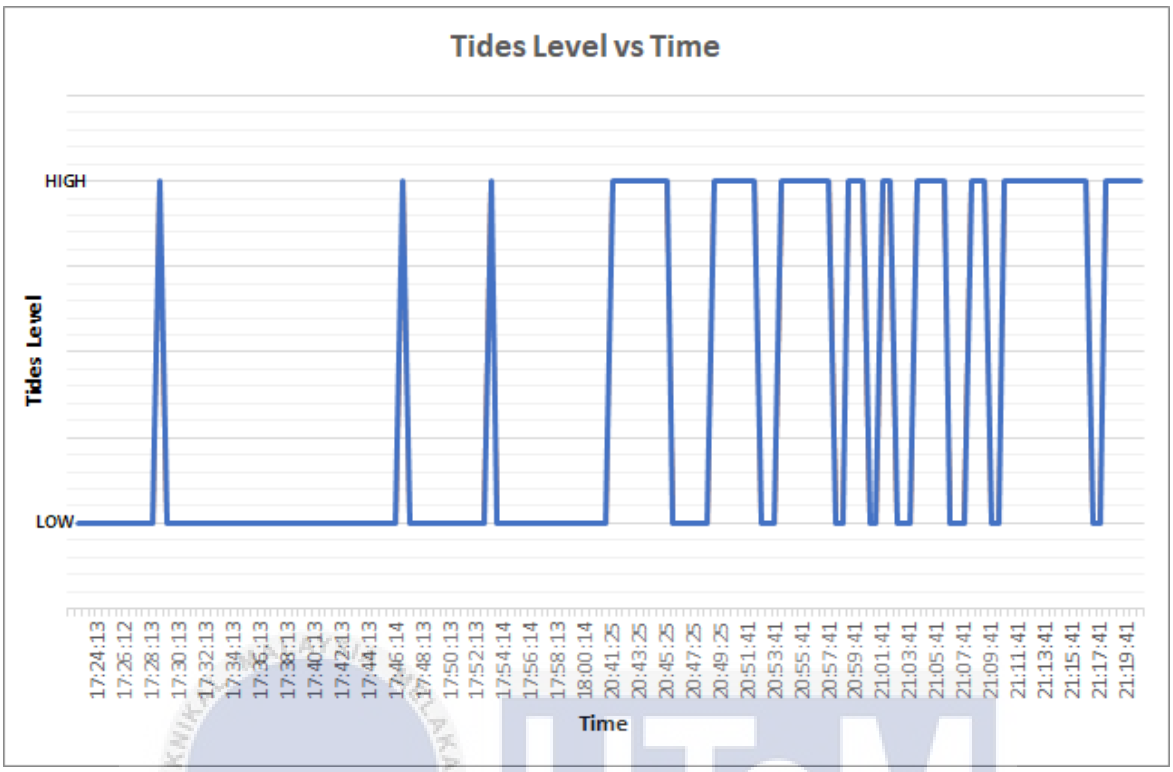

Figure 4.15 Data Tides Level Experiment Interpret in Chart

For low tide, time data taken starting from 5:24 PM until 6:00 PM. While, for high tide data taken from 8:41 PM until 9:19 PM. Figure 4.15 show chart 'Tides level vs Time' that has analysed from raw data Google Sheet history. As we can see, low tide trend going low all the time but at some point, it's going to high. This because at certain location and moment, general condition of the free surface on a large body of water with respect to wind waves and swell. Compare to actual tides from website on Figure 4.16, at 2:00 PM the tides start to decreasing until 7:29 PM. So, the tide level experiment represents for actual result from forecast website.

For high tide, the trend is fluctuating and not always in high level. Fluctuation rise and fall tides level irregularly in time. The revenues increase slightly over starting while there is a developing loss. Between 8:41 PM to 9:15 PM trend show increasing significantly but in always goes up or goes down cause by external factor. As, the tide level fluctuate, we assume the tides

level numbers are rising, but not falling. Therefore, the actual result from website show the tides level start to rising from 7:29 PM and keep going on until midnight. The data taken can represent for both actual and experiment result for high tide level. This result show that the system can be used to monitor tides level for fisherman community.

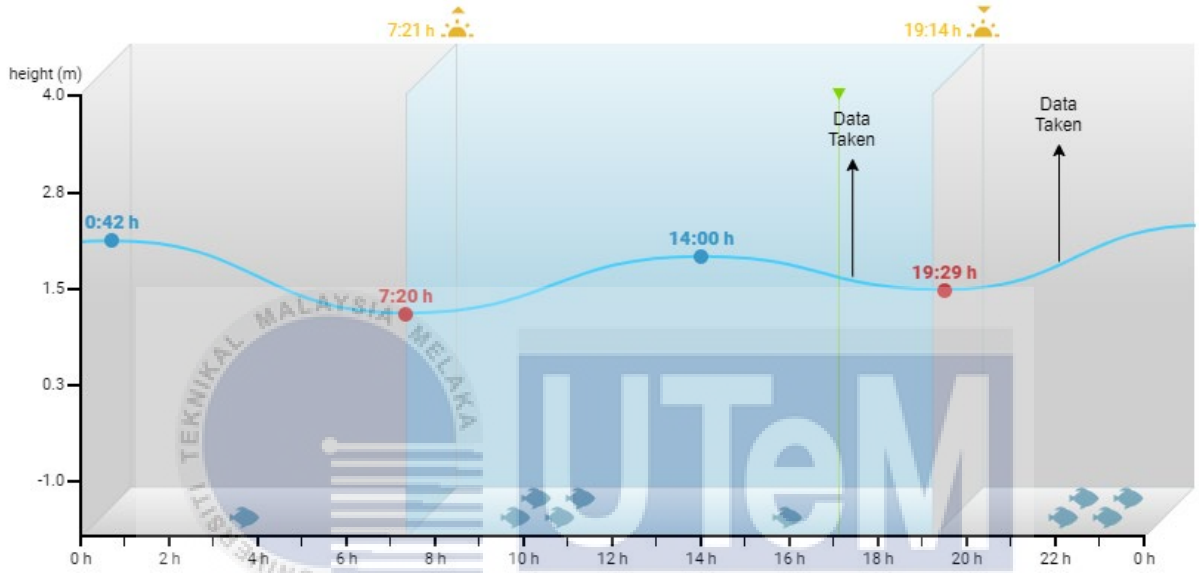

Figure 4.16 Actual Tides Level from Website Forecast

4.5 Summary

Furthermore, the whole concept and construction of this innovation design is to be facilitate the fisherman to detect any possible red tide existence and high tide level in the ocean. The objective of this project is archives as software implementation and hardware implementation work well as expected. It has been proven that the colour sensor to detect red tide and gyrometer to monitor tide level function as according to the user preferences mode by just request on the smartphone.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Conclusion

Ocean is a part of life. It is very important for human survival and as a source of clean drinking water. This situation kills the marine ecosystem and affects the ability of the oceans to provide food resources, protect sources of income and maintain water hygiene. However, this system could be applied to fisherman boat around the ocean to overcome red tide that cause many problems to marine life. This system has proven it can detect the existence of red tide and monitor tidal level based on real situation simulation. The best way to get a more accurate color detection, that more closely matches the human eye response, is to use an infrared filter in front of the sensor. TCS3200 color sensor can be used to detect the red tide existence of ocean water in solution through the colour intensity.

5.2 Recommendation

Based on the design and system that have been created, there are some recommendation to improve the system capability and marketability for future work. First, the ESP32 CAM is currently using local web server to reach the server and store image file. Whenever the device using different WiFi with smartphone, the server cannot be reach. So, it's much better to have own application web server that can communicate directly through internet connection. Even

owns web server a bit expensive, but it manages to access centralized resources in a network rather than shared a pool of computing resources that provides on-demand access to these resources via internet. Its also can focus only on particular project or application develop by user and provide more data storage.

Another thing that can be improve is provide location for each data taken. This prototype only take ocean data level and not showing exact latitude and longitude location on every single data taken. Device location can be monitor only when open the device location screen at one time. It is important to know how the data is collected as it determines the accuracy and depth of the collected data, this has direct implications on the suitability and usability of the data for any purpose. However, the system should consider various factors such as budget, accuracy requirements, and use cases when evaluating the source of their location data. This should also consider the ways different types of location data can complement each other. Thus, this system can be transmitting in the bigger scale of the information as can help for the ocean research on the red tides and ocean currents level.

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APPENDIX

PSM 1 DEVELOPMENT OF OCEAN CURRENT LEVEL AND RED TIDE MONITORING PORTABLE SYSTEM FOR BIG DATA APPLICATION																
Task / Week	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16
Briefing								MID SEMESTER HOLIDAYS								
Workshop PSM																
Discuss project with SV																
Chapter 1: Introduction																
Chapter 2: Literature Review																
Submission of 1st Progress																
Discuss with SV about project																
Chapter 3: Methology																
Design Plan																
Design the Project																
Chapter 4: Expected Result																
Submission of 2nd Progress																
Prepare Slide and Recheck Report																
Presentation PSM 1																

Appendix A Gantt Chart for PSM 1