UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF MISSING PERSON TRACKER SYSTEM THROUGH LoRa AND GPS BASED

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BACHELOR OF ELECTRONIC ENGINEERING TECHNOLOGY (TELECOMMUNICATION) WIITH HONOURS

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Faculty of Electrical and Electronic Engineering Technology

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Ihsan Asyraf Bin Mohd Amir

Bachelor of Electronic Engineering Technology (Telecommunication) with Honours

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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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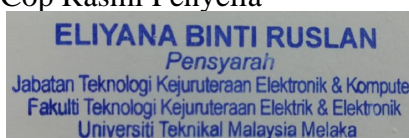
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APPROVAL

This report is submitted to the Faculty of Electrical 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:

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ABSTRAK

Pada masa kini, ramai orang ingin menceburkan diri di dalam aktiviti luar ekstrem seperti berbasikal di pergunungan, memanjat curam gunung, abseiling, bersiar-siar di dalam hutan, dan juga aktiviti mendaki. Tidak dapat dinafikan, segala perkara yang kita lakukan mempunyai risiko tersendiri, dalam hal ini, kita mungkin akan tersesat di dalam hutan. Pada tahun lalu, Malaysia digemparkan dengan berita kehilangan seorang pelari bernama Mohammad Ashraf Hassan, 29, ketika dia menyertai sebuah program larian Gopeng Ultra Trail Run 2019 yang dijalankan di kawasan hutan. Sehingga sekarang, mangsa mangsa masih belum lagi ditemui. Kemudian, beberapa lagi kes lain mengenai orang sesat di dalam hutan, tetapi nasib mereka baik kerana mereka berjaya diselamatkan. Tujuan projek ini adalah membina satu system pemantauan bagi pasukan penyelamat untuk memperuntukkan kedudukan mangsa sesat di dalam hutan. Projek ini terdiri darapada dua komponen utama iaitu pemancar dan penerima. Kedua-dua peranti yang dikendalikan oleh pengawal mikro ESP 32 yang dilengkapi dengan teknologi berasaskan LoRa dan GPS, di mana peranti ini dapat dihubungkan dengan telefon pintar melalui kaedah Bluetooth bagi tujuan pemantauan kemudiannya. LoRa ialah sebuah antara muka 'Long Range' tanpa wayar berkuasa rendah yang melanjutkan jarak komunikasi jenis sel kadar data rendah, manakala GPS pula ialah satelit, penerima dan algoritma yang digunakan oleh system navigasi untuk mendapatkan data lokasi, kelajuan dan masa untuk pergerakan di udara, laut dan darat. Dengan gabungan kedua-dua teknologi tersebut, LoRa yang ideal untuk menyediakan sambungan data kadar rendah yang cepat dalam jarak yang jauh menjadi kunci kejayaan projek ini. Walaupun keadaan hutan boleh menyebabkan gangguan disebabkan bukit dan pokok, jangkaan awal hasil daripada projek ini adalah untuk menerima data dari pemancar dengan jarak yang minimum dengan menggunakan sambungan LoRa.

ABSTRACT

Now a day, people venture into extreme outdoor activities such as mount biking, wall climbing, abseiling, jungle tracking and also hiking. Undeniably, everything that we do have its own risky, in this case, we might get lost in the jungle. A year back then, Malaysia have been shocked with news of a runner was named Mohammad Ashraf Hassan, 29, went missing after he joined Gopeng Ultra Trail Run 2019 where the event was held in the jungle trail. Until now, the victim is still missing. Then, there are several other cases about people missing in the jungle but luckily, they were founded safely. The purpose of this project is design as a monitoring system for the rescue team to allocate the position of the missing hikers who lost their tracks in the jungle. This project consists of two main component which are a transmitter and a receiver. Both devices controlled by ESP32 microcontroller that has been equipped with LoRa and GPS based technology, where these devices can connect with a smartphone via Bluetooth for a monitoring purpose later. LoRa is a low power wireless 'Long Range' interface developed low data rate cell type communication while GPS is a satellite, receiver and algorithm used by navigation system for synchronizing the location, speed and time data for air, sea, and land movement. With a combination of both technologies, plus, the ideal LoRa for providing fast low-rate data connectivity over significant distances will be the key of the success to this project. Even though, the condition in the forest may produce interference because of the hills and tree, the preliminary result of this project is to received data from the transmitter with a minimum range using LoRa connectivity.

DEDICATION

Countless thanks to my parents, Mr. Mohd Amir Bin Samdin and Mrs. Salinah Binti Sakrani, who never gave up on me and keep supporting me during my bachelor's degree studies. I am honoured to have you both as my parents. Thanks again for putting your trust on me and giving a chance for me to prove that I am going to finish my bachelor's degree with a flying colour. InshaAllah, I will give a Dean's Award on finishing my bachelor's degree studies as a sign of appreciation from me to both of you.

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I would like to show my gratitude towards my parents and siblings for the countless motivational support throughout this project. Without them, I may not finish it on time.

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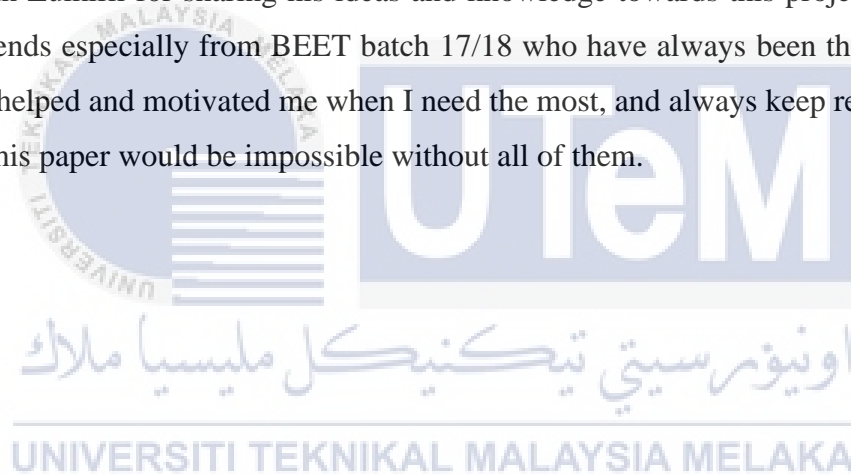
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CHAPTER 1

INTRODUCTION

1.1   Introduction

This chapter is an overview of tracking device for missing person especially for hikers. Moreover, the background study and the problem statement regarding to the research is defined. Then, it is followed by the useful resource of research objectives and scope which includes the aspect to improve the tracking system in the place with many interferences.

1.2   Background Study

This project is about the monitoring system for rescue team to allocate the position of missing hikers who loss tracks in the jungle. A software procedure: Arduino IDE, will be used to utilize the two units of ESP32 with a Long-Range technology (LoRa) as a microcontroller that will act as a transmitter and receiver. These findings are to incorporate a useful information for tracking person which is the longitude and latitude of the missing person that has been produce by the Global Positioning System (GPS) on the LoRa client/ transmitter. As an example, if the hiker loss their tracks, they will activate the LoRa client and send the location that have been produce by the GPS on the LoRa client. On a certain distance, the signal will be receiving by the LoRa gateway/ receiver; in this case it is the rescue team. Finally, the rescue team can locate the position of the hiker through the Google Map.

1.3   Problem Statement

These days, peoples started to intend on doing extreme outdoor activities such as mount biking, wall climbing, abseiling, jungle tracking and hiking. This is because of the influence from the professional people posting on social media such as Twitter, Instagram, Facebook, and so on. Just because of their post regarding on beautiful scenery of the place they have been visits, this will draw attention of newcomers to explore the places without having any knowledge about the place and have zero survival skills to survive in the jungle. These newcomers also do not know the procedure to get pass through the reserve forest area and they can be considered entering the area illegally. This can become a problem if anything happens to them and can be a problem to the Department of Forestry concerned because they do not know who have trespass the area. In early year of 2019, Malaysia have been shocked with news of a runner named Mohammad Ashraf Hassan, 29, who have been missing after he joined Gopeng Ultra Trail Run 2019. The event took place in the jungle around Gopeng, Perak. Until now, the victim cannot be found even with the traces of their mobile phone. So based on the above case, it is a need to design a device that can help the rescuer to locate the position for the hikers or any outdoor activist that involves with natures. At the same time, encouraging the newcomers to stay active, healthy, and last but not least is stay safe.

1.4   Objectives

The main objectives of this project are:

i.   To develop a missing person tracking system for hiker by using LoRa based.

ii.   To implement locating system in forest area using GPS.

iii.   To analyze the distance of receiving the signal by the client devices using LoRa to locate the location.

1.5   Scope of Work

Scopes is needed to ensure that the project will be as the expected point of confinement. It will be functional to ensure this project is on the correct course with an achievable goal. In designing the hiker tracking system, there are two aspects that need to be concerned which are the size of the portable transmitter and receiver, and the range of distance need to receive signal from transmitter to receiver in the jungle area where there is no internet coverage which means it is a point-to-point communication. In this case, the transmitter is the LoRa client while the receiver is the LoRa gateway.

It is important to make a minimum size of portable receiver for the rescuer. On the other hand, also a minimum size of portable transmitter going to be design for the hiker. This is because the size of the devices will give a huge impact for both users.

This project proposes a tracking system that uses mobile phone, ESP32 with a LoRa based technology and GPS as the application whereby a set of transmitter device will transmit the information of the hiker location that has been produce by the GPS to the receiver, which is the rescuer. Then, the rescuers must keep searching at the surrounding to reach the minimum range of the LoRa antenna. So, that the information can be receive in the place with many interferences

such as forest. After received the information, the rescuer mobile phone will locate the location of the hiker through the mobile apps on the mobile phone.

1.6   Project Contribution

This project will be very useful to the society especially for those who love on doing outdoor activities to be precise such as hiking, mountain climbing and any activities that regarding with wild nature. This project proposed a solution on tracing a missing person in an area without any internet coverage.

Moreover, the same techniques can be applied for any others tracking application in the place where there is much interference such as urban or suburban area. As for the future, hope this works may contribute to the researchers out there to create a tracking system in the rural area by using LoRa based efficiently
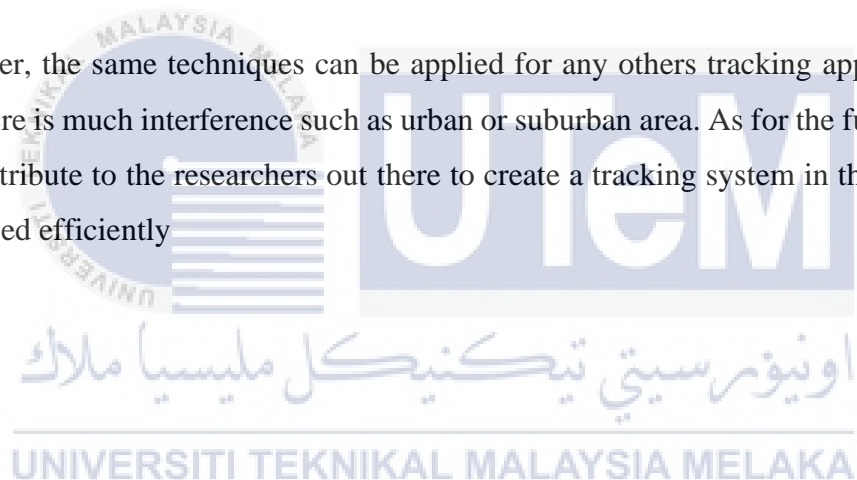
1.7   Thesis Structure

In Chapter 1, the possibility of the project will be explained. The background of this project will be discussed in this part. There are certain outlines that will be concentrated in this part which are the specifying of the objectives, the problem issues, and the scope of this project.

In Chapter 2, the idea, hypothesis and some other characteristic of the equipment and component that will be utilized in this project is taken from the past researcher. Furthermore, the idea and the theory of the researcher regarding to their project will be discussed.

In Chapter 3, the methodology will be explained in this section. Methodology means a step to build projects will be stated in order until the objective can be achieved. To be precise, this is explained about the procedure taken to complete the projects and consist with the detail about this project.

In Chapter 4, the expected result and discussion will be explained based on the data that have been produced and collected. The result then will be analysed with the outlined of the objectives achieved to be able to make some hypothesis and conclusion.

In Chapter 5, the conclusion will be made based on the expected result obtained. This conclusion section will be concluding all the work that have been done to complete this Bachelor Degree Project.

CHAPTER 2

LITERATURE REVIEW

2.1   Introduction

In this chapter, a few of publication journals and articles searched from IEEE explore, and some other search engine site is used. A several keywords are used to identify the related information regarding to the project. This research focuses on the information about the LoRa technology, GPS technology and several past project that use both technologies to be implemented into this project. To achieve this project, article about LoRa and GPS based technology has been studied.

2.2   Long Range Network (LoRa) Technology

2.2.1   Definition

According to Shilpa Deyalal and A. Karthikeyan (2018), LoRa was a new founded technology that expend rapidly which addresses the need of low battery to operate. This technology also known as less power consumes with a long-range technology. A new wireless connectivity group for Internet of Things (IoTs), it has recently changed and gained popularity in embedded system running low power battery systems which need to transmit small amounts of data over a long range at short intervals.

According to Umber Noreen, Ahcène Bounceur and Laurent Clavier (2017), LoRa is the protocol used by IoT application for Low Power Wide Area Network (LPWAN), which allows wireless sensor network technology in wide reach. The newest LPWAN technology has been suggested, based on broader-band propagation spectrum technique. Moreover, LoRa transmits a

signal that avoids noise, the long-term relative frequency, the Doppler effects and faing, over the entire channel bandwidth.

2.2.2   Performance of LPWAN Network Based

According Juha Peta¨ja¨ja¨rvi, Konstantin Mikhaylov, Marko Pettissalo, Janne Janhunen and Jari Iinatti (2017), the LoRa can transmit power of 14dBm and highest spreading factor of 12 which means more than 60% of the packets are received from the distance of 30 km on water by using boat. The performance of LoRa communication in mobile scenarios with the same configuration has been measured. As we can see, the result shown on Figure 2.1, at around 40 km/h, the performance get worse because of the duration of modulated signal exceeds coherence time. Hence, the communication link is more reliable when in lower spreading factors are used.
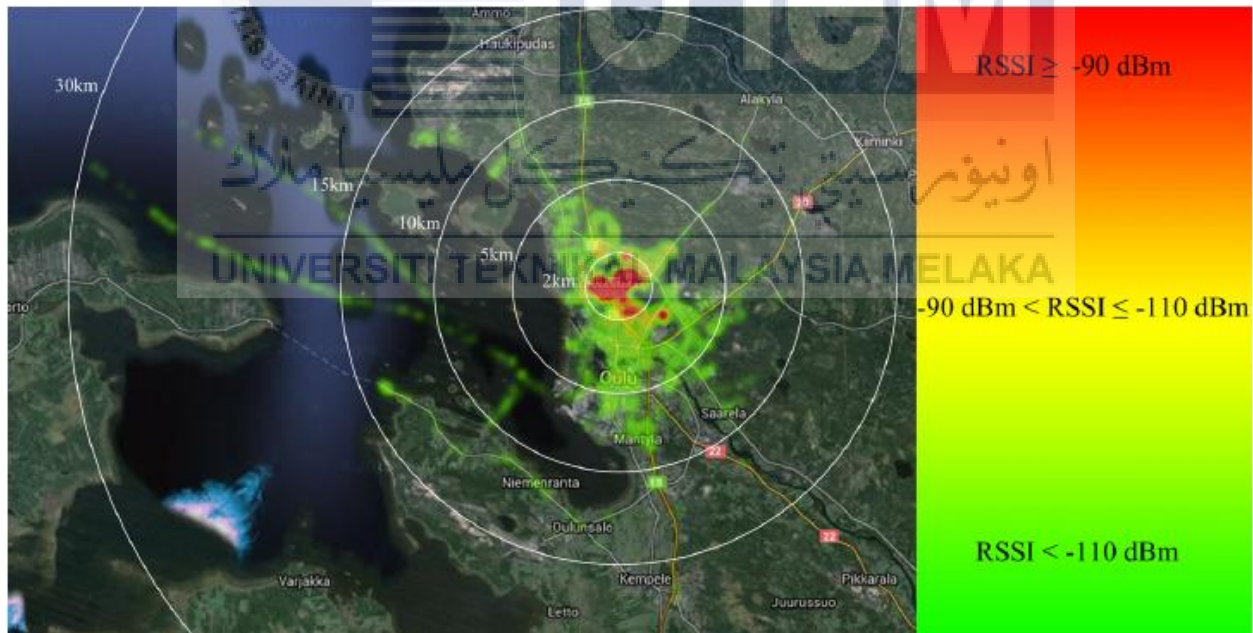

Figure 2.1 Received Signal Strength Different Location.