UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEVELOPMENT OF LANDSLIDE EARLY WARNING SYSTEM USING ARDUINO AND BLYNK

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 Honors

by

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TECHNOLOGY

2020

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: DEVELOPMENT OF LANDSLIDE EARLY WARNING SYSTEM USING ARDUINO AND BLYNK

Sesi Pengajian: 2020

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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:

Signature: ……

Supervisor : IR MOHAMMAD 'AFIF BIN KASNO

ABSTRAK

Sistem amaran awal tanah runtuh menggunakan Arduino dan Blynk dengan pelaksanaan Internet Thing (IoT). Projek ini bertujuan untuk mengurangkan masalah tanah runtuh. Selain itu, pengurangan pekerja dapat dilaksanakan melalui pelaksanaan sistem berteraskan IoT. Selain itu, ia boleh dipantau menggunakan telefon pintar dan memberikan tahap amaran kepada pengguna. Pada masa kini, teknologi memainkan peranan penting kepada rakyat. Berdasarkan projek ini, ia dapat membantu mengurangkan masalah pergerakan tanah dan mengesan faktor yang menggalakkan tanah runtuh berlaku. ESP8266 bertindak sebagai perantara internet untuk disambungkan ke internet atau Wi-Fi. Dengan menggunakan internet, projek ini dapat dikawal dan dipantau dari jarak jauh dan menerima notifikasi melalui Wi-Fi kepada telefon pintar. Sensor yang digunakan ialah sensor kelembapan tanah untuk mengesan air di dalam tanah dan sensor getaran untuk mengesan pergerakan dalam tanah. Projek ini menggunakan buzzer untuk sebagai alat pemberitahu amaran tanah runtuh mengikut tahap bahaya. Projek ini dapat memberitahu pengguna melalui aplikasi blynk. Risiko berlakunya tanah runtuh dapat dikurangkan dan kehilangan nyawa serta kerugian dan kerosakan harta benda dapat dijauhkan.

ABSTRACT

The project is the development of an initial ground-breaking system using Arduino and Blynk with the implementation of Internet Thing (IoT). The project is to make work easier and reduce the problem of landslides. Moreover, the reduction of workers can be achieved through the implementation of IoT-based systems. Additionally, it can be monitored using a smartphone and provides a level of alert to users. Today, technology plays an important role for the people. Based on this project, it can help reduce landslides and detect factors that encourage landslides. Data from various types such as Arduino, Raspberry pi and so on can be associated with any application such as Blynk, MIT or Firebase application creator with the help of Wi-Fi modules like ESP 8266. ESP8266 acts as an internet bridge object for internet or Wi-Fi connectivity. Using the internet, the project can be controlled and monitored remotely and receive notifications over Wi-Fi to smartphones. The sensors to be used in this project are soil moisture sensors to detect groundwater and vibration sensors to detect movement in the soil. The project uses a buzzer to serve as a ground warning system for hazardous landslides. This project can inform users through the blynk application. This indirectly reduces the risk of landslides and can prevent any death or loss and damage to property.

DEDICATION

To my beloved parents,

Mohd Noor bin Yuan and Noor Aana binti Zakaria who always there for me and support me to finish my report.

To my siblings that always give me idea in order to complete this report.

To my great supervisor,

IR Mohammad ‘Afif bin Kasno who encourage and guide me to finish this report.

ACKNOWLEDGEMENTS

A great deal of guidance and help was required for the success and final result of this project from many, and I am very proud for completing the whole report. All this happened because of good supervision and help. I would not forget to thank everyone that involved with me through all the hardness in order to completed this project and report.

First of all, thank to ALLAH, without His will everything cannot be done until this phase. Besides, I like to thank my great project supervisor, IR Mohammad 'Afif bin Kasno for his guidance, encouragement and support in order to make sure I did well for this project. Next, I also would like to thank all of my lectures and friends who willing to help and changing ideas to complete this project and report.

Finally, a very big thank to my beloved family for always there to support me and their blessing for me to finish this report and project.

TABLE OF CONTENTS

LIST OF TABLES

TABLE **TITLE** **PAGE**

LIST OF FIGURES

FIGURE **TITLE** **PAGE**

LIST OF APPENDICES

APPENDIX **TITLE** **PAGE**

CHAPTER 1

1.1 Background

This project focusing on developing and monitoring landslide early warning detection by using Arduino and Blynk. Landslide is an unpredictable disaster which could cause fatality and loss of belongings. Based on a report by ExpactGo (2015) it stated that 1740 slopes in Kuala Lumpur are liable to landslides [1]. Landslides and flood are the major two natural disaster that give largest effect to the countries such as loss of live, injuries, damage of property and financial [1].

Landslide depends on several criteria such as the soil movement, humidity ofsoil and properties of rocks. It can occur in many ways like fall, topple, slide, spread or flow [2]. Losses of infrastructure and lifeline facilities happened because of this phenomenon of landslide such as roads, railway, bridges, telecommunication, electrical supply lines and others. [2].

This project is a low-cost project as we used Arduino instead of wireless sensor network (WSN). This project focus on monitoring using sensors based on Internet of things (IoT). To make this project attached to IoT such as mobile application and cloud server its will be monitoring via smartphone or cloud server.

1.2 Problem Statement

Landslides are the most expensive and deadly natural phenomena in mountainous regions. Between 2007 and 2015, based on NASA 's Global Landslide Catalogue, more than 25.000 landslides have been killed worldwide by 7000 rainfall-triggered. The

U.S. Geological Survey evaluate that the expense of these events could get to $4 billion or more every year. Landslides are also one of the most difficult natural disasters to predict, as the factors affecting slope stability vary theatrically in both space and time [2].

Landslides often happen in response to severe or prolonged rainfall. Gravity is constantly working on hillsides to pull the soil and rock down, and rainfall infiltrating the soil changes the forces or stresses acting on those hillside materials [3]

The hazard of this phenomena can be drop by avoiding steep construction. Slopes and current landslides, or by stabilizing the slopes. Stability increases when groundwater is prevented from rising in the mass of landslides [4]. The significance feature of dealing with large-scale landslides is understanding them. Distribution, pattern and behavior based on geological and geomorphological characteristics. As for the infrastructure that has been built on them.

The minor of landslide happens based on some hint like warning signs such as crack on structure and also in or out of homes or concentrated amounts of water flowing over the slopes. Signboards to warn people not to use roads. Landslide-hit areas will also be located in bigger landslide region [4].

IoT technology in the landslide detection system project, all connected sensors can be monitored from anywhere in the world using only a cell phone. All sensors can be monitored in real-time, automatic alerts can be generated if something goes wrong [5].

1.3 Objectives

Based on the problem statement as mention earlier, there are some objective that can be achieve. The objectives are:

1. To study the fundamental and system which related to landslide early warning.
2. To develop the IOT landslide early warning system based on Arduino and Blynk.
3. To analyze the performance of developed system during real outdoor situation

1.4 Scope

Based on the objective, there are some scope that could be the case to achieve. The scope for this project is:

1. To focus the uses of Internet of Thing (IoT) by using Blynk interface inside the smartphone.
2. Arduino is an open source that can be programmed using Arduino IDEA software and upload the programmed to Arduino UNO and monitored using Blynk.

3. To focus only on soil moisture sensor and vibration sensor that can be monitored from far using the blynk apps.

1.5 Organization of Report

Based on final report consist of 5 main chapters which includes chapter 1,2,3,4 and 5. Chapter 1 describes the introduction of the project. Chapter 2 is literature review of project. Chapter 3 is methodology of the project. Chapter 4 is the analysis of the result obtained and the discussion and lastly chapter 5 which is conclusion of the whole project. The summary of each chapter is briefly explained as below:

Chapter 1: introduction

The things that will be explained in this chapter is introduction, problem statement, objective and scope of the project.

Chapter 2: Literature Review

Highlight the reviews and researches made from available resources such as articles, journals, newspaper, conference paper and magazines. Besides, the comparison for each research for the hardware and software used, the advantages and disadvantages of the project.

Chapter 3: Methodology

In this chapter is about the method and technique used for this project. The flowchart and the process needed in order to do the project will be explained in this chapter. All the component and software used will be explained.

Chapter 4: Result & Discussion

Overall findings of this project will be recorded in this chapter. All the data observe from the project will be attached in this part. Discussion are including the performance of current and proposed improved model.

Chapter 5: Conclusion

This is the final chapter for this project report. In this part it will be summarize all the important findings. Recommendation for future work also will be attached into this chapter.

CHAPTER 2

LITERATURE REVIEW

2.1 Background

Based on this chapter, the purpose of this literature review is to analysis previous project and research that is related to the landslide issue. In addition, it also will summarize the overview of landslide, theory and factor of landslide which is important in this project.

2.2 Overview of Landslide

Landslide happen every year and caused loss of life and asset. Landslide also called as slope failure in which there are a movement of soil from higher to lower level of ground and caused by several factors. Meanwhile, the factors of landslide can be by human activities, rainfall, earthquake, construction, deforestation in the hills and natural forces. Due to gravity slope movement occurs when forces acting down-slope [6]. Lack of technology, awareness and knowledge on disaster has cause huge impact of slope failure experience by community. When there is interaction between the landslide and human settlements, the availability of technology can improve the sensing of landslide, landslide warning and so on [7]. With the technology interact with human it will help to alert the people to be prepared

for the natural hazard. Based on an article post in November 2019, its stated that major landslide occur in Genting Highlands,Malaysia.[8]

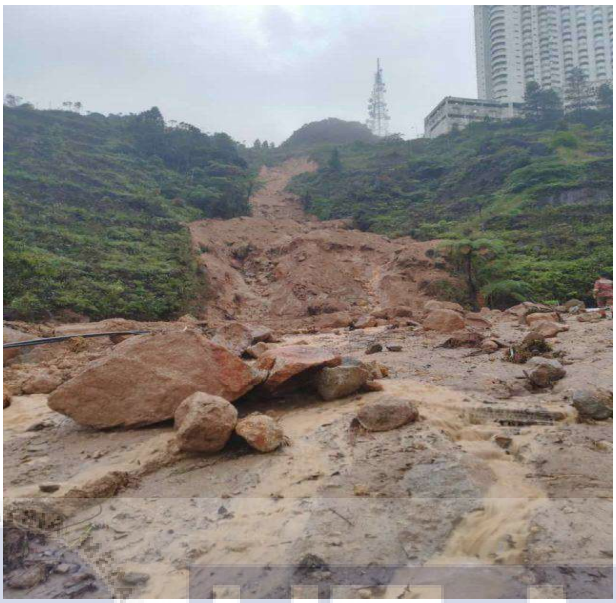

Figure 2.1: The major landslide in the Genting Highlands of Malaysia on 6 November 2019.

Basically, there were 21,000 landslide-prone areas throughout the country out of which 16,000 or 76% are in Peninsular Malaysia. About 3,000 are in Sabah and 2,000 in Sarawak. Common types of landslides in Malaysia are shallow slides where the slide surface is usually less than 4 m deep and occurs during or immediately after intense rainfall (Ting, 1984) [9]. In Malaysia, the rainfall can reach 4500 mm. One of the sectoral reports of Malaysia clearly mentioned about 49 landslides cases out of which 88% are recognized with manmade slopes (JKR, 2009a, 2009b) [9].