Faculty of Electrical and Electronic Engineering Technology

DESIGN OF AN IOT BASED SOLAR POWERED FOREST FIRE DETECTION AND CONTROL SYSTEM

NUR WAHIDA BINTI ABD RAHMAN

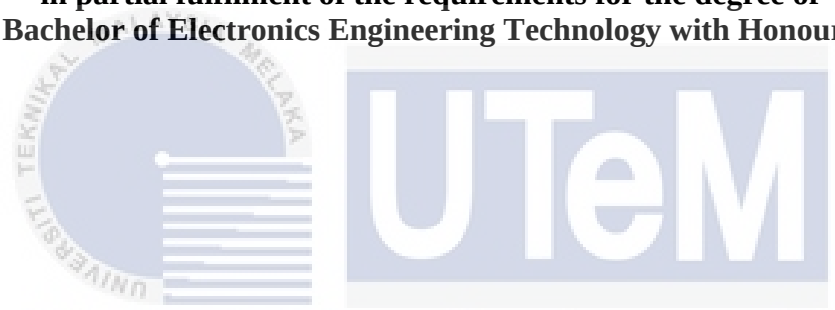
Bachelor of Electronics Engineering Technology with Honours

2021

DESIGN OF AN IOT BASED SOLAR POWERED FOREST FIRE DETECTION AND CONTROL SYSTEM

NUR WAHIDA BINTI ABD RAHMAN

A project report submitted
in partial fulfilment of the requirements for the degree of
Bachelor of Electronics Engineering Technology with Honours



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Alamat Tetap:
No.1 Jalan 3/8 Bandar Teknologi Kajang
43500 Semenyih, Selangor

PROF. MADYA MOHD ARIFF BIN MAT HANAFIAH
Pensyarah Kanan
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik Dan Elektronik
Universiti Teknikal Malaysia Melaka

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Student Name : NUR WAHIDA BINTI ABD RAHMAN

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I hereby declare that I have checked this project report and in my opinion, this project report is adequate in terms of scope and quality for the award of the degree of Bachelor of Electrical Engineering Technology with Honours.

Signature :

Supervisor Name : PROF. MADYA MOHD ARIFF BIN MAT HANAFIAH

Date : 11 / 01 / 2022

Signature :

Co-Supervisor :

Name (if any)

Date :

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DEDICATION

To my beloved mother, Noraini and father, Abd Rahman whose does not stop gives me support and motivation throughout my whole life and journey in studying at UTeM. To my dearest husband, Wan Mohd Aiman Syafiq, thank you for all the motivation that helps me facing my online distance learning in this pandemic which is quite hard due to different surrounding and the time that you spent accompanying me when I was stress studying and settling my assignment. Special thank you to my siblings who always help me in advising, giving idea, and solving problems. Besides, giving inspiration by showing their hardworking in pursues studying and end up with a good career.

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ABSTRACT

Forest is very important for human and earth. Thus, late detection of forest fire can cause a huge damage to the forest and wildlife habitat besides polluting the environment. This is because, there is no system to monitor forest fire automatically. Furthermore, using a direct supply from the grid can give disadvantage to the system because it is auto disconnected in the absence of electricity power supply. Hence, it is not a renewable energy and can run out any time. In addition, most of forest fire issue can be avoided if early fire detection is taken. This paper presents a computationally procedure to plan and implement a Solar Powered Forest Fire and Monitoring System using an Arduino Uno. The hardware execution will be using Arduino Uno board which use ATmega328 as the micro-controller. The proposes structure will be able to detect the presents of flame and will notify the user through an installed Blynk app whether in iOS or Android device and monitor the temperature of the forest. This thesis shows the notification received by the user once the detector, detects flame and its ability to measure the forest temperature.

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ABSTRAK

Hutan adalah sangat penting untuk manusia dan juga bumi. Oleh hal yang demikian, kebakaran hutan yang lambat dikesan akan menyebabkan berlakunya kerosakan yang amat dahsyat pada habitat hutan serta hidupan liar. Di samping itu, kebakaran hutan juga antara sebab berlakunya pencemaran alam sekitar. Hal yang demikian kerana, tidak ada sistem untuk melakukan pemantauan kebakaran hutan secara automatik. Seterusnya, terdapat kekurangan apabila menggunakan bekalan secara langsung daripada grid kerana sistem akan terputus secara automatik apabila tiada bekalan elektrik yang diberikan. Malah, bekalan elektrik tersebut bukan sejenis tenaga yang boleh diperbaharui dan boleh habis pada bila-bila masa. Tambahan pula, kebanyakan isu kebakaran hutan dapat dibendung sekiranya kebakaran hutan dapat dikesan pada peringkat awal. Laporan ini membentangkan prosedure komputasi dalam merancang dan melaksanakan 'Solar Powered Forest Fire and Monitoring System" dengan menggunakan Arduino Uno. Pelaksanaan perkakasan akan menggunakan Arduino Uno yang menggunakan ATmega328 sebagai pengawal mikro. Struktur yang dicadangkan akan dapat mengesan kehadiran nyalaan api dan memberi notifikasi kepada pengguna melalui aplikasi Blynk yang dipasang sama ada pada peranti iOS atau Android dan memantau suhu di hutan. Seterusnya, tesis ini menunjukkan notifikasi yang diterima oleh pengguna setelah pengesan api mengesan nyalaan api dan kebolehannya untuk mengukur suhu di hutan.

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In the Name of Allah, the Most Gracious, the Most Merciful

First and foremost, I thank Allah (SWT) for his blessing because I finally complete my PSM 1 successfully. With this, I would like to express my heartfelt gratitude to all people who helped me in making my Bachelor project success victoriously.

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My highest appreciation goes to my parents, husband, parents' in-law, and family members for their love and prayer during the period of my study. An honourable mention also goes to my siblings and to my friends, thanks for all the hardship, cooperation, and memories during our journey in UTeM and especially during this pandemic.

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LIST OF SYMBOLS

θ - Sun altitude angle

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LIST OF ABBREVIATIONS

IoT	-	Internet of Things
IIoT	-	Industrial Internet of Things
CO_2	-	Carbon dioxide
LCD	-	Liquid Crystal Display
V	-	Voltage
P	-	Power
I		Current
AH		Ampere Hour
W		Watt
ft		Feet
SCC		Solar Charge Controller

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CHAPTER 1

INTRODUCTION

1.1 Background

People are now live in a world driven by technology, and it is an integral part for every individual in daily life. Besides, technology is also use as a necessary tools and machine in our everyday life to make life easier by simplify the human tasks and becoming a developed world. Back in the days, everything is done manually such as, monitoring plant, going to library to find a reference, buying groceries at supermarket, and asking people on the street about directions. Now, everything is just at your fingertips. Watering plant by creating a smart system of monitoring plant by using an Internet of Things (IoT), use search engine to find references and installing mobile applications to buy groceries and find directions.

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Nowadays, an Internet of Things (IoT) has become a popular trend to be used and create as an intelligent digital system among users. This is very convenient for user to manage their work even from far and no longer needs an on-site observation and monitoring. According Lee and Lee (2015), IoT is a new model of technology with global network that is capable to communicate with one another. Other than that, IoT has been receiving wide attention as an important technology in future from industries. Figure 1.1 below shows the technology of an Internet of Things (IoT).

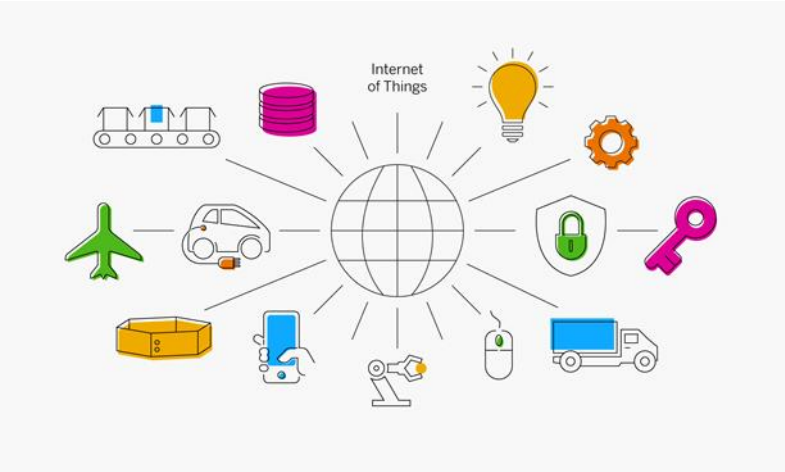

Figure 1.1 Internet of Things (IoT) technology

Currently our world is in trend with a revolution of fourth industry (Industry 4.0). According to Pereira and Romero (2017), the revolution of first industry is a productivity and efficiency that has been upgraded. Second Industry, the use electricity permits large quantities of production and electronics, and IT was characterized by an automation of production in third industry. Besides, an Industry 4.0 has grasp enormous potential and will provide an opportunity for social and economic.

Other than Industry 4.0, it is also occasionally mentioned as smart manufacturing or (IIoT) that stands for Industrial Internet of Things. Figure 1.2 shows the industry 4.0 technology pillars. IIoT is the hub of an IoT in a sector that are merge with technologies like sensors and others that go through long-established industrial procedures as mention by Zhao, Li and Yao (2019) as shown in the figure 1.3 of an architecture of an IIoT platform. Dalenogare *et al.* (2018) stated that Industry 4.0 is a new stage of industry with a combination of manufacturing operations systems and information and communication technologies (ICT).

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Figure 1.2 Industry 4.0 Technological pillars

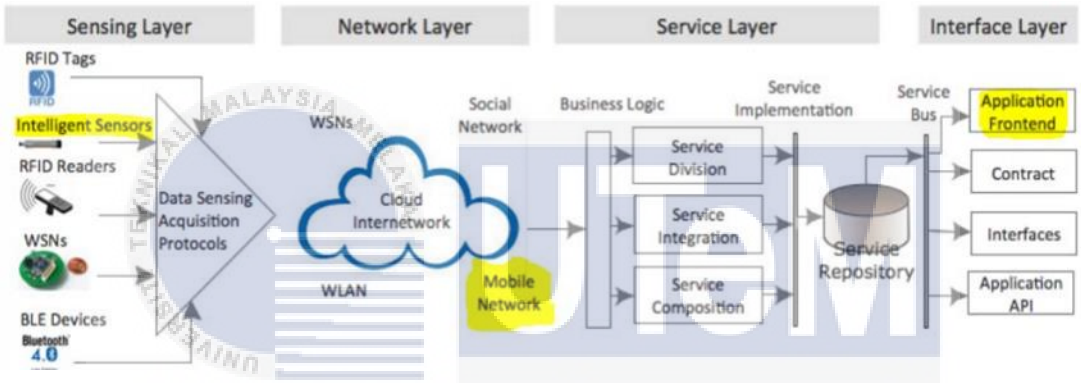

Figure 1.3 An architecture of an IIoT Platform

(Source: Zhao, Li and Yao (2019))

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Peatland in Malaysia have been linked with forest fire in these recent year as mentioned by Diemont *et al.* (2002). A survey showed that if fire can be detected early, 80% of losses can be avoid as stated by Abhinav *et al.* (2017). Jayaram *et al.* (2019) mentioned that once a fire ignited, it will cause a huge damage within the forest.

1.2 Problem Statement

Forest is very important for human and earth as it can prevent soil erosion and diminish climate change that may lead to a forest fire. Forest ecosystems are major part of global carbon cycle, contribute to earthly carbon sink and an advantage to the economic.

Furthermore, the richness of species in forest is the measurements of diversity and effect the growing literature of economic value of diversity.

Thus, late detection of forest fire can cause a huge damage to the forest and wildlife habitat besides polluting the environment. Most of the reported cases is occurred in degraded or logged-over peat swamp forests, either in Peninsular Malaysia and Sabah and Sarawak. This is because, there is no system to monitor forest fire automatically.

Electricity power supply is needed to give an electric and electronic load or devices such as laptop and oven, electricity power. Thus, they can run with the amount of supply received. In this case using a direct supply from the grid can give disadvantage to the forest fire detection and monitoring system because the system is auto disconnected and cannot be use in the absence of electricity power supply. Furthermore, it is not a renewable energy and can run out any time.

In addition, most of forest fire issue can be avoided if early fire detection is considered. To avoid flame from damage the biological substructure, it is very crucial to distinguish the flame. Besides, it can be very lethal for human life.

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1.3 Project Objective

The objectives that need to be achieved for the project:

a) To implement Internet of Things (IoT) for forest fire detection and monitoring system.

b) To design the solar powered forest fire detection and monitoring system using microcontroller.

c) To detect an early stage of forest fire and gives alert to user using IoT.