UNIVERSITI TEKNIKAL MALAYSIA MELAKA

THE DEVELOPMENT OF SMART HOME FIRE ALARM USING INTERNET OF THINGS (IOT)

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

AINA NABILA BINTI MOHD IZAT

FACULTY OF ELECTRICAL AND ELECTRONIC ENGINEERING TECHNOLOGY

2020/2021

DECLARATION

I hereby, declared this report entitled The development of Smart Home fire alarm using Internet of Things (IoT) is the results of my own research except as cited in references.

Signature: Ayna ……

Author : AINA NABILA BINTI MOHD IZAT

Date: 14/02/2021

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: whaszerila .....

Supervisor: WAN HASZERILA WAN HASSAN

ABSTRAK

Perkembangan aplikasi Rumah Pintar berdasarkan Internet Saling Berhubung (IoT) adalah sistem keselamatan Rumah Pintar yang dipertingkatkan. Perkara ini melibatkan kehidupan manusia dan harus dititik beratkan. Penggera Kecemasan Kebakaran Rumah Pintar dibina untuk mengelakkan kemalangan seperti mangsa yang terperangkap di dalam rumah semasa kebakaran, penyebaran api di dalam rumah, mangsa tidak menyedari keadaan kecemasan dll. Sistem ini mengandungi ESP8266 NodeMCU sebagai komponen utama untuk menhubungkan Wi-Fi supaya internet tetap berhubung dengan Aplikasi BLYNK di telefon pintar. Semasa kejadian kebakaran, sensor MQ2 mengesan asap / gas / api, penyiram air dan buzzer dipicu dan notifikasi muncul di telefon pintar menjadi penggera kepada pengguna. Seterusnya, kunci pintu solenoid berfungsi membuka kunci pintu secara automatik untuk mengelakkan pengguna daripada terperangkap di dalam rumah. Tambahan pula, sistem ini bertindak sebagai pengesanan awal sebelum kebakaran bertambah buruk dan membahayakan nyawa manusia. Projek ini dirancang dengan sistem keselamatan rumah yang lebih baik dan benar-benar memberi amaran, pemantauan dan diberi kuasa oleh pengguna untuk melindungi mereka dalam keadaan kecemasan.

ABSTRACT

The development of Smart Home Fire Alarm based on Internet of Things (IoT) is an improvement of the smart home security system. The system is built to prevent from accidents such as victims trapped inside the house during a fire, the spread of fire in the house, victims unaware of the emergency situation etc. This system contains ESP8266 NodeMCU as a main component for enabling the Wi-Fi and stay connected with BLYNK Application in the smart phone. During the fire incident, MQ2 sensor detects smoke/gas/fire, water sprinkler and buzzer is triggered and notification appears on the smart phone to alarm user. Next, the solenoid door lock automatically unlocks the door to avoid user from being trapped in the house. Furthermore, this system act as an early detection before the fire accident worsen and put the people's life in danger. This project is designed with a better home security system and completely alerting, monitoring and authorized by users to protect them in an emergency situation.

DEDICATION

I dedicate this project to my supportive parents and family, who have been my source of inspirations and always give me strength when I thought of giving up. I am feeling gratitude for having such a helpful supervisor throughout this project, Madam Wan Haszerila Wan Hassan. I also dedicate this work for my friends and to Siti Rafidah Kamalin someone I rely on during hard times while working on this project.

ACKNOWLEDGEMENTS

Firstly, I wish to thanks my project supervisor Madam Wan Haszerila Wan Hassan for teaching and guiding me throughout the process. I am truly grateful having my friends around to help me accomplishing this project. I would like to take this opportunity to express my gratitude towards everyone who supported me by expressed or implied. It would not have been possible to do this without their help.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

LIST OF ABBREVIATIONS

IoT	Internet of Things
HG	Home Gateway
GPS	Global Positioning System
AI	Artificial Intelligence
CCTV	Closed Circuit Television
SDN	Software Defined Networking

CHAPTER 1

INTRODUCTION

1.1 Background Study

The idea of connecting whole wide world cannot be visualized without the existing of Internet of Things (IoT). Smart Home is one of various applications that constructed by IoT. It is authorized by an IoT environment with different of things such as household appliances, smoke detector, security sensors, etc. These gadgets tethered to the Internet and permitting the user to authorize devices anytime and anywhere.

Significantly, the first generation of smart home had a few functions to do with intelligence and more focus into automation and remote control. Just a decade ago, a modern technology where could use the smart phone or run the thermostat to detect the preferred temperature was enough to show it a smart home technology. In 2020, this concept implies much more than that.

Therefore, the title of 'Smart Home' is called when it has an operating range of high technology devices that can control by automatic remote and set them the way consumer's preferred for security, housework or maintenance. This technology can combine in becoming one network.

1.2 Problem Statement

There are various of problems and issues commonly occurs in the Smart Home system. The implementation of loT is developed rapidly, it is hard to control all the applications in lot technologies including security applications. Therefore, this project is

to do some research by analysing the changing and converging of the Smart Home security system. Somehow, problems will occur such the way to handle and control these several applications. The entire system could not be easier and more secured if these applications not controlled effectively and intelligently. Thus, the security system of smart home is designed in this project as an easy application and convenient for users.

1.3 Objective

The objectives of this project are:

- To construct a system of Fire Emergency Alarm circuit using Fritzing Software.
- To design and develop the applications and features of Smart Emergency Alarm of Smart Home using BLYNK Application.
- To implement the simulation of Smart Emergency Alarm using NodeMCU in Arduino.

1.4 Scope of Study

In this study, project focuses on the studies of developing and constructing the Fire Alarm system that works as one of the home applications. This project describe the system and simulate the design of smart home fire alarm purpose. Furthermore, this project also implemented the prototype of a fire alarm system for the uses of every homeowners.

1.5 Thesis Organization

This proposal contains five parts. The parts consist of:

Chapter 1: Introduction

In this chapter, contains a description of the background study of the research, problem statement, objective of the research and the scope of study.

Chapter 2. Literature Review

This chapter is a survey for the development of Smart Home and the Internet of Things (IoT) from the other relevant publications.

Chapter 3. Methodology

This chapter discusses the simulation and design of Smart Emergency Alarm which is one of the Smart Home applications using IoT. Implement the design of Smart Home application using the software of IoT related.

Chapter 4. Result and Discussion

This chapter contains the information about the latest features of Smart Home based on IoT. Furthermore, consisting the outcome of Fire Emergency Alarm in Smart Home applications.

Chapter 5. Conclusion and Future Recommendation

This chapter discusses the conclusions and suggestions that can be drawn from this entire Final Project and the possibility of developing the research concerned.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

In this chapter, contains all of the studies associated to the development of Smart Home using Internet of Things (IoT). Contents that related with this research are taken from various sources such as article, website and journal. The use of the literature review is the right set of circumstances to the information related for this project in specific to require a comprehensiveness of the concepts.

2.2 Internet of Things (IoT)

"A Brief History of the Internet of Things" from (Keith D. Foote, 2016) stated that the IoT was unofficially titled but only a concept before 1999. The first experiment on the IoT is after 1979 which was applied to invent a refrigerator machine for water drink, located in a university. The engineers connected to the Internet for the refrigerator machine check if the drink is available or not, and if it was cold, before making the trip. In 2013, the IoT had converge into a system using different technologies, from the Internet to wireless network and from micro-electromechanical systems to fix systems known as embedded system. Since then, IoT supported wireless sensor networks, Global Positioning System or known as GPS, the automation of homes and buildings are also included.

2.3 Development of Smart Home

In an article of "The Evolution of Smart Home Technology" (Sinha G. Gaurav, 2018) stated that over the last decade, smart home technologies have converged outstandingly, became practicable for users to authorize their appliances even when they are somewhere else. Anyone that used this technology can access the internet and the interconnected devices in the house. Nowadays, the real estate developers are proposing houses that complete with smart home functions.

Besides from living eco-friendly, smart home technologies also provide security thus, it allows users to save their energy. This helps families to secure and manage their living by stay connected through IoT. At this moment, this technology is being integrate into other sector such as, offices, malls, airports and schools. As the demand is keep increasing in the market, the other consumers will aware with regard to the advantages of smart home in the future.

2.4 Functions of Smart Home

According to (Malche & Maheshwary, 2017), a smart home system comprising the implementation of IoT structure. The main functions of smart home applications are monitoring purposed, an alert device, control and intelligence.

2.4.1 Alert

This system is efficient to detect the unusual surrounding and transmit direct notification alerts to recorded consumer account or any interconnected devices. The alerts warning including the data related to surroundings. The type of information such

as the percentage of gases in a place, smoke, humidity, temperature and more.

2.4.2 Monitor

Monitoring system is the significant application of smart home. The ability of smart device is to monitor its environment with the functions of camera and several sensors. This function is to make sure the activities in a smart home is in the track which is the basic needs for further action and determination that can be made. As an example, monitoring the smoke detector and send warning to user if the smoke is detected above threshold.

2.4.3 Control

This application is authorizing by the owners for monitoring activities. The examples including light intensity control, doors unlocking, automatic windows and more. Consumer can control the device from certain range, method and location. Besides that, users also can control an automatic activity such as the lights automatically switch off when there is no human detected in a place.

2.4.4 Intelligence

Intelligence is one of the important functions that related to intelligent behaviour environment. This function can make automatic suitable decision in different events. Home intelligence's function rely on the Artificial Intelligence (AI) appliance for inventing the smart home technology. Furthermore, this intelligence function also a part of security in a house.

2.5 Smart Home Appliances

Based on a research, stated by (Li Jiang et al., 2004) smart home appliances are brilliant devices that can make a consumer live a cosy life and more fascinating. There is various type of appliances such as: -

2.5.1 Smart refrigerator

Besides on storing food, this smart refrigerator is furnished with an application related to groceries and food storage. The benefit of smart refrigerator is permitting the users to monitor the food's expiry date and manage the lists of groceries.

2.5.2 Gate reminder

Usually, some of us always forget to bring out important things for our needs in the office or school. But with the help of Gate reminder, they will call up the users to bring their daily need before leaving the house and never forget ever again.

2.6 Smart Home Services

According to (Balta-Ozkan et al., 2013), smart home serves its owner and the system provide features of smart home′s technology network components. Several types of services are classified based on customer's needs such as an interactive entertainment, healthcare, home security, communication, convenience living and energy saving. A monitored living by smart home serves an independent disabled person or an elderly to live in convenience and comfort life without worries of their friends and relatives. The monitoring purposes is to control and manage the user′s activity and alerting them if there is an accident occur.

Based on the literature examined, this assisted living applications of smart homes provide home security services, thus, recommend the use of motion sensor for home and identify the possibility of thief. Therefore, the capability of energy saving appliances assist the consumers by reducing energy, whether directly or indirectly.

2.7 System Design Configuration

Based on an article by (Santoso & Vun, 2015), the configuration of the advanced system is shown in Figure 1. It contains Home Gateway (HG) with various of IoT devices that connected to Wi-Fi system. By connecting the HG, consumer can authorize and control the system using a smart phone. By controlling and authenticating the interaction of mechanism in the network, shows how HG is operating. It offers translation to IoT standards lower layer and maintaining the security for other layers. IoT device can be interface by gateway only. The information from a device will activate the gateway with the user's selection by carrying a signal to other device in order to reflect back with suitable action.

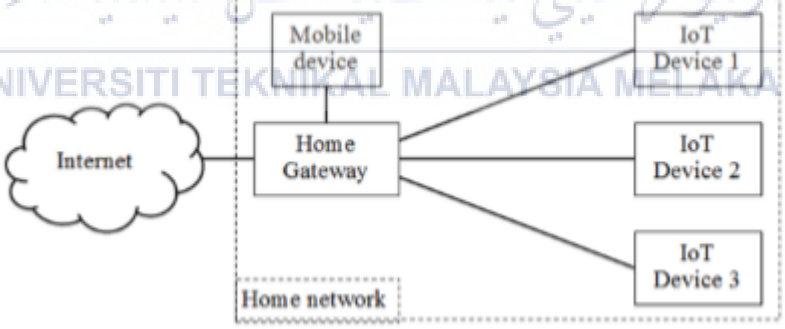


Figure 2-1 : System Setup

2.8 Secure Internet of Things

An article by (Sain et al., 2017) stated that almost all of the old technology are not completely secure and always searching a way to secure the system. A technology that does not develop, still rely on traditional framework and with no specific standard, it is risky for a security system. Nowadays, IoT is demand in the market for securing their customer's information and address. Therefore, every developer has to check whether the device is secured by following the suitable services.

2.8.1 Authentication

The upcoming problem for IoT system is authorizing the consumer's authentication. Compared to the old system, the latest protocol of authentication is hard to implement. This is because of two factor authentications with help of smart phone that stay connected anytime and anywhere with everyone. These features can make the smart phone becoming an authoritative factor that will enable our watch bracelet and temperature regulator to have an information of our identification.

2.8.2 Data Integrity

The most studies of IoT targeted important application such as security to secure the IoT system. Besides that, integrity is the greatest important component compared to another component. This application is related to medical consumption for someone or avoid from thief that can cost someone's life. Data Integrity works as securing information and have suitable functions

2.8.3 Access Control

According to the past system, users are only recognized by the system that can access controls thorough the system. Based on IoT technology, the system examines both of open and closed system where unrecognized third-party act as a good example of control accessing in IoT. This application has three decision factors that can authorize, obligate and conditions thus, two decision properties such as mutability and continuity.

2.9 Activities of smart home involving IoT applications

An example of journal article by (Alaa et al., 2017) said this article represents various of applications based on IoT. A CCTV, energy effective mechanism, network design, smart phone apps, security appliances also surrounding monitor is the type of examples in IoT applications for smart homes including.

2.9.1 Privacy and security applications

According to the security appliances and capabilities in smart home systems, this application is classified in different categories. It focusses on secured data and appliances, securing data in various devices, security improvement, network security design and privacy monitor using the Internet of Things. Furthermore, this application discusses about securing the healthcare framework and the point of communication network. In addition, the other problems between various of mechanism and more appliances in this technology that some research focus on the security password, secure updated software's in devices, and security system appliances. The awareness on risks of security and home automation provided some ways presented to overcome the leak of privacies in the administration process. In another work, it is containing the studies and application of machines technology based on smart homes security systems.

2.9.2 Network architecture applications

The classification of network design and applications with various of mechanism in smart homes using the Internet of Things. The connections between various devices and network in home mechanization systems, gateways and applications. Therefore, execution of the network design in smart homes based on IoT are established using smart home cloud computing based on a software known as software defined networking (SDN). SDN is an expression that applied in many types of web design for constructing the network in home mechanization active and adjustable. Next, a research shows the application of worldwide networks in the smart home structure. In addition of the other research, they manage to create new idea to collaborate with sensors devices in a web domain.

2.9.3 Monitoring applications related to health services

In different applications, the category covers a research on operation of a mobile and its function in healthcare system. It focusses on cloud and smart phone apps in home automation for controlling different perspective of the elderly and handicapped lives. Other than that, in a minor classification of smart device monitoring system in the use in health systems of smart homes. The administration of home automation apps for the senior citizens and handicap are also described.

2.9.4 Overview applications

Besides that, a platform involves in network-based of IoT applications using various mechanism in smart home structure. For examples, animal care application and services using homes intelligent technology. Thus, monitoring device based on IoT monitor system for homes automation is invented. The actual data were examined to authorize the operation of multi-control centre home appliances. Therefore, an IoT with locomotion sensing is utilized. Training procedures are acknowledged for smart home command systems. The program and applications of home automation based on IoT were designed. IoT and its function in home automation are established for the communication between human and devices with a complicated process. Network architecture carries large data in IoT for general application of smart homes.

2.10 Advantages of Smart Security and Home Automation System

Based on a conference proceeding, by (Kodali et al., 2017) stated that the advantages of Smart Security and Home Automation System are:-

Minimum requirements with low cost to construct the design of home security. Therefore, some of the security system not using any mobile application, any type of user interface but using numbers by the instrument panel of the phone instead. Some platform is independent hence authorized from an extensive radius of mobile with different management systems.

For working on the security system of home automation, the end-user has to allow the internet connection in his phone. The system operates with the Launchpad connected to Wi-Fi network everywhere. There is an alternative of mobile apps that make certain of the user who wish to manage their smart home device and do not trigger the sensors.

The Launchpad transmit an analogue call for several number in the web API, the security systems were secured as the system cannot be authorized by any other party. Wi-Fi operates the launchpad in the system and authorized the system to be managed from any part of the globe opposite to Bluetooth or InfraRed remote controlled in smart home.

The exact movement sensors are established for smart home and the secured system is easy to implement and low cost. This system is still offering the user with the benefit of inspecting environment without activated by user and then activating the security alarm remotely using their smart phone. This project controls the failure of security systems that cause faulty by activating false signal due to the systems malfunction.

2.11 Comparison of Literature Review

The comparison of papers from related work are presented in Table 1

Title	Year	Description/Component	Method	Advantages	Disadvantages
1.Smart Security and Home Automation System Based on IoT	2017	1) TI CC3200 LaunchPad 2) Wi-Fi Network 3) PIR motion detector Sensor 4) Alarm 5) Relays for connecting home appliances, electromechanically controlled doors or windows, 6) Smart phone 7) Energia Software	Pyroelectric or Passive Infrared Sensor (PIR), TI CC3200 Launchpad a Network Processor, Wi-Fi, microcontroller, Power-Management subsystems	- low-cost system -more secured	-The components are difficult to find. -Higher sensitivity
2. Securing IoT for Smart Home System	2015	STM32F4 ARM CortexM4F microprocessor, Raspberry Pi Linux computer board	IoT gateway via the mobile device	-convenient authentication process	-Expensive to implement -Complex process to invent

3. Smart home research	2004	Powerline (XlO, Em Powerline); Busline: EIB, Cebus, Lonwork, Batibus EHS etc) and Radio Frequency (RF), HAVi/Powerline Gateway	Various method such as sensing the body weight and footprint of the user (smart mat), authentication (smart table)	- unique ideas -creative authentication process.	-Components implement in a surrounding that has not benefited from a holistic. -Reliability
4. A review of smart home applications based on Internet of Things	2017	ZigBee wireless sensor networks, uninterruptible power supply (UPS), Multipurpose Infrastructure for Network Applications (MINA)	Applications of smart home for long-distance monitoring, connect using Ethernet or Wi-Fi.	-emergency alert -reduce energy consumption	-Risk of electrical hardware failures -short lifetime devices
5. Building smart home system using Internet of Things.	2017	FLIP board, Python	WiFi/Bluetooth that connects "FLIP" device to Internet by gateway, lighting control, intrusion detection	-Much more flexible for consumer needs with secured system -Improve living standard -save energy	-The complexity of the components -Expensive to implement

Table 2-1: Comparison of Literature Review

CHAPTER 3

METHODOLOGY

3.1 Introduction

The stage of the project preparation is shown in this chapter. The designing is preferred based on the literature review and experimental data collection in order to choose the best output to design and simulate that meet the requirement of the project.

3.2 Research method

Research method is a guideline for student's effective use the data and information of the project for a better understanding. This systematic method helps to complete the study follows as planned. Furthermore, this method conduct student to observe the project carefully and make a successful outcome.

3.3 Flow Chart

Diagram of flow chart for this project is introduced as shown below. The function of this flow chart is for describing the process of designation and simulation of the project.

3.4 Method of designing Smart Fire Alarm of Smart Home

The simulation is tested with two method using two IoT software's. The first software is Cisco Packet Tracer and second is Fritzing. Both of this software's have its own pros and cons.

3.4.1 Cisco Packet Tracer Software.

An IoT simulation for Smart Emergency Alarm of Smart Home is performed using this software. The function of using this software is to create a smoke detection topology. The list of hardware used in this software are: -

3.4.1.1 Home gateway

Figure 3-1: Home gateway

The function of this device is to connect the point between cloud and controllers, smoke sensors and smart devices such as smoke detector and smart phone.

3.4.1.2 Smart phone

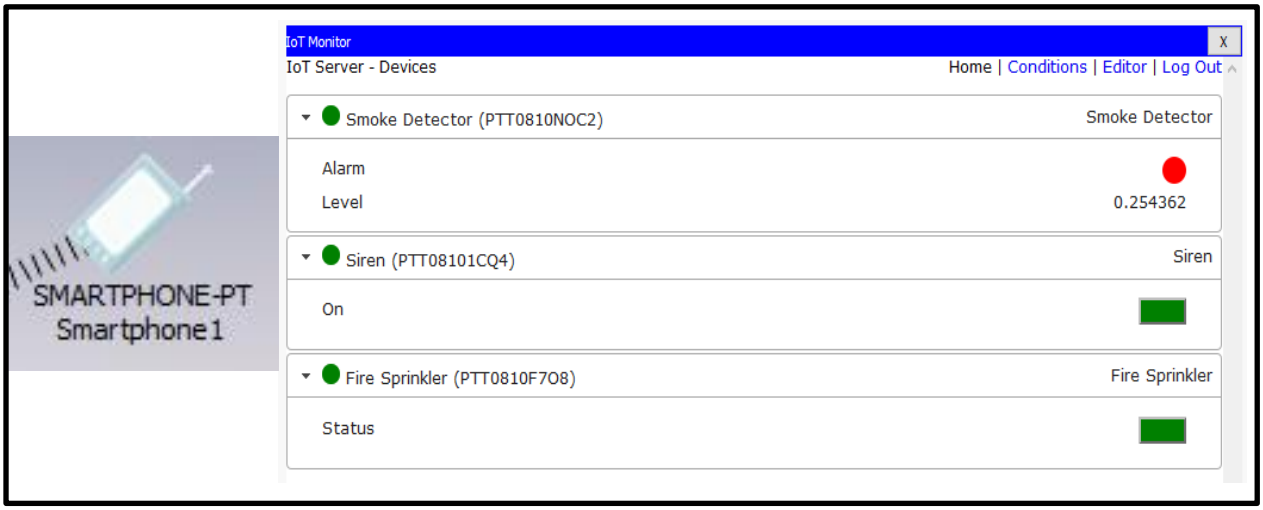


Figure 3-2: Smart Phone and it's monitor function

Smart phone is connected to home gateway to receive the status or home conditions. This device is used to monitor the devices for user to stay alert for their home's environment.

3.4.1.3 Smoke detector and Smoke sensor

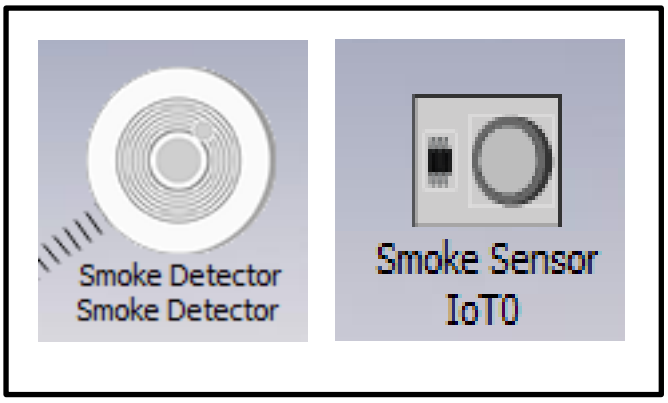


Figure 3-3: Smoke detector and Smoke sensor

This is a set of devices that will sense the presence of smoke. Smoke detector that connected to home gateway will send the data to the devices that connected to home gateway.

3.4.1.4 Siren

Figure 3-4: Siren

A device that will produce a loud sound if the smoke detector detects smoke. It is very useful for the user to alert of the emergency situation.

3.4.1.5 Fire sprinkler

Figure 3-5: Fire Sprinkler

Fire sprinkler is connected to home gateway to receive the information to sprinkle the water if the emergency situation occurs.

3.4.1.6 Old car

Figure 3-6: Old car

Old Car is an example of a device that producing Carbon monoxide or known as smoke.

3.4.2 Topology of Smart Emergency Alarm using Cisco Packet Tracer.

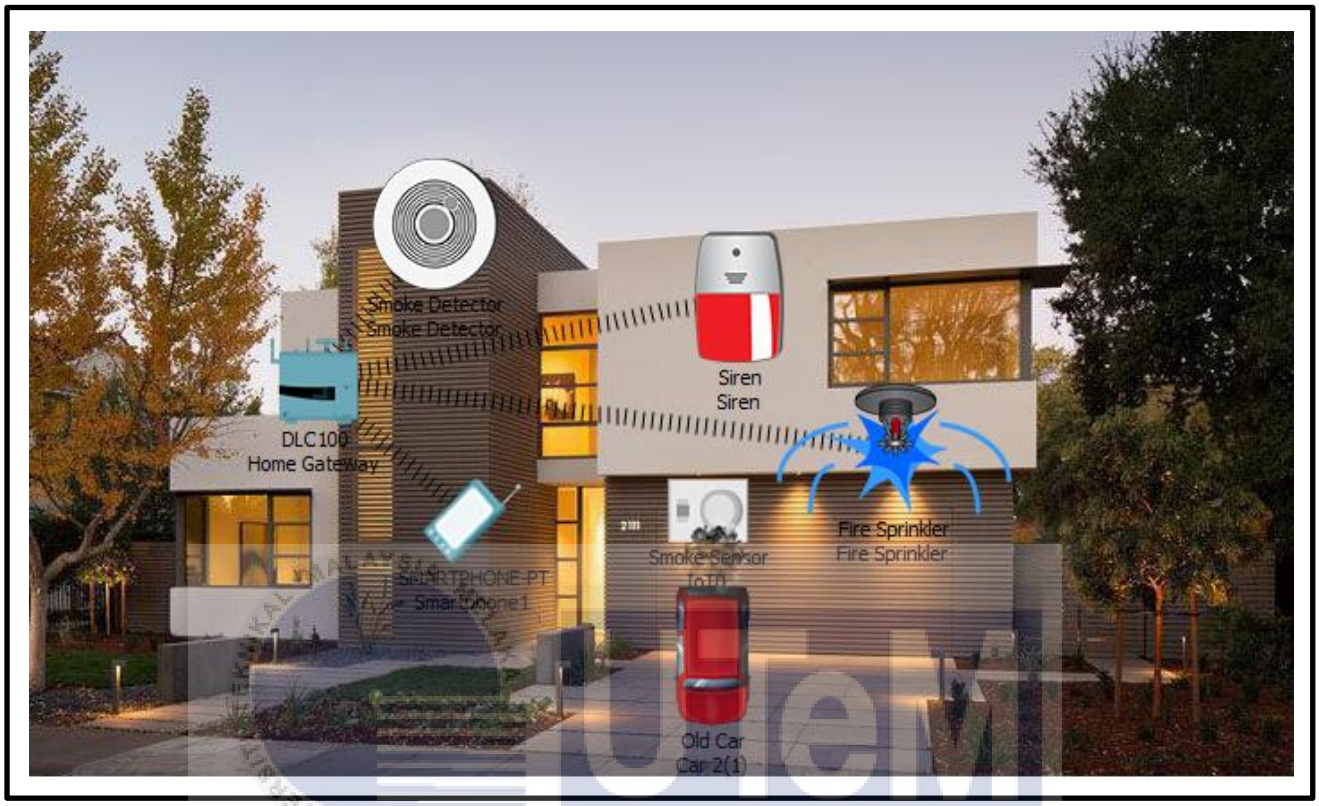


Figure 3-7: Topology of Smart Emergency Alarm.

The constructed topology as shown above illustrate an application of smart home using Internet of Things (IoT)'s software called Cisco Packet Tracer. All of the components are wireless and connected to home gateway using IP address. If the home is on fire, it will produce smokes and the smoke sensor will detect the smokes and send the information to smoke detector. After that, smoke detector will trigger home gateway to operates the fire sprinkler and siren for safety purpose. Next, the smart phone is a device for users to monitor their home environments and it will notify users if there are emergency situations.

3.4.3 Schematic Design using Fritzing Software

Fritzing is the software that have been used to design the schematic board for this project. It is used because provided a list of components that suitable for implementing Fire Emergency Alarm.

3.4.3.1 LOLIN NodeMCU V3 LUA Based ESP8266 Wi-Fi Module

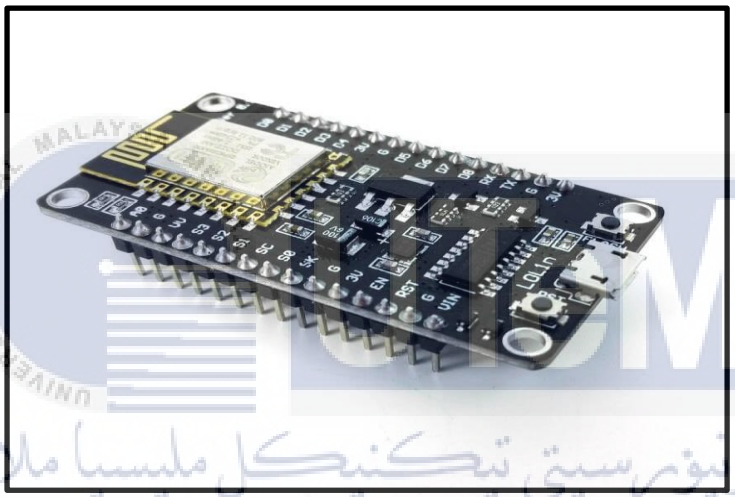


Figure 3-8: NodeMCU ESP8266 Wi-Fi Module

A development of IoT kit that helps to build a prototype with Lua script lines. This Wi-Fi Module by AI thinker Module is based on ESP-12/ESP8266. A module that integrates 3.3V Regulator, GPIO, PWM, ADC, etc all in one board. NodeMCU firmware is the default firmware for this board known as LUA interpreter. In addition, LUA script can be stored in the Flash ROM for user application.

3.4.3.2 MQ2

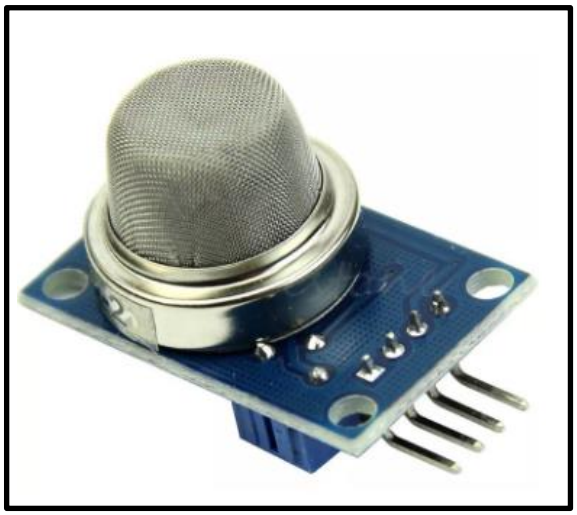


Figure 3-9: MQ2 Sensor

MQ2 is a type of sensor that use a simple voltage separator network. For this project, it is used as smoke, gas and fire detector. Operating at 5V with a concentration scope of 200 – 10000ppm, less than 800mw of heating consumption and 33Ω ± 5% of heat resistance.

3.4.3.3 Buzzer

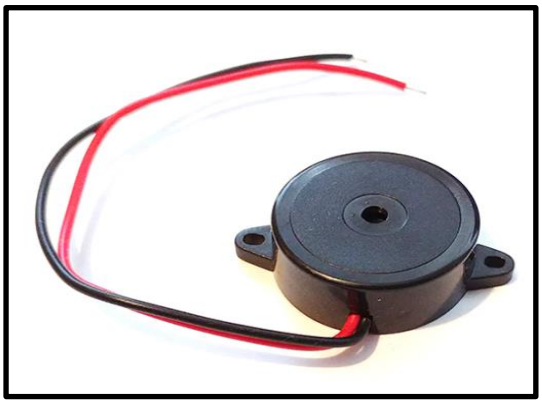


Figure 3-10: Piezo Electronic Buzzer

Piezo buzzer is a device that generate a sound or tones and had enough pressure wave sound to alert the users when emergency occurs. It works by using a crystal called piezo and it changes shape when apply some voltage into it. After that, the crystal will push a speaker to make a sound.

3.4.3.4 DC motor water pump

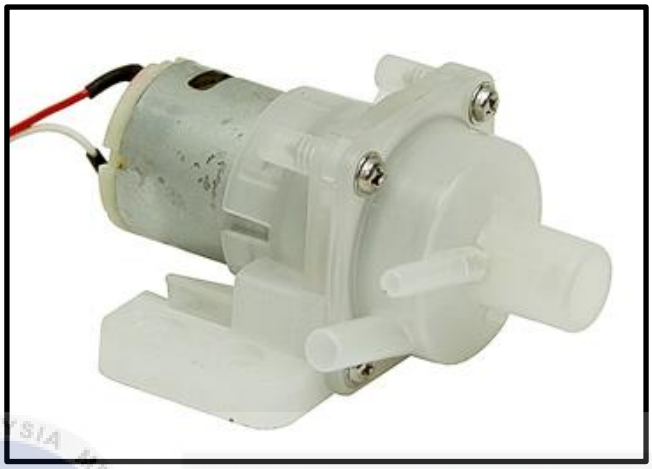


Figure 3-11:DC motor water pump

This DC powered device uses direct current for the motor to generate the water pump for sprinkles water in a place to reduce the amount of carbon monoxide, gas or fire. It is a controlled device that implement to be monitored by user.

3.4.3.5 Smart Phone

Figure 3-12: Smart Phone

Smart phone is a useful gadget that authorized by users to monitor and control a system in a smart home. By downloading an apps, it can be an intermediate device to monitor the home environment. This mobile device can bring anytime and anywhere without limitation as long as the battery life is not drained. It such a go-to gadgets by any user.

3.4.3.6 2-Channel 5V Relay Module

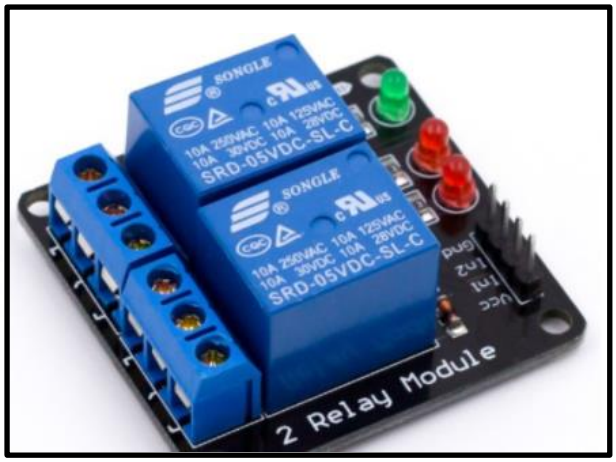


Figure 3-13: 2-Channel 5V Relay Module

2-Channel 5V Relay Module is a relay interface board that can be control directly by a wide range of microcontrollers such as Arduino. To control the relay, it uses a low-level triggered control signal value from 3.3 to 5 VDC. When the relay is triggered, it will operate normally open or normally closed junctions. It is frequently used in an automatic control circuit which is the automatic switch controls a high-current circuit with a low-current signal.

3.4.3.7 Smart Emergency Alarm schematic diagram

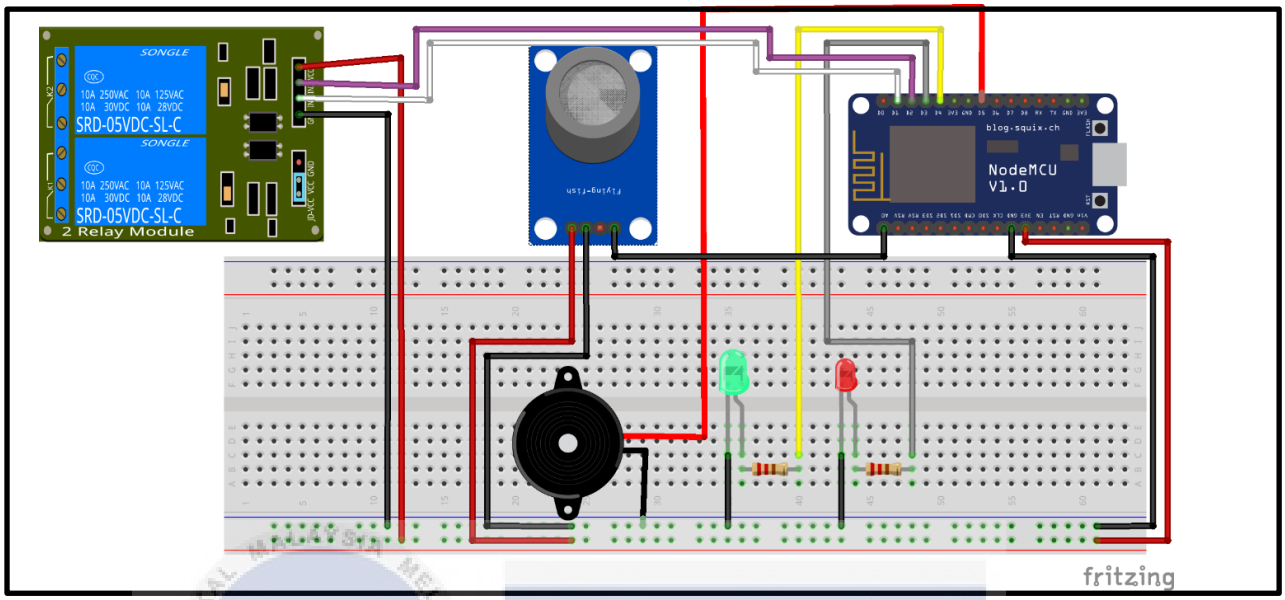


Figure 3-14: Fire Emergency Alarm schematic diagram.

A schematic circuit built using Arduino NodeMCU Wi-Fi Module as a main component that connects to other components such as MQ 2 as a sensor detects gas odour, fire and smoke, DC motor operates the water pump that act as water sprinkler for eliminating gas odour and smoke. The third component is a buzzer that act as an alarm for users to alert when emergency happens.

3.4.3.8 Automatic Lock-Unlock Emergency Door schematic diagram

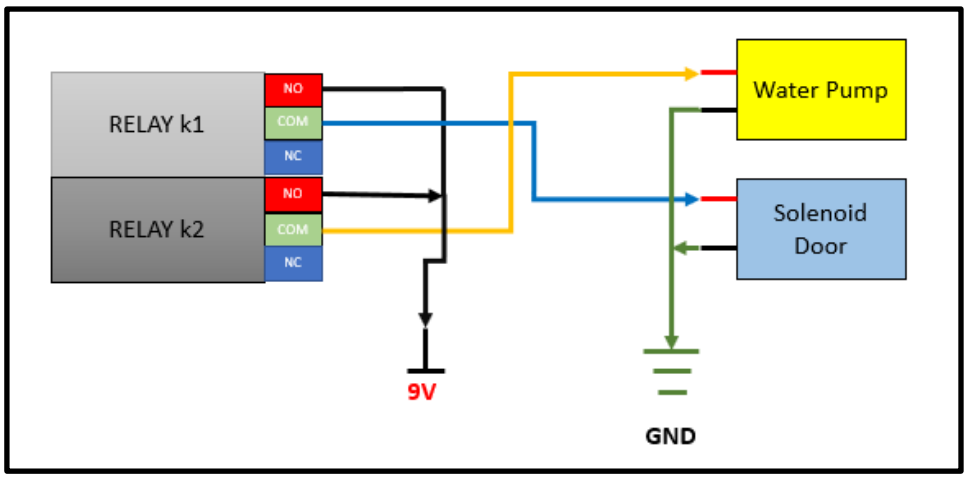


Figure 3-15: Automatic Lock-Unlock Emergency Door schematic diagram

The schematic circuit shown above is a pair of water pump and solenoid door to complete the Fire Emergency Alarm's circuit. Both is used to combine and form an emergency alarm of smart home system. The 2-channel relay operates with solenoid door for automatically lock and unlock the door with the monitor of users thus, it also connects with water pump to flow the water for water sprinkler. It is named as Automatic Lock-Unlock Emergency Door because it functions as emergency door. In case of an emergency situation such as fire or gas odour, users can authorize the automatic door using smart phone and exit the house safely.

3.4.3.9 Blynk Apps

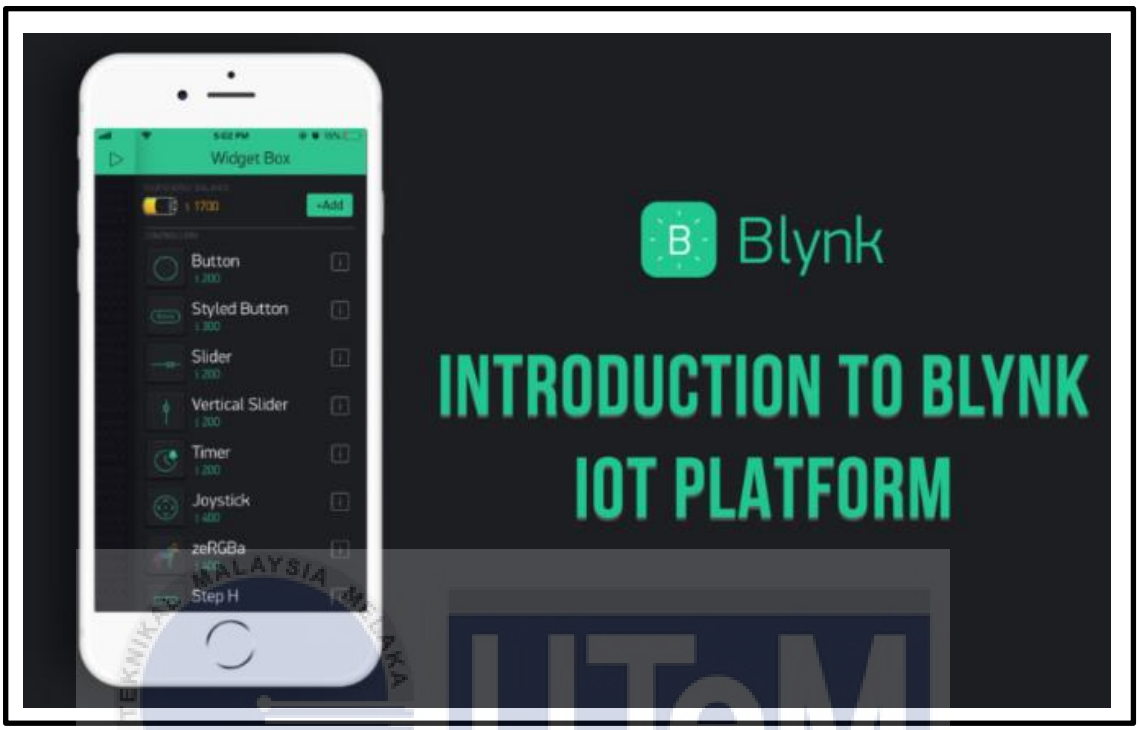


Figure 3-16: Blynk Apps

An Internet of Things (IoT)'s apps built to communicate with the constructed hardware. This application is used in this project to supports Arduino boards and controlled by user. This apps containing various of connection type such as Wi-Fi, Bluetooth, Ethernet, etc. It works all over the Internet network which is make any of IoT's devices operate in a simple way.

CHAPTER 4

RESULT AND DISCUSSION

4.1 Introduction

The results section is where the findings of this report based on study in the methodology part that applied to assemble the project's details. The findings of the research are stated arranged in a sequence and the results are described.

4.2 Software and Coding Development.

4.2.1 Coding for Smoke Sensor

The coding process for smoke sensor (MQ2) and setup in the coding for initialize the purpose of pin. Pin A0 is where the input of sensor to detect the existence of smoke in condition. The sensor operates as smoke sensor is ON when the reading of sensor is 700. The value is a prove of smoke's existence and the sensor is off when the value is 490 which is means no smoke in the condition. So, if the smoke sensor indicates value that higher than 700, "Smoke Detected" messages will send to BLYNK application. The sensor interfaced with the ESP8266 Wi-Fi module will communicate with the BLYNK application.

```
void MQ2_sensor() {
  smoke_analog_value = analogRead(sensor_pin);  //put Sensor insert into soil
  // Serial.println(smoke_analog_value);
  smoke_ppm_value = map(smoke_analog_value, no_smoke_analog, smoke_analog, 0, 9800);
  if (smoke_ppm_value >= 10000)
  {
    Serial.println("10000 PPM");
  }
  else if (smoke_ppm_value <= 0)
  {
    Serial.println("0 PPM");
  }
  else if (smoke_ppm_value > 200 && smoke_ppm_value < 10000)
  {
    Serial.print("Analog :");
    Serial.println(smoke_analog_value);
    Serial.print(smoke_ppm_value);
    Serial.println("PPM");
  }
  delay(1000);
  Blynk.virtualWrite(V1, String (smoke_ppm_value)); // For Blnyk apps configure Pin Virtual=V1 for value smoke ppm

}
```

Figure 4-1: Coding for Smoke Sensor (MQ2)

4.2.2 Coding for NodeMCU ESP8266 WI-FI Module

The authorization for connecting to the Wi-Fi is stated in the coding. It also defines all the components that included in this project.

```
char auth[] = "WrgX9MQh-uEINS9G_3WuShsD3_gmV1kS"; // auth token "IoT Smoke"
char ssid[] = "Nak ke??";//enter your hotspot@wifi name
char pass[] = "takboleh";//enter your hotspot@wifi password
//------------------------------------------------------------------------------

int state = 0; // hold value HIGH OR LOW
int statel = 0;

#define water_pump D1 // grey wire(MCU D1) >IN 2 (relay)
#define solenoid_door D2 // blue wire (MCU D2) > IN 1 (relay)

#define redLed D3 // grey wire (MCU D3) > resistor > + red led
#define greenLed D4 // white wire(MCU D4) > resistor > + green led
#define buzzer D5 // white wire (MCU D5) > + buzzer, gnd grey wire
// Your threshold value
int sensorThres = 7000;
```

Figure 4-2: Coding for NodeMCU ESP866 Wi-Fi Module

4.2.3 Coding in BLYNK Application process via NodeMCU

The coding stated shown below is the process of how NodeMCU communicates with BLYNK Application. It includes the smoke indicator and notifications from BLYNK for alerting user that smoke is detected, buzzer is on and the door is automatically open.

```
void loop()// process
{
  Blynk.run(); //
  timer.run(); // Initiates BlynkTimer
  int manual_pump = digitalRead(D7);

  if (manual_pump == HIGH) {
    //--------------------------------------------------------------------------------------

    //--------------------------------------------------------------------------------------
  }
  else {

    smoke_analog_value = analogRead(sensor_pin);  //put Sensor insert into soil
    // Serial.println(soilMoistureValue);
    smoke_ppm_value = map(smoke_analog_value, no_smoke_analog, smoke_analog, 0, 9800);


  // Checks if it has reached the threshold value
  if (smoke_ppm_value >= sensorThres)
  {
    digitalWrite(redLed, LOW);
    digitalWrite(greenLed, HIGH);
    digitalWrite(buzzer, HIGH);

    if (state == 0) {
      Blynk.notify("Smoke Detected");
      state = 1;
      digitalWrite(solenoid_door, LOW);
      digitalWrite(water_pump, LOW);
      delay(5000); //can change time for water sprinkler
    }
  }
  else
  {
    digitalWrite(redLed, HIGH);
    digitalWrite(greenLed, LOW);
    digitalWrite(buzzer, LOW);
    digitalWrite(solenoid_door, HIGH);
    digitalWrite(water_pump, HIGH);
    state = 0;
  }
  delay(1000);
}
```

Figure 4-3: Coding in BLYNK Application process via NodeMCU

4.2.4 Coding for solenoid door in BLYNK Application

The command is specified for solenoid door whether it is in the ON or OFF condition. If the condition is LOW, it means that the sensor does not detect smoke and the door is close. If the condition is HIGH, it means that the sensor detects smoke and the door is open.

```
}

BLYNK_WRITE(V5) // SOLENOID DOOR
{
  if  (statel == 0) {
    digitalWrite(solenoid_door , LOW);
    statel = 1;
  }
  else {
    digitalWrite(solenoid_door , HIGH);
    statel = 0;
  }
}
```

Figure 4-4: Coding for solenoid door in BLYNK Application

4.3 Hardware Development and Project's Work

The fire alarm emergency system with solenoid door using Arduino that connects with BLYNK Application was successfully developed based on the objectives and the internal functionality has been tested. An initial prototype was implemented as shown in figure below where the Arduino NODEMCU act as "main commander" to control the flow of the system.

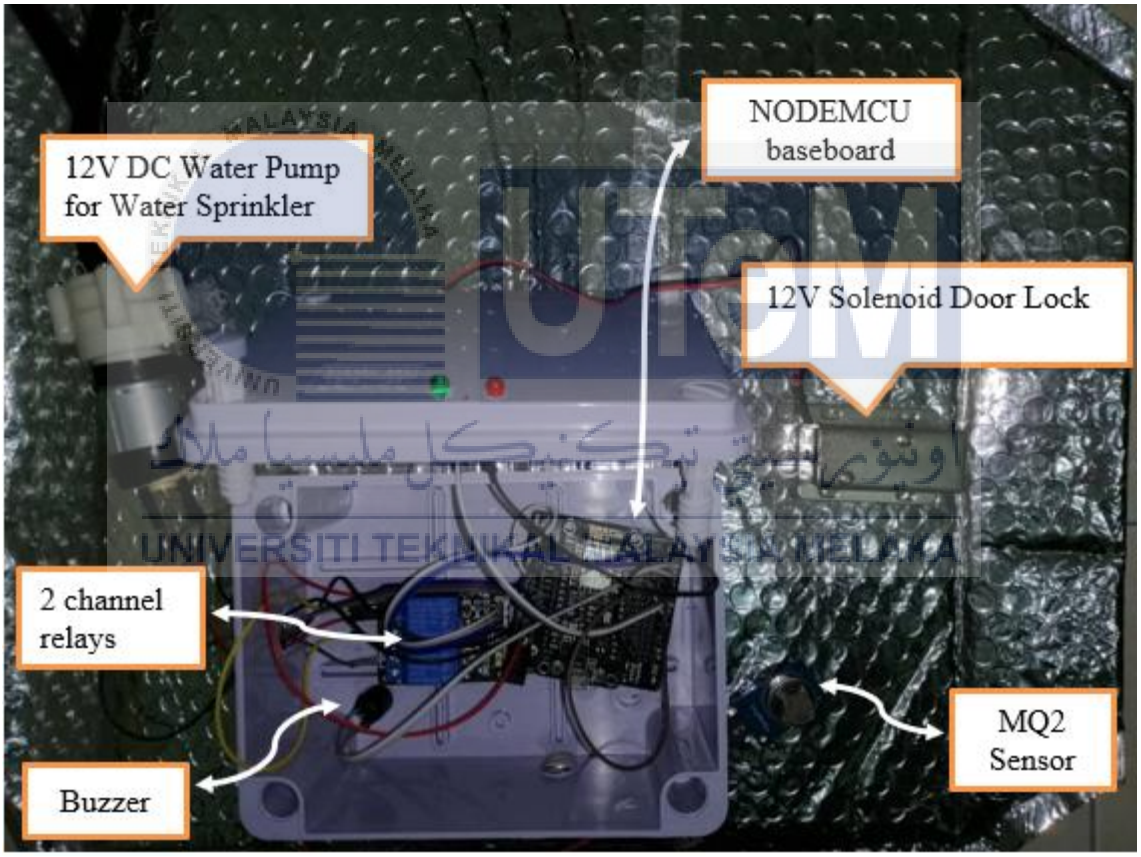


Figure 4-5: Hardware for fire alarm emergency system

4.3.1 Working of Fire Alarm System with Solenoid Door

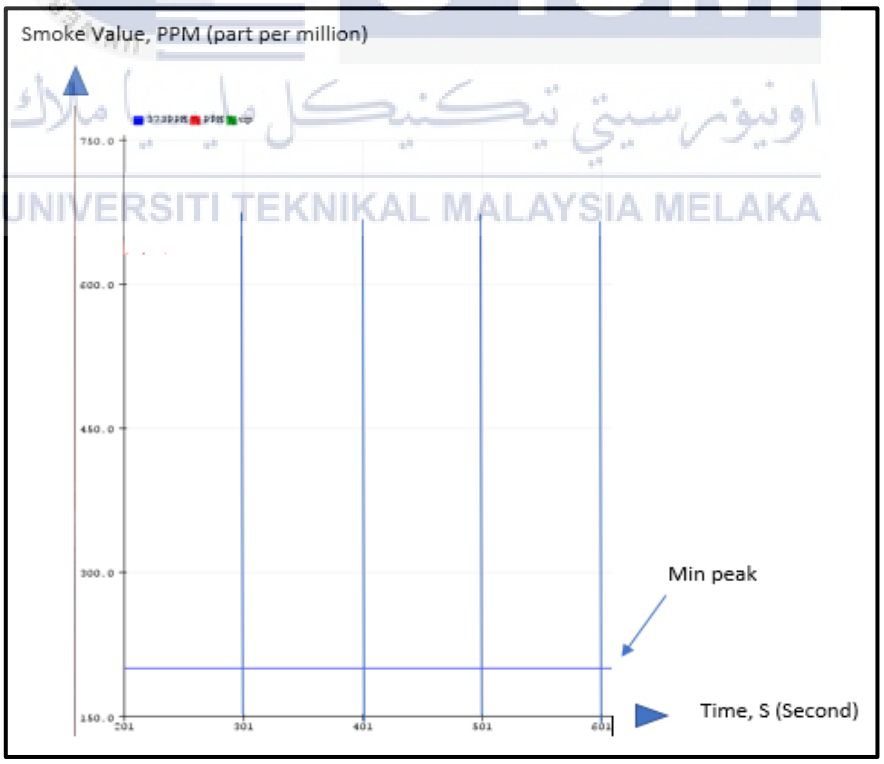
This system is only designed for fire alarm system with solenoid door system which is directly connected to the owner's mobile phone through wireless fidelity network. The whole system is installed in a house. When the fire/smoke is detected, user will get a message from BLYNK Application the existence of smoke in the house. Next, buzzer will immediately be triggered to keep alarming user or neighbourhood in this emergency situation. Furthermore, to avoid the fire from spreading in the house, water sprinkler will immediately on. During this emergency situation, user can unlock the door using smartphone via BLYNK application to exit the house from this condition to save their life.

4.4 Project Analysis

In this project analysis, the aim of this experiment is to analyse the response time of the message in terms of sending the alert notification to the user during the emergency situation. The purpose of this analysis is very important in order to determine the performance of IoT technology to send and receive the message.

4.4.1 Condition when no smoke detected

The data is taken when there is no smoke detected and the house is in the normal condition. When sensor does not sense any smoke, it does not have any trigger peak that will activate the MQ2 sensor.



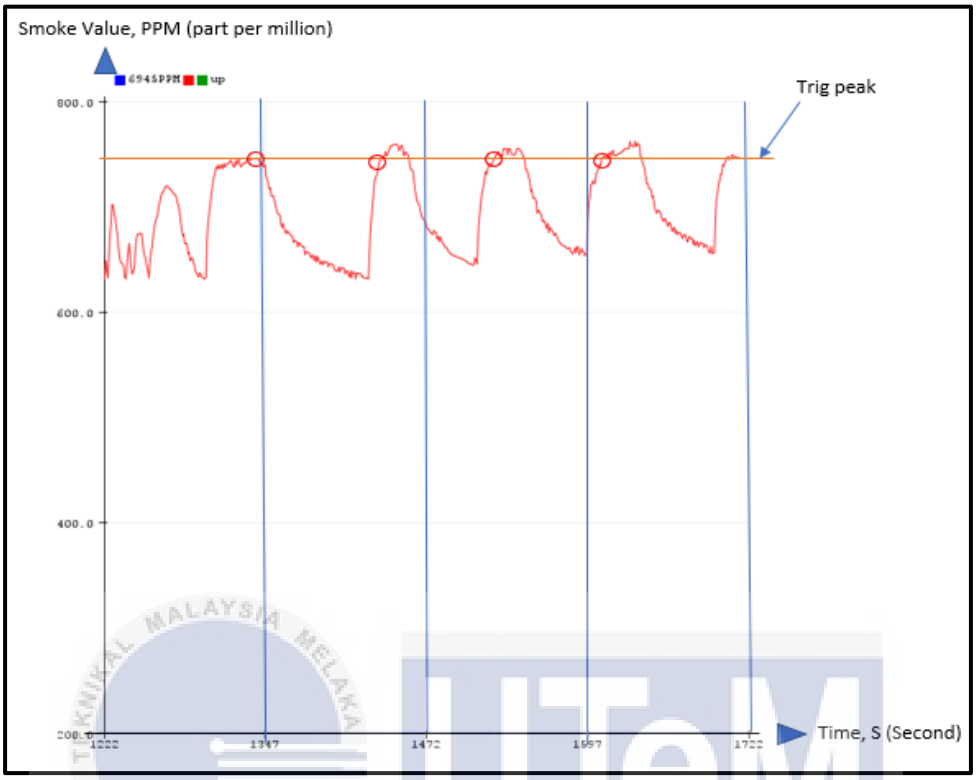
Graph 4-1: Graph of no smoke detected

4.4.2 Condition when smoke is detected

The data is taken when there is smoke detected and the house is in the crucial condition. When sensor detects smoke, the trigger peaks referred in Part Per Million (ppm) will activate the MQ2 sensor and BLYNK Application will send the notification to user.

Trigger Test	Part Per Million (ppm)	Time taken for receiving the notification (s)
1	7700	1.35
2	7720	1.47
3	7740	1.59
4	7760	1.72

Table 4-1: Time taken for receiving the message in emergency situation



Graph 4-2: Graph of smoke detected

4.5 Discussion and analysis

In this project, the main focus is to provide a fire emergency alarm system of smart home to avoid the life threatening due to fire. User can access and alert during the emergency situation through a notification in mobile phone. It was a long journey where it begins with the problem statement and comes out with an idea until developing process and facing problems during the development of smart home fire emergency alarm. Finally, the prototype of fire alarm system and solenoid door using NodeMCU Arduino technology was successfully implemented and achieved the objectives stated. It is implemented for minimize the death that cause by fire especially the person who

trapped in a house on fire. Although, there are numerous of fire alarm system has been implemented and sold in the market, but there still have some limitation in term of portability, cost and durability. There are few problems during complete the software and hardware such as develop the coding in NodeMCU Arduino as it is was new experience to learn. In addition, the troubleshoot process of the coding took some time. Besides that, the other problem is when completing the hardware where the sensor is too sensible for detecting the smoke/methane also the coding is complicated to control and initialize. By guidance of research methodology of fire emergency alarm using IoT could make it at ease and helpful for some source to this project. Based on the previous research, most of the researcher used only sensor to detect smoke whereas this project makes with combination of NodeMCU Arduino, Wi-Fi technology for mobile communication and auto unlock solenoid door to avoid user trapped in the house on fire.

CHAPTER 5

CONCLUSION AND FUTURE RECOMMENDATION

5.1 Introduction

In this chapter, the overall development of fire emergency alarm system is discussed thus, the achievement of this project objectives and overall performance as well as evaluations and briefly outline the fire emergency alarm system with the NodeMCU Arduino and Wi-Fi technology. Besides that, recommendations and propositions to the future work is suggested in the terms of how to further improve and develop the system more efficiently.

5.2 Conclusion

Nowadays, the risk of death that cause by fire is still increasing worldwide. This is because the low of awareness about the installation of fire emergency alarm for every homeowner. Some of victims were trapped in the house and cannot exit the house properly while the fire is rage. Sometimes, firefighter arrive late and unable to save people from the fire. To overcome this problem, there are numerous technologies are available in the market such as Home Gateway and Wi- Fi systems. Currently, most of the smart homes are designed with Wi-Fi based systems, which provides the home automation system.

Initially, the intent of this project is to study on NodeMCU Arduino and Wi-Fi technology on smart home in order to avoid death that cause by fire. In the end, the idea came out to develop a new fire emergency alarm system that comes with solenoid automatic door, which will notify on mobile phone without wasting any time, when emergency situation occurs. By installing the fire emergency alarm system in the house, the risk of death will decrease also provides a smart home system that preventing the house from worse burning. The objectives have been achieved through developing a situation by sending a notification to the mobile phone of the concerned authority when the house is on fire. At the point when the fire in the house takes place, the home owner receives a warning notification that his house is on fire and he can send the stop message from his mobile phone, at this point the signal will be directly open the door and the water pump starts to sprinkle water in the house. The home owner can exit the house immediately without being trapped in the fire. The most important is the life of the homeowner is a priority compared to any other things.

REFERENCES

Mussab Alaa, A.A Zaidan, B.B Zaidan, Mohammed Talal, and M.L.M Kiah 2017. A review of smart home applications based on Internet of Things. *Journal of Network and Computer Applications*, Volume 97, pp.48-65

Sovik Sinha Chowdhury, Subam Sarkar , Soujanya Syamal , Soumyajit Sengupta and Priti Nag 2019. IoT Based Smart Security and Home Automation System. *2019 IEEE 10th Annual Ubiquitous Computing, Electronics & Mobile Communication Conference (UEMCON)*

Himanshu Singh , et al. 2018. IoT based smart home automation system using sensor node. *2018 4th International Conference on Recent Advances in Information Technology (RAIT).*

Li Jiang, et al, 2004. Smart home research. *Proceedings of 2004 International Conference on Machine Learning and Cybernetics (IEEE Cat. No.04EX826).*

Mohammad Shorif Uddin, Jagdish Chand Bansal 2019. *Proceedings of International Joint Conference on Computational Intelligence.*

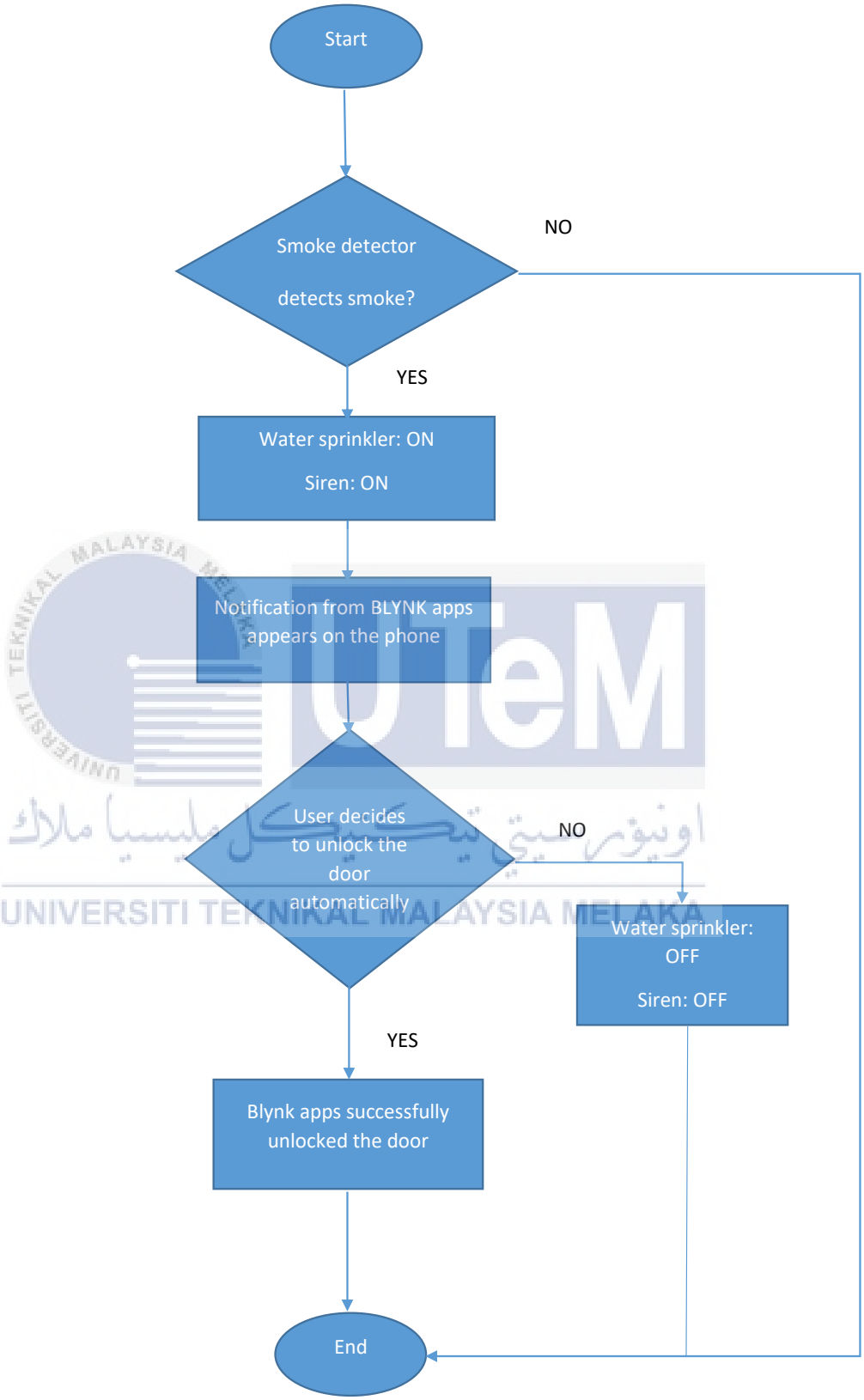
Ravi Kishore Kodali, et al. 2016. IoT based smart security and home automation system. *2016 International Conference on Computing, Communication and Automation (ICCCA)*

APPENDIX

PROJECT TITLE: THE DEVELOPMENT OF SMART HOME USING INTERNET OF THINGS (IOT) (PSM1)

ACTIVITY	PROJECT PLANNING														
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
INTENSIVE RESEARCH OF PROJECT TITLE															
CONFIRMATION OF HARDWARE															
STUDIES OF WORKING PRINCIPLE															
SUBMISSION CHAPTER 1 (INTRODUCTION)															
SUBMISSION CHAPTER 2 (LITERATURE REVIEW)															
SUBMISSION CHAPTER 3 (METHODOLOGY)															
SUBMISSION OF TURNITIN REPORT															
SUBMISSION OF FINAL REPORT															
PREPARATION OF PROJECT PRESENTATION PSM 1															

Appendix 1: Gantt Chart



Appendix 2: Flowchart of working Fire Alarm System with Solenoid Door