Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IoT BASED HOME AUTOMATION AND SECURITY SYSTEM

AIMEN FATIMAH BINTI ELIAS

Bachelor of Electronics Engineering Technology with Honours

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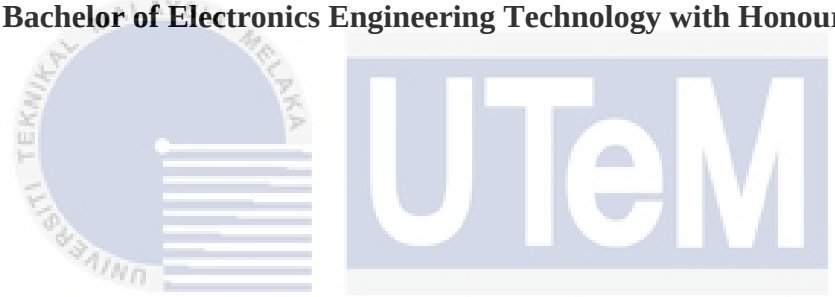
DEVELOPMENT OF IoT BASED HOME AUTOMATION AND SECURITY SYSTEM

AIMEN FATIMAH BINTI ELIAS

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



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I declare that this project report entitled “Development Of IoT Based Home Automation And Security System” is the result of my own research except as cited in the references. The project report has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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APPROVAL

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 :

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DEDICATION

To my beloved mother, Jamilah Yunoos, and father, Elias Mohamed,

family members

and

supervisor, Dr. Fara Ashikin

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ABSTRACT

In recent years, IoT-based home automation and home security systems received a lot of attention. Generally, home automation technology is a system that allows users to operate virtually anywhere from home via application as long as there is an internet connection. There is a possibility that the user forgets to turn off their home appliances where cause electrical waste. Besides, there is also a possibility of burglary enter the house or gas leaking where causes a fire that will lead to serious injuries and fatalities. Therefore, there are several home automation and home security systems have been proposed. This paper proposes affordable and user-friendly IoT-based home automation and home security systems. This project utilizes Arduino Uno as a microcontroller, a WiFi-Shield, PIR sensor, gas sensor, buzzer, and LED as the hardware for home security while fan and lamp as the home appliances for this project. For the software, Arduino IDE, Thinkercad, and Blynk applications are used to configure the activity of the system. Whenever the home appliances are in on condition, the user may turn off the home appliances when not in use. Meanwhile, for home security, if sensors are triggered, a notification will be sent to the user's smartphone. The buzzer and led as the output give an alert to the user. As result, the hardware prototype for this project has been constructed in which the home appliances and sensors are controlled and monitored by the smartphone via the Blynk application. The results show that the home appliances can control the on and off button and the sensors are triggered if in an on mode and able to be displayed notification on the Blynk app. Furthermore, the PIR sensor in a security system can detect motion in a range of 31-150 degrees in an average time of 5 seconds. When the gas level exceeds 300 ppm, the gas sensor will be triggered. Thus, by applying this project, it is hoped that will help to make life easier and safer in terms of saving electrical consumption as well as reducing the possibility of anything unpleasant from happening.

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ABSTRAK

Sejak kebelakangan ini, automasi rumah berasaskan IoT dan sistem keselamatan rumah menerima banyak perhatian. Secara amnya, teknologi automasi rumah ialah sistem yang membolehkan pengguna beroperasi hampir di mana-mana dari rumah melalui aplikasi selagi ada sambungan internet. Terdapat kemungkinan pengguna terlupa untuk mematikan peralatan rumah mereka yang menyebabkan pembaziran elektrik. Selain itu, terdapat juga kemungkinan berlakunya pecah rumah atau kebocoran gas yang boleh menyebabkan kebakaran yang akan mengakibatkan kecederaan parah dan kematian. Oleh itu, terdapat beberapa automasi rumah dan sistem keselamatan rumah telah dicadangkan. Projek ini mencadangkan sistem automasi rumah dan keselamatan rumah berasaskan IoT yang berpatutan dan mesra pengguna. Projek ini menggunakan Arduino Uno sebagai mikropengawal, WiFi-Shield, sensor PIR, sensor gas, buzzer dan LED sebagai perkakasan untuk keselamatan rumah manakala kipas dan lampu sebagai peralatan rumah untuk projek ini. Untuk perisian, aplikasi Arduino IDE, Thinkercad, dan Blynk digunakan untuk mengkonfigurasi aktiviti sistem. Setiap kali peralatan rumah dalam keadaan buka, pengguna boleh mematikan peralatan rumah apabila tidak digunakan. Sementara itu, untuk keselamatan rumah, jika penderia dicetuskan, notifikasi akan dihantarkan ke telefon pintar pengguna. Buzzer dan led sebagai output memberi amaran kepada pengguna. Hasilnya, prototaip perkakasan untuk projek ini telah dibina di mana peralatan rumah dan penderia dikawal dan dipantau oleh telefon pintar melalui aplikasi Blynk. Keputusan menunjukkan bahawa perkakas rumah boleh mengawal butang hidup dan mati dan penderia dicetuskan jika dalam mod hidup dan pemberitahuan boleh dipaparkan pada aplikasi Blynk. Tambahan pula, sensor PIR dalam sistem keselamatan boleh mengesan gerakan dalam julat 31-150 darjah dalam masa purata 5 saat. Apabila paras gas melebihi 300 ppm, sensor gas akan dicetuskan. Justeru, dengan mengaplikasikan projek ini diharap dapat membantu menjadikan kehidupan lebih mudah dan selamat dari segi penjimatan penggunaan elektrik serta mengurangkan kemungkinan berlaku perkara yang tidak menyenangkan.

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LIST OF ABBREVIATIONS

IoT	-	Internet Of Things
PIR	-	Passive Infrared
LDR	-	Light Dependent Resistor

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CHAPTER 1

INTRODUCTION

1.1 Background

In this technological and IoT world, inventors are upgrading houses to make them more digitally and technically advanced, and safer. Home automation involves the use of technologies to automate or monitor different household functions remotely. Home automation systems give users control over many things, especially the electrical and electronic types of equipment. Home automation can be controlled for the electronic devices in the home. According to [1], this system is internet-based and can be remotely controlled from anywhere as long as it is connected to the internet. Home automation is based on the configuration of devices connected to the network via various connectivity protocols such as Wi-Fi, ZigBee, and Bluetooth. The user can monitor remote devices via an electronic exchange, whether they are voice appliances either Google Assistant or Alexa, or using an application. The majority of these IoT devices have the technology to detect changes in movement, gas, and lighting to provide users with details about the device's surroundings. To require external modifications to the device, users create home automation such as light switches, light bulbs, or motors that activate remote control devices. Today's environment monitoring and device control allows for new levels of comfort in homes, as well as efficient management of energy consumption, which encourages savings.

On the other hand, the security system is also a part of home automation. It is a way or mechanism of securing things across a system of integrated installations. It can be

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integrated into home security systems like network access and alarm systems. This telecommunication network works with high-level committees to protect against burglars and other potential home intruders. The security system is an important concept in home automation. Many burglaries are happening nowadays thus the issue of home security is a big concern that worries the public. On top of that, there are also many cases of a house fires due to gas leakage in the house. Therefore, for safety or protection purposes a gas sensor can be installed too to detect the presence of gas leakage in the house. This sensor may give a warning signal with an alarm sound to alert the user.

There are several surveillance solutions accessible on the market that are used today by integrating smart home security systems. This system can improve home security or safety system. At the same time, this device will even notify the user in case of a bad incident happens for security and safety reasons. Meanwhile, result from burglary Statistics, Research, and Facts in 2021 [2] as shown in figure 1, conducted a national survey of 1,500 US and US homeowners to gain a deeper understanding of everyday concerns and personal safety and security concerns. Research has found that 46.9% do not have a home security system installed, 20.2% of people had their car stolen, but only 5.8% had their home burglaries.15.9% of respondents choose dogs for safety reasons. Outdoor cameras are listed as the most important miracle of security systems (32.3%). Motion sensors (28.6%) and the spotlight (24.5%) are one of the most important factors. 17.2% of people do not close their doors when they are at home, but the front door is a way to catch 34% of thieves. 56.1% of respondents did not attend individual peace training classes and 55.4% of respondents have a safe evacuation plan. Lastly. for personal security reasons, 38% of people own a gun.

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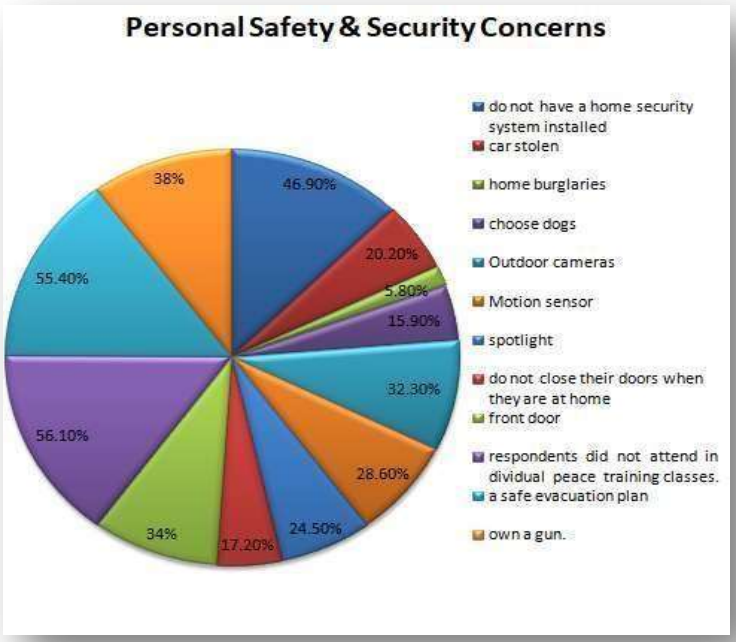

Figure 1.1 The statistics of personal safety and safety concerns

Source: https://www.thezebra.com/resources/research/burglary-statistics/

Therefore, this project proposes IoT based home automation and security system. The home functionality solutions that offer home automation, protection, and security system capabilities rely on the IoT to operate easily and efficiently with a low budget. This remote supervision of the system has many benefits to be able to integrate the home's electronics into a single app. It is a big advancement towards technologies and home management. The comfort aspect is significant in this scenario where it would be able to tap into a multitude of functions and appliances in the household, making it easy and convenient to control the features that we want from anywhere. Moreover, it also has the potential to control energy demand efficiently, resulting in cost savings. Other than that, the project hopes to address the limitations of home automation and security systems by providing current situation information while the owner is in or out of the home. It will also improve IoT network security by encrypting and decrypting user data. As a result, it is vital to make it cost convenient and easy to configure. If this system is accessible to people, they will be willing to acquire it for their homes. To look at it another way, a device

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improvement for home automation is needed to minimize the cost of installing it in homes. As previously mentioned, home automation provides people with peace of mind and physical comfort in their homes by allowing them to do what they want with a single click.

1.2 Problem Statement

People nowadays are searching for ways and means to improve their lifestyles by using the most recent innovations that are affordable. Users come across all new technologies and believe that new integration will make things easier. Connected to the main switches are located in several portions of the house and often require manual intervention to turn these switches on or off to control various appliances. It becomes nearly impossible to keep track of running appliances and monitor their efficiency. Keeping track of running appliances and monitoring their performance becomes almost impossible. Sometimes, the consumer will forget to switch off the lights at times. This may result in a loss of current and energy efficiency.

Other than that, nowadays, people are preoccupied with their daily activities. Adults are concerned with their careers, while children are preoccupied with their studies. Only the elderly are left at home or mostly there is nobody home particularly during the day. Other than that, the challenges when the user encounters as they leave their house may lead to bad stuff, such as thefts, burglaries if users are not at home especially at night. This was because the user's house did not have a safe setup. Just basic security systems, such as CCTV monitoring and enforcement are used with no security rescue response. When the consumer is away from the home, the situation and safety of the house are unknown. The number of break-ins and burglaries on these easy targets has lately increased. On top of that, [3] stated that the gas used in the home is a liquid petroleum gas (LPG) form in which the gas is extremely flammable.LPG is utilized for cooking at home and ceratin utilization

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for others. They have certain shortcomings that make the gas leakage happen where only humans can sense the gas leakage in the area. Although even people who have a poor sense of smell could not identify it. Moreover, a gas leak might start a flame, causing significant injuries or deaths and it can also damage valuable property. Thus, IoT-based home automation and security system are needed in the current scenario to provide people with peace of mind and physical comfort, and safety in their homes by allowing them to monitor and do what they want with a single tap.

1.3 Project Objective

The project is conducted to achieve the following objectives;-

a) To develop home automation for home appliances and security systems for house
b) To develop IoT based monitoring system using the Blynk application
c) To test the feasibility of the prototype

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1.4 Scope of Project

This project is to build IoT-based home automation, security, and safety system which can control and monitor by using the Blynk application. This project is divided into two parts which are the implementation of a home automation system and a security safety system. The project offers home automation control by remotely controlling the light and fan using the user's phone to turn on or off. When it’s necessary, the user can turn on the home appliances through the phone and turn them off when not in use from anywhere. The project also provides home surveillance and safety by using sensors in connection with the Internet of Things (IoT). This project's microcontroller is an Arduino UNO, which is an 8-bit microcontroller where it can carry out separate operations depending on the signals

obtained from the devices. Besides, the Wi-Fi shield will be attached to operate with the Blynk application. The microcontroller serves as a slave, receiving signals from sensors and works along with the Wi-Fi shield. Any detection signal of either PIR or gas sensor, the signal is processed and the user is notified by the Blynk app. The placement of the PIR sensor will be top of the front door. Finally, this project also consists of a warning device consisting of the buzzer's sound and led blink audible alert system.

1.5 Thesis Organization

This thesis is constructed as follows. Chapter 1 describes the main ideas of the project, mostly about the objectives, problem statement, and project scope. Next, Chapter 2 will brief more on theory and literature reviews that have been done. These studies are discussed that are related to this project where the information was retrieved via journal articles, papers, and online sources. The methodology used to implement this project is discussed in Chapter 3 which includes the methods used in programming, block diagram selection of components, and flowchart. Chapter 4 is where the overall results and discussion are included. Lastly, the conclusion for this project is in Chapter 5.

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