UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BORANG PENGESAHAN STATUS LAPORAN PROJEK SARJANA MUDA

Tajuk: **SMART HOME MONITORING**

Sesi Pengajian: **2018/19 Semester 1**

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I hereby, declared this report entitled "Smart Home Monitoring" is the results of my own research except as cited in references.

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APPROVAL

This report is submitted to the Faculty of Mechanical and Manufacturing 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

Sistem Pemantauan Rumah Pintar adalah projek yang menggabungkan dua sistem iaitu sistem keselamatan dan automasi. Untuk sistem automasi, ia menggunakan MCU Node sebagai unit mikrokontroler manakala untuk sistem keselamatan ia menggunakan Arduino UNO untuk mengesan input yang dicetuskan oleh pengguna atau sensor. Bagi bahagian automasi, projek ini dilengkapi dengan modul Wi-Fi Node MCU untuk menyediakan sambungan antara pengguna, aplikasi dan peralatan yang ingin dikawal. Sementara untuk bahagian keselamatan, sistem ini dilengkapi dengan sensor dan modul GSM iaitu sensor gerak Pasif Inframerah (PIR) dan sensor suis magnet untuk mengesan penceroboh di rumah. Idea utama membina projek ini adalah untuk mewujudkan sistem rumah pintar berdasarkan sistem IoT yang mempunyai kos pemasangan yang rendah supaya semua orang boleh mempunyai sistem automasi dan keselamatan di rumah. Sistem keselamatan akan menghantar amaran kepada pemilik rumah dalam bentuk 'Short Message Service' (SMS). Dari persediaan ujian eksperimen, hasilnya menunjukkan bahawa sistem itu dapat melaksanakan kedua-dua fungsi automasi dan keselamatan dengan baik. Projek ini telah direka dan dilaksanakan dengan jayanya.

ABSTRACT

Smart Home Monitoring System is a project which combine two systems which is security and automation system. For automation system, it used Node MCU as the microcontroller unit while for security system it used Arduino UNO to detect the input that is triggered either by user or sensor. For the automation part, the project equipped with Node MCU Wi-Fi module to provide a connection between user, application and the controlled appliances. While for the security part, the system equipped with GSM modules and sensor which is Passive Infrared (PIR) motion sensor and magnetic switch sensor to detect an intruder at the house. The main idea of building this project is to create a smart home system based on IoT system that has low installation cost so that everyone can have an automation and security system at home. The security system will sent an alert to homeowner in the form of Short Message Service (SMS). From experiment testbed setup, result shows that the system is able to perform both automation and security functions well. The project has been designed and implemented successfully.

DEDICATION

Special thanks to Allah S.W.T for His blessful and gift because giving me this ability to finish my Projek Sarjana Muda (PSM). This report is as a mark of my sincere appreciation to Universiti Teknikal Malaysia Melaka (UTeM) for giving me this chance to further study on Bachelor's Degree in Electronics Engineering Technology (Telecommunication) in Faculty of Engineering Technology (FTK). I also would like to thank to my supervisor, Puan Norlezah Binti Hashim for the guidance, advices, encouragement, inspiration and attention given throughout the day in development of my final year project and while writing this report entitled as Smart Home Monitoring. With this continuous support and interest, she was guiding me to complete this project with full commitment and dedication. My gratitude goes to my beloved parents En. Azhar Bin Hj. Sarbin and Pn. Shamsiah Binti Ramthan, my family and my friends that always give courage and support me to achieve the goal of my project. Thanks to their moral support and care they had given to me up until this project done. Finally, I would also to say thank you to all lecturer and staff who also involved directly or indirectly in helping me completing this project. May your charity and goodwill will be blessed.

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BLE	-	Bluetooth Low Energy
CCTV	-	Closed Circuit Television
CMOS	-	Complementary Metal-Oxide Semiconductor
EPROM	-	Erasabale Programmable Read-Only Memory
GHAS	-	GSM Home Automation System
GPRS	-	General Packet Radio Service
GSM	-	Global System Mobile
HD	-	High Definition
HVAC	-	Heating, Ventilation, Air-Conditioning
IDE	-	Integrated Development Environement
IEEE	-	Institutes of Electrical and Electronic Engineer
IoT	-	Internet of Things
IP	-	Internet Protocol
ISDN	-	Integrated Service Digital Network
LAN	-	Local Area Network
LED	-	Light Emitting Diodes
OS	-	Operating System
PC	-	Personal Computer
PIC	-	Programmable Interface Controller
PIR	-	Passive Infrared
RF	-	Radio Frequency
ROM	-	Read-Only Memory
SMS	-	Short Message Service
SPDT	-	Single Pole Double Throw
USB	-	Universal Serial Bus
UHF	-	Ultra High Frequency
WPAN	-	Wireless Personal Area Network

CHAPTER 1

INTRODUCTION

1.0 Introduction

This chapter focused on the creation of the frameworks on this project. Basically, these include the objectives that needed to be achieved by the researcher. It includes the main information such as problem statement, objectives of this study, scope of work.

1.1 Problem Statement

Nowadays, the security aspect has a very high demand among the people over the world. This case is due to the rise of crime statistic that occur at their residential area which include theft and robbery. Therefore, the committee need a mechanism that can help them to ensure the safety of their residential area from theft issues. In addition, the Closed Circuit Television (CCTV) camera system is the common way on how people monitor their home environment area.

Firstly, as the CCTV is a common way to monitor the security of the home environment, the homeowner need an additional notification system that can inform them about their home security conditions. The existed alarm system only producing the sound that tell the neighbourhood when one of the house is being entered by unauthorized people. The homeowner only realize that their house is being entered by either from the neighbour or by itself when reaching the house.

The power consumption that used by the Malaysian's citizen are among the highest in the Asian countries. So the government had promote many campaign such as

Earth Hour to encourage peoples to use the electric energy wisely. From the growth of existed technologies, people always rely on electronic devices that could help them in their daily activities. Home automation is the best example that become a need for everybody, especially for the busy person which emphasize every seconds in their daily life.

Next, the common scenario when people want to go for a holiday or come back to their home town are they leaving their houses with front light remains on. This is to ensure their house clearly visible so that neighbour can help to monitor their house. If they planned to leave their house for a long period, this may cost a lot for the electricity bill. So the implementation from this home automation system project can contribute something for committee to have a system which can control their home appliances even they are on outstations.

Other than that, the costing always be the barrier for owning the smart technologies. The smart devices are high cost because it has a special chip which act as receiver that process the signals sent by the controller. Due to high cost, not all the people from the middle and low class afford to equipped their home with this smart home systems. For the example, the smart lamp which embedded with special chip cost about RM 50 each. Compared to normal lamp which cost about RM 15 but still can be control through the combination of Arduino and Wi-Fi module, this can save a lot and the people also able to own their smart home system with a lower cost.

Besides that, almost all peoples had an experiences where they forgot to switch off the home appliances after leaving the house. When they have reached at workplace and suddenly they just remembered that they forget to switch off the home appliance, this may take time and cost to return back to homes. So the home automation may solve this

situations which able to control the home appliances as long as they have the internet connections. Moreover, the prevention action from the unwanted accidents has been done so that the risks can be reduce as almost all of the home appliances can harm or explode when remains on.

1.2 Objective

From the problem statement explained as above, there are several objectives that need to be achieved at the end of this project. The main objectives of this project are:

1. To build and develop a low cost monitoring system based on Internet of Things (IoT) technology using the Arduino microcontrollers, sensors, and Wi-Fi modules.
2. To construct an experiment setup based on the design and conduct testing to test the network performance.

1.3 Scope of Work

In the process of planning and designing the Smart Home Monitoring system, there had several criteria which has limited scope. These comes from both software and hardware parts where it includes method, circuit configuration and costing to build the project.

First, the input and output port of the microcontroller has a limited number depend on its type. So the researcher had use both Arduino Mega and Arduino Uno because the implementation on the home automation and security system required a lot of port numbers to be used. The Arduino Uno is used for building the security system where it only involve two sensors and a GSM module to interact each other. While For the home

automation system, the researcher had used Arduino Mega once this system control variables home appliances that require more ports.

The ability to control all the home appliances also face some limitations. The number of controlled device are depend on the available port of the Arduino microcontroller where for Arduino Mega, it has 54 input or output port while for Arduino Uno consists of 14 input or output ports. So if the user want to build a complete home automation system which control many devices, they need to use more than one Arduino board to support the load.

Next, it is about the external hardware which is the casing that placed the microcontroller unit. The casing build using an acrylic board because it required a big space to protect the Arduino board and other device from damage. Besides that, the acrylic was chosen because it is low cost and lightweight so that it can reduce the costing and easy to bring the device anywhere.

Other than that, the security systems also required the continuous electricity supplies to power-up the systems. This limitation can be overcome by using the external battery instead of power adapter, so that it can still operate even when the home electric supply is unavailable. For the Wi-Fi router, it also faced the same limitation. So that, the automation system cannot be done once the electricity is disconnected.

Other than that, Arduino only perform a basic repetitive tasks such as notifying the user if there is an intruder in the house. Although the Arduino only perform the basic tasks such as reading the sensor value, this board always become the simpler board compared to the other board such as Raspberry Pi which need a complicated program and also special operating system that is Linux. Moreover, this board also have a lower cost

compare to Raspberry Pi but still serve the robust function so that it still powerful to run the task that has been programmed.

1.4 Rational of Study

This Smart Home Monitoring system is the combinational of two system which is home automation and security system which build to help the user to monitor and control the home surrounding for easier lifestyles. Besides that, the system also help the user from doing repetitive task which can save their money and time. The safety issue also get the high concerns from the home owner as the house is among the places where they keep their assets or valuable things.

For the home automation system, this features help the people to control their home appliances by only click the provided interface on the smart phones. This projects contributes a lot as the home owner does not need to return back to home just to check and switch off the idle state of the home appliances. In addition, this projects also help the people with disabilities to control the home devices through the smartphone as the limited movement that can be done by them.

The home owner is able to control the home appliances from the long distance range as long as both user and system is connected with the internet connections. This ability had make the user for saving their daily power consumption where they do not need to pay an excess electricity bills for the unwanted devices that remain on. As this occur, the people indirectly had supported the saving the electricity bill campaigns that can save our Earth.

For the security parts, the project contributes a system which notify the user when detecting the presence of intruder in their homes. This features is beneficial as most of

the home owner do not know if their house is being entered by intruder. From this prevention system, the user can do the further action such as checking the status of the house or calling the police station. So this project can help the home owner for protect and inform the security level of the house.

From the implementation on this projects, the home owner can take a relief as the project had helped the priority issues that commonly become a burden for them to perform better daily activities.

1.5 Expected result

For the automation part, the system should able to control the home appliance such as light, water pump and fan. The remote process can be done everywhere as long as the user and the processing unit are connected with the internet networks. The software that used to control the appliances is Blynk application, while for the processing unit, the author use Node MCU ESP8266 Wi-Fi modules to ensure the connection with the internet connections. The system also equipped with backup battery which will support the system once power failure occur. The backup system disabled the controlling features, so that it only can switch on the supply which are connected to the backup battery.

For the security part, the system equipped with motion and magnetic switch sensor which detect any movement around the targeted area. There is two condition which need to be complete where both motion and magnetic switch sensor need to trigger any input before the system can send an alert to the homeowner.

Firstly, the motion sensors detect the movement of any objects which triggered a signal to Arduino that light up the Light Emitting Diode (LED). Next, the process continue with the magnetic switch sensor which placed at the door to verify the presence

of the intruder. When both Passive Infrared (PIR) and magnetic switch sensors triggered any abnormal condition, the system will light up the LED and buzzer to give a warning alert in that home. After that, the Arduino will process the signal and sent the information the Global System Mobile (GSM) modules to send a SMS alert to the user. Once receive an alert, the homeowner can decide to make further actions.

1.6 Project Cost

Table 1.1 below shows the list of components that are used to build the project. The aim is to make a smart home system that is cost-effective in term of designing and developing the project for testing knowledge on related fields.

Table 1.1: Project component cost.

No.	Product	Price per Unit (RM)	Quantity (pcs)	Total (RM)
1	Arduino Uno	30.00	1	30.00
2	Magnetic Switch sensor	4.90	1	4.90
3	PIR Motion sensor	6.00	1	6.00
4	LED	3.00	1	3.00
5	Buzzer	3.00	1	3.00
6	Node MCU ESP8266	28.00	1	28.00
7	GSM module	65.00	1	65.00
8	3.7V Li Ion battery	10.00	2	20.00
9	DC 5V Voltage Regulator	9.00	2	18.00
10	Voltage sensor	8.90	1	8.90
11	9V battery	3.00	1	3.00
Total (RM)				189.80

1.7 Thesis Organisation

There are five chapters included in this thesis. Chapter 1 is the introduction which covers the project overview, problem statement, objectives, scope of work, rational of study, expected result and thesis organisation of the projects.

Chapter 2 present the Literature Review on related theories and previous related work to this project. The theories include the discussion and overview of the smart home and security system which covered both software and hardware architecture.

Chapter 3 is the Methodology which includes planning and implementation processes of the project. Under planning, the flow chart are elaborated in detail so that the project flow can be understand in a better way. Implementation includes the discussion on the testing methodology used in this project.

Chapter 4 consists of result and discussion. It covered the experimental results from the project. This chapter will also discuss the findings observed from the results. So the students can deliver the finding based on theoretical and experimentally.

For Chapter 5, this part covered the conclusion and future work of the projects. This chapter concludes the thesis and suggestion of future development.

CHAPTER 2

LITERATURE REVIEW

2.0 Introduction

This chapter consists of two section which explain about the related previous research and the description of the common technologies used for this projects. The previous research had been compared so that better implementations can be done through this projects. While for the hardware or project parts, this chapter explain on how the wireless technologies are selected and contributed in this projects.

2.1 Past Related Research

For this part, there will be an overview about the existing of the previous project that are done either by student, technologist or company. The references came from the various authorized and reliable source such as books, journals, articles and websites. Besides that, this part also includes the advantages and disadvantages of the previous projects over this project.

(Shaikh, 2016) developed a smart home automation system based on web based application where allows user to control and monitor home appliances using either personal computer or mobile devices that is connected to internet. The system can be control and monitor after getting the permission from the administrator. In addition, the number of user is flexible which can be used by any members inside the home after getting permission. Mainly, there are three purposes that focus on this system which is

remote control and monitoring the home appliances, power management and security alert.

The implementation and design of the project are done by using three element which is sensor technology, RF remote control and Wi-Fi router that is connected to the microcontroller to control of their appliances that connected to the system. There are two software used that are an assembly language for program the microcontroller and visual basic language that act as an interface to communicate between transmitter and receiver part.

There are some advantages of this smart home automation system where the system is low cost to be held as the component that used is easy to find in the market as well as the cheap price. Besides that, this system also flexible if there is an addition of the controlled devices and also the number of users. In the other hand, there is a disadvantage from this project which is the system has a complicated software which includes the coding to build the system.

(Rajiv, Raj and Chandra, 2016) stated that with the existing of the new technology which is Internet of Things (IoT), people have expect this technology will give them a faster, reliable and on-demand home security access via the internet. In this research, the author had proposed an architecture that use email as the input to notify and update the owner or user about the home access.

The project used email as the input by sending and receiving the email for controlling the door. Before the owner unlock the door, the system will detect the presence of the person in front of the door. After that, the Internet Protocol (IP) camera that is connected with the system will capture the person's face and sent it through the

mail. If the owner accept to open the door, the owner will sent the email back through the internet.

There is an advantage when using this system which is it had a special feature which can give access for the selected character to unlock the door without asking the permission from the owner. This process work by storing the face and skin gestures at the database. Other than that, this system work by capturing and comparing the visitor image and also need the fingerprint matching for extra safety purposes. For the advantage, the weakness are come from the input itself where the email are not the best way to give permission to unlock the door. The email can be access or intercept by the other if their device are being used, hacked and stolen by the unauthorized user.

(Younis *et al.*, 2017) stated that the development in speech recognition software and wireless communication modules had bring the home automation system to be placed into a new level of innovation process. The aim of this proposed idea is to construct a speech recognition home automation system which is efficient, low cost, user friendly, easy to build and using the latest technology.

This home automation system is separated into two section which is base station and remote station. Both base station and remote station are connected wirelessly through the RF Zigbee wireless communication module. At the base station, the Raspberry Pi has been used for the speech recognition purpose which will perform a control command to the remote station through the wireless module. The input speech is collected by using microphone and processed in Raspberry Pi using a speech recognize software that will produce a speech binary sequence. Next, the binary sequence are sent to the microcontroller unit in the remote station through Zigbee to control the state of the device whether on or off.