DEVELOPMENT OF AN IOT SYSTEM FOR DOMOTICS

BADIUZZAMAN BIN JAMASRI

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

BACHELOR OF ELECTRICAL ENGINEERING WITH HONOURS
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

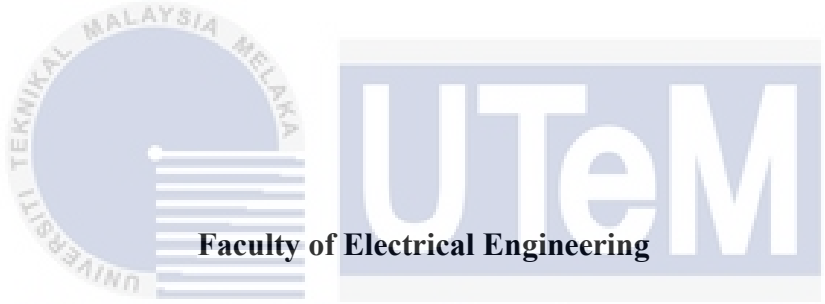
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DEVELOPMENT OF AN IOT SYSTEM FOR DOMOTICS

BADIUZZAMAN BIN JAMASRI

A report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electrical Engineering with Honours



Faculty of Electrical Engineering

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

DECLARATION

I declare that this thesis entitled " DEVELOPMENT OF AN IOT SYSTEM FOR DOMOTICS is the result of my own research except as cited in the references. Therefore, the thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

Signature :

Name : BADIUZZAMAN BIN JAMASRI

Date : 5TH JULY 2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

APPROVAL

I hereby declare that I have checked this report entitled “title of the project” and in my opinion, this thesis it complies the partial fulfillment for awarding the award of the degree of Bachelor of Electrical Engineering with Honours

Signature : .....

Supervisor Name : HYREIL ANUAR BIN KASDIRIN

Date : 5TH JULY 2021

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

DEDICATIONS

My heartfelt gratitude goes to my beloved parents, Jamasri Bin Johari and Suriani Binti Md Kassim, as well as my supportive family members. I also want to thank my supportive friends for their encouragement and spirit to complete this project.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ACKNOWLEDGEMENTS

While completing this report, I communicated with many people, including researchers, academics, and practitioners. They also contributed to my learning and understanding. I would like to express my sincere gratitude to Dr Hyreil Anuar Bin Kasdirin, my primary project supervisor, for his support, guidance and friendship. This project would not have been the same as described here without his continued encouragement and involvement. My fellow undergraduate students should also be remembered for their support and not forgotten. My heartfelt gratitude also applies to my friends and those who have assisted me on different occasions. Their opinions and tips are also helpful. Unfortunately, it is not possible in this limited space to list all of them. Finally, to all the members of my family, I am grateful and Alhamdulillah.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRACT

Recently, home safety has become a critical issue in metropolitan and suburban areas, particularly for those who must go out but keep an eye on their home and children. There are many innovative home systems, but there are still several functions or features that are lacking. First, Some of the smart home systems in Malaysia are not user-friendly. Second, Some smart home systems lack a proper security system, and lastly, Some smart home systems cannot update information in the home and cannot be controlled in an emergency. The objective of this project has been made to counter the problem. The first objective is to develop a Smart Home System that user-friendly can easily be understood and operated by non-technical user. The second is to develop a smart home system to update the information from the sensor or device to the user via a website. Lastly, develop a Smart Home System that can combine security, monitoring and automation with the smartphone. This project started with the study and exploration of the IoT security system for automation. This research is based on the essential steps taken by focusing on the indicators of success in connecting the NodeMCU ESP8266 module and other devices so that multi-objective issues can be solved. The sensors will have the NodeMCU ESP8266 interface. The status of our home appliances is uploaded through the wireless module to the Blynk platform. On the same wireless network, our system should be linked to our mobile device. This project will serve as an example of how our lives can be made simpler by IoT applications. Testing the system, which had both hardware and software integrated, revealed that it functioned properly according to the intended algorithm. In future works, more smartness can be added to this proposed project.A camera may also be linked to a microcontroller, allowing suspicious pictures to be captured and sent to the cops. This system may also incorporate a voice call function that allows users to control their household appliances.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

ABSTRAK

Baru-baru ini, keselamatan rumah menjadi isu kritikal di kawasan metropolitan dan pinggir bandar, terutama bagi mereka keluar tetapi memerhatikan rumah dan anak-anak mereka. Terdapat banyak sistem rumah yang inovatif, tetapi masih terdapat beberapa fungsi yang kurang. Pertama, sistem rumah pintar di Malaysia tidak mesra pengguna. Kedua, sistem rumah pintar tidak mempunyai sistem keselamatan yang betul. Akhir sekali, sistem rumah pintar tidak dapat mengemas kini maklumat di rumah dan tidak dapat dikawal dalam keadaan darurat. Objektif projek ini dibuat untuk mengatasi masalah tersebut. Objektif pertama adalah untuk membangunkan Sistem Rumah Pintar yang mesra pengguna mudah difahami. Kedua ialah Membangunkan sistem rumah pintar yang dapat mengemas kini maklumat dari semua sensor atau peranti kepada pengguna melalui telefon pintar. Terakhir, Sistem Rumah Pintar yang dapat menggabungkan keselamatan, pemantauan dan automasi dengan telefon pintar. Penyelidikan ini berdasarkan pada langkah-langkah penting yang diambil dengan menumpukan pada menghubungkan NodeMCU ESP8266 dan peranti lain supaya masalah pelbagai objektif dapat diselesaikan. Sensor akan mempunyai antara muka NodeMCU ESP8266. Status perkakas rumah dimuat naik melalui modul tanpa wayar ke platform Blynk. Pada rangkaian tanpa wayar yang sama, sistem kami harus dihubungkan dengan peranti mudah alih kami. Projek ini akan menjadi contoh bagaimana kehidupan kita dapat dipermudah dengan aplikasi IoT. Dengan menguji sistem yang telah diintegrasikan, kedua-dua perkakasan dan perisian menunjukkan bahawa sistem ini berfungsi dengan betul dan terancang. Dalam karya yang akan datang kamera juga boleh disambungkan ke mikrokontroler untuk megambil gambar. Juga, ciri panggilan suara dapat disertakan dalam sistem ini di mana pengguna dapat mengendalikan peralatan rumah mereka.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

TABLE OF CONTENTS

PAGE

DECLARATION

APPROVAL

DEDICATIONS

ACKNOWLEDGEMENTS **1**

ABSTRACT **2**

ABSTRAK **3**

TABLE OF CONTENTS **4**

LIST OF TABLES **6**

LIST OF FIGURES **7**

LIST OF SYMBOLS AND ABBREVIATIONS **9**

LIST OF APPENDICES **10**

CHAPTER 1 INTRODUCTION **11**
1.1 Overview 11
1.2 Research Background 11
1.3 Problem Statement 12
1.4 Motivation 12
1.5 Objective 13
1.6 Scope 13

CHAPTER 2 LITERATURE REVIEW **15**
2.1 Overview 15
2.2 Project Background 15
2.3 Popular Brand Internet of Thing(IoT) Devices in 2021 16
2.4 Microprocessor Unit NodeMCU ESP8266 17
2.5 Different between NodeMCU and Arduino UNO 19
2.6 Sensor Unit 20
2.6.1 Door Sensor 20
2.6.2 Gas Sensor 20
2.6.3 IR sensor 21
2.6.4 Flame Sensor 21
2.7 Actuator and Load 22
2.7.1 Bulb 9V 22
2.7.2 Cooling Fan 22
2.7.3 Solenoid Lock Door 23
2.8 BLYNK Application 24
2.9 Summary 24

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 3 METHODOLOGY **25**
3.1 Introduction 25
3.2 Project Methodology 25
3.3 Design the smart home security system 27
3.4 How to programme the NodeMCU board in ARDUINO IDE software 29
3.5 Method to Achieve Objective 1 31
3.5.1 BLYNK setting Application 32
3.6 Method to Achieve Objective 2 35
3.6.1 Connection Pin sensor to NodeMCU 8266 36
3.7 Method to Achieve Objective 3 37
3.7.1 Connection RELAY Module to NodeMCU 8266 38
3.7.2 Connection Actuator to Relay Module 39
3.8 Summary 40

CHAPTER 4 RESULTS AND DISCUSSIONS **41**
4.1 Introduction 41
4.2 The hardware of the system 41
4.3 Result and Data 43
4.3.1 Reed sensor (Door Sensor) 43
4.3.2 Flame Sensor 44
4.3.3 IR Sensor 45
4.3.4 Gas Sensor 46
4.4 House Appliances 48
4.4.1 Lamp 9V 48
4.4.2 Fan 12V 49
4.4.3 Solenoid lock door 49
4.5 Summary 50

CHAPTER 5 CONCLUSION AND RECOMMENDATIONS **51**
5.1 Conclusion 51
5.2 Future Works 52

REFERENCES **53**

APPENDICES **54**

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF TABLES

Table 2.1 : Configuration of Nodemcu ESP 8266 [2]..... 18

Table 3.1 : Connection Flame sensor.....36

Table 3.2 : Connection IR Sensor.....36

Table 3.3 : connection door sensor.....36

Table 3.4 : Connection Gas Sensor.....36

Table 3.5 : Connection Relay Module.....38

Table 3.6 : Connection Bulb 9V.....39

Table 3.7 : Connection Fan 12V.....39

Table 3.8 : Connection Solenoid Lock.....39

Table 4.1 : List the item for this project.....42

Table 4.2 : Length of fire detected by a flame sensor.....44

Table 4.3 : Length of IR sensor detected the object.....45

Table 4.4 : Length and concentration gases.....47

Table 4.5 : Length of gas sensor detected gases in the atmosphere.....47

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF FIGURES

Figure 2.1 : Xiaomi logo....16

Figure 2.2 : Xiaomi home security devices....16

Figure 2.3 : Block diagram of IoT Architecture [1]....17

Figure 2.4 : NodeMCU ESP8266 Pin Diagram....18

Figure 2.5 : type of micro-controller....19

Figure 2.6 : Door Sensor(Reed Sensor)....20

Figure 2.7 : Gas Sensor....20

Figure 2.8 : IR Sensor....21

Figure 2.9 : Flame Sensor....21

Figure 2.10 : Bulb 9V....22

Figure 2.11 : Cooling Fan....22

Figure 2.12 : Solenoid Lock Door....23

Figure 2.13 : Blynk Application Software....24

Figure 3.1 : Flowchart Development of an IoT Security home....26

Figure 3.2 : Home Security System Schematic 1....27

Figure 3.3 : Home Security System Schematic 2....28

Figure 3.4 : Install ESP8266 latest Version. [3]....29

Figure 3.5 : Insert the URLs at the Preferences Tab....30

Figure 3.6 : The programming at the Arduino IDE....30

Figure 3.7 : Flowchart methodology 1....31

Figure 3.8 : First-page BLYNK setting....32

Figure 3.9 : New project page....32

Figure 3.10 : Auth Token....33

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

Figure 3.11 : BLYNK's Widget.....33
Figure 3.12 : IoT Smarthome Widget.....34
Figure 3.13 : Flowchart methodology 2.....35
Figure 3.14 : Flowchart methodology 3.....37
Figure 3.15 : Relay module.....38
Figure 4.1 : Hardware Project IoT smart home.....42
Figure 4.2 : The closed and opened door.....43
Figure 4.3 : Push notification appears on the device screen.....43
Figure 4.4 : Flame sensor detect fire.....44
Figure 4.5 : 5cm object from IR sensor.....45
Figure 4.6 : Concentration of gas and length of the lighter from the gas sensor.....46
Figure 4.7 : Push notification appears on the device screen.....46
Figure 4.8 : The bulb light up.....48
Figure 4.9 : The fan Spinning.....49
Figure 4.10 : The solenoid door.....49

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF SYMBOLS AND ABBREVIATIONS

IoT	-	Internet Of Thing
cm	-	Centi meter
IR	-	Infrared
IDE	-	Integrated Development Environment
ESD	-	Electrostatic Discharge

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

LIST OF APPENDICES

Appendix 1 : Coding for Room 1 54

Appendix 2 : Coding for Room 2 55

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 1
INTRODUCTION

1.1 Overview

In recent years, home automation has been on the rise. Domotics or home automation is more focused on environmental issues, energy-saving, and the improvement of people's lifestyles. There have been more intelligent and more advanced technologies in home automation, but several functions or features are lacking in terms of security. The first chapter defines the project's inspiration, problem statement, objectives, and the scope of the analysis.

1.2 Research Background

Today, hundreds of thousands of Internet of Things (IoT) devices are readily available to customers. Domotics (from the Latin word "Domus", house) in this project defined as the encounter of information technology, electrotechnics and electronics that makes a home become "smart". It is the tool that allows us to control systems, devices and automation. These include security cameras, smart homes, intelligent speaker systems, intelligent toys, baby monitors, drones, home appliances, routers, and web gateways, and any other hardware products which can transmit data and be controlled over the Internet.

Most of these devices are relatively cheap, mass market-oriented, with little to no attention paid to access control and data protection. Therefore, they immediately become a prime target for unscrupulous crooks who are all too eager to exploit their vulnerabilities – and either co-opt them into a botnet or use them to spy on their owners. This project makes securing such devices an absolute necessity. Furthermore, as the number of IoT devices on the market grows exponentially, this necessity becomes more urgent with each passing month.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

1.3 Problem Statement

A smart home will inevitably provide us with numerous benefits, but nothing is perfect in the world. There are many innovative home systems available on the market today, but there are still several functions or features that are lacking.

Some of the smart home systems in Malaysia are not user-friendly because the set of security home devices need to be bought with their controller. Furthermore, all the devices need to be operated by technical users with advanced technical knowledge of the program.

Some smart home systems lack a proper security system to protect the peaceful house members and the appliances. All sensor-equipped devices are more expensive than the actuator. The cost of building security devices must be reduced, but the performance remains unrivalled.

Some smart home systems cannot update information in the home and cannot be controlled in an emergency. Therefore, the per cent of losses will also rise if the owner fails to control the emergency properly.

UTeM
اونيۏرسيتي تيکنيکل مليسيا ملاک
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

1.4 Motivation

In recent years, home automation has been on the rise. There have been more intelligent and more advanced technologies in home automation, including revolving technology. The appliances should be fully automated without any user interaction to increase the quality of living.

This project enables the end-user to interact with the appliances without physically pushing a button since the appliances learn and respond to the user's needs. However, it is more challenging to operate wired sensor systems and often needs many wiring at various locations for the sensors. Therefore, the value of wireless sensor nodes has been growing and is a crucial factor for home automation to be implemented efficiently.

1.5 Objective

i. .To develop a Smart Home System that user-friendly can easily be understood and operated by the non-technical user without any advanced technical knowledge.

ii. Developing a smart home system can update the information from all the sensor or device to the user via a website.

iii. To develop a Smart Home System that can combine security, monitoring and automation with the smartphone.

1.6 Scope

The project scope is to focus on the Security Smart Home System by using the Internet of Things. Four sensors have been used in this project for the input process and four output processes. Gas sensor, Flame sensor, Ir sensor and Reed sensor are the input insecurity part. Meanwhile, the buzzer, lamp, fan and solenoid lock door are the output of this project. All the sensors were strategically placed throughout the house can detect danger, and the buzzer would also notify the owner via a smartphone. The user will receive this notification regardless of whether the phone is locked or unlocked or whether any other app is currently available. This was the project's main goal: to make the user feel safe and unconcerned about intruders, break-ins, or fires while he is away from home. The connectivity between the ESP8266 (WiFi module) NodeMCU and the Blynk server is another essential component. The additional ability to remotely control the alarm is also beneficial and can be very useful in certain unexpected situations. It was also noted that the Blynk app operated smoothly and carried out all contacts very accurately between the hardware and the application.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

As below, the organization of this study is illustrated,

a) Chapter 2, Literature Review: The topic will cover the previous and current work or study to understand and concept the project's progress.
b) Chapter 3, Methodology: This chapter will interpret the method step by step from developing the hardware until the connection server achieves this project's main objective.
c) Chapter 4, Result and Discussion: This chapter shows the outcome of the design model, security notification and controlling the home automation.
d) Chapter 5, Conclusion and Recommendation: This chapter will give the summary from the project done whether the objective achieved or not and will state the improvement for the project to have better performance

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

CHAPTER 2

LITERATURE REVIEW

2.1 Overview

The literature review is written to support the trusted data, such as article, journal and conference. The topic will be discussed in this chapter is the development of an IoT system for domotics. This chapter will be explained about other past developers in the same project. With an existing idea, a new improvement outcome generated in this project. Thus, all this data is essential to future development.

2.2 Project Background

In this paper, Wireless technology was used to create the system, making it more secure, less costly, and simpler to install. Each installed sensor will be connected to the local network through the NodeMcu ESP8266 module, which interacts with the router. This project made use of security modules such as a gas sensor, an infrared sensor, and a reed switch module. This module's goal is to accept input from each installed module and then give real-time output in the form of alerts, notifications, and statistics to smartphone users. The notification given is information that requires access to the application from the user. This project also includes automation control, such as opening the lamp, fan, and solenoid lock door with a smartphone application.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.3 Popular Brand Internet of Thing(IoT) Devices in 2021

Figure 2.1: Xiaomi logo

Xiaomi Corporation was founded in April 2010 and was listed on the Main Board of the Hong Kong Stock Exchange on July 9, 2018 (1810.HK). Xiaomi is an internet company with smartphones and innovative hardware connected by an Internet of Things (IoT) platform at its core. Xiaomi ranked third globally in terms of smartphone shipments in the fourth quarter of 2020. The company has also established the world's leading consumer AIoT (AI+IoT) platform, with 324.8 million smart devices connected to its platform. [5]

Figure 2.2: Xiaomi home security devices

Many types of smart devices produced by Xiaomi in 2013 include security for home safety. The figures depict popular Xiaomi smart home devices such as door and window sensors, security cameras, lamps, and air purifiers. These smart home devices are helpful in this technological era because most people nowadays want to control everything with their fingertips.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.4 Microprocessor Unit NodeMCU ESP8266

The system is divided into two main parts: the design of hardware and software. Hardware configuration requires the arrangement of microcontrollers, sensors, and actuators, while programming code and uploading to each of the microcontrollers is included in the software part. The system is made up of sensors connected to microcontrollers and electrical devices to be tracked and controlled. This section illustrates how various components of the hardware are set up. Below are descriptively explained the requirements and details about different components used in this device.

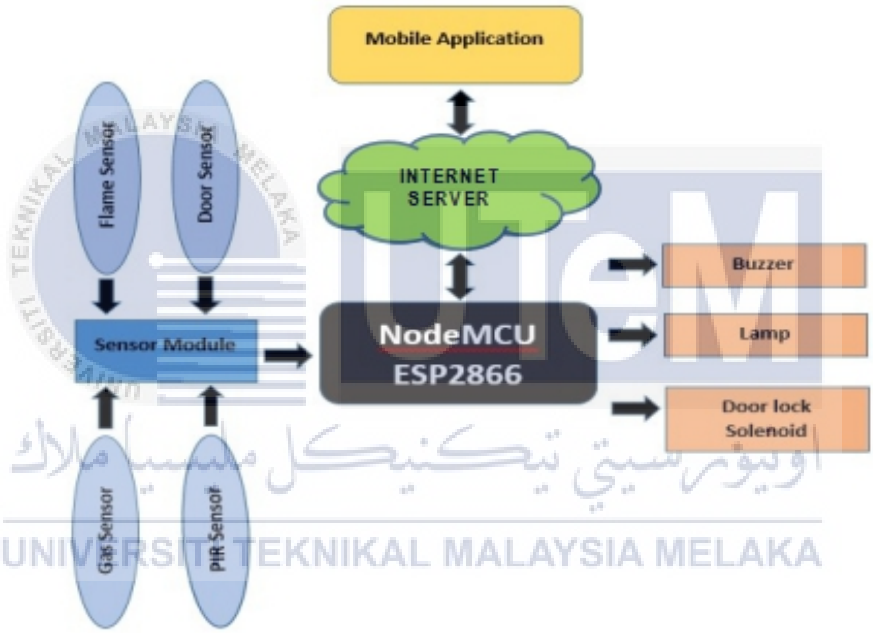


Figure 2.3: Block diagram of IoT Architecture [1]

The main goal of the Smart Home is to be valuable by providing efficiency, comfort, and improved genuine security. The goal and objective of this project are to present a network-based home IoT system based on the Node MCU ESP8266. The system is capable of monitoring and securing home electronic devices over the Internet through a cell phone.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

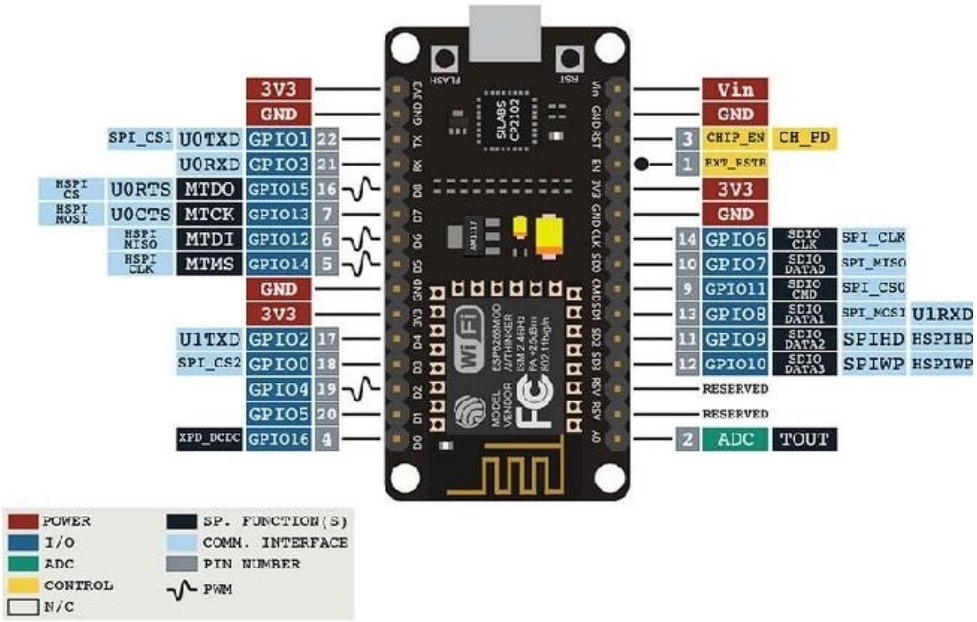


Figure 2.4: NodeMCU ESP8266 Pin Diagram

Table 2.1: Configuration of Nodemcu ESP 8266 [2]

Type	32-bit processor microcontroller
CPU	80 MHz to 160 MHz
Memory	64KB boot ROM (flash) 64 KB instruction RAM 96KB data RAM
Input	16 GPIO pins
Power	3.3V DC
Modulation	Pulse-Width modulation
Network	2.4 GHz Wi-Fi(802.11 b/g/n, supporting WPA/WPA2

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2.5 Different between NodeMCU and Arduino UNO

The Internet of Things (IoT) is making us well-connected all around the world. Microcontrollers are small, self-contained computers that reside on a microchip. They allow connection and control of any device that can be linked to the Internet.

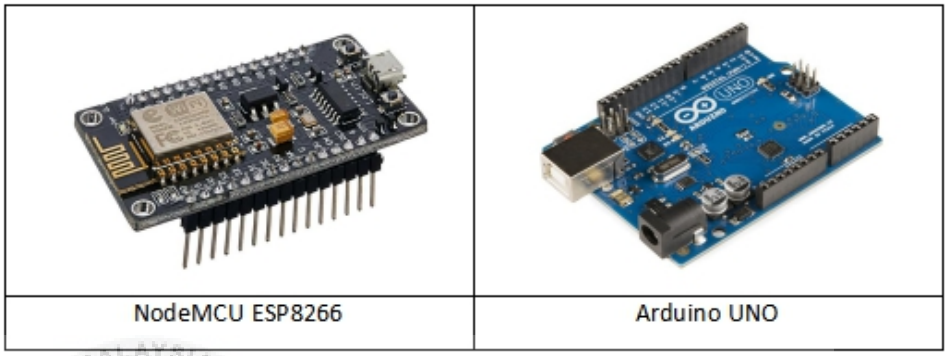


Figure 2.5: type of micro-controller

The differences between ESP8266 and Arduino UNO are controllers provided with WiFi and Bluetooth capability. The ESP8266 includes Bluetooth and WiFi and does not require any additional connection components. The second reason the ESP8266 is the main micro-controller for this project is that the cost of the ESP8266 is cheaper than the Arduino Uno.

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

The ESP8266-based boards are fast and consume very little power. The current consumption is significant for battery-based projects to increase the lifetime of the project. The nodeMCU is based on the ESP8266 microprocessor. Its low current consumption of between 15 μA and 400 mA can be further decreased with the deep sleep mode activated to 0.5 μA. When a battery is used as a power source, the ESP8266 is useful.

In this micro-controller comparison, we look at different sizes of boards with one significant impact factor on the total number of pins. The nodemcu is smaller than these Arduino boards and will fit on a breadboard, allowing for more compact and user-friendly device construction. The ESP8266 microcontroller is required in this case to be the best solution for this project.