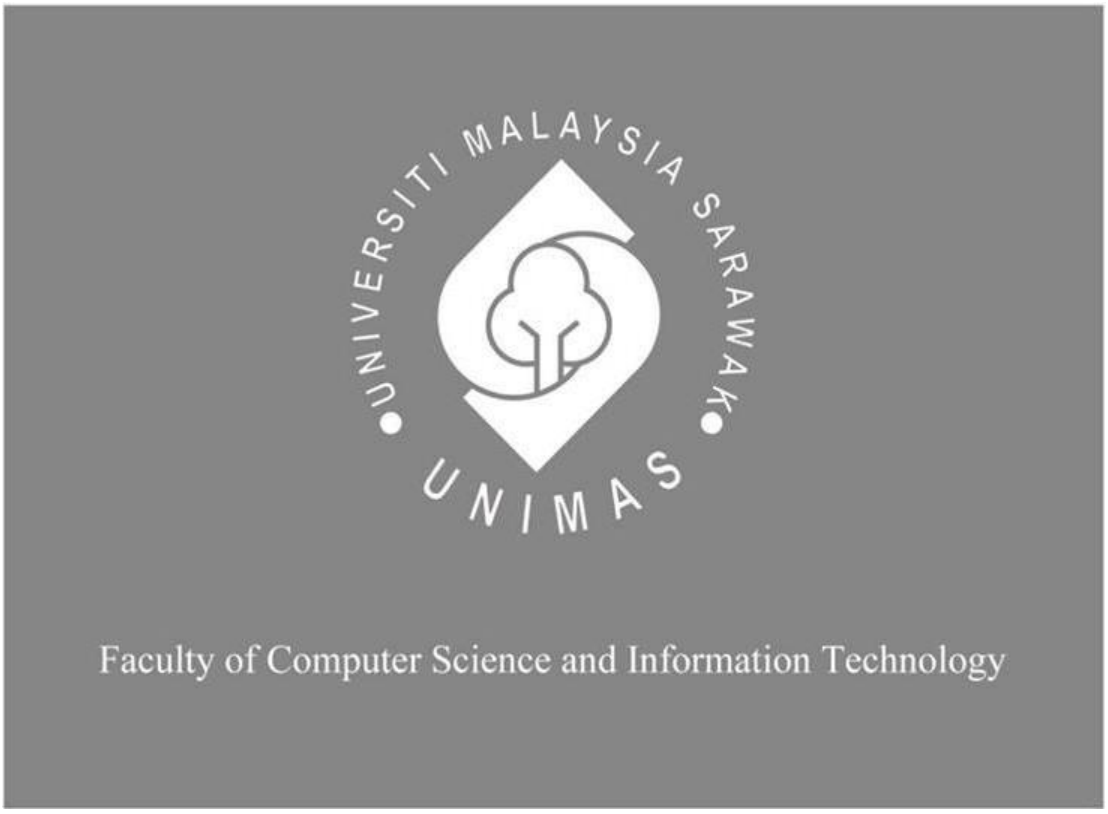


# *TEMPERATURE ROOM MONITORING SYSTEM USING INTERNET OF THINGS (IoT)*

Siti Nurfazera Izzati Abdul Saibeh

Bachelor of Computer Science with Honours

(Network Computing)

2020

# TEMPERATURE ROOM MONITORING SYSTEM USING INTERNET OF THINGS (IoT)

SITI NURFAZERA IZZATI ABDUL SAIBEH

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## ABSTRACT

*Temperature Room Monitoring System using Internet of Things (IoT) is a type of temperature recorder that capture a temperature of rooms and show the current temperature data over the Internet using the ThingSpeak server. This project uses NodeMCU as a microcontroller where instructions and software set are stored in order to make this system function properly. The sensor DHT11 is used to capture, then transmit temperature data via the Wi-Fi to allow device communication. ESP8266 Wi-Fi sends the data to ThingSpeak IoT online temperature monitoring cloud platform. The main purpose of this project is to make it easy for user to monitor the current temperature and analyse the temperature reading over time graph. This project also will be connected with a smartphone device through a mobile application that will be created using Blynk.*

# ABSTRAK

Sistem Pemantauan Suhu Bilik menggunakan *Internet of Things (IoT)* merupakan projek yang membaca suhu bilik dan menunjukkan data suhu semasa melalui Internet menggunakan pelayan ThingSpeak. Projek ini menggunakan NodeMCU sebagai mikrokontroler yang mana arahan dan set perisian disimpan untuk menjadikan sistem ini berfungsi dengan baik. Sensor DHT11 digunakan untuk membaca suhu, kemudian menghantar data suhu melalui WiFi untuk membolehkan komunikasi peranti. WiFi ESP8266 menghantar data kepada sistem pemantauan suhu di platform ThingSpeak IoT. Tujuan utama projek ini adalah untuk memudahkan pengguna memantau suhu semasa dan menganalisis bacaan suhu dari masa ke semasa. Projek ini juga menggunakan telefon pintar melalui aplikasi mudah alih yang akan dilaksana menggunakan Blynk.

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# CHAPTER 1:

# INTRODUCTION

## 1.1 INTRODUCTION

As human being there are things that we cannot control and to precisely predict, especially when it comes to natural phenomenon related to weather. As a result, a laboratory room temperature must be kept 20 to 25 Celsius or else the room might warm and may cause a student to be unable to concentrate on their study. Faculty has to choose either to place a person to monitor the temperature, or to save on human capital by developing a system that can monitor the temperature from other places at any given time. In order to solve the problem, Temperature Room Monitoring System using Internet of Things that can be accessed anywhere and anytime through the Internet is built.

This project use NodeMCU ESP8266 an Arduino based microcontroller where collection of instructions or program are stored for process thus enable this system to properly function and will automatically retrieve the temperature data. The device have a build in WIFI module that enable status communication and allow the system view temperature data via ThingSpeak webserver. This device will integrate with DHT11 sensor temperature and humidity since it is the heart of the system. Temperature sensor device will capture temperature data and send to ThingSpeak server and Blynk cloud. By this method, temperature and humidity data can be monitored over internet, and logged data and graph can be displayed over time on the ThingSpeak dashboard and Blynk application. The main purpose of this project is to make it easy for user to monitor the current temperature and analyse the temperature reading over time graph. This project will be connected with a smartphone device through a mobile application that will be created using Blynk.

## 1.2 PROBLEM STATEMENT

Temperature that is so high which around 28 to 35 degree Celsius, especially in UNIMAS always causes discomfort for student and lecturer every day. Even though each tutorial room and laboratory room has air conditioning, the temperature cannot be predicable easily because the environment and weather condition. Therefore, this project able to help not only students, but lecturers and staffs as well as monitoring the temperature.

The challenges that staff and students face unable to provide sufficient evidence for university's management by writing the report that the room still warm despite the air conditioning. Moreover, it is very difficult for them to take the temperature of each room in faculty. In order to solve the problem, Temperature Room Monitoring System is developed to allow the user to know the temperature reading and also can analyze that temperature. Therefore, this project does not only take a temperature reading, but the user especially the staff able to know the temperature from the screen and also can make the temperature analysis.

In addition, the main reason for this project not used Raspberry Pi due to costly price. NodeMCU ESP8266 microcontroller is cheaper than Raspberry Pi which NodeMCU costs around RM 20-30 while price of Raspberry Pi is around RM 200-250 depending on the version. The NodeMCU is low cost technologies to Wi-Fi enabled IoT compare to Raspberry Pi. Even though the Raspberry Pi is capable run multiple programs at once, the cost are also need to be take consideration since there will be huge demand on the budgeting of the hardware itself.

## 1.3 SCOPE

Temperature Room Monitoring System allows the user to monitor the temperature of the room remotely. It will also enable the user to read from a far using their computer through wireless network. During the process, the data is stored in the database and current temperature is shown. Moreover, this project also allows the user to view the reading of temperature and to analyse the temperature over time graph.

## 1.4 AIM AND OBJECTIVE

The aim and main objectives of this project are as follows:

a) To design and develop Temperature Room Monitoring System using Internet of Things (IoT).
b) To view current temperature.
c) To analyse the temperature over time graph.

## 1.5 BRIEF METHODOLOGY

The common uses of methodology is significant for the achievement of the project. The methodology that have been chooses is the CISCO Network Lifecycle known as PPDIOO. There are 6 phases in PPDIOO which is Prepare, Plan, Design, Implement, Operate and Optimize.

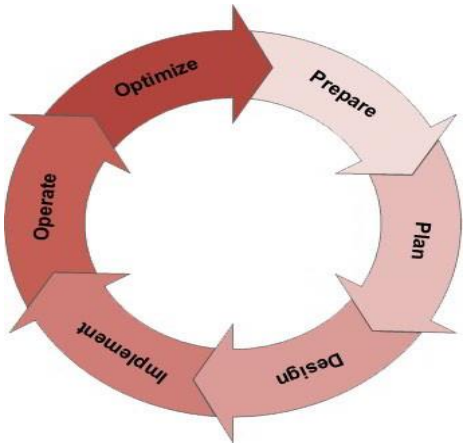


Figure 1.1: The 6 Phases of PPDIOO

The first phase in Network Lifecycle is the prepare phase. The proposal contain the objective of the project, the project scope, problem statement and also the project schedule.

The second phase is to plan for the project. During this phase, student need to identify what is the hardware and software that required in this project. Student also need to do some research on previous studies that have similarity to the current development project. Planning for the project schedule also needed in this phase so that the project run according the schedule and finish in the time.

The third phase is to design the environment of the project so that it is easier for the student and supervisor to understand the project. Design phase is important to have the overview of the project. It will be a guidance later when it comes to implementing the project using the hardware and software.

The next phase is to implement the project using the hardware and software. In this phase, the temperature sensor that have been decided will be connect to the NodeMCU microcontroller. After that, the sensor will communicate with the microcontroller and then sense the temperature. Later after the process is success, the temperature sensor will be send the data to computer through Wi-Fi.

The fifth phase is operate. During this phase, the project will be testing and there will be monitoring process to monitor the performance of the project. The reason for the performance monitoring is to see if the project able to display the temperature of each room to the user according to the objective of the project.

The last phase of CISCO Network Lifecycle is the optimize phase, it is similar as maintenance phase. The goal of this phase is to solve any problem occur during the operate phase and propose new solution to the problem. In PPDIOO, the network design can be rebuilt in the optimize phase if the previous network design is not suitable with the current progress project.

## 1.6 SIGNIFICANT PROJECT

This project will be beneficial to the user where they will continuously monitor the room temperature from computer. Besides that, the user will know the temperature reading and also can analyze the temperature data logger over time graph. In addition, the user mental health will slightly improve as they no longer have the stress of having to worry about the temperature their room. On commercial site, this project able to generate income if it is commercialize to the public.

## 1.7 PROJECT OUTCOME

The outcome of the project is the user will be able to continuously monitor and analyze the temperature condition of the room and the data can be monitored at anytime and anywhere from the Internet. The user will no need to struggle with carrying the thermometer to measure

the temperature of the room. This project will be beneficial to users and to the IT personnel if it being commercialized.

## 1.8 PROJECT OUTLINE

In Chapter 1, the introduction of the Temperature Room Monitoring System using Internet of Things where the whole description of the proposed project is drafted in this chapter. The key points of this chapter are the problem statement, project objective, methodology, project scope, significant of project, project schedule and the expected outcome of this project. Comparison of the existing project with the Temperature Room Monitoring System is shown in Chapter 2, Literature Review. The comparison can be done by referring on journals, articles and also conference papers. From the comparison between other existing system features, the strength and the weakness of the proposed system will be obtained throughout the process.

In Chapter 3, Requirement Analysis and Design, it will establish the requirements and sources to analyse the problem of the project, develop a design of the project implementation, and approaches for project development. In Chapter 4, Implementation and Testing will be done after the prototype has been developed or implemented. The established prototype will be tested is several areas in order to determine the usability of the system, or any bugs in the system or any error will occur during the test. The feedback and the result will be recorded where the features of the system is refined to improve and upgrade the performance and usability of the system. Lastly, in Chapter 5, Conclusion and Future Network will concluded the entire project process and outcome whether the objectives and the project scope have been accomplished and attained. Besides that, suggestion which can improve the functionality and performance of this system are added for future works.

## 1.9 SUMMARY

Temperature Room Monitoring System using Internet of Things is designed to help user view the current temperature of room. Other than that, to enable user to monitor the reading of their temperature through wireless network communication using computer and to have the ability to analyse the temperature over time graph.

# CHAPTER 2:

# LITERATURE REVIEW

## 2.1 INTRODUCTION

Temperature Room Monitoring System using Internet of Things (IoT) is the proposed system of this project. IoT is the innovation where day to day or any equipment or apparatus are connected to the internet (Matt, 2018). In this chapter, several existing systems that implemented IoT for personal and home applications will be analysed. In the end, comparison between the existing systems and the proposed Temperature Room Monitoring System using Internet of Things will be done in order to identify the potential strength and/or weakness of the proposed system.

## 2.2 BACKGROUND OF EXISTING SYSTEM

In this specific section, background study of three (3) existing system are carried out in detail for the use to established the proposed system.

### 2.2.1 Temperature and Humidity Monitoring System using Raspberry Pi

The Temperature and Humidity Monitoring System using Raspberry Pi was proposed by Vatsal and Bhavin from Charotar University of Science and Technology (CHARUSAT), Changa, India. This system was implemented to detect of real time temperature and relative humidity employing Raspberry Pi in a cost effective way by polling sensor at fixed interval of time. According to Vatsal et al. (2017), the system will display of live temperature and humidity and store data to mySQL database and provide means to read that temperature data with any web enabled device web browser such as computer and phone. Vatsal et al. (2017) stated that the system will operate based on Raspberry Pi and temperature sensing DHT22

sensor for measurement. Vatsal et al. (2017) stated that DHT22 temperature sensor used Pin1 which is Vcc and Pin 2 to collects data and send the data to the Raspberry Pi.


Figure 2.1: The Raspberry Pi 2 Model B

This system used Raspberry Pi 2 model B as microcontroller and runs with the Python programming language. The Raspberry Pi 2 diagram is shown in figure above. Raspberry pi 2 have a quad-core Cortex A7 processor CPU running at 900 MHz and RAM of 1GB. Furthermore, it also has 40 GPIO pins, HDMI video output, 2 USB ports, Ethernet port, 3.5mm audio jack, Video Camera Interface (CSI), the Display Interface (DSI), and Micro SD card slot. The Raspberry Pi has ability to interact with the outside world and has been used in a wide array projects like temperature monitoring system.

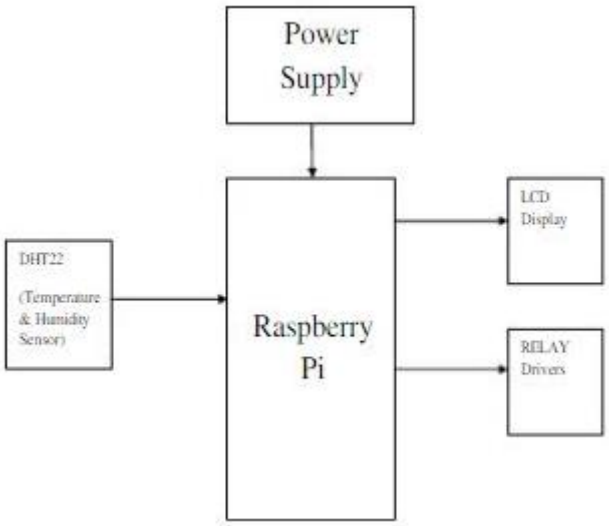


Figure 2.2: The Flow of Circuit

Figure 2.2 above visualize the flow of the system. The DHT22 temperature and humidity sensor is connected by jumper wire to Raspberry Pi kit. The Raspberry Pi kit used to store and display the temperature relative humidity in real time. Besides, the Raspberry Pi programmed using Python language. After the Raspberry Pi capture the data, the temperature will displayed in degree Celsius or Fahrenheit as required on LCD. Furthermore, the user can login on the web browser by entering username and password of the user to know the current temperature and relative humidity. On the cloud server, the data processed by Raspberry Pi will be continuously updated and the user will know the data stored on an hourly and daily basis. Wireless Wi-Fi (mini USB adapter) is connected so that the user can connect and monitor temperature and humidity from anywhere in the world with the help of the internet.

### 2.2.2 Arduino Based Wireless System for Temperature and Humidity Monitoring

Arduino Based Wireless System for Temperature and Humidity Monitoring was proposed by Manghnani, Rajitha and Priyanka from Sphoorthy Engineering College, India. This system is kind of environmental conditions monitoring project which consumes low power, low cost, works in real time and at remote places. Manghnani et al. (2017) stated that

the system will operate with the core of the system control module ATMEGA328 microcontroller based on the Arduino Uno platform which high-performance single chip microcomputer with a wide voltage, low power consumption, high integration, anti-interference and strong portability characteristics. Besides, the DHT11 temperature and humidity sensor is used to collect the data ambient temperature and humidity and the results of communication are displayed on LCD12864. The processed data will transmitted through nRF24L01 wireless transceiver module.

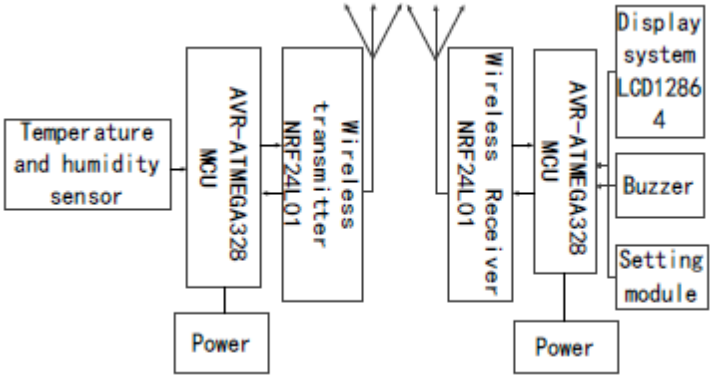


Figure 2.3: Block Diagram of Arduino Based Wireless System

Figure 2.3 shows the overall block diagram of the system. The system is divided into two main parts which are data acquisition and control system. The data acquisition system consists of ATMEGA328 based on Arduino platform, DHT11 temperature and humidity sensor and wireless transceiver module nRF24L01. Control system is through single chip microcomputer ATMEGA328 which controls the wireless transceiver module nRF24L01 and then displays the received data on LCD12864 in real time. In addition, the control part also provides the flexibility of setting the upper and lower limits of temperature and humidity data at any time. The received data will be checked for the upper and lower limits, if the values obtained are not within the original data scope, the buzzer will make a sound to the people to take appropriate action. The nRF24L01 requires a +3.3V for power requirement and the power