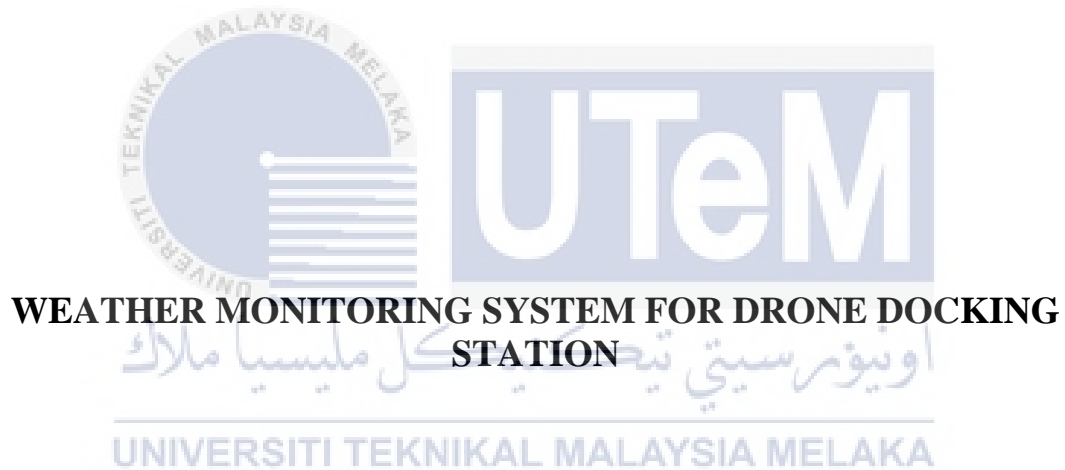




Faculty of Electrical and Electronic Engineering Technology



MUHAMAD LUTFIASHRAF BIN BAHARUDIN

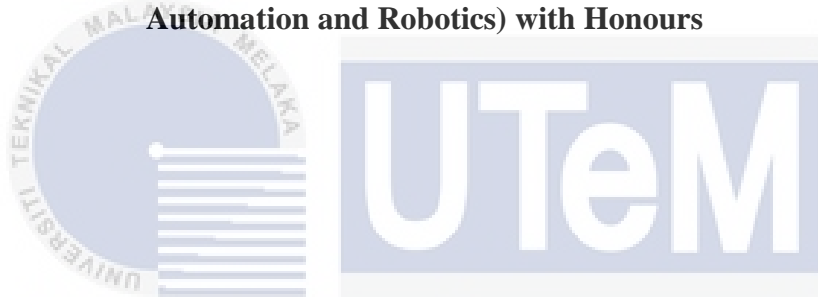
**Bachelor of Electronics Engineering Technology (Industrial Automation and Robotics)
with Honours**

2021

WEATHER MONITORING SYSTEM FOR DRONE DOCKING STATION

MUHAMAD LUTFIASHRAF BIN BAHARUDIN

**A project report submitted
in partial fulfillment of the requirements for the degree of
Bachelor of Electronics Engineering Technology (Industrial
Automation and Robotics) with Honours**



Faculty of Electrical and Electronic Engineering Technology

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2021

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : Weather Monitoring System For Drone Docking

Sesi Pengajian : 2021/2022

Saya Muhamad Lutfiashraf Bin Baharudin mengaku membenarkan laporan Projek Sarjana Muda ini disimpan di Perpustakaan dengan syarat-syarat kegunaan seperti berikut:

1. Laporan adalah hakmilik Universiti Teknikal Malaysia Melaka.
2. Perpustakaan dibenarkan membuat salinan untuk tujuan pengajian sahaja.
3. Perpustakaan dibenarkan membuat salinan laporan ini sebagai bahan pertukaran antara institusi pengajian tinggi.
4. Sila tandakan (✓):

SULIT*

(Mengandungi maklumat yang berdarjah keselamatan atau kepentingan Malaysia seperti yang termaktub di dalam AKTA RAHSIA RASMI 1972)

TERHAD*

(Mengandungi maklumat terhadap yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)

TIDAK TERHAD

Disahkan oleh:



(TANDATANGAN PENULIS)

Alamat Tetap: BG-02, Pangsapuri Cemara,
Jalan Seksyen 3/1,
Kajang Utama,
43000 Kajang, Selangor



(COP DAN TANDATANGAN PENYELIA)

AMINURRASHID BIN NOORDIN

Pensyarah Kanan
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik Dan Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 2 January 2022

Tarikh: 11/01/2022

DECLARATION

I declare that this project report entitled “Weather Monitoring System For Drone Docking Station” 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.

Signature

:



Student Name

:

Muhamad Lutfiashraf Bin Baharudin

Date

:

2 January 2022



اونيورسيتي تيكنيكل مليسيا ملاك
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

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 Electronics Engineering Technology (Industrial Automation and Robotics) with Honours.

Signature :



Supervisor Name :

AMINURRASHID BIN NOORDIN

Date :

11/01/2022

Signature :



Co-Supervisor :

Name (if any)

Date :

DEDICATION

This thesis is specially dedicated to:

My beloved father and late mother,

Baharudin bin Mohammad, Mislina binti Baharin,

My supervisor,

TS. Aminurrashid bin Noordin, And all my friends,

Thank you for their encouragement and unconditionally support.



ABSTRACT

The key goals of Weather Monitoring System for Drone Docking Station was to assist drone pilots in accessing and obtaining weather data. The weather monitoring technology allows the drone to dock anywhere in real time. Drones have both autopilot and manual flight modes. In comparison to manual drones, autoflight allows drones to fly and dock autonomously. However, in order to focus on weather monitoring, this project only used manual piloting. To study the weather and climate, atmospheric conditions like wind, rain, humidity and temperature are measured using weather station facility. The information provided can be used to predict weather forecast for the drone to dock safely. Without a weather station, users can't be alerted of the strong winds, heavy rain, heat waves, or any other weather-related emergency. As a result, the drone suffers damage, perhaps costing additional money to repair. Different sensors are used as a device to collect data related to the weather and environment for the weather station. To overcome the problems faced, there are techniques that can be implemented to assist this project. Internet of Things with sensors will be used to build a weather station for the project. The weather station can help provide data for forecasts in order to use drone. The user can view the history of information as well once a weather station is connected. Command prompt is used to connect the IP address with the system. The Ip will receive and react to the ping and command to enter the raspberry pi. Finally, the result will show at command prompt and at the IoT program.

ABSTRAK

Matlamat utama Sistem Pemantauan Cuaca untuk Stesen Pelabuhan Dron adalah untuk membantu pengendali dron mengumpul dan mendapatkan data cuaca. Teknologi pemantauan cuaca membolehkan dron mendarat di mana-mana. Dron mempunyai dua mod penerbangan autopilot dan manual. Autoflight Dron membolehkan dron terbang dan mendarat sendiri secara autonomi berbanding manual dron. Projek ini hanya menggunakan panduan arah secara manual supaya dapat mengkaji cuaca dan iklim, keadaan atmosfera seperti angin, hujan, kelembapan dan suhu diukur menggunakan kemudahan stesen cuaca. Maklumat yang diberikan boleh digunakan untuk meramalkan ramalan cuaca untuk dron berlabuh dengan selamat. Tanpa stesen cuaca, pengguna tidak boleh dimaklumkan tentang angin kencang, hujan lebat, gelombang panas atau sebarang kecemasan berkaitan cuaca yang lain. Akibatnya, dron mungkin mengalami kerosakan dan memerlukan wang tambahan untuk dibaiki. Penderia yang berbeza digunakan sebagai peranti untuk mengumpul data yang berkaitan dengan cuaca dan persekitaran untuk stesen cuaca. Bagi mengatasi masalah yang dihadapi, terdapat teknik yang boleh dilaksanakan untuk membantu projek ini. Internet Pelbagai Benda dengan penderia akan digunakan untuk membina stesen cuaca untuk projek itu. Stesen cuaca boleh membantu menyediakan data untuk ramalan untuk menggunakan dron. Pengguna boleh melihat sejarah maklumat sebaik sahaja stesen cuaca disambungkan. Command prompt digunakan untuk menyambungkan alamat IP dengan sistem. Ip akan menerima dan bertindak balas kepada ping dan arahan untuk memasuki raspberry pi. Akhirnya, hasilnya akan ditunjukkan pada command prompt dan pada program IoT.

ACKNOWLEDGEMENTS

Assalamualaikum Warahmatullah Wabarakatuh.

First and foremost, I thank to Allah the Almighty for blessing me to finish my Bachelor Degree Project 1. With my sincere gratitude I would like to say thank to TS Aminurrashid bin Noordin for giving me his consolation, direction, backing and inspiration all through this entire venture. Under his watch, I obtained a great deal of significant information and proposal just as certainty to finish this undertaking. Despite he is occupied with his activity and obligations, he despite everything figured out how to direct me along to accomplish this undertaking. In this way, here I am to demonstrate my gratefulness to him for showing me calmly and I am thankful to have him as my supervisor.

In addition, I might want to thank to my kindred companions who consistently prepared to help me when I required. What more, my gratefulness to them for has helped me and offer a great deal of smart thoughts that help to achieve my venture.

At long last yet significantly, my most profound appreciation goes to my father and late mother Baharudin bin Mohammad and Mislina binti Baharin for supporting me intellectually and monetarily all through the whole examinations in UTeM. Their unending help has reached out to me all through this certificate study and my life when all is said in done.

TABLE OF CONTENTS

	PAGE
DECLARATION	
APPROVAL	
DEDICATIONS	
ABSTRACT	i
ABSTRAK	ii
ACKNOWLEDGEMENTS	iii
TABLE OF CONTENTS	i
LIST OF TABLES	iii
LIST OF FIGURES	iv
LIST OF SYMBOLS	vi
LIST OF ABBREVIATIONS	vii
LIST OF APPENDICES	viii
CHAPTER 1 INTRODUCTION	1
1.1 Background	1
1.2 Problem Statement	3
1.3 Project Objective	4
1.4 Scope of Project	5
CHAPTER 2 LITERATURE REVIEW	6
2.1 Introduction	6
2.2 Weather Monitoring Station	6
2.3 IoT (Internet of Things)	7
2.4 Weather Monitoring System Using IOT	9
2.5 Comparison between each development	10
2.6 Summary	13
CHAPTER 3 METHODOLOGY	14
3.1 Introduction	14
3.2 First Milestone	15
3.3 Second Milestone	16
3.3.1 Design and Construction of IoT weather monitoring system	16
3.3.2 Design of base for weather monitoring drone docking station	17
3.4 Third Milestone	19
3.4.1 Raspberry Pi 3 Model B+	19
3.4.2 DHT11 Sensor	24

3.4.3	Raindrop Sensor FC-37 Module	25
3.4.4	Wind Speed Anemometer NPN Output	26
3.4.5	Digital Infrared Sensor	27
3.4.6	HD Webcam	28
3.4.7	IoT Apps Thinger.io	29
3.5	Fourth Milestone	30
3.5.1	Analysis and testing of the IoT monitoring weather station	30
CHAPTER 4	RESULTS AND DISCUSSIONS	31
4.1	Introduction	31
4.1.1	Streaming Raspberry PI 3B+ with all weather data to Command Prompt	31
4.1.2	Streaming Raspberry PI 3B+ with DHT11 sensor to Thinger.io	32
4.1.3	Streaming Raspberry PI 3B+ with Wind Speed sensor to Thinger.io	34
4.1.4	Streaming Raspberry PI 3B+ with Raindrop and Digital IR sensor to Thinger.io	36
4.1.5	Streaming Raspberry PI 3B+ with HD Webcam to Web Browser	37
4.2	Summary	38
CHAPTER 5	CONCLUSION AND RECOMMENDATIONS	41
5.1	Conclusion	41
5.2	Future Works	42
5.3	Project Potential	42
REFERENCES		44
APPENDICES		46



LIST OF TABLES

TABLE	TITLE	PAGE
Table 2.1	Comparison is based on IoT weather monitoring system	10
Table 3.1	Advantages and disadvantages of microcontrollers	21
Table 3.2	Advantages Raspberry PI over Arduino	22



LIST OF FIGURES

FIGURE	TITLE	PAGE
Figure 1.1	System design of weather monitoring system for drone docking station	2
Figure 1.2	General ideas for the electronics components used in this project	3
Figure 2.1	The various function of Internet of Things	8
Figure 3.1	Flowchart of methodology	14
Figure 3.2	Flowchart of literature review	15
Figure 3.3	Fritzing Raspberry PI Weather Station	17
Figure 3.4	AutoCAD of Weather Monitoring Drone Docking Station	18
Figure 3.5	Raspberry Pi 3 Model B+ with pinout	20
Figure 3.6	DHT11 Temperature and Humidity Sensor with sensor pinout	24
Figure 3.7	Raindrop Sensor FC-37 Module with sensor pinout	25
Figure 3.8	Wind Speed Anemometer NPN Output	26
Figure 3.9	Digital Infrared Sensor	27
Figure 3.10	HD Webcam	28
Figure 3.11	Thingier.io application for IoT	29
Figure 3.12	Algorithm of testing	30
Figure 4.1	Weather data in Command Prompt	32
Figure 4.2	Sunny temperature and humidity data in Thingier.io	33
Figure 4.3	Rainy temperature and humidity data in Thingier.io	33
Figure 4.4	Cloudy temperature and humidity data in Thingier.io	34
Figure 4.5	Windy temperature and humidity data in Thingier.io	34
Figure 4.6	Wind speed data from sunny weather in Thingier.io	35
Figure 4.7	Wind speed data from rainy weather in Thingier.io	35

Figure 4.8	Wind speed data from cloudy weather in Thinger.io	35
Figure 4.9	Wind speed data from windy weather in Thinger.io	36
Figure 4.10	Raindrop and drone not detected data in Thinger.io	36
Figure 4.11	Raindrop and drone detected data in Thinger.io	37
Figure 4.12	HD Webcam show the box that display at live streaming video	38
Figure 4.13	Full data of weather station in Thinger.io IoT	39
Figure 4.14	Weather Monitoring Drone Docking Station	40



LIST OF SYMBOLS

°C	-	Celcius
%	-	Percent sign
V	-	Voltage
cm	-	Centimetre
in	-	Inches
g	-	Gram



LIST OF ABBREVIATIONS

IoT	-	Internet Of Things
GUI	-	Graphic User Interface
VCC	-	Voltage Common Collector
GND	-	Ground
LED	-	Light Emitting Diode
ADC	-	Analog-to-Digital Converter
NPN	-	Negative Positive Negative
DC	-	Direct Current
IR	-	Infrared
VDC	-	Volts of Direct Current
PWM	-	Pulse-Width Modulation
WI-FI	-	Wireless Fidelity
LCD	-	Liquid Crystal Display



LIST OF APPENDICES

APPENDIX	TITLE	PAGE
Appendix A	Codding of Weather Monitoring System Drone Docking Station	46
Appendix B	Codding of HD Webcam	49
Appendix C	Gantt Chart	53



CHAPTER 1

INTRODUCTION

1.1 Background

Weather is one of the important factors for human to decide activities they can do for the day. For example, in sunny weather most of people love to do outdoor activities such as sunbathe, playing in garden or even hang their clothes due hot temperature outside their house. Meanwhile if rainy days, people tend to stay inside and play indoor activities with their family and friends. Weather or climate changing are not easy or accurately can be determine by people themselves. Thanks to technological improvements, weather may now be projected and monitored on a regular basis using modern techniques. Data collected over time can be utilised to improve the accuracy of weather information.

Drones are divided into two types: manual flight, which is controlled by humans, and autonomous flight, which can fly autonomously without the intervention of humans. In today's society, using a drone has several advantages. Drones can collect data in regions that people find difficult or inaccessible. It also takes more exact measurements and collects more accurate data than humans. However, it has limitations, particularly in terms of weather. Drones can only fly and collect data in clear, sunny conditions. If the drone is flown in an area with bad weather, the electronic components will be damaged and connection between the drone and the controller will be disrupted.

Weather monitoring for drone docking station is a real-time weather monitoring system that can be accessed via IoT to determine the weather conditions for docking drones. A timetable high-way traffic monitoring can be implemented in the future by deploying autonomous pilot. It's crucial to have a pleasant weather while releasing the drone from the docking station. That is why, with the assistance of technology and IoT, weather station monitoring in docking systems may be accomplished.

Therefore, this project focuses on designing a weather monitoring system for a drone docking station. This task just shows the weather parameters such as wind, rain, humidity and temperature for drone docking system by utilizing an appropriate and moderate microcontroller and sensors. This project likewise will present or show the preparing of the weather monitoring system that may show ongoing activity of the process through. Figure 1.1 shows the idea of drone docking station with weather monitoring system. Subsequently, a source coding will be Python and make to understand the process from the sensors and display the parameters. A test will be lead for ongoing activity and do revision or improvement of the system both coding and equipment.

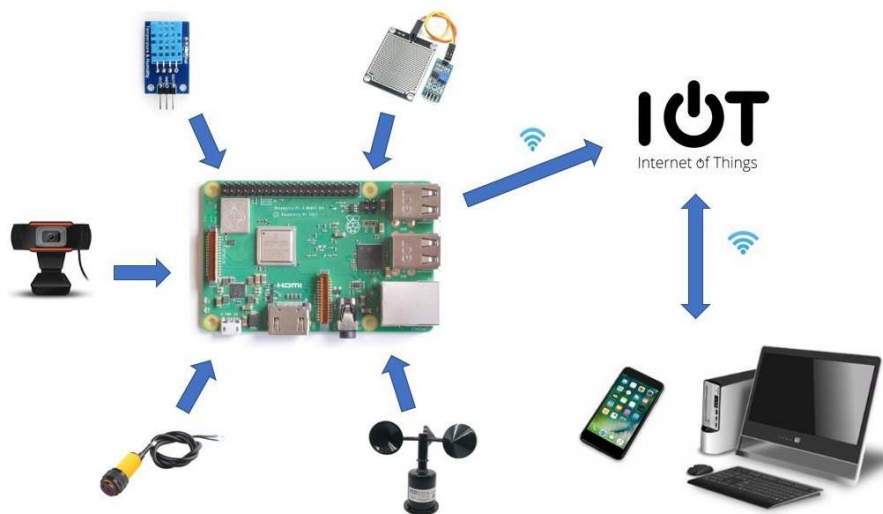


Figure 1.1: System design of weather monitoring system for drone docking station

1.2 Problem Statement

Drone nowadays been used for a autonomous mission such as highway traffic monitoring by a software such as autopilot, mission planner, drone harmony and others. However, for such mission the pilot needs to know the weather information at drone docking before launched or taking-off. For instances when there is strong wind, heavy rain, thunderstorm, hurricane or flash flood drone will not be released for flight. Else, the drone will be damaged, and the cost of maintenance to fix the damage will be significant. As a result, the project's goal is to develop a real-time weather monitoring system for drone docking station so that drone safety may be ensured before a mission starts. Hence weather information such as temperature, rain, wind speed and humidity are being monitored by sensors and IoT techology is utilized to gather all information including security using camera for the drone docking station. Figure 1.2 show general ideas for the electronics components used in this project.

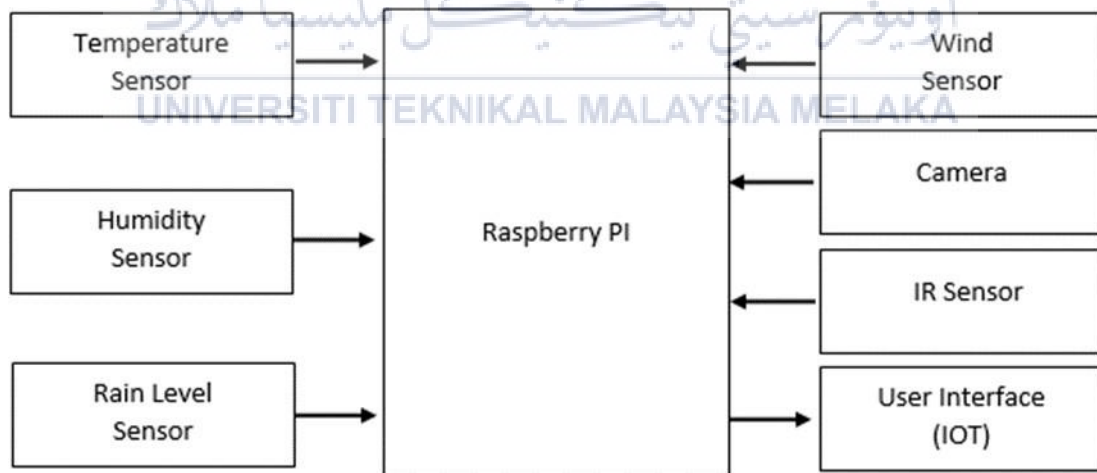


Figure 1.2: General ideas for the electronics components used in this project

Therefore, based on the above statement the IoT weather monitoring system needed to be developed with the suitable and affordable sensors and software that capable to execute weather monitoring from anywhere. All the consideration while develop this project will lead advantages to the weather monitoring capability. The enhancement and quality for the weather monitoring will ensure the system will gives the best accomplishment for weather station.

1.3 Project Objective

The following are the project's objectives:

- a) To design weather monitoring system for drone docking station.
- b) To develop a remotely monitored system using internet of thing (IoT) and display via web browser.
- c) To analyze the performance of a weather monitoring system that display diverse weather informations such as wind, rain, humidity and temperature and security for the drone docking station.

1.4 Scope of Project

A few guidelines are proposed, by narrowing the needs for this project, to ensure that this project will achieve its objectives. The scopes covered are:

- a) Raspberry PI is used as the main controller in this project.
- b) The monitoring system consist of sensor such as wind, rain, humidity and temperature to monitoring the weather information at docking station.
- c) A surveillance camera is installed to monitor drone docking station for security purposes.
- d) This project used thinger.io as the IoT platform.
- e) A graphic user interface (GUI) is designed for web-based application to monitor real time weather information system via smartphones and PC.
- f) The entire test of the project will be made based on temperature and humidity of the environment, the presence of raindrops, wind speed, and system reliability performance.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

The aim of weather monitoring system is to assist drone to dock better under weather changes. The controller system is required for it to control the sensor, python coding and etc. to develop the weather monitoring system. This project will use the interface by using the camera vision and Raspberry Pi controller for the measurement of variable sensor parameter thus the research will comprise these criteria so as to satisfy the objectives.

2.2 Weather Monitoring Station

Nowadays, weather monitoring system have advanced using recent technology to predict climate change. To do a weather monitoring system, a model of weather station must be built for gathering data from the sensor. Based on Mahmood et al., 2020, weather station is a tool to calculate weather variables to predict weather condition and analyze data. Alam et al., 2020 also describe in their journal that weather station gives information and forecast the weather conditions by analyzing the data using few methods.

This indicate that weather station compiles all the data from different sensor and do forecasting for weather based on the data. Weather station also store data that been compiled for the future prediction. It also used for monitoring and controlling of the weather conditions using the microcontroller (Mahmood *et al.*, 2020). From this, it shown that weather station important component that for monitoring, data gathering and forecasting weather for future use.

Weather station collect different types of weather information such temperature, wind, humidity, air and etc. to determine climate changes of the weather. This can be proving in Singh et al., 2020 journal where they said weather stations capable of collecting weather related information such as temperature, humidity, air pressure, wind speed, wind direction, visibility, particle levels and air etc.

In another studies (Math and Dharwadkar, 2019), weather station is developed to monitor three basic parameters such as rain, temperature and humidity to make it low cost-effective. From the statement we can see that parameter or data that been gather for weather station is climate related and depend on the cost project. If the cost project is high, more data can be collected, more parameter is need. Thus, this will make prediction much more accurate.

2.3 IoT (Internet of Things)

According to (Bhagat, Thakare and Choudhary, 2019), IoT connect various type of device to complete machine to machine interaction. In other words, IoT concept is connecting device to the Internet. This advances the intelligent level of devices when using Internet as the connector between two worlds without interaction of human. To connect the devices, sensor or actuator is needed. Tiwari et al., 2020 said, applications based on Internet of Things such as transducers and sensors attached to the microcontroller transform raw data to an important information that can be used anywhere. This sensor connected to IoT to get the raw data that needed in order to exchanges the information for future used. IoT connect and collect data from different devices (sensor) to distributed in many ways. This shows that different devices or sensor have different used, IoT get the data from sensor and upload in to Internet for the next process.