



**FACULTY OF ELECTRICAL AND ELECTRONIC
ENGINEERING TECHNOLOGY**



**DEVELOPMENT OF SMART WEATHER MONITORING SYSTEM
USING IOT**

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**Bachelor of Computer Engineering Technology in
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DEVELOPMENT OF SMART WEATHER MONITORING SYSTEM USING IOT

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A project report submitted
in partial fulfilment of the requirements for the degree of
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I declare that this project report entitled “Development of Smart Home: Fire Safety System Using IoT” 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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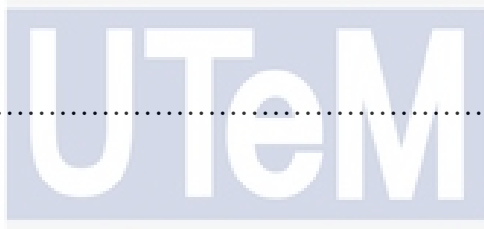
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ABSTRACT

In this moment, weather is something that we cannot predict. Meteorologists' weather forecasts are dependent on data, which might be inaccurate at times. There are also hard to find a cheap, portable and easy to use weather monitoring system that allowed the user to monitor the weather at their home, office and remote area. The weather detection project was created to address this issue by allowing users to see the current weather conditions in their home. Because it will be immediately connected to the database that will hold the data for the user, this project will notify the user via their smartphones. The objectives of this project are to design a weather monitoring system using analog sensor, microcontroller, to develop a database system to store and monitor the collected data and to validate the developed project prototype for weather monitoring. This system is using ESP8266 as the main component, Light Dependent Resistor (LDR), DHT 22, Rain sensor and Ultraviolet level sensor as their sensors. This system is link to the website that display the real-time data and a database to store all the data. The benefits of this system are users can be more aware about the present weather with this system, and in some situations, users can analyse weather patterns based on data collected through the system. Overall, this project is designed to assist the general public, particularly meteorologists, in being more aware of current weather conditions and for research purposes.

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ABSTRAK

Pada masa ini, cuaca adalah sesuatu yang tidak dapat kita jangkakan. Ramalan cuaca pakar meteorologi bergantung pada data, yang mungkin tidak tepat pada masa-masa tertentu. Terdapat juga sukar untuk mencari sistem pemantauan cuaca yang murah, mudah alih dan mudah digunakan yang membolehkan pengguna memantau cuaca di rumah, pejabat dan kawasan terpencil mereka. Projek pengesanan cuaca telah dibuat untuk menangani isu ini dengan membenarkan pengguna melihat keadaan cuaca semasa di rumah mereka. Kerana ia akan segera disambungkan ke pangkalan data yang akan menyimpan data untuk pengguna, projek ini akan memberitahu pengguna melalui telefon pintar mereka. Objektif projek ini adalah untuk mereka bentuk sistem pemantauan cuaca menggunakan sensor analog, mikropengawal, untuk membangunkan sistem pangkalan data untuk menyimpan dan memantau data yang dikumpul dan untuk mengesahkan prototaip projek yang dibangunkan untuk pemantauan cuaca. Sistem ini menggunakan ESP8266 sebagai komponen utama, Perintang Peka Cahaya, DHT 22, Sensor Hujan dan Sensor Tahap Keamatan Ultraviolet sebagai sensornya. Sistem ini adalah pautan ke laman web yang memaparkan data masa nyata dan pangkalan data untuk menyimpan semua data. Faedah sistem ini ialah pengguna boleh lebih mengetahui tentang cuaca semasa dengan sistem ini, dan dalam beberapa situasi, pengguna boleh menganalisis corak cuaca berdasarkan data yang dikumpul melalui sistem. Secara keseluruhannya, projek ini direka bentuk untuk membantu orang awam, khususnya ahli meteorologi, supaya lebih mengetahui keadaan cuaca semasa dan untuk tujuan penyelidikan.

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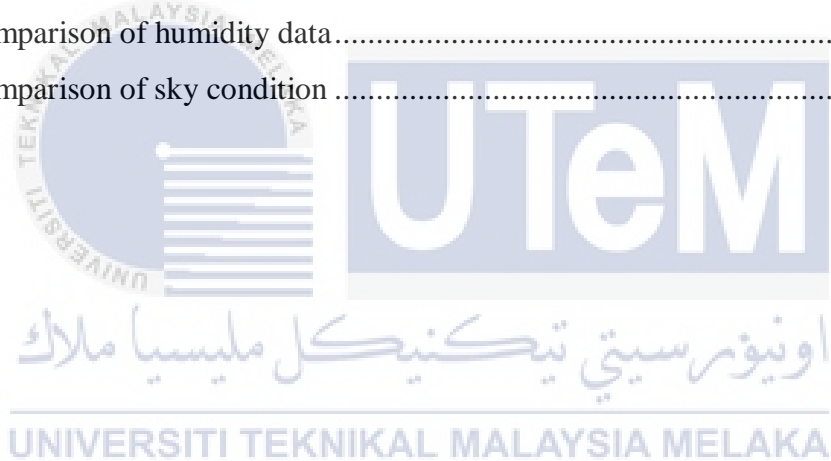
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CHAPTER 1

1.0 INTRODUCTION

1.1 Introduction

The background of the project, problem statement, objectives, scope of the project and the project outline will be discussed in this chapter.

1.2 Research Background

Weather is defined as the state of the atmosphere on a given day and refers to quick variations in heat, moisture, and air movement [1]. Weather is the result of processes attempting to balance differences in the distribution of net solar radiant energy. In other words, weather is the weather conditions at any given time [2]. The weather is typically described as fine, fair, foggy, cloudy, wet, sunny, or windy. Because of the state's proximity to the equator, Malaysia has only three types of weather: sunny, cloudy, and rainy [3]. However, the weather in Malaysia can be harsh at times, for example, the weather can be extremely hot, and there will normally be a flood around the east coast of the peninsular Malaysia at the end of the year.

But, weather is something that we cannot predict. Meteorologists' weather forecasts are dependent on data, which might be inaccurate at times. Based on the recent floods that occurred in the Klang Valley, the weather is extremely unpredictable. Thousands of families have lost their valuable possessions as a result of the flood, which pushed them to save themselves before their possessions [4]. Because the incident occurred during business hours, most of them were not at home and did not have time to save anything valuable from their home.

The weather detection project was created to address this issue by allowing users to see the current weather conditions in their home. Because it will be immediately connected to the database that will hold the data for the user, this project will notify the user via their smartphones. If the rain is severe and continues for an extended period of time, there is a high risk of flash flooding and the user can take urgent action by rushing home to save their family and valuables before anything horrible happens. Furthermore, this project also can be used to monitored the weather condition of a state.

1.3 Problems statement

This Weather Detector is a project build to show and alert people for the condition of their climate changes in their area whether their house nor office. Lately, the climate change was very extreme nowadays. It is undeniable that there has been a lot of rain in our country. As the result was there were big flood occurred [4]. As the water level rises, it floods the normally dry areas around it. There is a lot of interest in hydrology when it comes to studying floods. Thunderstorms are the most frequently occurring and widespread natural severe weather event. One inch of water can create several feet of damage; therefore, floods can take on many different forms [5]. In December 2021, an intense tropical recession hit the eastern coast of Peninsular Malaysia, bringing three days of heavy rain to the region. At least 54 people have been killed and two are still missing as a result of the devastating floods that have hit eight states across the country. There were thousands of people affected by the shocking climate change. Most of their shelter was destroy and broken by the floods [6].

Serious action needs to be taken to make sure all people to be alert of the climate change on their surrounding so that they can prepare themselves from the worst case. So, this project is suitable to all the people in Malaysia because of its features that easy to use and affordable in terms of price. Furthermore, more people will now be alert when the rains come to avoid any damage as early as possible. Following that, this study will look into the shortage of a low-cost, portable monitoring device. A portable, low-cost weather monitoring system that can be swiftly set up at a remote place is tough to come by. We require a portable, low-cost, and simple-to-use monitoring device in some circumstances where we need to collect weather data from a remote location.

1.4 Project Objectives

To complete this project, numerous objectives must be met in terms of determining the project's success. The main objective of this project is designing a weather detector device that directly connect to the database and the user smartphone:

- a) To design a weather monitoring system using analog sensors and microcontroller.
- b) To develop a database system that stores and monitoring the collected data.
- c) To validate the developed project prototype for weather monitoring.

1.5 Scope of Research

This project focuses on new product technology in accordance with current requirements. Additionally, this project is followed by designing a weather detector that link with the database and user smartphones. Therefore, this project follows the scope of the study below:

- I. Design a weather detector system that contain a number of sensors.
- II. Type of sensor that have been used in this system is Light Dependent Resistor (LDR) that will detect the light to determine whether the weather is sunny or cloudy.
- III. Secondly, rain sensor is used to determine the absent of rain.
- IV. Thirdly, humidity sensor is used to calculate the humidity level and temperature.
- V. All the input from the sensors will be shown in Liquid Crystal Display (LCD).
- VI. All the input from the sensors will be stored in database and send to the user's smartphone notification at the same time.

1.6 Project Outline

The project's introduction is the most significant component of Chapter 1, which we must go through in detail. This chapter also includes details on the project's beginnings, goals, problem statement, scope of work, and explanation.

Following that, Chapter 2 describes and compares an existent product to the one presented in Chapter 1. The benefits of this project, as well as the flaws of the current product, will be discussed in Chapter 2. After that, some different simulation approaches employed by various analysers will be reviewed in this section.

In Chapter 3, the project technique will be discussed. The intricacies of component selection and project functionality, as well as how the interface will be conducted, will be exposed in this chapter. This chapter will also cover the installation of the project's flow chart and block diagram.

Chapter 4 will go through the product prototype, as well as the expected outcome and analysis. The method for guaranteeing that this project is completely operational will be examined, though.



CHAPTER 2

2.0 LITERATURE REVIEW

2.1 Introduction

This chapter discusses the significant points and information that have been discovered by various studies and research from prior studies. Therefore, the discussion begins with the study of smart weather monitoring with connection to database concepts. It is critical to conduct research on these themes because they are the project's key objectives. Furthermore, because this project uses the Internet of Things (IoT), it is critical to understand the technology's fundamentals in order to have a comprehensive understanding of the scope. In conclusion, this chapter concludes with a comparison of prior relevant projects and the type of implementation that will be appropriate for this project.

2.2 Concept of Smart Weather Monitoring

In general, smart refers to technology that is sensor-based, data-driven and more programmable [7]. Weather monitoring is a method where meteorologist have been used for the since the 19th centuries [8]. Smart weather monitoring benefits in multiple ways by using the same method that has been improved with novel technology, such as providing live weather updates, an easy to access database, and various types of weather information [9]. Furthermore, it will also a useful device to install at home or office to monitoring the weather that sometimes cannot be predicted. It is important to know the live weather so that we can know and prepare for every possibility. It is much simpler if we create a simple system that easy to install and easy to use. Based on that, this technology has done many changes in weather monitoring sector such as:

1. Real-time monitoring system
2. Data from sensor will store in database
3. Data from sensor will be transfer to user smartphones

Smart weather monitoring concept consists of various type of sensors that are able to monitor the detail of the weather in real-time. With that, the sensors will perform their part to detect the input and to take part in the control system that will be aid to monitor the weather.

2.3 Concept of Internet of Things (IoT)

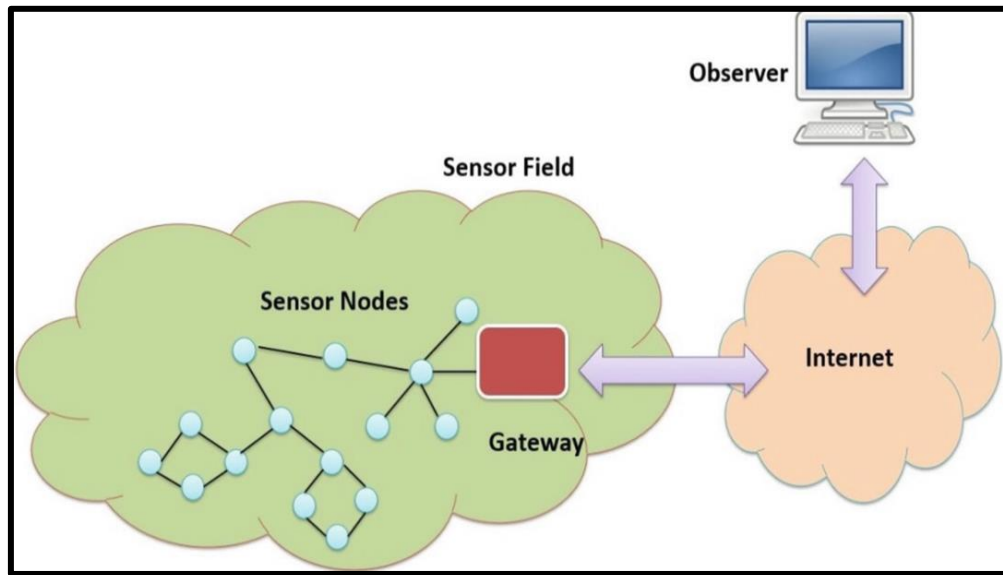


Figure 2. 1: Concept Internet of Things (IoT)

The Internet of Things (IoT) is a trying to cut process and cost-effective solution for linking the rest of the world of objects in a network and interacting with them via the internet [10]. It is a system that collects weather and environmental data using advanced electronic sensors and transmits it via the world wide web to a website for real-time weather monitoring and data handling for future research and analysis. The use of an IoT-based weather monitoring system is beneficial because it allows for real-time monitoring of weather conditions from any location. It is also excellent for data storage [11].

There are four separate components make up a comprehensive IoT system. The sensors or devices are the initial component. Sensors aid in the collection of extremely small data from the environment. The connectivity component comes next. The data is transported to a cloud or database, but it must be delivered across a network such as mobile, satellite, Wi-Fi, or Bluetooth. The IoT's next component is data processing [12]. The software performs data processing on the data that has been acquired. The user interface is the final component. The data is revealed available to the end user in some way. This can be done by setting alarm systems on their smartphone or sending notifications or emails to them.

2.4 Concept of Weather Monitoring

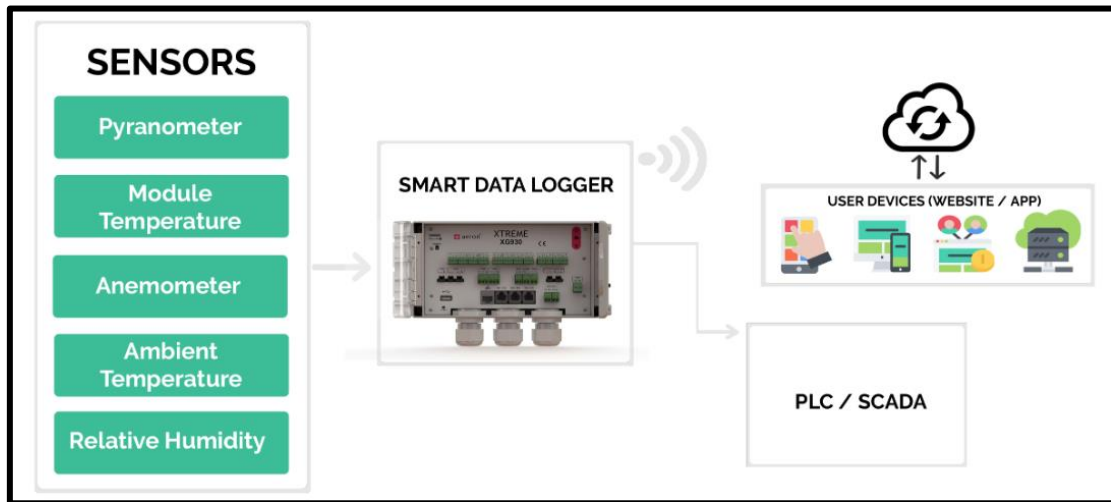


Figure 2. 2: Concept of Weather Monitoring

The periodic or continuous analysis or assessment of the conditions of the environment and climate, including factors such as temperature, moisture, wind velocity, and barometric pressure [13], is known as weather monitoring. Weather monitoring is important not only for documenting present situation, but also for perceiving climate change and giving information for models that can forecast future changes in our environment. It's also crucial for us to be aware of the current or forecasted weather so that we can prepare for any eventuality [14]. Like the most recent calamity in the Klang Valley, the majority of the victims are not at home and are not prepared to salvage anything. That is why, at times, we must be aware of the weather conditions.

Weather monitoring is also necessary for study and forecasting future weather based on patterns and behaviour. They can forecast the weather for future days and act to warn people about coming disasters based on the information received [15]. As a result, many people can plan for a disaster and protect their valued item from harm.

2.5 Previous Related Projects

The study of previous related projects that are largely focused on weather monitoring system via wirelessly is vital to have a good consideration of the project so that fundamental bits of knowledge is gathered to meet the objectives of this project. This IoT project comprises of smart weather monitoring system. As a result, this section will cover past projects that use a similar strategy and have a similar goal to fulfil the main goal of this project.

2.5.1 IoT based Data Logger System for Weather Monitoring Using Wireless Sensor Networks

Kondamudi Siva Sai Ram and A.N.P.S Gupta's [16] development is about weather monitoring using wireless technologies. To connect the sensor network to the internet, they used a Wi-Fi module as an information transmission interface controlled by the microcontroller. They used an ESP8266 Wi-Fi module with an integrated TCP/IP protocol stack. As a result, any microcontroller can use it to connect to a Wi-Fi network. The research and development of a system based on an IoT scenario is now complete. The system was tested indoors, and the weather patterns were successfully updated using sensor data. It is also a less expensive option due to the use of minimal wireless sensors and an integrated Wi-Fi module in the SoC.

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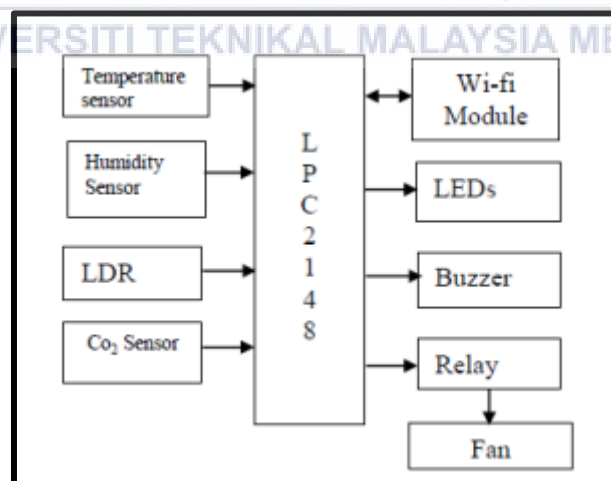


Figure 2. 3: Block Diagram of the Project [16]

2.5.2 Weather Monitoring Using Wireless Sensors Network Based on IoT

The authors of this project [17] are L.Chandana and A.Sekhar, and they indicated that the advantages of observing the weather conditions at a specific location and making the data visible anywhere in the world. The technology underlying this is known as the Internet of Things (IoT). The framework monitors and adjusts natural factors such as temperature, relative humidity, light intensity, and CO2 level using sensors, and then sends the data to a website page. The microcontroller is an LPC2148, and the Wi-Fi module is an ESP8266. The evaluation and development of systems for evaluating natural parameters necessitates expertise. In this project, a web page is also used to plot sensor data and convert it to graphical understanding.

2.5.3 IoT based Monitoring System

This project's authors are R Suresh Babu, T Palaniappan, K Anushya, M Kowsalya, and M Krishnadevi [18]. The project's goal is to control and monitor various activities remotely, then collect information to forecast the weather behaviour of a specific location. They want to formulate and construct an efficient monitoring system that can be controlled remotely via the internet, and the data collected from the sensors will be stored in the cloud for the research study to estimate trend on the web browser. For the hardware components they using ESP 8266 as the heart of the device and also provides the platform for IoT. All the sensors are connected to this microcontroller where they send the data to it and this microcontroller will upload it to the cloud where the values are analysed.

The sensors that have been used in this project are DHT11 sensor, soil moisture sensor and rain gauge sensor. They also used ThingSpeak to analyse the data in the clouds. The simulation result for this project show that all the data from the sensors have been automatically send to the web server and they use a graphical method to show the result on the web page. The weather monitoring system employing IoT developed as a result of this research provides a low-power and cost-effective alternative for weather monitoring.

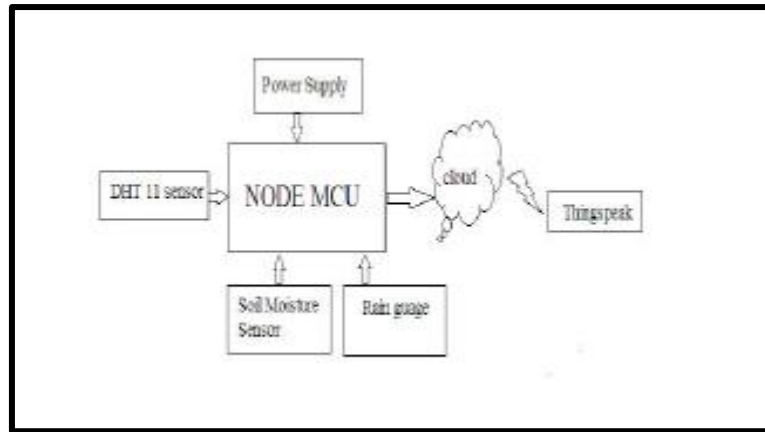


Figure 2. 4: System Architecture of the Project [18]

2.5.4 Smart Weather Monitoring and Real Time Alert System Using IoT

Yashaswi Rahut, Rimsha Afreen, and Divya Kamini [19] created a system to become the advanced solution for weather monitoring using IoT to make its real information easily accessible over a wide range. Temperature, moisture, wind velocity, humidity, light intensity, UV radiation, and even carbon monoxide status in the air can all be detected by the system. This system is small and compact, making it simple to install. This system hardware component consists of Arduino Uno, Node MCU, LDR (Light Dependent Resistor), CO2 sensor, DHT11, ML8511, Anemometer and Dark Sky.net. Dark Sky is an open source Internet of Things (IoT) application and API that interfaces with a Raspberry Pi and uses the HTTP protocol to retrieve the information from things over the Internet or a local area network. They are using an Android app which provide notifications on weather live updates and to act as a warning system for the software portion of this project.

The simulated outcome for this project is that all of the sensors are operational, and all of the sensed data is automatically transferred to the web server via a secure connection. They can also supervise and control the system by entering the IP address of the server being monitored on the web server page. The web page displays the weather conditions in the geographical area where the implanted monitoring system is installed. Finally, the project's result is that all of the data collected is displayed in a graphical representation to allow the viewer to easily identify weather patterns and behaviour. The conclusion for this project is that all the system is working well and the project is successful.