Faculty of Electrical and Electronic Engineering Technology

DEVELOPMENT OF IOT-BASED WEATHER MONITORING AND REPORTING SYSTEM USING NODEMCU

AINUL BALQIS BINTI HAIRUDDIN

Bachelor of Electrical Engineering Technology (Industrial Automation & Robotics) with Honours

2022

DEVELOPMENT OF IOT-BASED WEATHER MONITORING AND REPORTING SYSTEM USING NODEMCU

AINUL BALQIS BINTI HAIRUDDIN

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

Faculty of Electrical and Electronic Engineering Technology
UNIVERSITI TEKNIKAL MALAYSIA MELAKA

UNIVERSITI TEKNIKAL MALAYSIA MELAKA

2022

UNIVERSITI TEKNIKAL MALAYSIA MELAKA
FAKULTI TEKNOLOGI KEJUTERAAN ELEKTRIK DAN ELEKTRONIK

BORANG PENGESAHAN STATUS LAPORAN
PROJEK SARJANA MUDA II

Tajuk Projek : DEVELOPMENT OF IOT-BASED WEATHER MONITORING AND REPORTING SYSTEM USING NODEMCU

Sesi Pengajian : 2022/2023

Saya AINUL BALQIS BINTI HAIRUDDIN 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)
☐	(Mengandungi maklumat terhad yang telah ditentukan oleh organisasi/badan di mana penyelidikan dijalankan)
☑	**TIDAK TERHAD**

Disahkan oleh:

(TANDATANGAN PENULIS)
Alamat Tetap: No 26, Lorong Cakera Purnama 12/15, Seksyen 12, Bandar Puncak Alam, 42300, Kuala Selangor, Selangor.

MOHD RAZALI BIN MOHAMAD SAPIEE
Pensyarah
Jabatan Teknologi Kejuruteraan Elektrik
Fakulti Teknologi Kejuruteraan Elektrik Dan Elektronik
Universiti Teknikal Malaysia Melaka

Tarikh: 10 / 01 / 2023

Tarikh: 26/1/2023

*CATATAN: Jika laporan ini SULIT atau TERHAD, sila lampirkan surat daripada pihak berkuasa/organisasi berkenaan dengan menyatakan sekali tempoh laporan ini perlu dikelaskan sebagai SULIT atau TERHAD.

DECLARATION

I declare that this project report entitled “Project Title” 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 : AINUL BALQIS BINTI HAIRUDDIN

Date : 10th JANUARY 2022

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 Electrical Engineering Technology (Industrial Automation & Robotics) with Honours.

Signature : 

Supervisor Name : TS. MOHD RAZALI BIN MOHAMAD SAPIEE

Date : 26/1/2023

Signature :

Co-Supervisor :

Name (if any)

Date :

DEDICATION

I want to express my heartfelt thanks to my parents, Hairuddin Bin Mustafa and Rodziah Binti Mat Nayan, for their constant support and encouragement until I finished my final project. My father gives me a lot of support as I try to make my project a reality. He gave an idea of how to do it on time and stress-free. They also set up a welcoming space where I could get inspiration and ideas for completing my projects. Aside from that, I also want to mention my colleague Amni Najihah Binti Abd Aziz, who gave me a lot of advice on how to do my tasks effectively. In addition, I want to thank my supervisor, Ts. Mohd Razali Bin Mohamad Sapiee, for all the advice and support he gave me whenever I had questions concerning the project, regardless of the time.

ABSTRACT

This project aims to make it simple for individuals to obtain current weather data from any location. Weather predictions and real-time weather stations are different. The true purpose of current weather is to predict the weather for a particular location at a specific moment. The true purpose of a weather forecast is to predict the weather for a specific area at a particular time. On the other hand, a current-time weather station is a system that collects meteorological and environmental data using many sensors. On the other hand, a weather station is a device that monitors atmospheric characteristics such as temperature, humidity, and rain to offer data for weather study and discovery. Some believe that without weather stations, people won't be able to foresee and be notified about severe calamities like high winds, heat waves, heavy rain, tornadoes, lightning, and other weather-related occurrences that often occur in our country. As a result, these weather stations are necessary to gather current weather data and update predictions. These approaches might be employed to address the project's issues. This project, which will use sensors to construct weather stations, will use the Internet of Things. These weather stations may also supply data for forecasting purposes. Once this weather station is ready to be linked, users may monitor and review the history of information on previous and present weather.

ABSTRAK

Projek ini bertujuan untuk memudahkan individu mendapatkan data cuaca semasa dari mana-mana lokasi. Ramalan cuaca dan stesen cuaca masa nyata bukanlah perkara yang sama. Tujuan sebenar cuaca semasa adalah untuk meramal cuaca untuk lokasi tertentu pada masa tertentu. Tujuan sebenar ramalan cuaca adalah untuk meramal cuaca untuk kawasan tertentu pada masa tertentu. Stesen cuaca masa semasa, sebaliknya, ialah sistem yang mengumpul data meteorologi dan persekitaran menggunakan banyak penderia. Stesen cuaca, sebaliknya, ialah peranti yang memantau ciri-ciri atmosfera seperti suhu, kelembapan dan hujan untuk menawarkan data untuk kajian dan penemuan cuaca. Ada yang percaya bahawa tanpa stesen cuaca, orang ramai tidak akan dapat menjangka dan dimaklumkan tentang bencana yang teruk seperti angin kencang, gelombang panas, hujan lebat, puting beliung, kilat dan kejadian berkaitan cuaca lain yang sering berlaku di negara kita. Akibatnya, stesen cuaca ini diperlukan untuk mengumpulkan data cuaca semasa dan mengemas kini ramalan. Ini adalah beberapa pendekatan yang mungkin digunakan untuk menangani isu projek. Projek ini, yang akan menggunakan penderia untuk membina stesen cuaca, akan menggunakan *Internet of Things*. Stesen cuaca ini juga mungkin membekalkan data untuk tujuan ramalan. Setelah stesen cuaca ini sedia untuk dipautkan, pengguna boleh memantau dan menyemak sejarah maklumat tentang cuaca sebelumnya dan semasa.

ACKNOWLEDGEMENTS

First and foremost, I would like to express my gratitude to my supervisor, Ts. Mohd Razali Bin Mohamad Sapiee for their precious guidance, words of wisdom and patient throughout this project.

I am also indebted to Universiti Teknikal Malaysia Melaka (UTeM) and my parent for the financial support which enabled me to accomplish the project—not forgetting my colleague, Amni Najihah Binti Abd Aziz for the willingness to share his thoughts and ideas regarding the project.

My highest appreciation goes to my parents and family members for their love and prayer during my study. An honourable mention also goes to my father for all his motivation and understanding.

Finally, I would like to thank all the staff at the lectures, colleagues and classmates, the Faculty members, and other individuals not listed here for being cooperative and helpful.

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF APPENDICES

CHAPTER 1

INTRODUCTION

1.1 Background

Using a variety of sensors, a weather station collects data and makes it easy for the user to obtain information about the weather and the environment. The weather stations are also a facility that can be used to measure atmospheric conditions to provide data for weather forecasts, study weather and climate, and control environmental conditions dependent on forecast data. A weather station measures temperature, air pressure, humidity, wind speed, direction, and precipitation levels, among other things. Weather stations are also known as weather centres, personal weather stations, professional weather stations, home weather stations, and weather predictions [1].

1.2 Problem Statement

Weather conditions influence human activity, and weather monitoring may aid activity regulation. It's critical to monitor and assess the region's weather patterns. Users only have a few options for learning about the weather, such as temperature, humidity, and wind speed, all of which are essential factors to consider [1]. Without a weather station, the user will not be notified of the weather. Strong winds, heat waves, or any other type of weather disaster are all possibilities.

Furthermore, forecasting the weather requires data. When a user uses a weather station, they can see the data's history. The user may identify the trends in the measurements. As a result, the user can examine patterns more closely.

1.3 Project Objective

This project's primary purpose is to develop a systematic and practical mechanism for accurately monitoring and reporting weather across the whole distribution network system. The following are the specific objectives:

a) To create a real-time weather station that allows users to obtain data in real-time from anywhere.

b) To implement the Internet of Things on the weather station.

c) To evaluate the weather station's capabilities and efficacy, as well as to create data for the user.

1.4 Scope of Project

The scope is essential since it limits the extent of the project. As a consequence, the weather station collects weather data such as temperature, humidity, air pressure, rain drop and light via the Internet of Things.

a) It can view temperature, humidity, and air pressure, rain drop and light data in the user scope.

b) It will be based on the system scope. Temperature, humidity, and air pressure data are collected from the weather station.

c) The data was saved in real time and transferred to a local server.

d) Every 5 minutes, the data from the weather station will be transferred to the database.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

New technical applications have recently enabled us to analyze various air characteristics from a distance, allowing us to monitor air quality remotely [2]. As a result of the internet of things and the development of new gadgets, some applications have been developed. Monitoring systems need an application interface, which might be a web page, software, or a mobile app, to identify what data was received or operate the system.

For weather forecasting and monitoring, many weather stations still utilize analogue technology. They utilize several types of equipment to monitor changes in the weather, including thermometers for temperature, barometers for air pressure, wind vans, rain gauges for precipitation, and so on. The bulk of these devices is based on basic analogue technology. Their results are then carefully documented and stored. The information is then supplied to news stations, TV networks, and radio stations so they may report on the weather.

2.2 Previous Related Projects

Similar projects in the past focused on using Internet of Things technology, which helped me understand this latest project better. This information will help with carrying out the project and wrapping it up. Because of this, the next section will give some background on a similar project that tried to solve some of the problems with weather stations.

2.2.1 Internet of Things (IoT) Based Weather Monitoring System.

This project is proposed by Bulipe Srinivas Rao, Prof. Dr. K. Srinivasa Rao, and Mr. N. Ome [3]. A suitable implementation model has been identified; it comprises several sensor devices and other modules with their respective functionalities. For this particular implementation approach, we utilized as an embedded device, an Arduino UNO board with a Wi-Fi module is used to detect and save data in the cloud. An analogue-to-digital converter (ADC), a digital-to-analog converter (DAC), digital output pins (D0-D13), and a Wi-Fi module that links the embedded device to the internet are all included on the Arduino UNO board. Sensors are connected to an Arduino UNO board for monitoring purposes. The analogue-to-digital converter (ADC) will transform the sensor's analog reading into a digital value. The appropriate environmental parameters will be monitored based on that value.

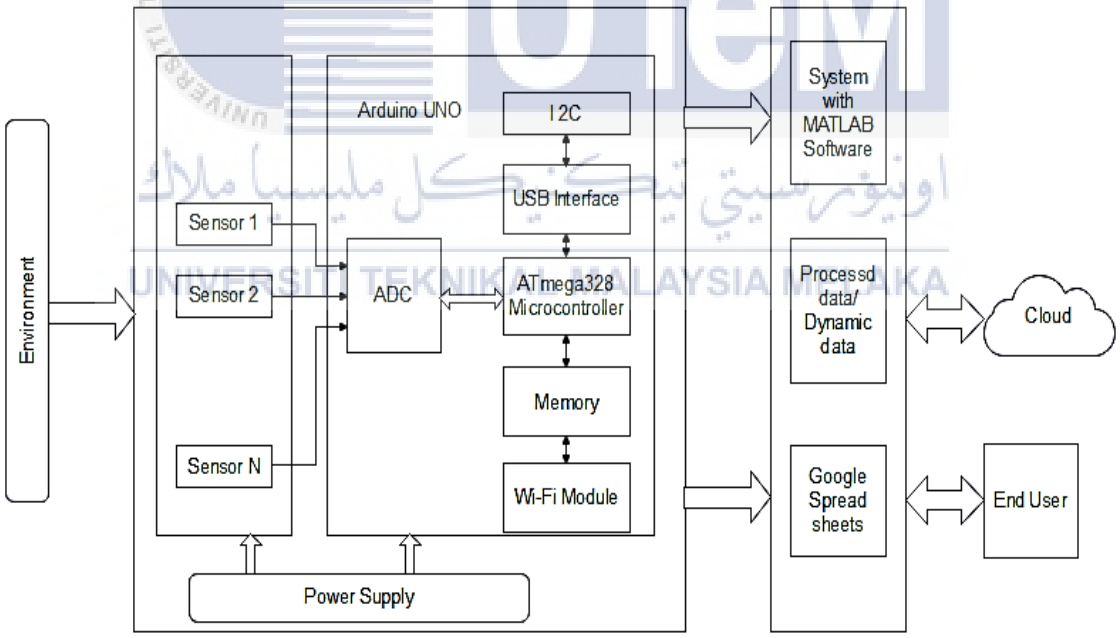

Figure 2.1 Schematic diagram of implementation model.

Figure 2.1 it depicts an embedded system designed with the aim of environmental monitoring, as well as the components that make it up. The embedded device is placed in a

specific location for testing purposes. The sound sensor and the carbon monoxide (CO) sensor MQ-9 will record the air quality at that spot. If the threshold limit is exceeded, the proper steps will be taken. The sound sensor will record the air quality, while the CO sensor will measure the sound levels in the region. Wi-Fi modules are used to link each sensor device to the internet.

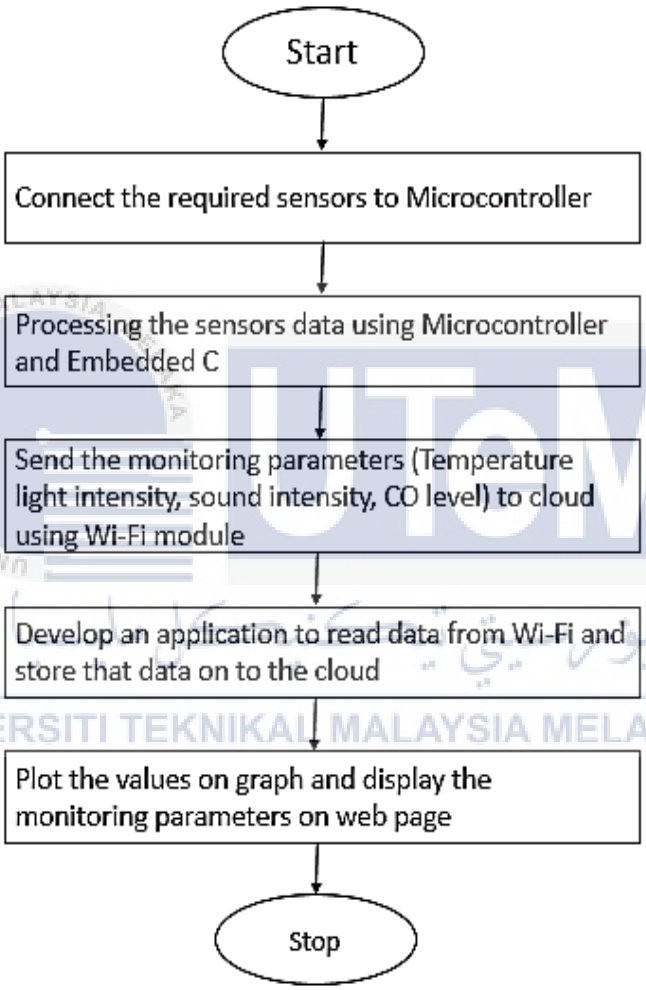

Figure 2.2 The flowchart.

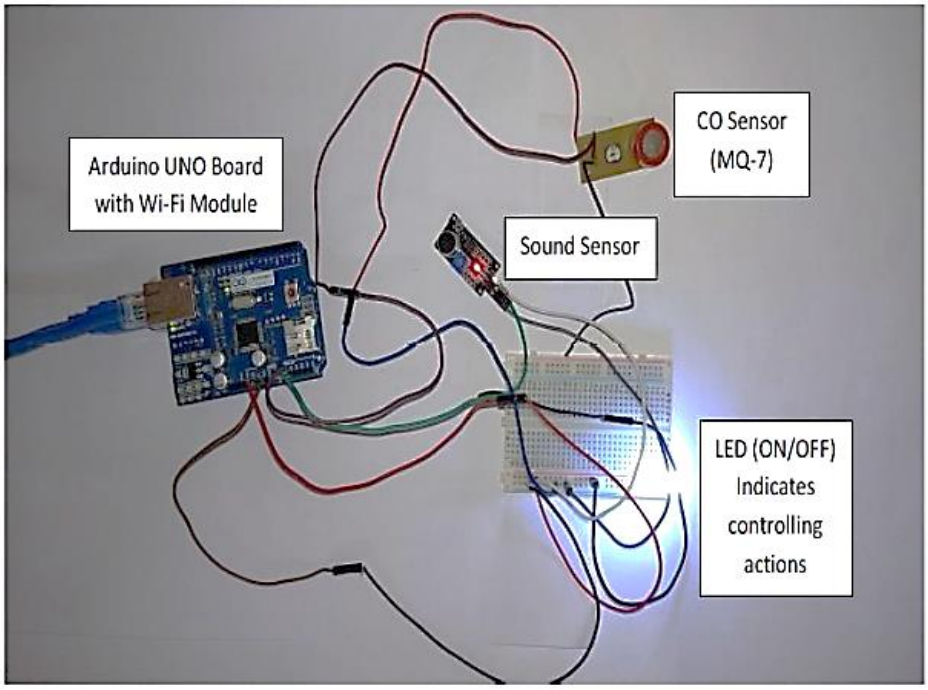

Figure 2.3 The noise and air pollution monitoring embedded system with its components.

See Figures 2.2 and 2.3 to see how the embedded system and its parts get environmental parameters from the cloud and store them. After the sensing is done without a hitch, the information will be analyzed and put in a database for future use. After the data analysis, the control threshold values will be set.

We will use the web server page to monitor and control the system. We will be able to access the related web page once we have entered the server's IP address that has been set up for monitoring. The website gives information on CO level and sound intensity changes in the area where the embedded monitoring equipment is placed.

2.2.2 Arduino-Based Weather Monitoring System.

This project was proposed by Ejodamen Pius Uagbae, Ekong, Victor Eshiet, Inyang, Udoinyang Godwin [4]. The functionality of the system includes the function of the whole system after the connectivity of all of its components, including software and peripheral devices. The operation of the system is broken down into three stages: the first stage involves

reading the data from the sensors; the second stage involves reading the data from the EEPROM; and the third stage involves sending the data to the server (web page).

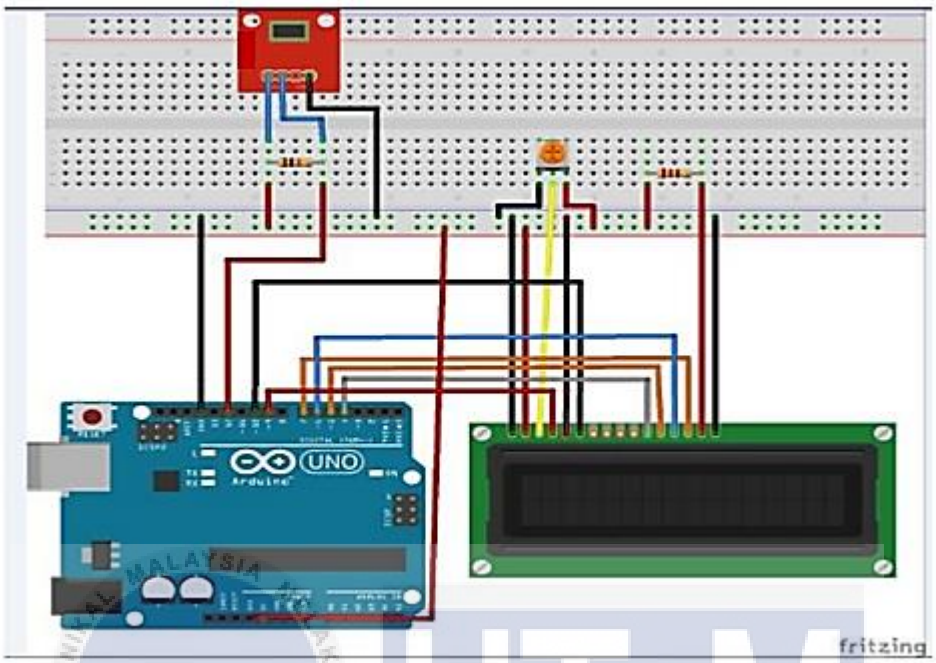

Figure 2.4 The connection for the Arduino-Based Weather Monitoring System.

The Arduino Uno Microcontroller Board was used as the primary piece of hardware. Instruction codes were written using the Arduino IDE and then uploaded to the microcontroller. Figure 2.4 shows how the chosen parts can be combined to make the circuit diagram work. The addition results in the connections that exist between the various components.