REPORT 6: WIRELESS DATA INTERFACING

GROUP 2

MCTA 3203

SEMESTER 1 2024/2025

MECHATRONICS SYSTEM INTEGRATION

DATE OF SUBMISSION: 11/12/2024

	NAME	MATRIC NUMBER
1.	AKMAL ZARIF BIN NAJIB	2211971
2.	AMIR FARHAN BIN GHAFFAR	2115617
3.	AMIRAH HUDA BINTI JAMALULAIL ASRI	2210776
4.	AMIRUL AIZAD BIN AMIR	2211263
5.	ANAS BIN BADRULZAMAN	2219945

TABLE OF CONTENTS

ABSTRACT

This experiment is aimed at creating a wireless temperature monitoring system using Wi-Fi technology. The system utilizes an LM35 temperature sensor to measure ambient temperature interfaced with a Wemos D1 Mini microcontroller, which serves as the primary processing unit to read its temperature data. The data collected by the sensor is transmitted wirelessly via a Wi-Fi connection to Blynk, a user-friendly monitoring smartphone application. The primary objective is to explore the integration of IoT (Internet of Things) components to achieve efficient wireless data transmission and visualization. Results demonstrate the feasibility of this wireless temperature monitoring system using cost-effective IoT hardware and open-source applications. This experiment highlights the potential application of such systems in environmental monitoring for home or industrial use.

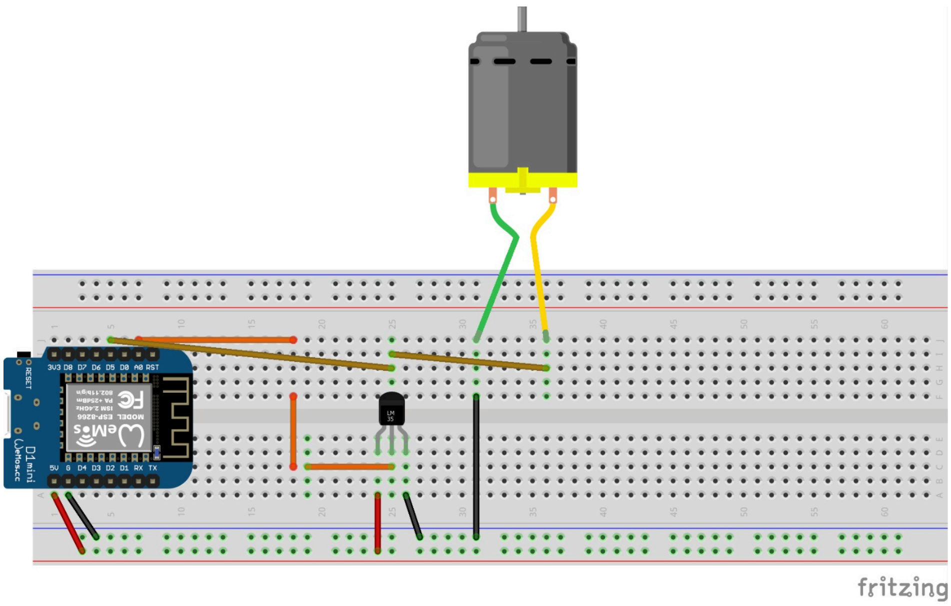
INTRODUCTION

The Internet of Things (IoT) has revolutionized the way data is collected, processed, and transmitted across devices, improving efficiency and accessibility. Its wireless sensing and seamless connectivity in a temperature monitoring system make it an essential application when providing critical data for environmental control and safety. This experiment explores the design and implementation of a wireless temperature monitoring system with the core of the system being a compact Wi-Fi-enabled microcontroller, Wemos D1 Mini. Another IoT component used in this system due to its simplicity and accuracy is the LM35 temperature sensor to measure ambient temperature. Blynk is a smartphone application that acts as a graphical user interface (GUI) to visualize the data captured by the sensor and transmitted by the microcontroller via Wi-Fi. Although the system is very reliant on internet access, the application being made user-friendly makes it very appealing to the general audience. This system also incorporates an LED to provide visual feedback and demonstrates the functional and cost-effectiveness of an IoT-enabled monitoring system.

MATERIALS AND EQUIPMENT

- Wemos D1 Mini microcontroller
- Temperature sensor (LM35)
- Smartphone with Bluetooth support (Blynk)
- Wi-Fi network and internet access
- Power supply for the Wemos D1 Mini
- Breadboard and jumper wires
- LEDs/DC Motor

EXPERIMENTAL SETUP



METHODOLOGY

The project focused on developing a wireless temperature monitoring and control system using Wi-Fi for communication between the Wemos D1 Mini microcontroller and the Blynk application on a smartphone. The goal was to monitor real-time temperature and allow user interaction to control a fan (simulated by an LED) when the temperature exceeded a user-defined threshold.

The methodology was structured into three main phases:

1. **System Design**:
    - Integration of hardware components such as the Wemos D1 Mini, LM35 temperature sensor, and LED using a breadboard and jumper wires.
    - Establishing Wi-Fi connectivity to enable communication between the microcontroller and the Blynk application.
2. **Software Development**:
    - Writing Arduino code to handle sensor data, establish Wi-Fi communication, and enable real-time monitoring and control through the Blynk app.
    - Configuring the Blynk app to display temperature data and send control commands via the internet.
3. **Testing and Optimization**:
    - Assembling and validating the circuit connections.
    - Debugging the firmware to ensure accurate sensor readings and reliable communication over Wi-Fi.

PROCEDURE

Hardware Setup:

- Connect the LM35 temperature sensor to the A0 analog input of the Wemos D1 Mini.
- Attach an LED (representing the fan) to the D5 digital pin.
- Connect the 5V and GND pins to power the components.
- Assemble all components on a breadboard using jumper wires.

Wi-Fi Configuration:

- Configure the Wemos D1 Mini to connect to a local Wi-Fi network by embedding the network credentials (SSID and password) in the Arduino code.
- Use the Blynk app to link the microcontroller via a unique authentication token.

Software Configuration:

- Write Arduino firmware to:
  - Read and process temperature data from the LM35 sensor.
  - Transmit temperature readings to the Blynk app via Wi-Fi.
  - Receive control commands from the app to activate the LED.
- Upload the code to the Wemos D1 Mini using the Arduino IDE.

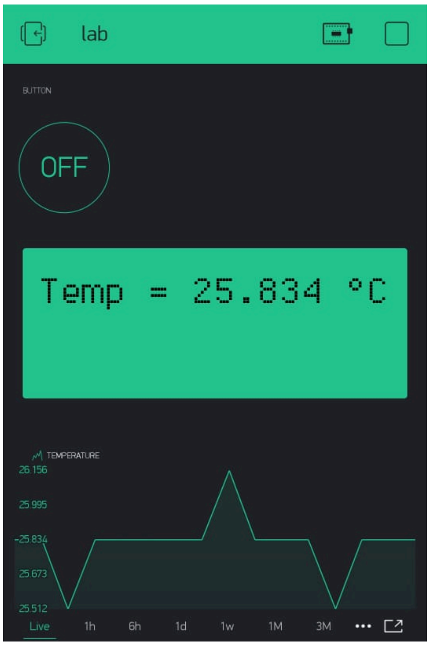
System Testing:

- Power up the circuit and ensure that the Wemos D1 Mini successfully connects to the Wi-Fi network.
- Verify that real-time temperature readings are displayed correctly in the Blynk app.
- Test the LED control functionality by adjusting the temperature threshold in the app and confirming LED activation/deactivation.

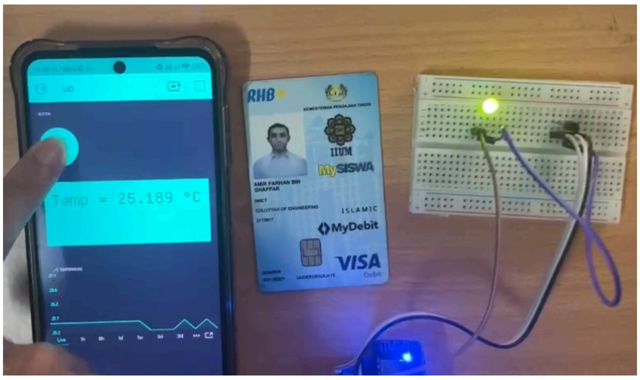
Performance Validation:

- Conduct multiple tests in different Wi-Fi signal conditions to assess system reliability.
- Collect data on temperature readings and control responses for analysis and refinement.

RESULTS



The Temperature sensor (LM35) will detect the surrounding temperature and send it to the microcontroller then send the data to the phone via a Wi-Fi connection. The data will be shown on the screen to show the real-time temperature in the surrounding area.



When reaching a certain temperature (which can be set by the user), The user can push the button from the phone to turn on a fan (in this experiment LED represents the fan) to reduce the temperature

DISCUSSION

- **Software**

  The experiment's main goal is to combine multiple parts, including the Blynk, LM35, and Wemos D1 Mini, to form a single system that can monitor temperature and operate an LED that serves as a fan. By converting user inputs via Blynk into hardware actions, the Arduino firmware, which is intended to handle LM35 and LED control and command processing, guarantees smooth operation. Similarly, the firmware of the Wemos D1 Mini collects temperature information from a sensor and transmits it to the Arduino, ensuring that the user receives real-time updates from the Blynk app. Using the Blynk app enhances user interaction and communication while also lowering the complexity of app development.

- **Electrical**

  The circuit design follows basic electrical principles to ensure proper current flow. The LM35 is connected to the A0 analog input of the Wemos D1 Mini while the DC Motor/LED is connected to the D5 digital input. Lastly, 5V and GND are connected across all components. Connections are double-checked to avoid short circuits that could damage the components.

- **Hardware**

In order to develop a wireless temperature monitoring and control system, the hardware setup for this project included integrating an Arduino board, a temperature sensor (LM35), a Wi-Fi connection, a fan (motor) and other peripherals such as a breadboard and jumper cables. Meanwhile, the Wi-Fi connection allowed local contact with a smartphone application for fans. Through meticulous debugging and testing, issues with managing power supply requirements, guaranteeing steady Wi-Fi connectivity, and handling any noise in sensor readings were all handled. The selected hardware elements worked well for real-time monitoring, and there is room for future advancements such as the use of more accurate sensors, the addition of more environmental monitoring parameters, or the integration of cutting-edge microcontrollers for increased performance and scalability.

CONCLUSION

This experiment successfully demonstrates the communication between a simple smartphone application, Blynk, and the Wemos D1 Mini microcontroller via WiFi. By building the circuit and writing the coding above, the application Blynk allowed us to send commands to control the LED, based on the temperature data received from the Wemos D1 Mini microcontroller. This experiment also allowed us to generate real-time graphs from the data collected via the application Blynk. These show how accessible hardware and software tools can be integrated to perform real-time monitoring and analysis.

RECOMMENDATIONS

To enhance this experiment, it could be conducted in environments with varying levels of WiFi interference to evaluate and improve its reliability under real-world conditions. Additionally, incorporating error-checking mechanisms would help detect and recover from failed connections or command errors, improving system robustness. Testing the effective range of the WiFi module and documenting performance at different distances would also provide valuable insights into its limitations and practical usability.

ACKNOWLEDGEMENT

We would like to express our gratitude to Dr. Wahju Sediono, Dr. Ali Sophian, Dr. Zulkifli bin Zainal Abidin, my teaching assistant, and my peers for their invaluable help and support in finishing this project. Their advice, feedback, and experience have greatly influenced the level of quality and understanding of this work.

STUDENT'S DECLARATION

Certificate of Originality and Authenticity

This is to certify that we are responsible for the work submitted in this report, that **the original work** is our own except as specified in the references and acknowledgement, and that the original work contained herein has not been untaken or done by unspecified sources or persons.

We hereby certify that this report has **not been done by only one individual** and **all of us have contributed to the report**. The length of contribution to the reports by each individual is noted within this certificate.

We also hereby certify that we have **read** and **understand** the content of the total report and that no further improvement on the reports is needed from any of the individual contributors to the report.

We, therefore, agreed unanimously that this report shall be submitted for **marking** and this **final printed report** has been **verified by us.**

Signature:	**Read**	/
Name: AKMAL ZARIF BIN NAJIB	**Understand**	/
Matric No: 2211971	**Agree**	/

Signature:	**Read**	/
Name: AMIR FARHAN BIN GHAFFAR	**Understand**	/
Matric No: 2115617	**Agree**	/

Signature:	**Read**	/
Name: AMIRAH HUDA BINTI JAMALULAIL ASRI	**Understand**	/
Matric No: 2210776	**Agree**	/

Signature:	**Read**	/

Name: AMIRUL AIZAD BIN AMIR	**Understand**	/
Matric No: 2211263	**Agree**	/

Signature: 	**Read**	/
Name: ANAS BIN BADRULZAMAN	**Understand**	/
Matric No: 2219945	**Agree**	/