الجامعة الإسلامية العالمية ماليزيا

INTERNATIONAL ISLAMIC UNIVERSITY MALAYSIA

# MECHATRONICS SYSTEM INTEGRATION

EXPERIMENT 8: Bluetooth

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## Abstract

This lab activity explores the integration of wireless communication technologies within a microcontroller-based system to enable real-time temperature monitoring and remote device control. Utilizing an Arduino board with built-in Wi-Fi (ESP32) and an LM35 temperature sensor, temperature data is acquired and transmitted over a Wi-Fi network to a cloud platform (ThingSpeak) for visualization. This setup demonstrates the synergy between IoT (Internet of Things) components for smart environmental monitoring and control applications. The collected data is analyzed to observe room temperature variations and assess system response to control inputs.

## Introduction

In modern mechatronics systems, wireless communication plays a critical role in enabling remote monitoring and control, particularly in Internet of Things (IoT) applications. This lab activity focuses on integrating temperature sensing with wireless data transmission and actuation using Arduino-based microcontrollers. By using WiFi technology, the system is capable of sending sensor data to a cloud platform for real-time monitoring.

The primary objective of this experiment is to build a wireless temperature monitoring and control system. A temperature sensor (LM35) reads ambient temperature data, which is then transmitted via Wi-Fi to a cloud-based service such as ThingSpeak for remote access and visualization.

This activity not only illustrates the practical implementation of data acquisition, processing, and wireless communication in embedded systems, but also reinforces key concepts in IoT system integration and real-time data interaction between sensors, actuators, and user interfaces.

## Materials and Equipment

1. Arduino board with Wi-Fi capability (e.g., Arduino ESP8266, Arduino MKR1000, or an ESP32)
2. Temperature sensor (e.g., DHT11 or DHT22)
3. Bluetooth module (e.g., HC-05 or HC-06)
4. Smartphone with Bluetooth support

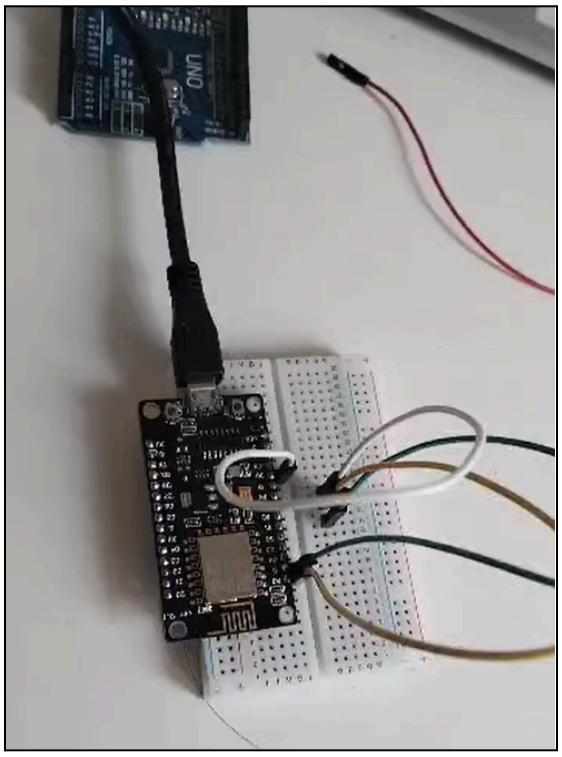
5. Wi-Fi network and internet access
6. Power supply for the Arduino
7. Breadboard and jumper wires

## Experimental Set-up

Experiment Steps:

1. Hardware Setup:
• Connect the temperature sensor (thermistor) to the Arduino.
• Connect the Arduino to your Wi-Fi network using the built-in Wi-Fi capabilities.

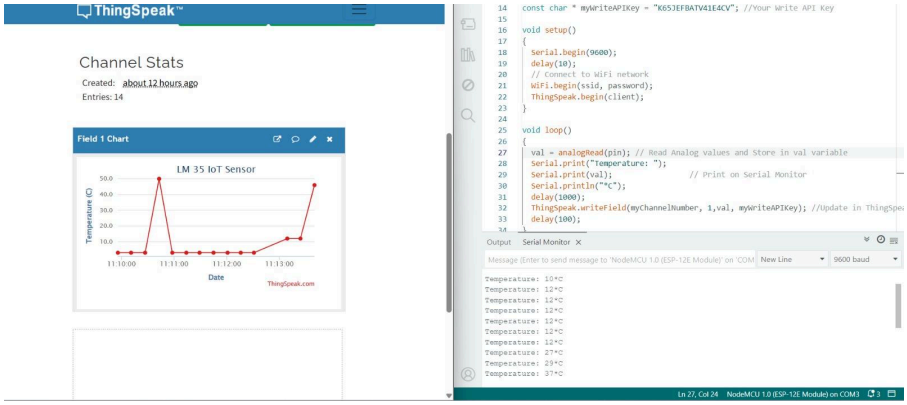
2. Arduino Programming:
• Write an Arduino sketch that reads temperature data from the sensor.
• Set up Wi-Fi connectivity to send temperature data to a cloud service like ThingSpeak, where you can create a simple dashboard to visualize the data



## Methodology

1) Set the Arduino in a room, the LM35 already fixed to it
2) Upload the code you've written to the Arduino and make sure it's connected to the WiFi
3) Set up a new channel and name it
4) Interface your Arduino with the channel via WiFi, using IoT

## Results




As displayed in the image above, the ThingSpeak graph is directly connected to the Arduino IDE through IoT, indicating the change in temperature measured by the LM35.

## Discussion

Interfacing the Arduino IDE with ThingpSpeak using IoT (internet of things) - a network of devices that can share data with each other without human involvement - was a success, as the communication between the two IDEs was seamless. An LM35 (temperature sensor) was connected to an Arduino board, tasked to measure its surrounding environment's temperature. It was able to capture the data, which was sent to the serial monitor of the Arduino IDE. After that, the data was transferred to ThingSpeak, using IoT, and plotted on a graph. However, there was a slight delay in the data being plotted due to the WiFi signal being slow.

## Conclusion

The lab activity successfully demonstrated the integration of wireless technologies with microcontroller-based systems for real-time temperature monitoring. By using an Arduino board equipped with Wi-Fi capabilities, the system effectively captured temperature data from an LM35 sensor and transmitted it to the ThingSpeak cloud platform, enabling users to monitor environmental conditions remotely through an interactive dashboard.

Overall, this project highlights the practical application of IoT principles in developing smart, connected environments. It reinforces key skills in sensor integration, data communication, and system control—paving the way for more advanced automation and monitoring systems in real-world scenarios.

## Recommendation

Overall, with this experiment being a success, there are no recommendations to be made, other than ensuring that the strength of the WiFi signal is strong, so that there aren't any delays when the data is plotted on the ThingSpeak graph.

Student Declaration Form

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

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