MECHATRONICS SYSTEM INTEGRATION (MCTA 3203)

SEMESTER 1 2024/2025

WEEK 8: BLUETOOTH

SECTION 2

GROUP 8

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ABSTRACT

This experiment developed a wireless temperature monitoring and control system using an Arduino microcontroller with Wi-Fi and Bluetooth capabilities. A temperature sensor measured room temperature, which was transmitted to a ThingSpeak dashboard via Wi-Fi for real-time monitoring and logging. Bluetooth functionality enabled a smartphone application to send control commands to devices like fans or heaters. Combining hardware setup, Arduino programming, and Python-based data visualization, the system showcased effective remote temperature management with potential applications in smart home automation and IoT solutions.

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INTRODUCTION

This lab focuses on creating a temperature monitoring and control system using an Arduino microcontroller, a temperature sensor, and Bluetooth communication. The system reads temperature data from the sensor and transmits it via serial communication over Bluetooth to a paired device, such as a smartphone. By establishing a Bluetooth connection, the temperature data can be displayed in real-time on the receiving device. Additionally, the smartphone can send input commands to the Arduino to perform specific actions, such as turning on a heater or a fan, based on the temperature readings. This experiment explores the integration of sensors, Bluetooth communication, and control mechanisms, providing hands-on experience with practical applications in wireless data transmission, temperature monitoring, and device control.

MATERIALS AND EQUIPMENTS

1. ARDUINO MEGA 2560
2. TEMPERATURE SENSOR (LM35)
3. BLUETOOTH MODULE
4. SMARTPHONE (app : Arduitooth)
5. BREADBOARD
6. JUMPER WIRES
7. SERVO MOTOR

EXPERIMENTAL SETUP

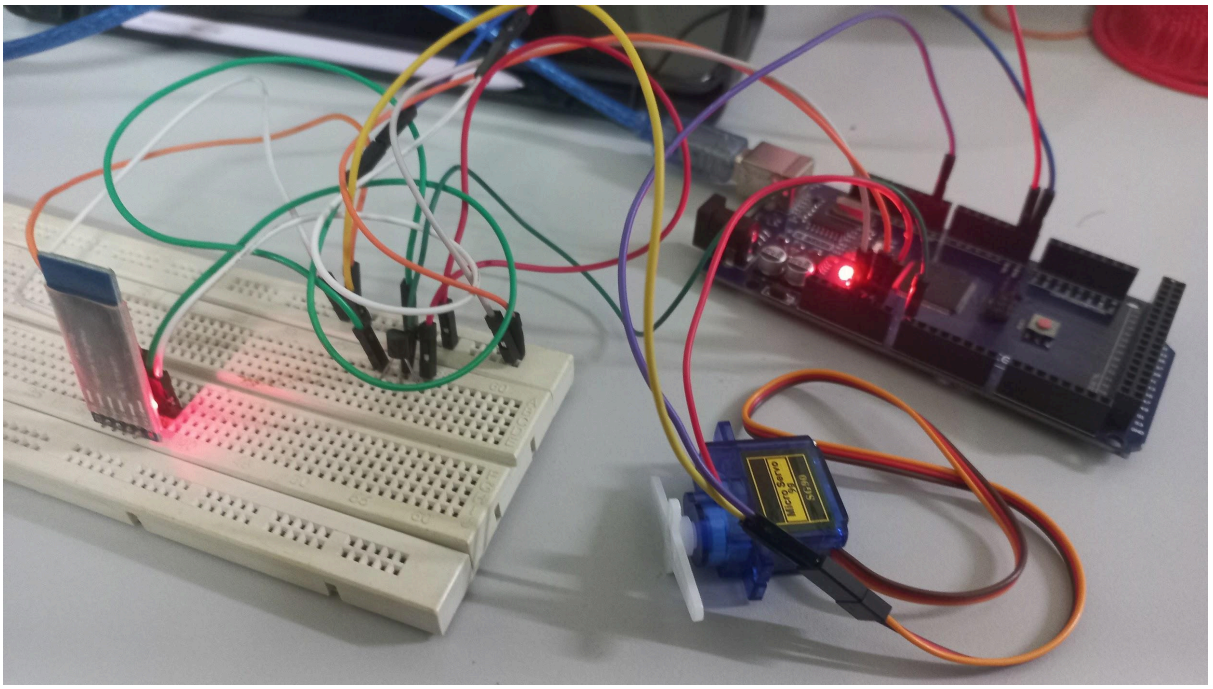

Figure 1 : Experimental setup

METHODOLOGY

1. Setup Arduino MEGA 2560, Bluetooth HC-05, Servo, LM35 Sensor
2. Download ThingSpeak App on smartphone
3. Code implementation
4. Testing
5. The temperature data that can get from a real time data at ThingSpeak App

Arduino Code

```
#include<Servo.h>
Servo s;

void setup() {
 s.attach(9);
 Serial.begin(9600);
}
void loop() {
 int i = analogRead(A0); //read analog pin A0 which is LM35
float temp = (i/1024.0)*500;
 // Send temperature data over serial
 Serial.println(temp);
 Serial.println(";");
 delay(1000); // Delay for 1 second
 if (Serial.available())
 {
   char data=Serial.read();
   if (data=='h')
   {
     s.write(90);
   }
   else if (data=='j')
   {
     s.write(0);
   }
 }
}
```

DATA COLLECTION

Figure 2: Temperature reading via arduitooth app

DATA ANALYSIS

From the data collection above, we can see that the communication between the arduino and the bluetooth module is successful. The temperature reading from LM35 was sent to the application which connects to the bluetooth via serial. The variability in temperature readings may arise from rapid environmental changes, sensor noise, or insufficient averaging.

RESULTS

The Bluetooth-based temperature monitoring system was successfully implemented and tested. The Arduino microcontroller accurately read temperature data from the connected sensor and transmitted it to a paired device via Bluetooth. The paired device, such as a smartphone or computer, displayed real-time temperature readings, enabling effective monitoring. Additionally, the Bluetooth module facilitated bidirectional communication, allowing the smartphone to send commands for controlling connected devices, such as a fan or heater. Temperature data collected over time showed consistent performance, with variations corresponding to changes in the room's conditions. The integration of Bluetooth for data transmission and device control demonstrated the system's reliability and versatility in achieving wireless monitoring and automation.

DISCUSSION

The experiment demonstrated the feasibility of using Bluetooth technology to create a functional temperature monitoring and control system. The Arduino microcontroller proved effective in managing data acquisition and Bluetooth communication. The bidirectional communication enabled seamless interaction with the system, allowing manual control of devices based on temperature readings.

However, some challenges were encountered during the implementation. Ensuring stable Bluetooth connectivity was crucial for consistent data transmission, and occasional delays were observed in updating the paired device’s display. The accuracy of the temperature sensor was also dependent on environmental factors, emphasizing the importance of proper calibration. Despite these challenges, the experiment successfully demonstrated how mechatronic systems can integrate sensors, communication modules, and user interfaces to address real-world applications in environmental monitoring and automation.

CONCLUSION

The Bluetooth-based temperature monitoring and control system achieved its objectives by combining Arduino-based data acquisition with Bluetooth communication. The integration of a paired device provided a convenient platform for real-time data analysis, while the smartphone application offered user-friendly remote control functionality. This experiment highlights the potential of wireless technologies in developing efficient, flexible, and accessible solutions for monitoring and control applications. Future improvements could include optimizing the system for more robust connectivity, enhancing sensor accuracy, and incorporating additional features like automatic device control based on predefined temperature thresholds.

RECOMMENDATIONS

We recommend using more accurate temperature sensors like the DS18B20 and adding encryption to secure Wi-Fi and Bluetooth communication. A user-friendly smartphone app would make it easier to control and monitor the system, while adding sensors for humidity or air quality could make it more versatile. Using energy-efficient microcontrollers like the ESP32 and including local storage for offline data logging would enhance reliability. Automating device control based on temperature thresholds and scaling the system to monitor multiple areas would make it even more practical and user-friendly. These upgrades would make the project more effective and adaptable for real-world use.

REFERENCES

- https://projecthub.arduino.cc/sachendra003/temperature-monitoring-on-smartphone-a7153f

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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 no further improvement on the reports is needed from any of the individual's 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.**

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