Arduino Nano 33 BLE Sense - IMU and Temperature Sensor

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1 Introduction

This project explores the onboard sensors of the Arduino Nano 33 BLE Sense Rev2, focusing on the Inertial Measurement Unit (IMU) system that features the BMI270 and BMM150 modules, as well as the HS300x temperature and humidity sensor. Although these sensors together offer a comprehensive snapshot of the board orientation and surrounding climate, in this project, each sensor was tested separately to demonstrate their individual capabilities. The aim is to provide a practical understanding of sensor data acquisition in embedded systems.[1][2]

2 Methodology

The project was implemented using the Arduino IDE and the following approach:

2.1 Software and Hardware Used

- Programming Language: C++ (Arduino IDE)
- Libraries:
  - `Arduino_BMI270_BMM150` for IMU readings[1]
  - `Arduino_HS300x` for temperature and humidity data[2]
- Hardware: Arduino Nano 33 BLE Sense (with IMU and HS300x sensor)[2]

2.2 Code Repository

The complete source code and documentation for this project are available at: `https://github.com/Rajyalakshmi-12504103/Rajyalakshmi.git`

2.3 Code Implementation

2.3.1 Reading IMU Data

```
13  void loop() {
14  float x, y, z;
15  if (IMU.accelerationAvailable()) {
16  IMU.readAcceleration(x, y, z);
17  Serial.print("Acceleration:_X="); Serial.print(x);
18  Serial.print("_Y="); Serial.print(y);
19  Serial.print("_Z="); Serial.println(z);
20  }
21  delay(500);
22  }
```

Figure 1: important parts of the Reading IMU

2.3.2 Reading Temperature and Humidity Data

```
void loop() {
    float temp = HS300x.readTemperature();
    float humidity = HS300x.readHumidity();
    Serial.print("Temp:␣"); Serial.print(temp); Serial.print("C␣␣");
    Serial.print("Humidity:␣"); Serial.print(humidity); Serial.println("%");
    delay(2000);
}
```

Figure 2: important parts of the Reading Temp and Hum

3 Results

The Arduino Nano 33 BLE Sense was successfully programmed to read acceleration data and environmental data. The following output was observed on the serial monitor.

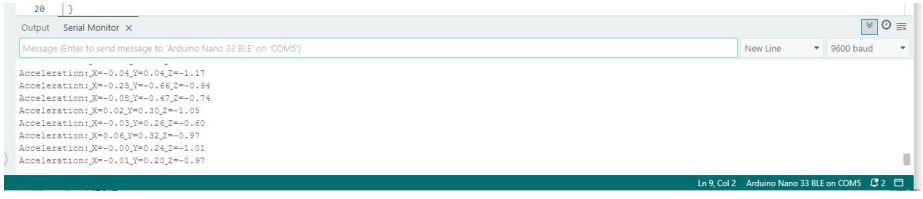

Figure 3: Output from the serial port for IMU

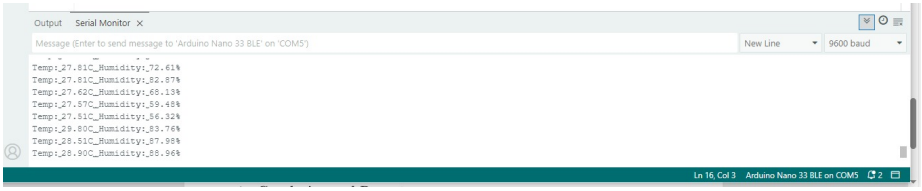

Figure 4: Output from the serial port for Temperature and Humidity

4 Challenges, Limitations, and Error Analysis

4.1 Challenges Faced

- Initial library installation and hardware interfacing with the Arduino Nano 33 BLE Sense.
- Understanding and configuring sensor initialization correctly.

4.2 Error Analysis

- Compilation errors due to missing library dependencies.
- Serial communication errors when the device was not properly connected.

4.3 Limitations of the Implementation

- The current implementation reads only acceleration and temperature/humidity data.
- Environmental factors can affect sensor accuracy.

5 Discussion

The project successfully demonstrated the interfacing of the Arduino Nano 33 BLE Sense's onboard IMU and temperature sensors using the Arduino IDE. The acceleration and environmental data obtained were consistent with expected values, confirming the accurate functionality of the sensors and the reliability of the chosen libraries and implementation approach. This validates the feasibility of using the Arduino Nano 33 BLE Sense for embedded sensor data acquisition in practical applications.

6 Conclusion

This report demonstrated the effective use of the Arduino Nano 33 BLE Sense to capture and process real-time sensor data, showcasing the simplicity and reliability of interfacing with onboard sensors through dedicated Arduino libraries.

Future work could focus on enhancing the project by integrating Bluetooth Low Energy (BLE) communication to enable wireless transmission of sensor data, thereby expanding its practical applications in IoT and wearable devices.

References

[1] Arduino. *IMU - Accelerometer*. `https://docs.arduino.cc/tutorials/nano-33-ble-sense-rev2/imu-accelerometer/`, accessed: 2025-06-06.

[2] Arduino. *Reading Temperature & Humidity on Nano 33 BLE Sense Rev2*. `https://docs.arduino.cc/tutorials/nano-33-ble-sense-rev2/humidity-and-temperature-sensor/`, accessed: 2025-06-06.