**Source Code**

**Reading IMU Sensor Data**

#include "Arduino\_BMI270\_BMM150.h"

void setup() {

Serial.begin(9600);

while (!Serial);

if (!IMU.begin()) {

Serial.println("IMU␣initialization␣failed!");

while (1);

}

}

void loop() {

float x, y, z;

if (IMU.accelerationAvailable()) {

IMU.readAcceleration(x, y, z);

Serial.print("Acceleration:␣X="); Serial.print(x);

Serial.print("␣Y="); Serial.print(y);

Serial.print("␣Z="); Serial.println(z);

}

delay(500);

}

**Reading Temperature and Humidity Data**

#include <Arduino\_HS300x.h>

void setup() {

Serial.begin(9600);

while (!Serial);

if (!HS300x.begin()) {

Serial.println("HS300␣sensor␣initialization␣failed!");

while (1);

}

}

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);

}

**Installation Instructions**

**1. Install the Arduino IDE**

* Download the latest version of the **Arduino IDE** from:  
   https://www.arduino.cc/en/software
* Follow the installation instructions for your operating system (Windows, macOS, Linux).

**2. Set Up the Board Package for Arduino Nano 33 BLE Sense**

* Open the Arduino IDE.
* Go to **Tools → Board → Boards Manager...**.
* In the **Boards Manager**, search for "**Arduino Mbed OS Nano Boards**" or "**Arduino Nano 33 BLE Sense**".
* Click **Install**.

**3. Install Required Libraries**

Open the **Library Manager**:

* **Sketch → Include Library → Manage Libraries...**
* In the Library Manager, search for and install these libraries:
  + **Arduino\_BMI270\_BMM150** (for IMU)
  + **Arduino\_HS300x** (for temperature and humidity sensor)

**4. Connect the Arduino Board**

* Connect your **Arduino Nano 33 BLE Sense** to your computer via a USB cable.
* Go to **Tools → Port** and select the correct COM port for your board.

**5. Upload the Sketch**

* Copy the sketch (code) into a new Arduino sketch file.
* Save the file with a meaningful name, e.g., imu\_reading.ino or temp\_humidity\_reading.ino.
* Click the **Upload** button in the IDE (the arrow icon).

**6. Open the Serial Monitor**

* After successful upload, open the Serial Monitor (**Tools → Serial Monitor**) to view the sensor data in real-time.
* Make sure the **baud rate** in the Serial Monitor matches the one in your sketch (9600 in your code).

**7. Additional Notes**

* If you see **“initialization failed”** errors, ensure:
  + Libraries are installed correctly.
  + Connections and board selection are correct.

**Arduino Nano 33 BLE Sense - IMU and Temperature Sensor Data Collection**

## **Project Overview**

This project demonstrates how to use the **Arduino Nano 33 BLE Sense Rev2** board to:

* Measure **temperature** and **humidity** using the embedded **HS3003 sensor**.
* Measure board **tilt and position** using the onboard **BMI270\_BMM150 IMU** accelerometer.

The project outputs sensor readings via the Serial Monitor and implements change detection thresholds for efficient data reporting.

## **Hardware Requirements**

* Arduino Nano 33 BLE Sense Rev2 (built-in sensors used, no external components needed)
* USB cable to connect board to PC

## **Software Requirements**

* Arduino IDE or Arduino Cloud Editor (latest version recommended)
* HS300x library (for HS3003 sensor)
* Arduino\_BMI270\_BMM150 library (for IMU sensors)

## **Setup Instructions**

### 1. Environment Preparation

* Install Arduino IDE or use Arduino Cloud Editor.
* Install the libraries:
  + Search for and install **HS300x** library.
  + Search for and install **Arduino\_BMI270\_BMM150** library.

### 2. Connect the Arduino Board

* Connect Arduino Nano 33 BLE Sense Rev2 to your PC via USB.
* Ensure the board and port are correctly selected in Arduino IDE or Cloud Editor.

## **Usage Instructions**

### A. Temperature & Humidity Monitoring

1. Upload the provided **Temperature\_Humidity** sketch to the Arduino.
2. Open the Serial Monitor (baud rate 9600).
3. The board will print temperature and humidity only when:
   * Temperature changes by **≥ 0.5°C**
   * Humidity changes by **≥ 1%**
4. To test, breathe gently on the sensor to observe changes.

### B. Accelerometer & Tilt Detection

1. Upload the provided **Accelerometer** sketch.
2. Open the Serial Monitor (baud rate 9600).
3. Hold the board with the USB port facing up and away from you.
4. Tilt the board in different directions:
   * Up, down, left, right
5. The board will print tilt direction and approximate angle in degrees.

## **Code Summary**

### Temperature & Humidity Key Logic:

* Initialize sensor using HS300x.begin().
* Read temperature and humidity values continuously.
* Print values only if they changed beyond the defined thresholds.

### Accelerometer Key Logic:

* Initialize IMU using IMU.begin().
* Read accelerometer values for X and Y axes.
* Map raw values to degree ranges.
* Print direction and degree of tilt when exceeding ±0.1g threshold.

## **Troubleshooting**

| **Problem** | **Possible Cause** | **Solution** |
| --- | --- | --- |
| No output in Serial Monitor | Wrong baud rate | Set baud rate to 9600 |
| Board not recognized | Missing USB driver/plugin | Install Arduino Create plugin |
| Sensor initialization fails | Hardware connection issue | Reconnect USB cable; restart IDE |
| No data printed on value change | Change thresholds not met | Try creating larger temp/humidity changes |

## **Future Improvements Suggestions**

* Add wireless BLE transmission for remote monitoring.
* Implement data logging to SD card.
* Add OLED display for local readout.
* Calibrate sensors for better accuracy.
* Expand accelerometer to include full 9-axis orientation.
* Implement power-saving sleep modes.