Experiment 10

Title: IoT implementation for displaying position using MPU6050 on Blynk using NodeMCU.

Objectives:

- Interface the MPU6050 6-axis Gyro/Accelerometer Sensor with NodeMCU to measure X, Y, and Z acceleration forces.
- Convert the measured acceleration forces into 3D angles to determine the 3D orientation of the sensor.
- Transmit the measured tilt angle to the Blynk Application via the Blynk cloud for real-time monitoring and analysis in IoT.

Key concepts:

MPU6050 Sensor, NodeMCU, Blynk IoT Application, Calibration, Visualization.

Algorithm:

- Initialization: Set up NodeMCU and connect MPU6050 sensor.
- Configuration: Configure Blynk IoT app for NodeMCU and set up gauges.
- Main Loop: Read MPU6050 data, convert to tilt angles, and transmit to Blynk.
- Data Transmission: Establish Wi-Fi connection and send tilt angle data.
- Visualization: Display real-time tilt angles on Blynk dashboard.

Theory:

The InvenSense **MPU-6050** sensor includes a MEMS accelerometer and a MEMS gyro on a single chip.

3-Axis Gyroscope:

The MPU6050 consists of a 3-axis Gyroscope with Micro Electro Mechanical System(MEMS) technology. It is used to detect rotational velocity along the X, Y, Z axes as shown below figure.

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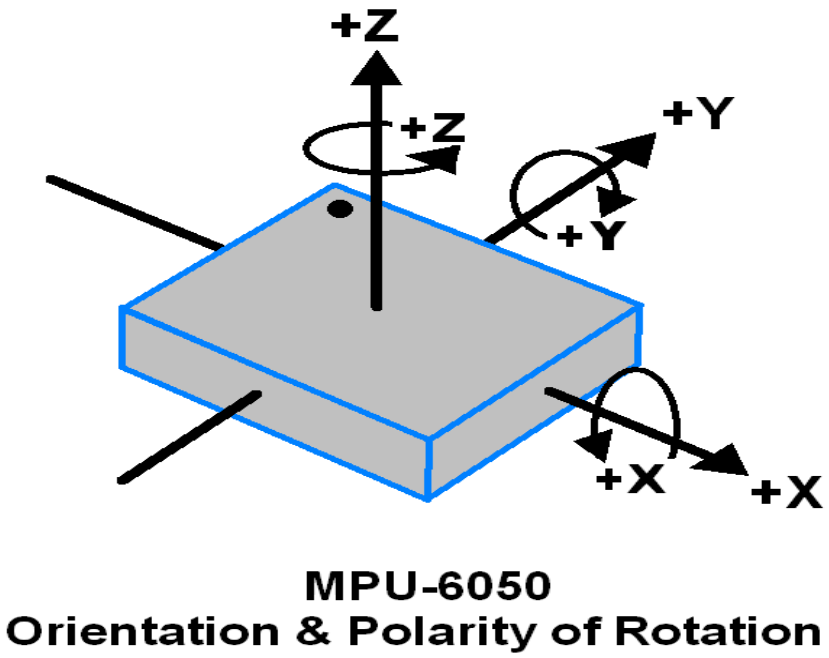
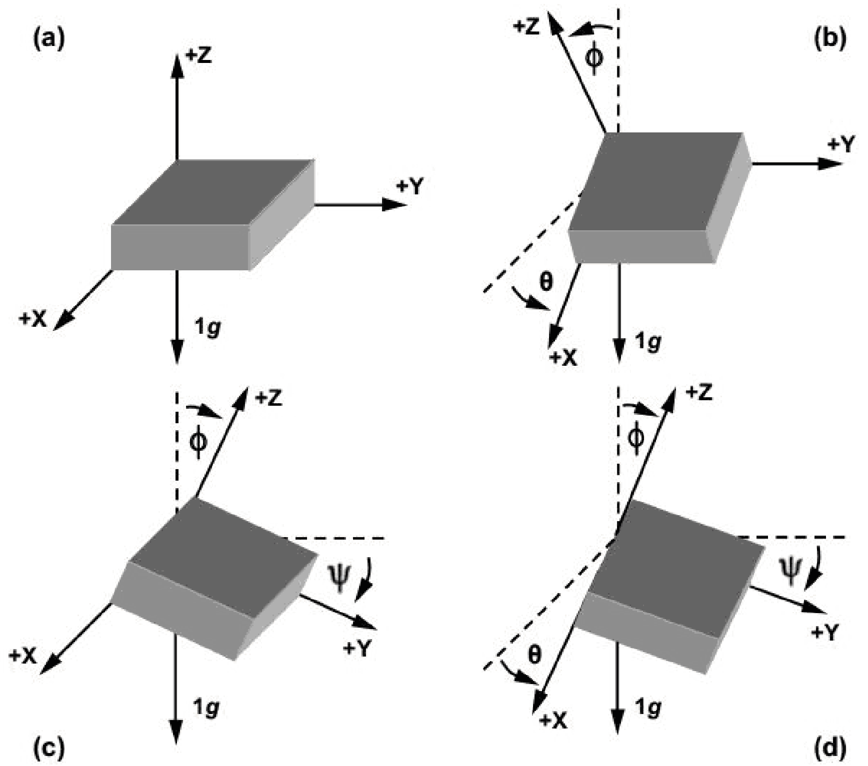


3-Axis Accelerometer:

The _MPU6050 consists of a 3-axis Accelerometer with Micro Electro Mechanical (MEMs) technology. It used to detect the angle of tilt or inclination along the X, Y, and Z axes as shown below figure.



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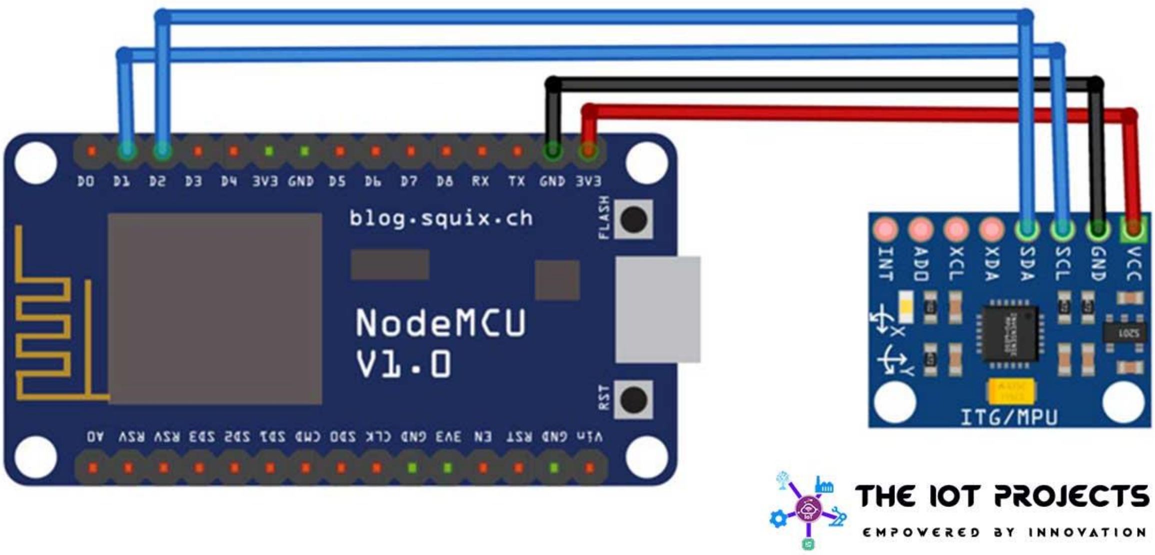
Circuit Diagram: Here is the circuit diagram for interfacing the **MPU6050 Gyro/Accelerometer** with Node **MCU ESP8266.**



Setting Up Blynk IoT Application for MPU6050 Tilt Monitoring:

1. Download and install the Blynk app from the Google Play Store for Android users or from the App Store for iOS users.
2. Once installed, open the app and sign up using your email address and password.
3. Click on "Create a new project" and provide a name for your project.
4. Choose the NodeMCU board from the list of available boards.
5. Select the connection type as Wi-Fi, then click on the "Create" button.
6. The Blynk authentication token will be sent to your email address. Keep this token safe as we'll need it later during programming.
7. Click on the "+" icon at the top right corner of the screen to add widgets to your project.
8. Search for "Gauge" and add 3 Gauges to your main screen.
9. Click on the first Gauge and name it as "Angle X".
10. Set the Input Pin for the first gauge to Virtual Pin V2 and choose the value range to 360.
11. Write the label as "degree" for clarity.
12. Choose the refresh rate as 1 second for real-time monitoring.
13. Similarly, repeat the same steps for Angle Y and Angle Z Gauges. Set the Input Pin for Angle Y as Virtual Pin V3 and Virtual Pin V4 for Angle Z.
14. Ensure that all settings are properly configured before proceeding.
15. Your Blynk IoT application is now set up for monitoring MPU6050 tilt angles using NodeMCU.

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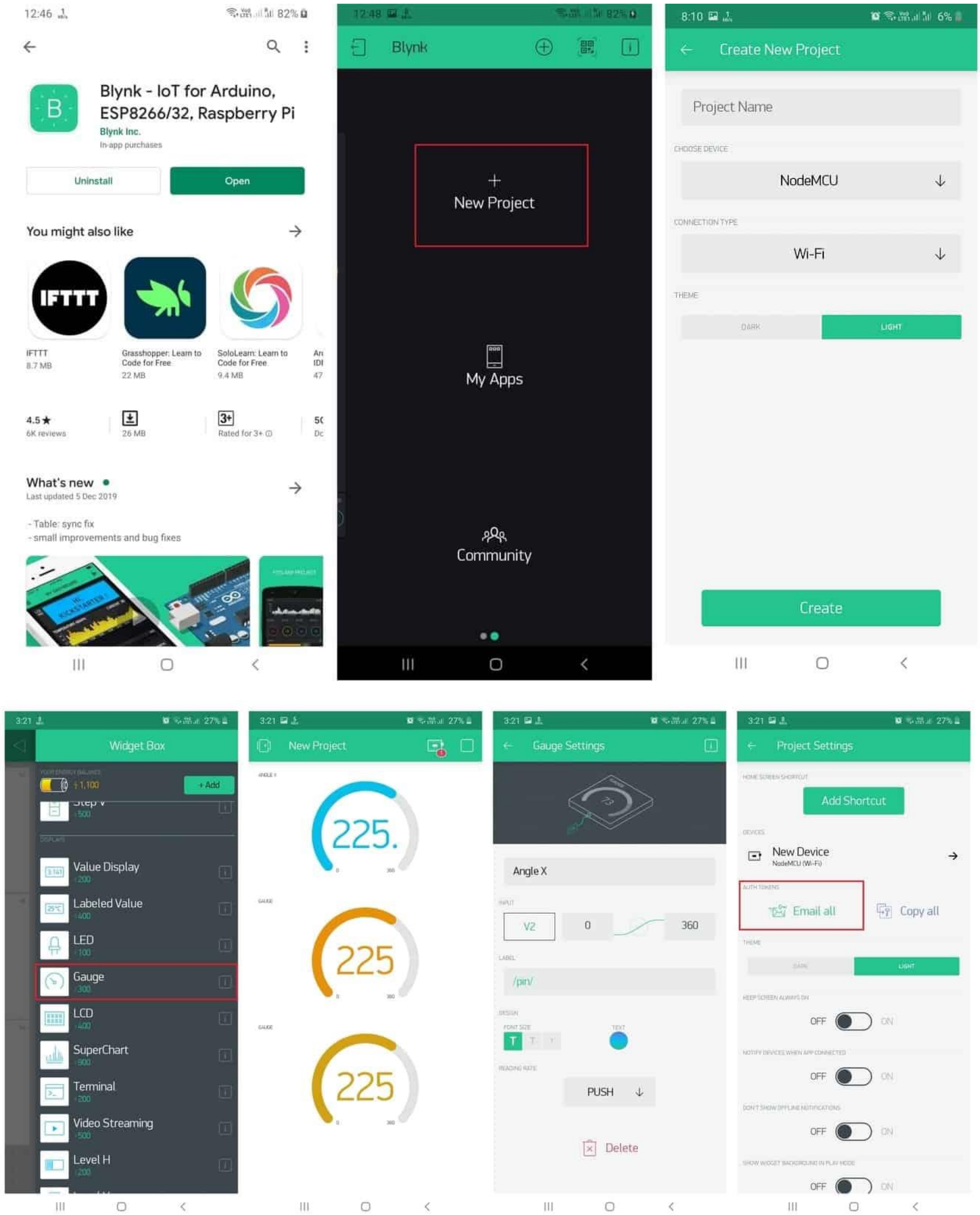

Program:

```
#include <Wire.h>

#define BLYNK_PRINT Serial

#include <Blynk.h>

#include <ESP8266WiFi.h>
```

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```
#include <BlynkSimpleEsp8266.h>


char auth[] = "LHvT-tj0Uoy9xXfjGshKOyRk_cVYZhZd"; // You should get Auth Token in the Blynk App.

char ssid[] = "Alsan"; // Your WiFi credentials.

char pass[] = "1234567890";


const int MPU_addr = 0x68;

int16_t AcX, AcY, AcZ, Tmp, GyX, GyY, GyZ;

int minVal = 265;

int maxVal = 402;

double x;

double y;

double z;


void setup() {

  Wire.begin();

  Wire.beginTransmission(MPU_addr);

  Wire.write(0x6B);

  Wire.write(0);

  Wire.endTransmission(true);

  Serial.begin(9600);

  Blynk.begin(auth, ssid, pass);

}


void loop() {

  Blynk.run();


  Wire.beginTransmission(MPU_addr);

  Wire.write(0x3B);
```

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```
  Wire.endTransmission(false);
  Wire.requestFrom(MPU_addr, 14, true);

  AcX = Wire.read() << 8 | Wire.read();
  AcY = Wire.read() << 8 | Wire.read();
  AcZ = Wire.read() << 8 | Wire.read();

  int xAng = map(AcX, minVal, maxVal, -90, 90);
  int yAng = map(AcY, minVal, maxVal, -90, 90);
  int zAng = map(AcZ, minVal, maxVal, -90, 90);

  x = RAD_TO_DEG * (atan2(-yAng, -zAng) + PI);
  y = RAD_TO_DEG * (atan2(-xAng, -zAng) + PI);
  z = RAD_TO_DEG * (atan2(-yAng, -xAng) + PI);

  Serial.print("AngleX= ");
  Serial.println(x);
  Serial.print("AngleY= ");
  Serial.println(y);
  Serial.print("AngleZ= ");
  Serial.println(z);
  Serial.println("----------------------------------------");

  Blynk.virtualWrite(V2, x);
  Blynk.virtualWrite(V3, y);
  Blynk.virtualWrite(V4, z);

  delay(1000);
}
```

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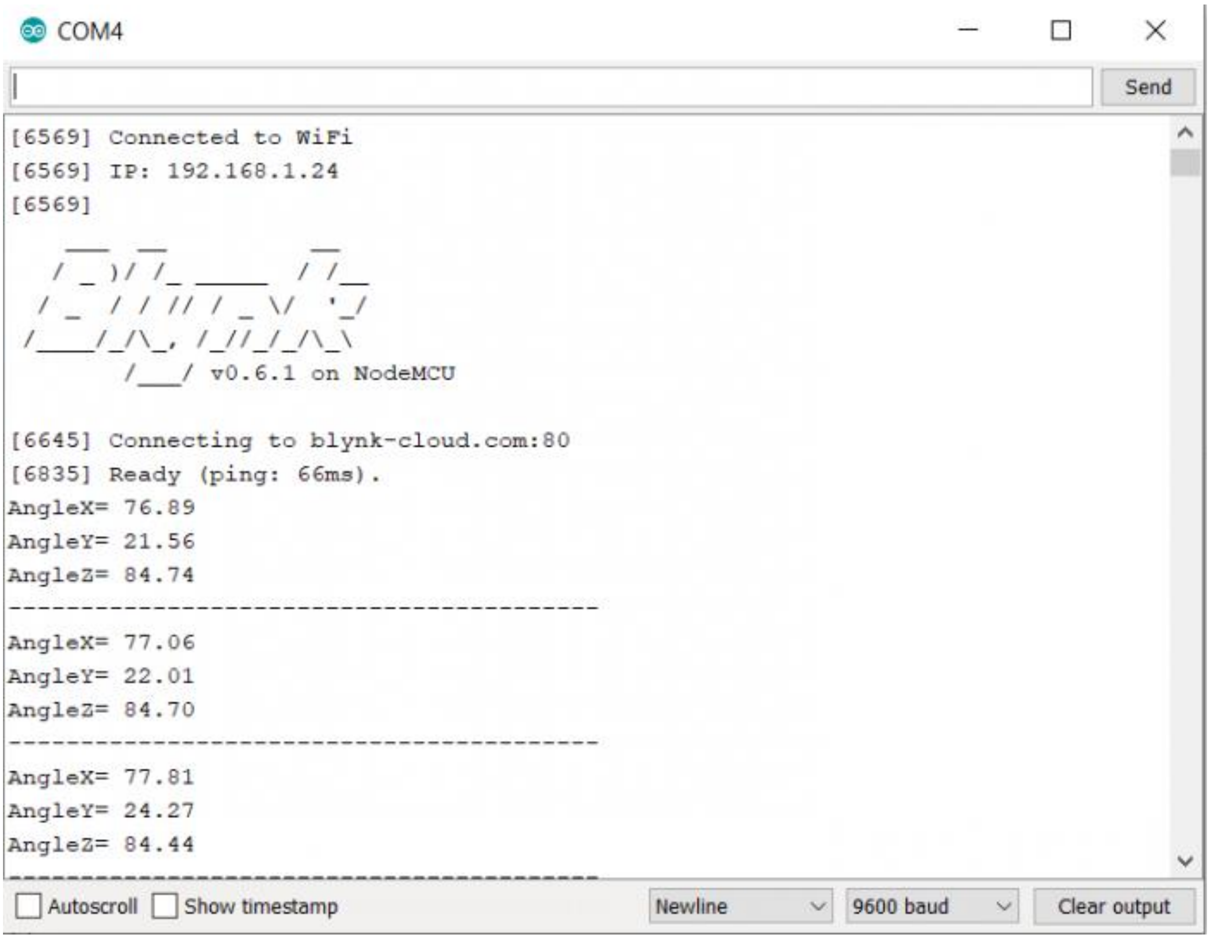
Output:



Conclusion:

In conclusion, by integrating the MPU6050 sensor with NodeMCU and Blynk, we successfully monitored tilt angles in real-time. This setup showcases the potential of IoT for remote sensor monitoring and opens avenues for applications in smart devices and environmental tracking.