**Gyroscope Visualizer**

**Project Overview**

The Gyroscope Visualizer project aims to create a visual representation of the orientation of an object using an MPU6050 sensor, which combines a gyroscope and an accelerometer. The project utilizes an Arduino Uno to process the sensor data, an OLED display to show the current tilt angles, and a NeoPixel ring to provide a colorful visual feedback based on the orientation.

**Components Required**

To build this project, you will need the following components:

* An Arduino Uno microcontroller to serve as the main processing unit.
* An MPU6050 sensor module, which includes both a gyroscope and an accelerometer, to measure the orientation of the device.
* A NeoPixel ring, which consists of multiple individually addressable RGB LEDs, to visually represent the orientation with colors.
* An OLED display that communicates via I2C to show the current tilt angles in real-time.
* A breadboard and jumper wires for making the necessary connections between the components.

**Working Principle**

1. **Sensor Initialization**: The project begins by initializing the MPU6050 sensor. This involves waking up the sensor from its sleep mode and preparing it to send data.
2. **Data Acquisition**: The Arduino continuously reads data from the MPU6050. This data includes the accelerometer readings (which measure the acceleration along the X, Y, and Z axes) and the gyroscope readings (which measure the angular velocity around the X, Y, and Z axes).
3. **Angle Calculation**: Using the accelerometer data, the project calculates the tilt angles in the X and Y directions. The angles are derived from the accelerometer readings using trigonometric functions, specifically the arctangent function, which helps determine the orientation based on the ratio of the accelerometer values.
4. **Display Output**: The calculated angles are then displayed on the OLED screen. The display updates in real-time, providing users with immediate feedback on the orientation of the device.
5. **Visual Feedback with NeoPixel Ring**: The NeoPixel ring provides a visual representation of the tilt angles. The project maps the calculated angles to specific positions on the ring. For example, as the angle in the X direction changes, a corresponding LED on the NeoPixel ring lights up in a specific color. This creates a dynamic visual effect that allows users to see how the orientation changes in real-time.
6. **User Interaction**: As the user tilts the device, the OLED display updates to show the new angles, and the NeoPixel ring changes colors accordingly. This interactive feedback loop makes it easy to visualize the effects of movement and orientation.

**Conclusion**

The Gyroscope Visualizer project effectively combines sensor technology with visual output to create an engaging and informative experience. By using the MPU6050 to measure orientation, the OLED display to show real-time data, and the NeoPixel ring to provide colorful visual feedback, this project serves as an excellent demonstration of how sensors can be used in practical applications. It can also be a foundation for more advanced projects, such as motion-controlled games or interactive installations.

**PROJECT LINK:** **https://wokwi.com/projects/414805231542638593**