Gyroscope Sensor

Group N10

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Guide

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What is Sensor?

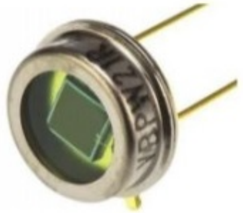
- A sensor is a device that detects physical properties and converts them into electrical signals for processing and analysis by a computer or other electronic system

Temperature Sensor

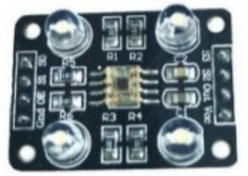

Humidity Sensor


Proximity Sensor

- They are used in various applications and their accuracy depends on their design, calibration, and environmental conditions.

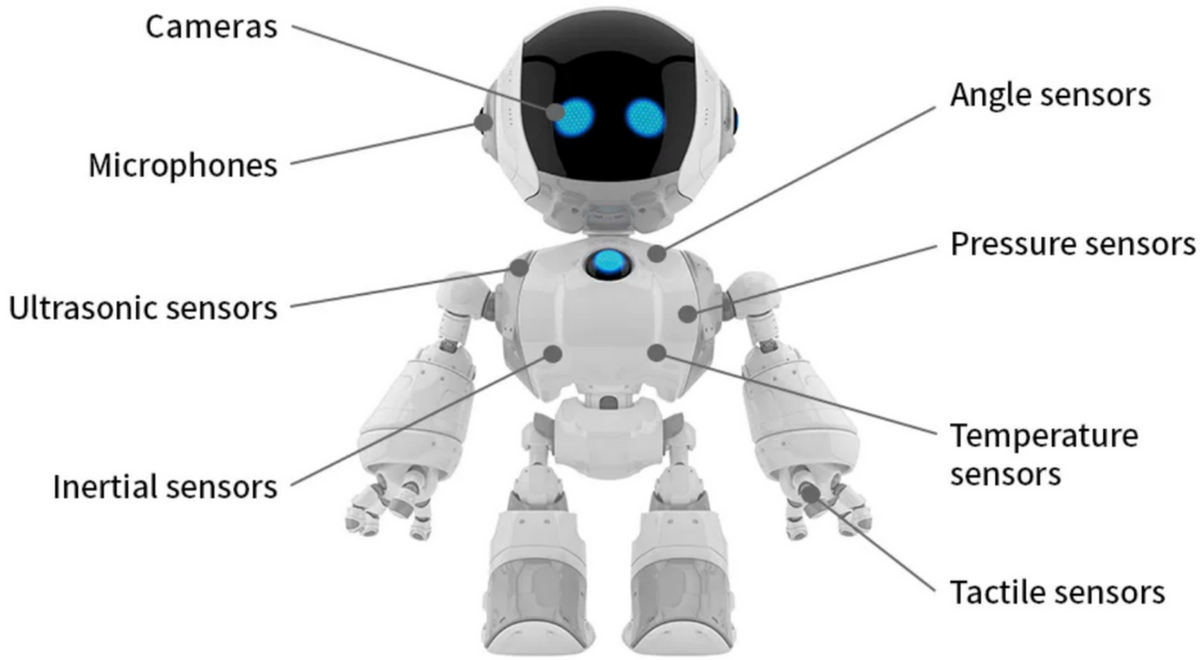

Light Sensor


Metal Sensor


Color Sensor

Need of Sensor in Robotics

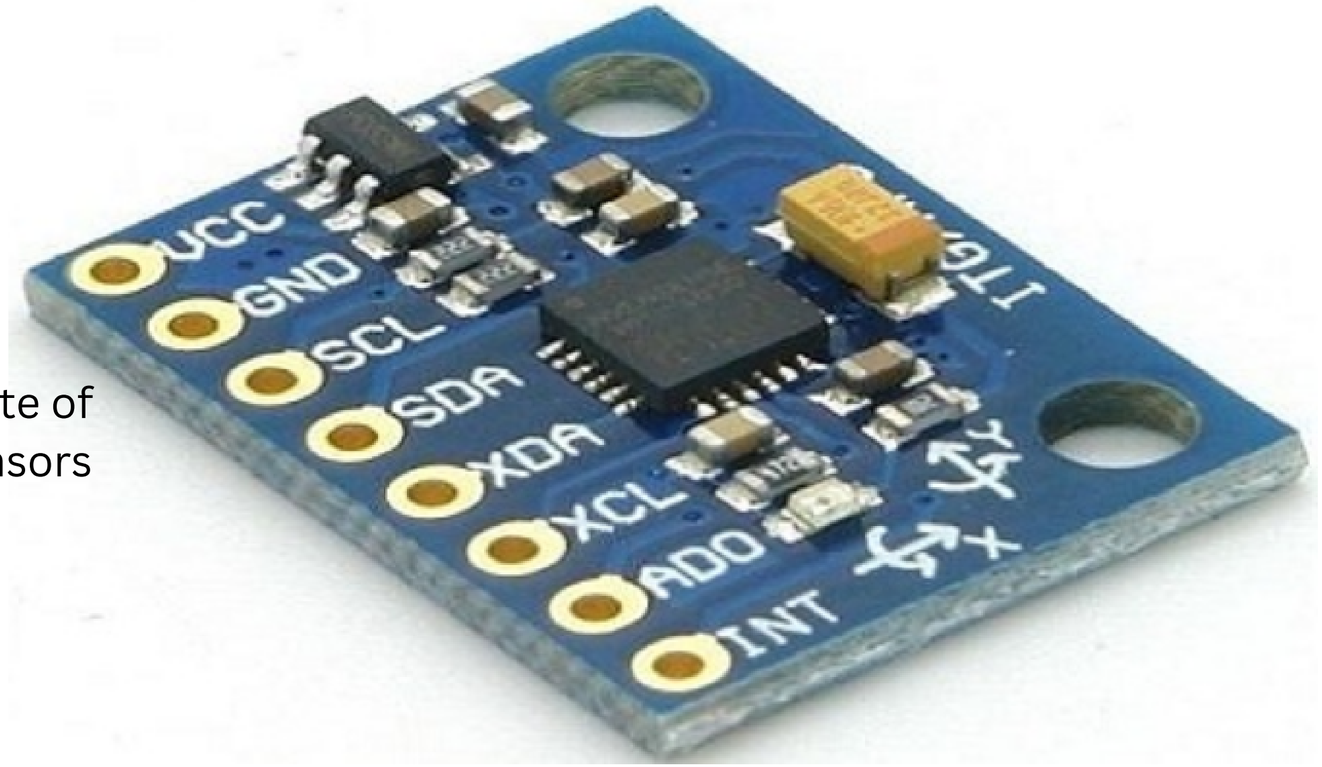
- Sensors allow robots to gather information about their environment.
- They enable robots to make decisions and perform tasks more accurately and efficiently.
- Sensors can help robots navigate and avoid obstacles.
- Sensors enable robots to detect and respond to changes in their surroundings in real-time.



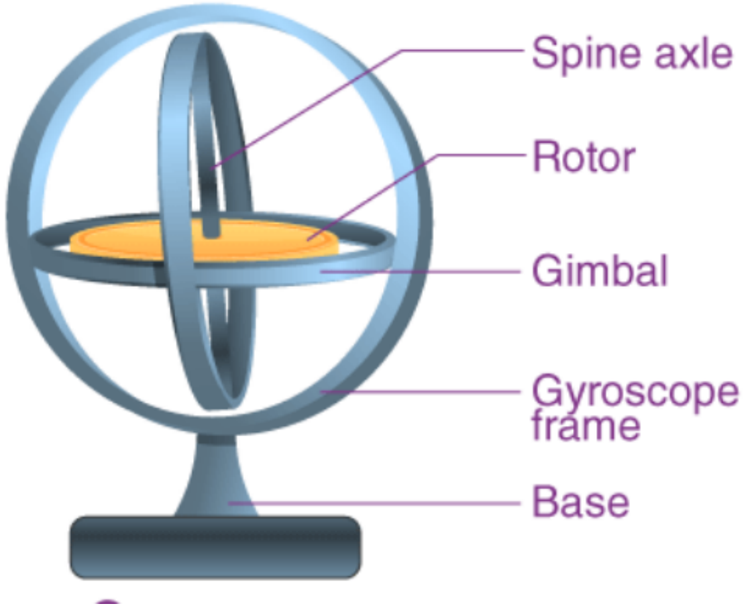
What is Gyroscope Sensor

- A gyroscope sensor is a device that measures rotation rate and orientation using the principle of angular momentum.

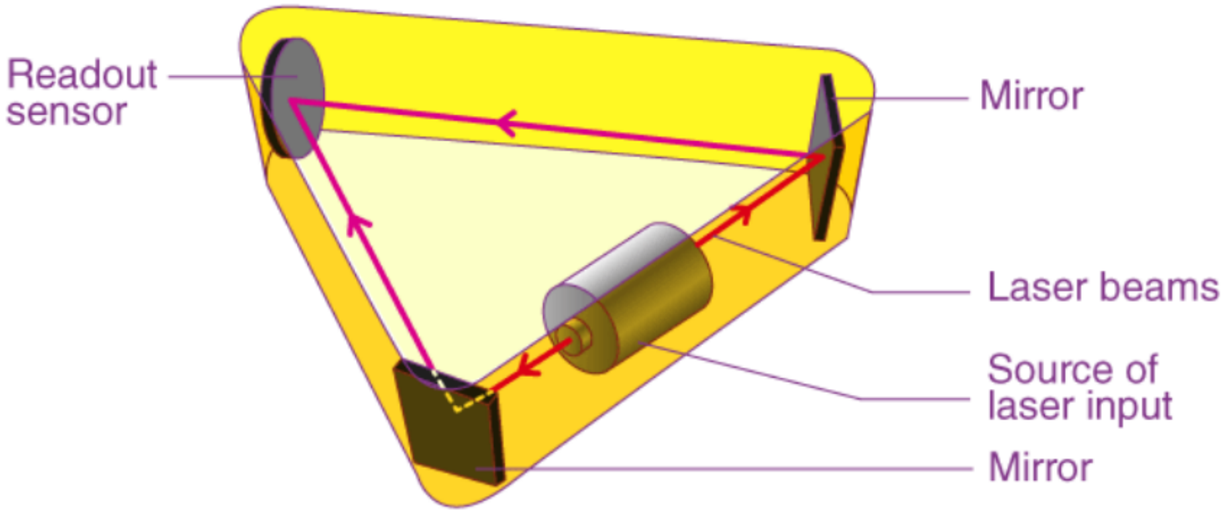
- The output of a gyroscope sensor is typically a voltage or current that is proportional to the rate of rotation, and it can be combined with other sensors such as accelerometers for more accurate measurements.



Types of Sensor



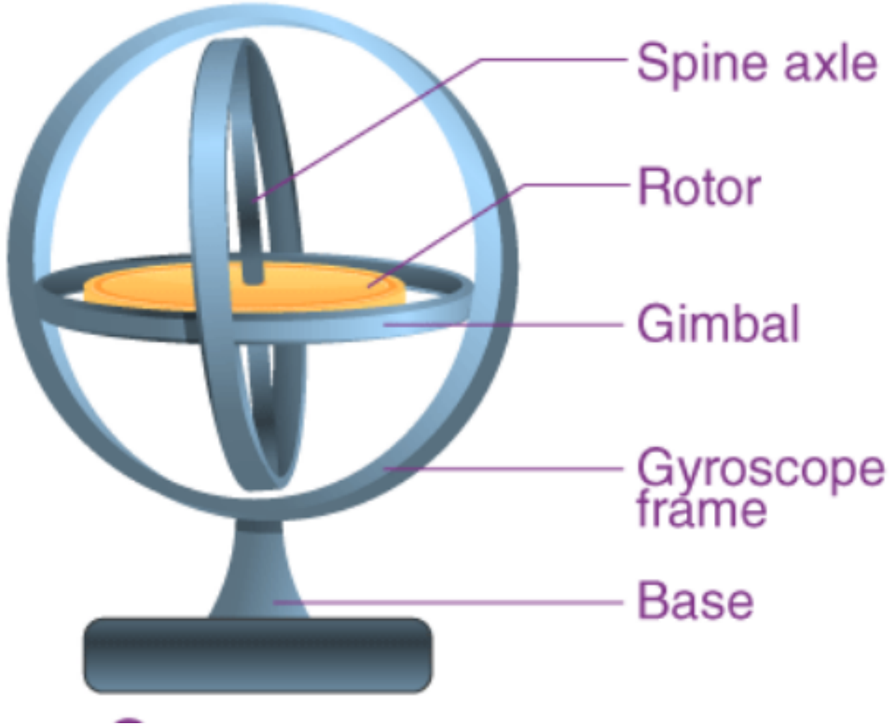
Mechanical Sensor



Optical Sensor

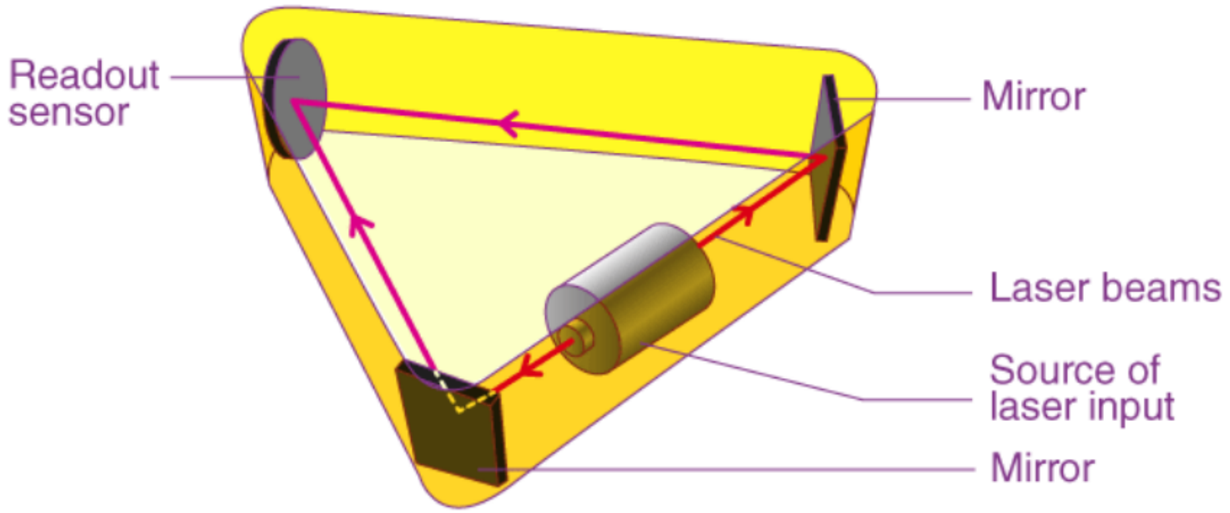
Mechanical Sensor

- Mechanical gyroscopes use a spinning mass to detect rotation.
- They consist of a rotor that is suspended by a set of gimbals, which allows it to move in any direction.
- When the device rotates, the rotor experiences a force that is perpendicular to its direction of rotation
- This force causes the rotor to move, and this movement can be detected by a sensor.

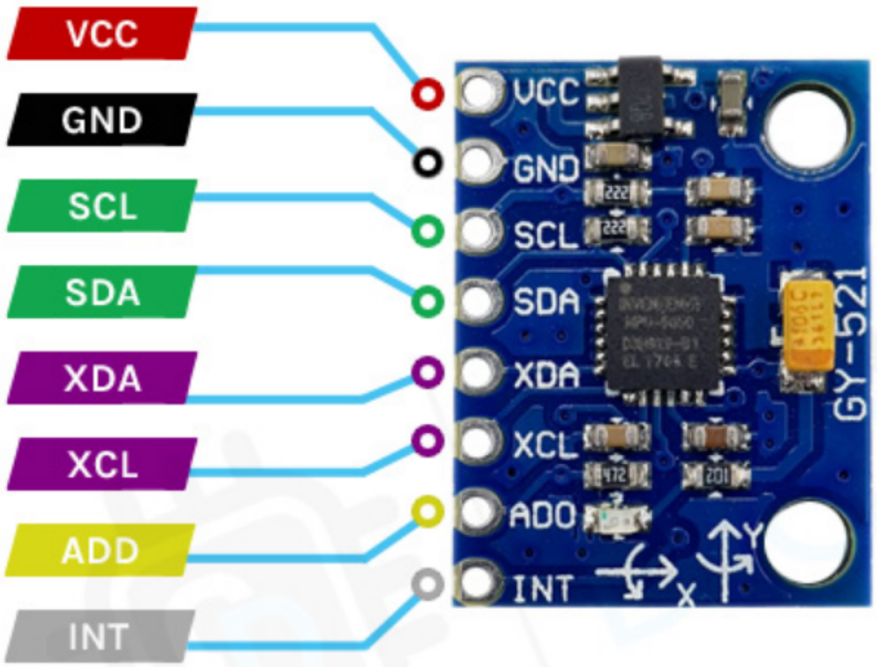


Optical Sensor

- Optical gyroscopes use the interference of light waves to detect rotation.
- When the device rotates, the light waves travel different distances through the fibers, and this causes a phase shift in the light waves
- This phase shift can be detected by a sensor, which allows the gyroscope to measure the rate



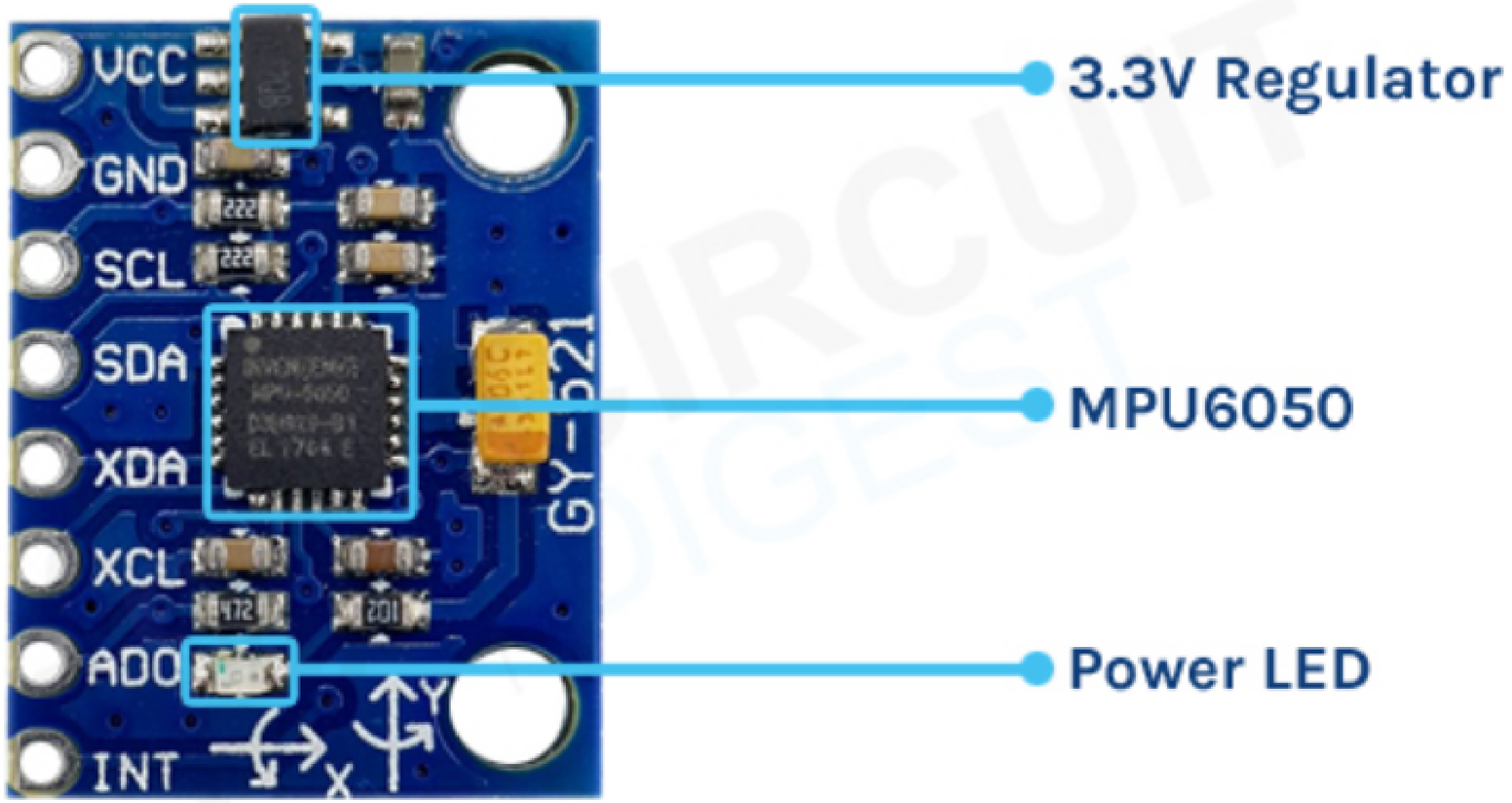
Construction of Gyro Sensor



- VCC
- GND
- I2C Pins
- External Sensor Pir
- Address Select Pin
- Interrupt Outpu

VCC	Provides power for the module, Connect to the 5V pin of the Arduino.
GND	Ground Connected to Ground pin of the Arduino.
SCL	Serial Clock Used for providing clock pulse for I2C Communication.
SDA	Serial Data Used for transferring Data through I2C communication.
XDA	Auxiliary Serial Data - Can be used to interface other I2C modules with MPU6050.
XCL	Auxiliary Serial Clock - Can be used to interface other I2C modules with MPU6050.
ADD/ADO	Address select pin if multiple MPU6050 modules are used.
INT	Interrupt pin to indicate that data is available for MCU to read.

Construction of Gyro Sensor



Need for the sensor

- Gyroscope sensors are necessary for accurate navigation in vehicles such as aircraft, ships, and spacecraft.
- They are essential for robotics to detect movement and maintain stability.
- Gyroscope sensors are used in virtual reality systems to track user movement and enhance the immersive experience.
- Consumer devices such as smartphones and gaming controllers use gyroscope sensors for motion sensing and orientation detection.

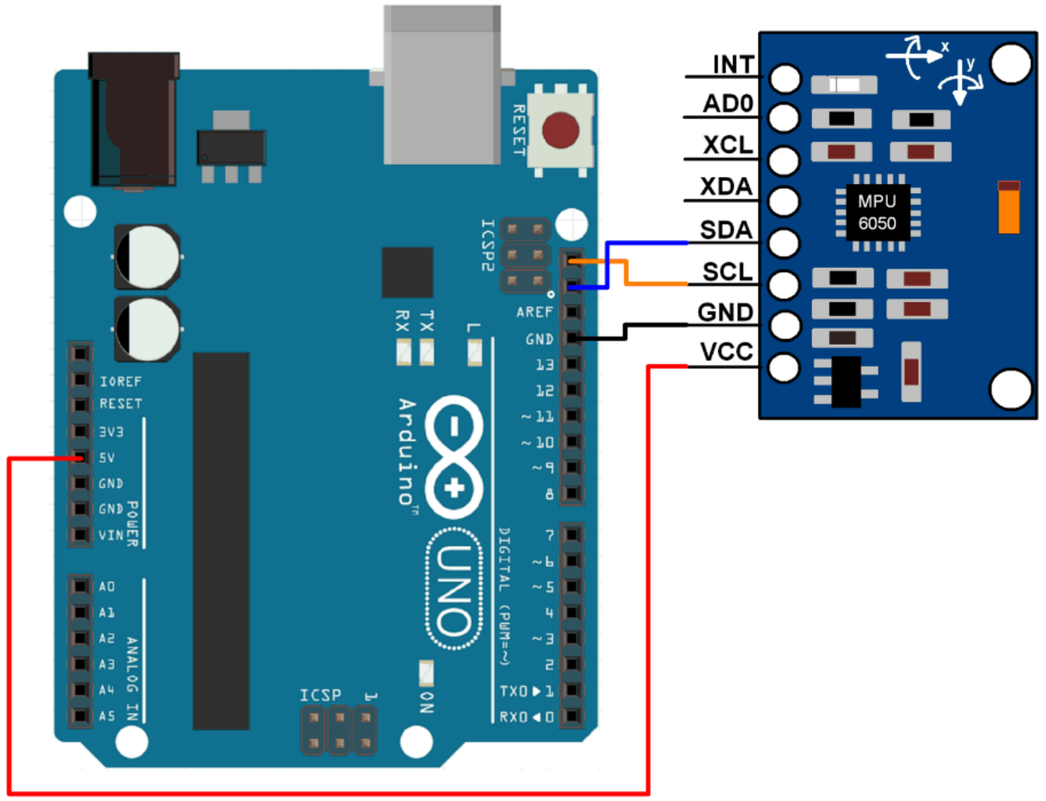
Working

- A gyroscope sensor consists of a rotor that spins at a high speed inside a housing.
- When the housing rotates, the spinning rotor resists changes in its orientation due to the principle of conservation of angular momentum.
- The resulting force created by the rotor's resistance to changes in orientation is measured by the sensor and used to determine the rate of rotation or changes in orientation.
- The sensor may use a variety of technologies to detect changes in the rotor's orientation, such as optical, magnetic, or piezoelectric sensors.
- The output of the sensor is typically a voltage or digital signal that can be processed by a microcontroller or other control system.

Specification

- Measurement range: Typically several hundred degrees per second
- Resolution: Usually measured in degrees per second (DPS) or radians per second (RPS)
- Accuracy: Can vary from a few degrees per hour to several degrees per second, depending on the quality and design of the sensor
- Bandwidth: The range of frequencies over which the sensor can accurately measure angular velocity
- Sensitivity: The amount of change in angular velocity that can be detected by the sensor
- Power consumption: The amount of power required to operate the sensor
- Output type: Digital or analog output, and the specific protocol used (e.g. I2C, SPI, etc.)
- Operating temperature range: The range of temperatures over which the sensor can operate correctly
- Size and weight: The physical dimensions and weight of the sensor, which can be important in applications where size and weight are critical factors.

Working with Arduino



Interfacing MPU6050 Module With Arduino UNO

Working with Arduino

- Connect the MPU6050 module to the Arduino UNO board using jumper wires. Connect VCC to 5V, GND to GND, SDA to A4, and SCL to A5.
- Download and install the I2Cdev and MPU6050 libraries on the Arduino IDE.
- Upload the I2Cdev library's sample code to the Arduino board to verify that the module is properly connected and detected by the Arduino.
- Modify the sample code to read and display the gyroscope and accelerometer data from the MPU6050 module.
- Optionally, process the data using filters or other algorithms to obtain the desired output.
- Use the data to control the motion of a robot or other device, or to provide feedback on changes in orientation or angular velocity.

Advantages v/s Disadvantages

- High accuracy and precision
- Fast response time
- Compact and lightweight design
- Low power consumption

- Limited measurement range
- Sensitive to external forces and vibrations
- Susceptible to drift over time without calibration
- Higher cost compared to some other types of sensors

Conclusion

In conclusion, gyroscope sensors are an essential component in many different applications and play a crucial role in enabling many of the features and functions that we rely on every day. As technology continues to advance, it is likely that gyroscope sensors will continue to play an increasingly important role in our lives.