Universitatea POLITEHNICA din București
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Wireless MOTION REPLICATING MODULE

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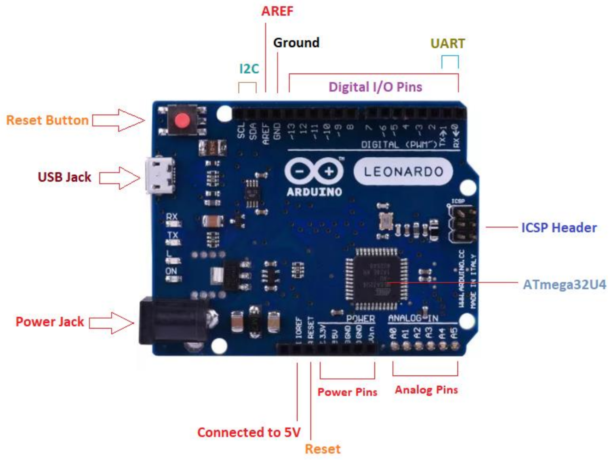
Concept of work

- Although human and machine presences have their own place in this world when it comes to capabilities, neither can hold the candle to the other in some high-risk.

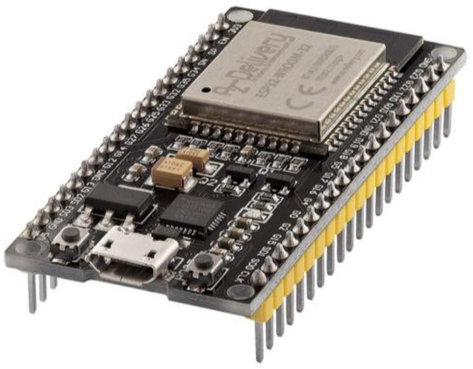
- By putting them together, we can achieve the highest chance of success. One area where this argument is especially applicable is constituted by all the high-risk environments humans must operate in (i.e.: battlefields, fires, high-altitude spaces etc.)

Components

- □ 1x Arduino Leonardo microcontroller

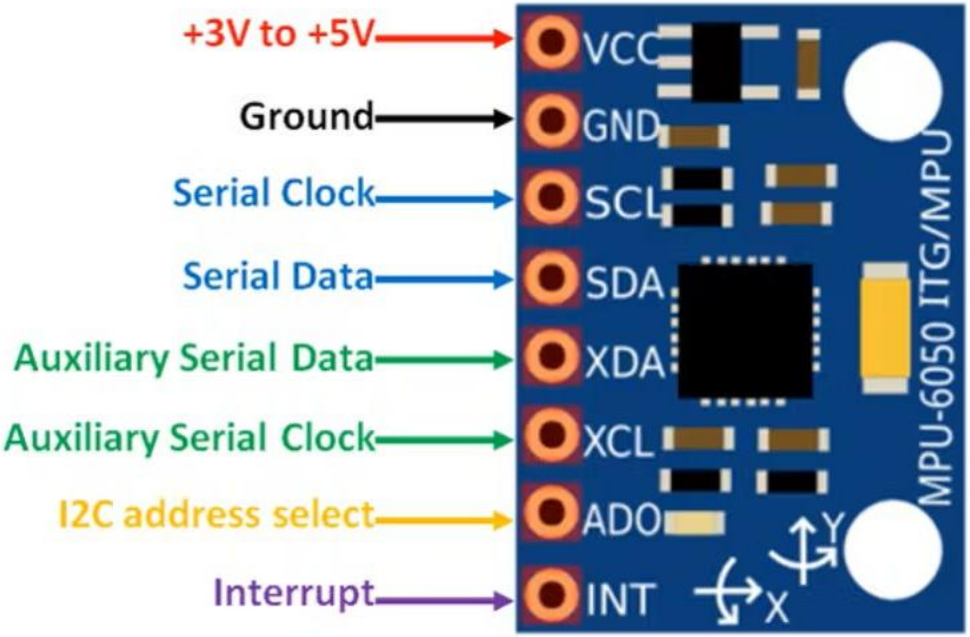


- □ 1x ESP32 microcontroller



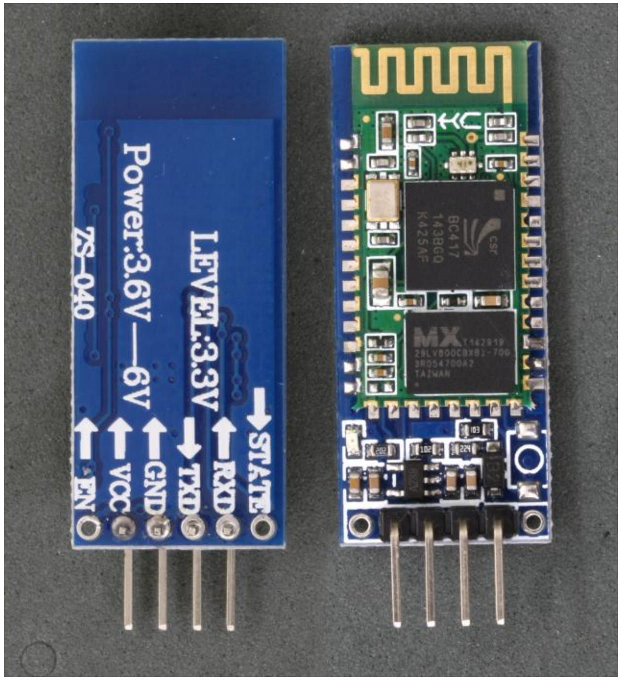
Components

- □ 1x MPU 6050 accelerometer/gyroscope;



Components

- □ 1x ZS-040HC-05/-06 Bluetooth module;

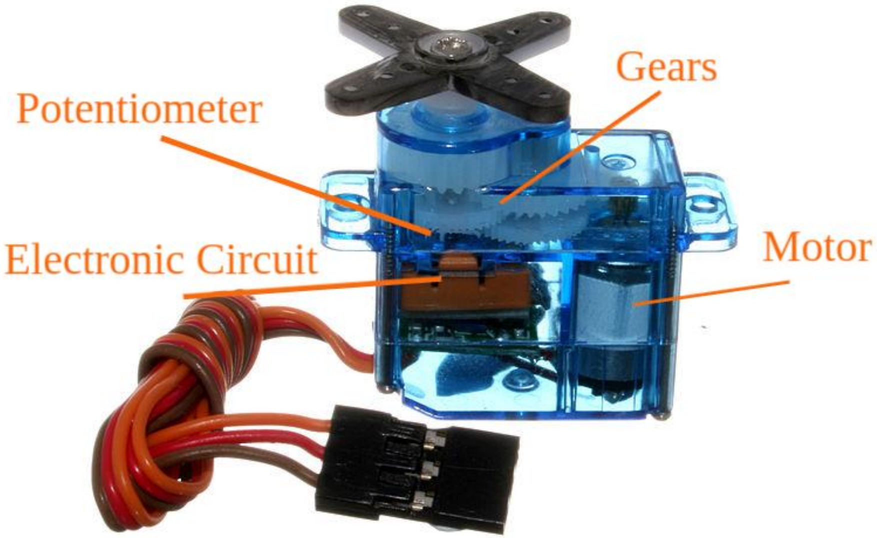


Components

- 2x SG92R micro servo motors;

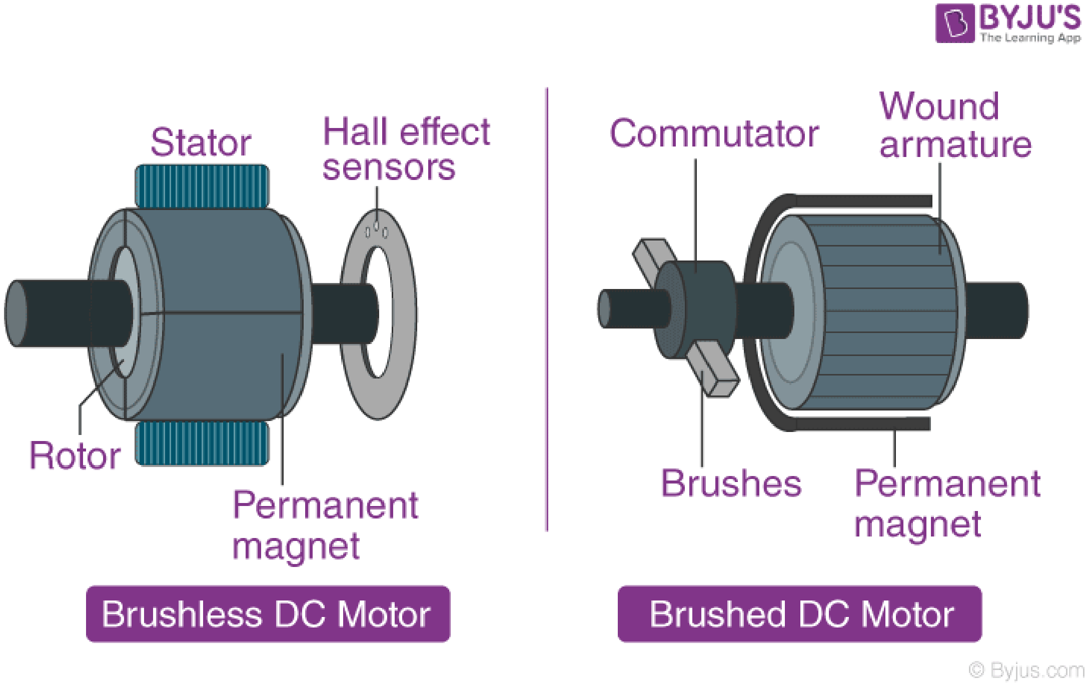
- Male-male cables;
- Male-female jumper cables;
- Female-female jumper cables;

Servo motor vs. dc motor



- □ +: more sensitive to stimuli; can work at any speed;
- □ - : lighter, less rugged; positional ones only rotate180°; 4x more expensive;

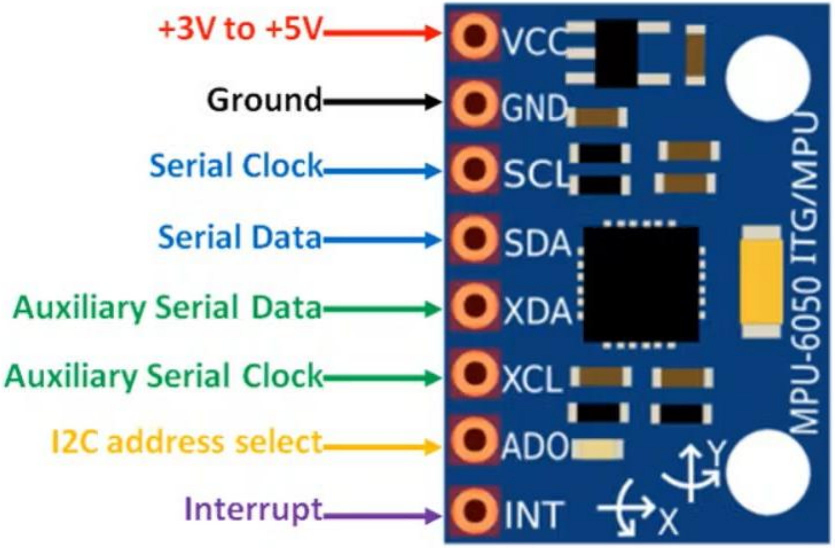
Servo motor vs. dc motor

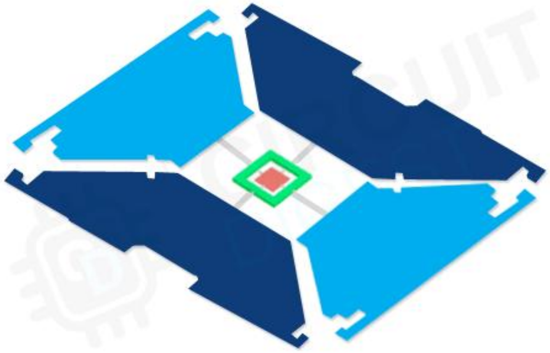


- □ + : works at higher speeds; more solid; cheaper
- □ - : needs extra components to control direction and speed; less sensitive to stimuli; lags when powered;

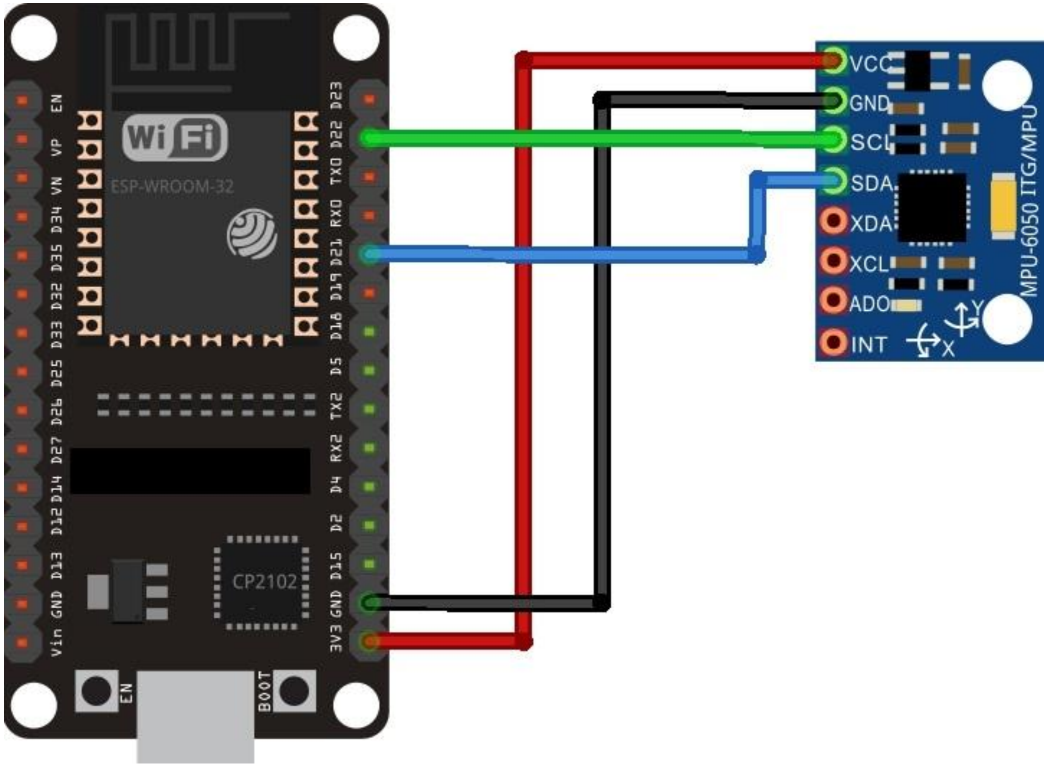
Gathering data using the mpu6050

- 3-axis accelerometer;
- 3-axis gyroscope;
- Calculates the angle it has on each axis and sends certain data to the motors as degrees;
- Uses I2C data bus;





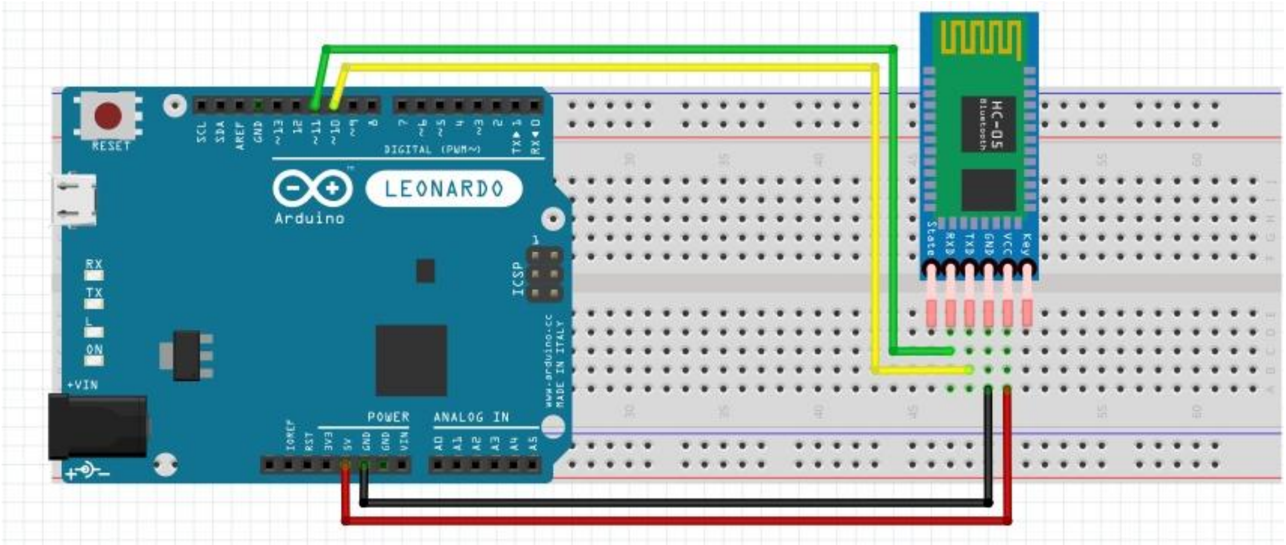
Master microcontroller



□ ESP32 acts as a ‘master’ in the Bluetooth connection;

□ ESP32 reads data from MPU6050 and sends said data via the integrated Bluetooth module to the ‘slave’ microcontroller;

Slave microcontroller



□ - The Arduino Leonardo microcontroller does not have an integrated Bluetooth module, so we must use a ZS-040 HC-05/-06;

□ - This microcontroller acts as the ‘slave’ in the Bluetooth connection, as it acts upon the data that it receives from the ‘master’ microcontroller;

Code libraries used

- <SoftwareSerial.h> - used in the Arduino Leonardo microcontroller for it to read the data transmitted by the ESP32 microcontroller via Bluetooth;

- <Servo.h> - used in the Arduino Leonardo microcontroller in order to command the two servo motors;

- <BluetoothSerial.h> - used in the ESP32 microcontroller in order to make it Bluetooth available and transmit data to the Arduino Leonardo microcontroller;

- <MPU6050_light.h> - used in the ESP32 microcontroller in order to read and compute the data sent by the MPU6050 accelerometer/gyroscope;

Examples of device already in use

- Attack helicopters;

- Camera gimbals;

Conclusions

- Unfortunately, because of some unexpected technical issues, we are unable to produce a fully wireless prototype (establishing the Bluetooth between the two microcontroller). And so, we decided to bring a wired prototype to demonstrate how the full device was envisioned to look like.
- Our further goal is exactly to convert this device to become fully wireless and independent of the distance between the user and the module itself.