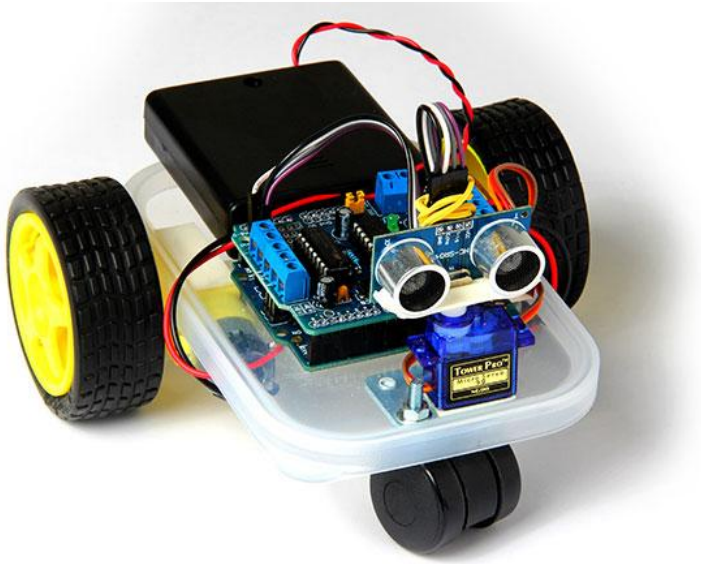
EP486 Microcontroller Applications

Topic 12

Arduino Apps:

MPU 6050

IMU Sensor



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IMU (Inertial Measurement Unit)

- IMU measures craft's velocity, orientation, and gravitational forces.

- IMU sensors usually consists of two or more parts. accelerometer, gyroscope, magnetometer and altimeter.

- IMU sensors like the MPU 6050 are used in self balancing robots, UAVs, smartphones, etc.
- The MPU 6050 is a 6 DOF (Degrees of Freedom) or a six axis IMU sensor, which means that it gives six values as output.

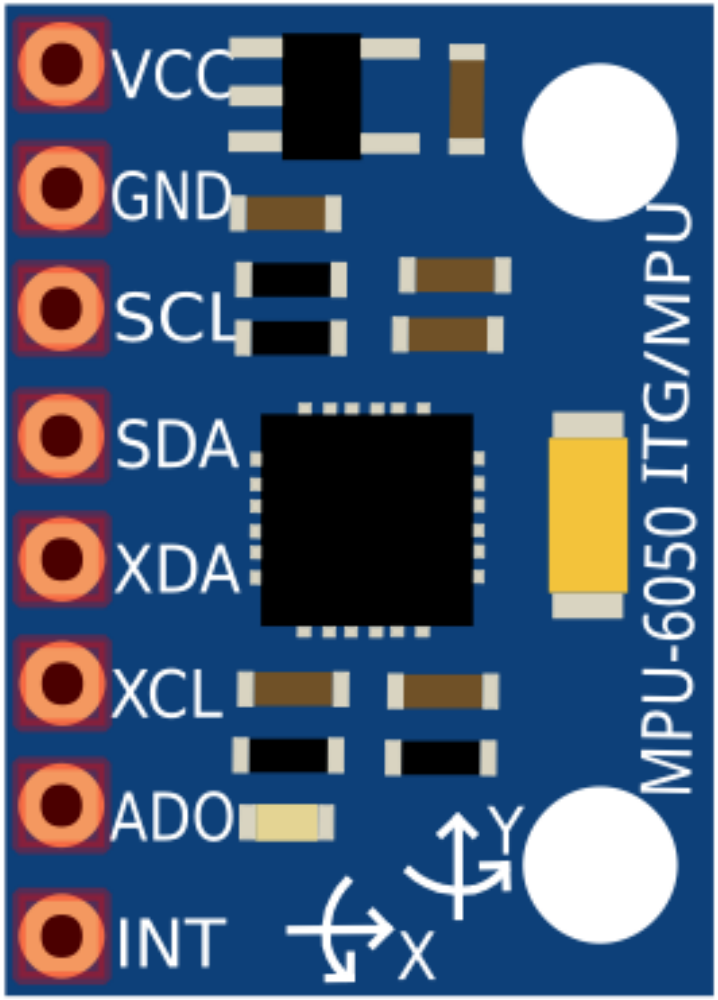
MPU 6050

- IMU sensors like the MPU 6050 are used in self balancing robots, UAVs, smartphones, etc.

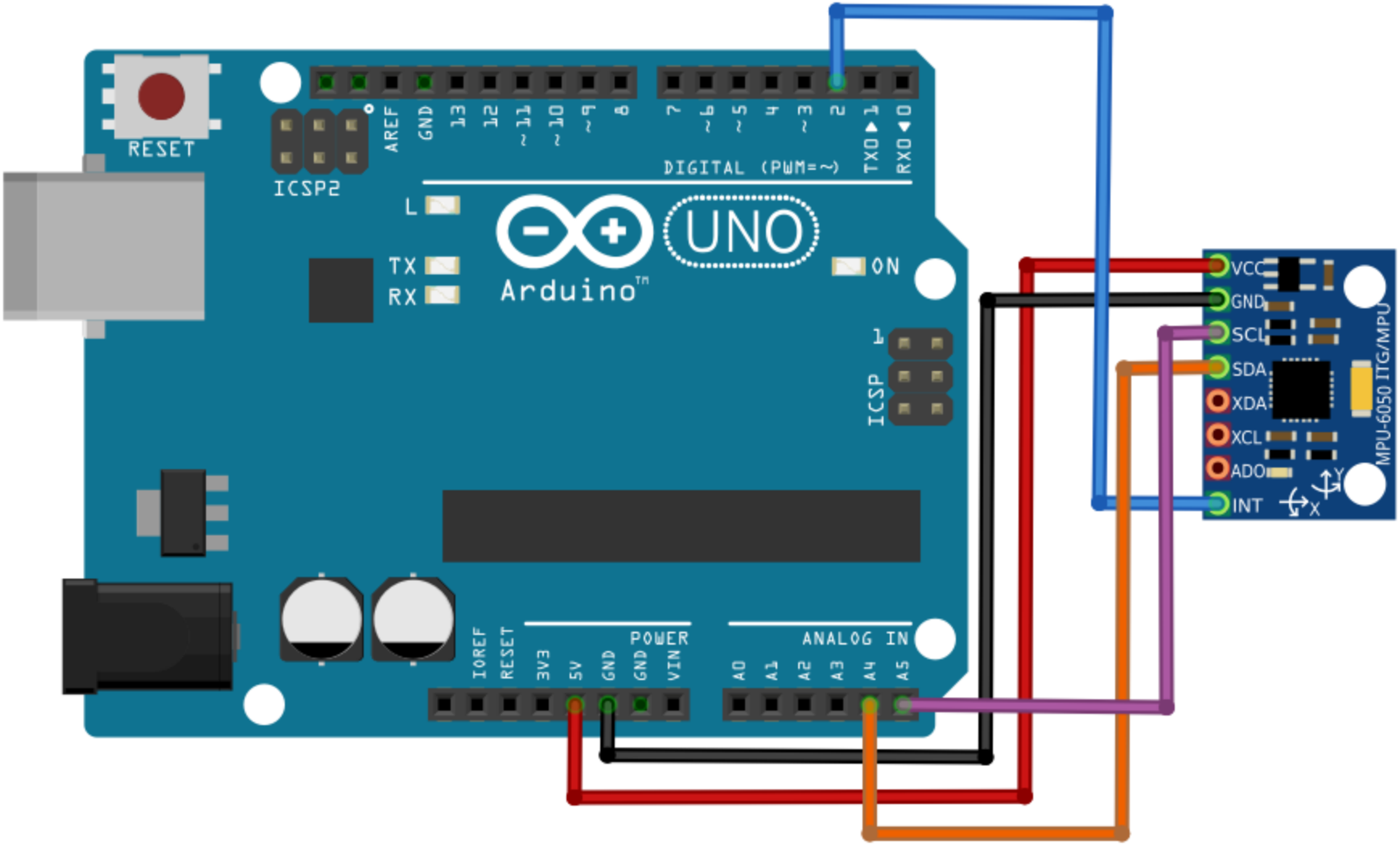
- The MPU 6050 is a 6 DOF (Degrees of Freedom) or a six axis IMU sensor, which means that it gives six values as output. These are:
  Acceleration components: ax, ay, az
  Angular velocity components: wx, wy, wz

- MPU 6050 is a sensor based on MEMS (Micro Electro Mechanical Systems) technology. Both the accelerometer and the gyroscope is embedded inside a single chip. This chip uses I2C (Inter Integrated Circuit) protocol for communication.

MPU 6050



Interfacing



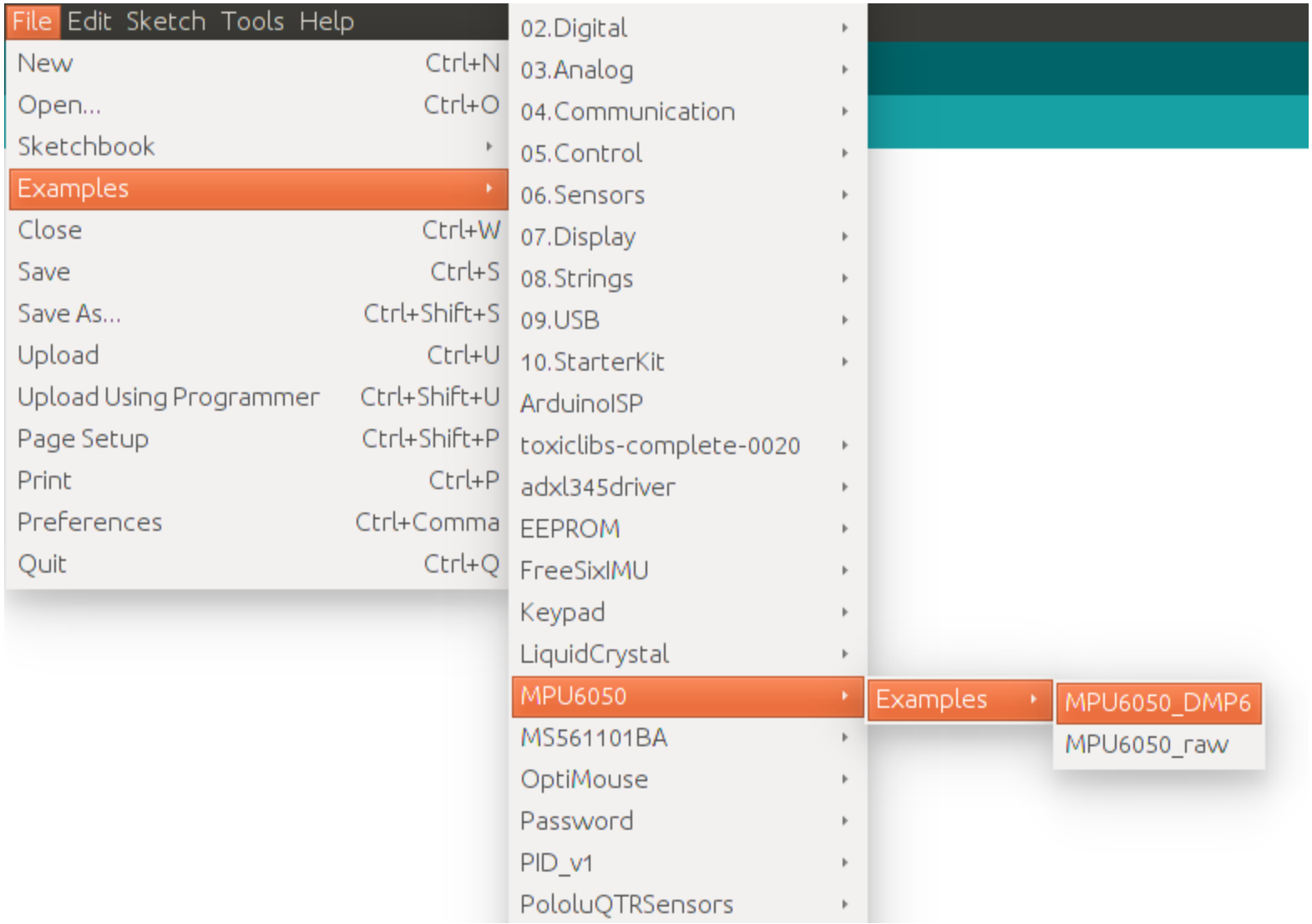
Coding

1. Download the following two files from course web page:
   www1.gantep.edu.tr/~bingul/ep486/src/MPU6050.zip
   www1.gantep.edu.tr/~bingul/ep486/src/I2Cdev.rar

2. Unzip/extract these files.

3. Paste them inside the arduino’s "library" folder.

Coding


File Edit Sketch Tools Help
New Ctrl+N
Open... Ctrl+O
Sketchbook
Examples
Close Ctrl+W
Save Ctrl+S
Save As... Ctrl+Shift+S
Upload Ctrl+U
Upload Using Programmer Ctrl+Shift+U
Page Setup Ctrl+Shift+P
Print Ctrl+P
Preferences Ctrl+Comma
Quit Ctrl+Q
02.Digital
03.Analog
04.Communication
05.Control
06.Sensors
07.Display
08.Strings
09.USB
10.StarterKit
ArduinoISP
toxiclibs-complete-0020
adxl345driver
EEPROM
FreeSixIMU
Keypad
LiquidCrystal
MPU6050
MS561101BA
OptiMouse
Password
PID_v1
PololuQTRSensors
Examples
MPU6050_DMP6
MPU6050_raw

Coding

- MPU6050_raw: no modification has been done.
- MPU6050_DMP6: contains many useful functions.

Note on modifying raw data:

Each value (ax, ay, az, gx, gy, gz) is in the range [-32768, +32767].

```
ACCEL_CONFIG = +/- 2g, 4g, 8g or 16g where g = 9.8 m/s^2
   +16384 = +1g (at a sensitivity of 2g)
   -32768 = -2g  (at a sensitivity of 2g)

GYRO_CONFIG  = +/- 250, 500, 1000, or 2000 deg/sec.
   +32767 = +250 deg/sec
   -32768 = -250 deg/sec
```

Coding

Conversion from raw acceleration (ax) to SI units

```
rax = 2*9.8 * ax / 32767
```
(m/s²)

To get velocity:

```
vx = vx0 + rax*dt
```

Conversion from raw gyroscope (gx) to SI units

```
rgx = 250 * gx / 32767
```
(deg/s)

To get angle:

```
thetax = thetax0 + rgx*dt
```