# Department of Electronic and Telecommunication Engineering, University of Moratuwa

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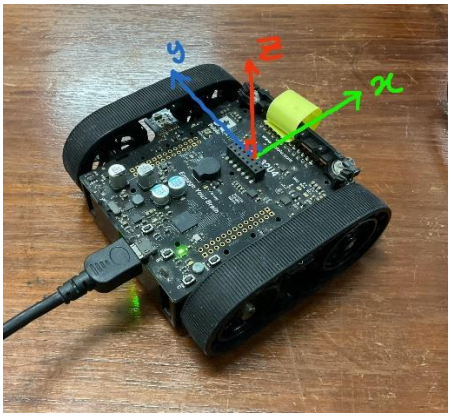
1. **What does IMU stand for? What sensors are included in an IMU?**

   - IMU stands for Inertial Measurement Unit
   - 3 Accelerometers
   - 3 Gyroscopes
   - 3 Magnetometers

2. **Sketch the local coordinate frame of the Zumo IMU sensor.**




3. **Give the accelerometer calibration matrix and magnetometer min, max values**

```
Calibration matrix

    1.01178 -0.00866024  -0.0248484
 0.00554196     0.98924   0.0260002
 0.00142623   -0.020539     1.00984
   0.163755  0.00385699   -0.949452
Press CTRL+C to end!
```

Min

Mx = -5843
My = -1722
Mz = -1933

Max

Mx = -556

My = 2738

Mz = 2941

4. **It is required to find Earth's gravitational acceleration in terms of standard g = 9.81 $ms^{-2}$.**

Hint:

Example: An LSM303DLH gives an accelerometer Z axis reading of -16144 (decimal) with its default full scale (FS) setting of +/- 2 g. Dropping the lowest 4 bits gives a 12-bit raw value of -1009. The LSM303DLH datasheet (page 11) states a conversion factor of 1 mg/digit at this FS setting, so the value of -1009 corresponds to -1009 * 1 = 1009 mg = 1.009 g.

**What is the magnitude of Earth's gravitational acceleration obtained from the accelerometer raw sensor readings?**

- Accelerometer reading in -Z axis : -17130
- 16-bit representation: 1011110100010110
- 12-bit representation: 101111010001
- Decimal representation: -1031
- Calculated gravitational acceleration : -1031 * 1 = 1031 mg = 1.031 g.

**After calibration, what is the magnitude of Earth's gravitational acceleration obtained from calibrated sensor readings?**

- Row data decimal

  (16 – bit)

  Ax = -550

  Ay = 10

  (12 – bits)

  Ax = 34

  Ay = 0

  Ax = 0.034 g

  Ay = 0 g

- Gravitational acceleration after calibration = 9.25589291 $ms^{-2}$