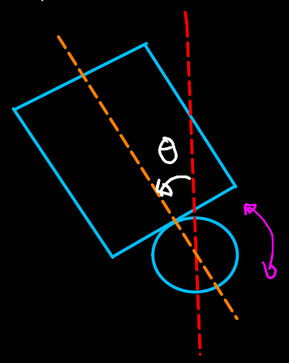
Control of a pendulum robot

1. Introtion

- The natural dynamics of the system is to fall



- Using the rotation of the wheels they system can be stabilized

- In order to perform this stabilization we must measure the error. The error is the difference between the ideal vertical line and the robot inclination.

- Once the error is measured a control system can be implemented. The most common control system is the PID controller.

2. PID controller

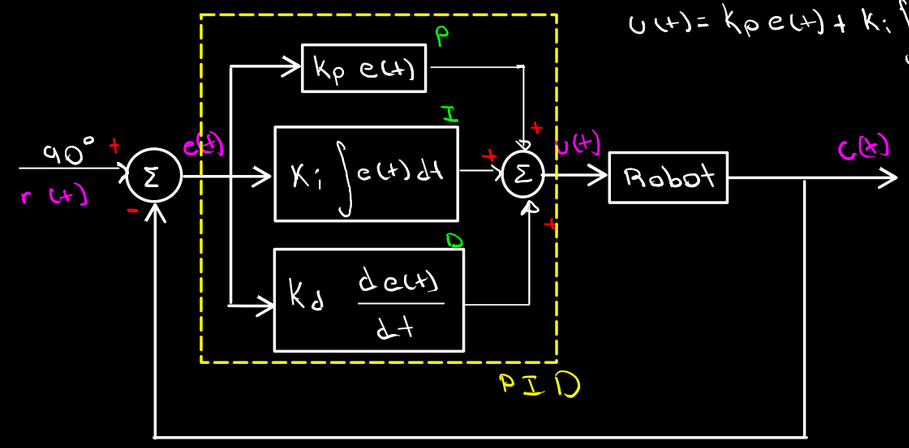
- Because of its simplicity is widely use inside and outside the industry.

- It doesn't requireres a mathematical model of the system to be control to work.

- PID comes from P (proportional) I (integral) and D (differential)

- Diagram and equation:

$$U(t) = K_p e(t) + K_i \int e(t)dt + K_d \frac{de(t)}{dt}$$



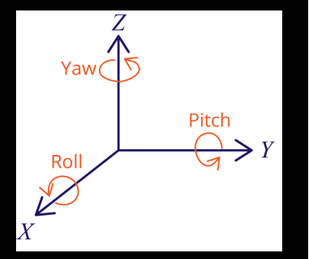
- Because we are working with a digital system (micro controller), we must consider the sample time (T_s)

3. IMU - Inertial Measurement Unit - MPU6050

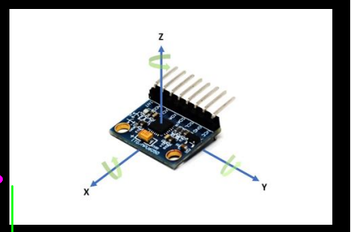
. It is composed by 3 main sections:

a) Accelerometer:

- Static: Constant, ex: gravity
- Dynamic: Vibrations and movements

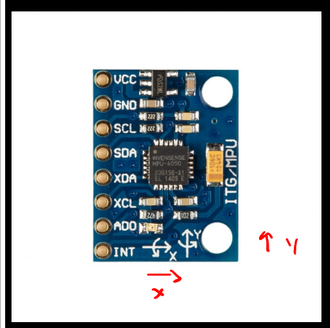


b) Gyroscope: Rotational velocity (rad/s), i.e. change in the angular position around a 3-dimention frame with axes x, y, z.



c) Termometer

- Pinout



- V_{cc} - 5v
- GND - Ground - 0v
- SCL - Clock
- SDA - Data
- xDA, xCL, ADO } Not used
- INT -> Interruptions

	One	Leonardo
	PC5	SCL
	PC4	SDA
	pin 2	pin 7