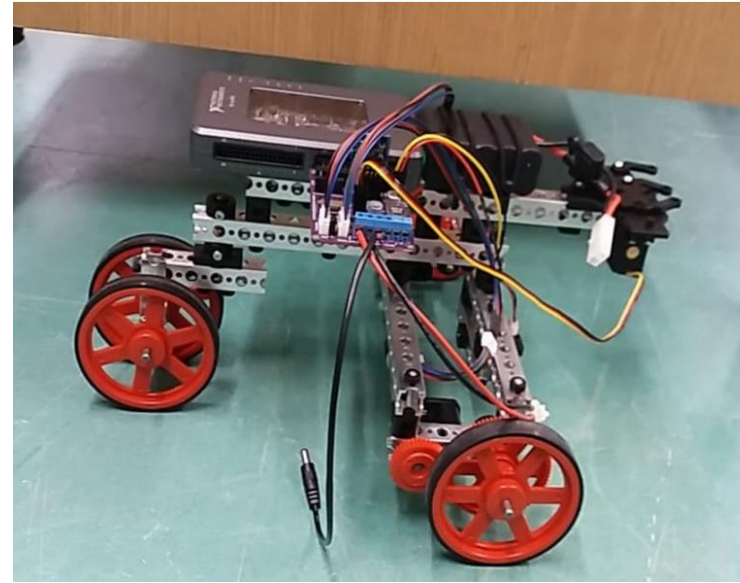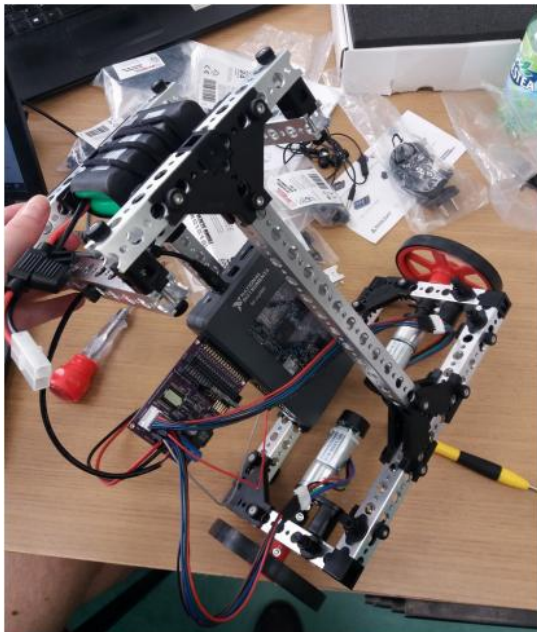# Robots in Great Physical Experiments

Roman Ibrahimov, Azerbaijan

Lucia Chiriacescu, Romania

Rover Vehicle for NICA and Self Balancing Robot

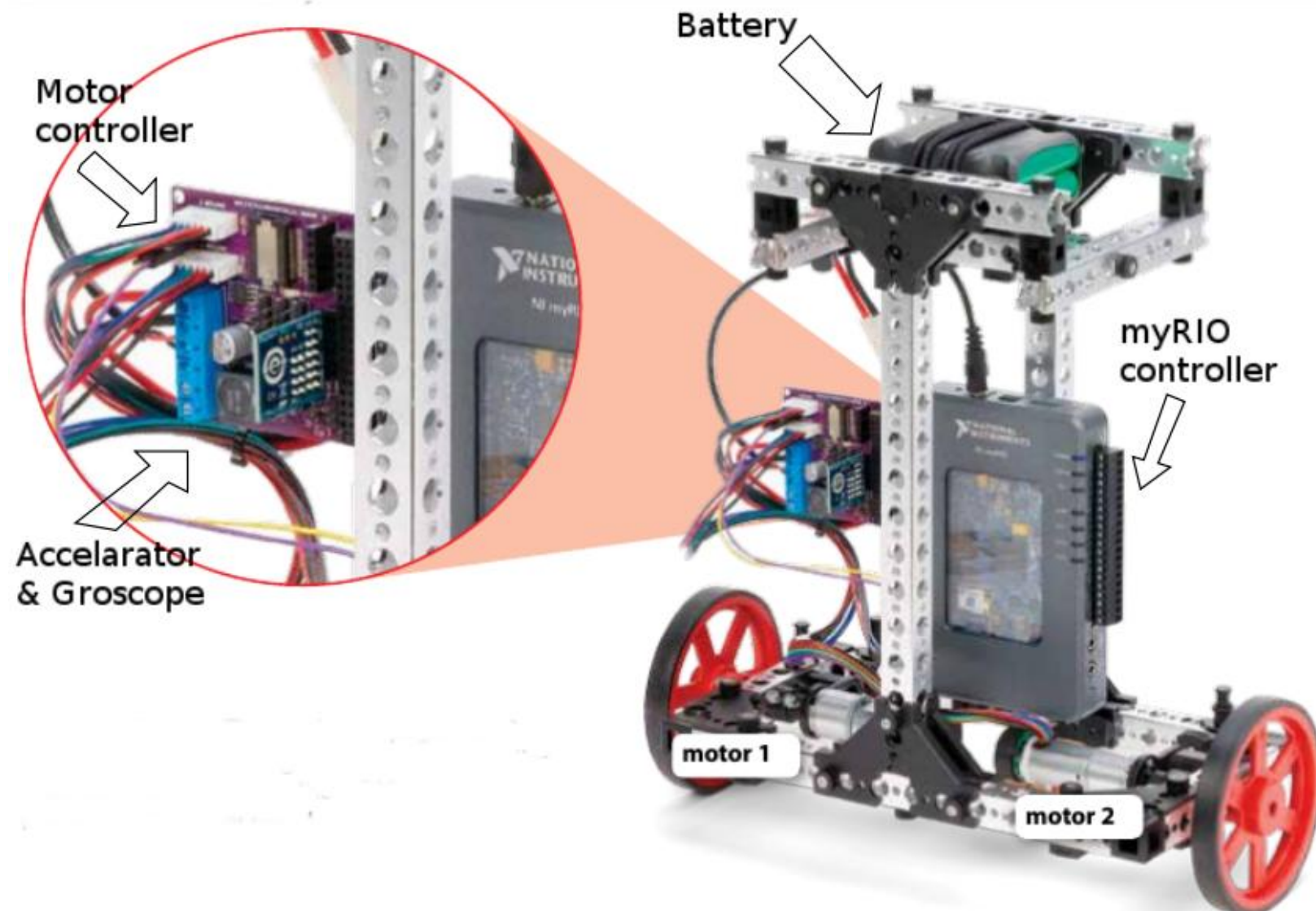## Rover

► Programming it to move autonomously

► In the future it will have a thermal camera

► Will be used to search for gas leaks around NICA

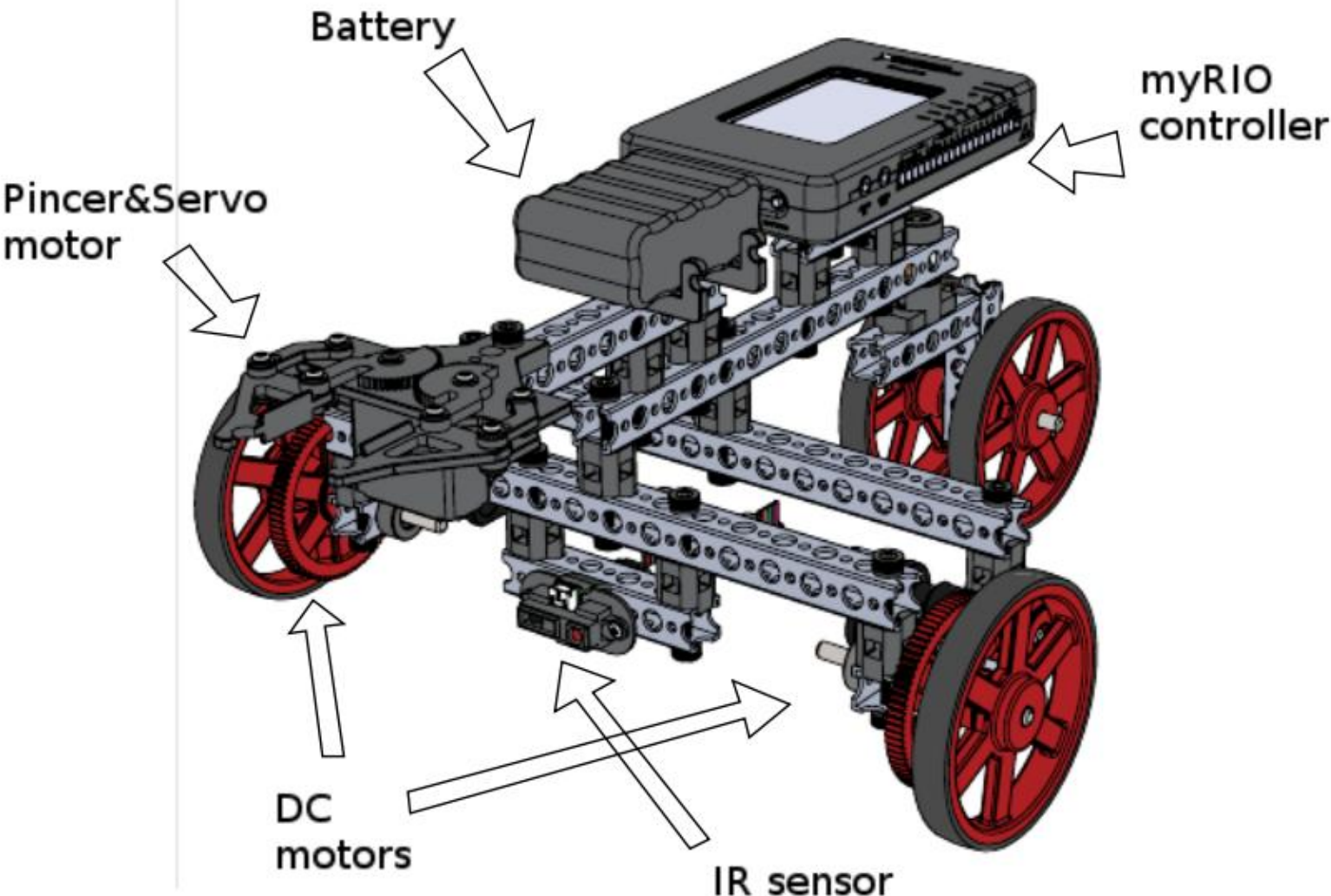## Self Balancing Robot

► Inverted Pendulum

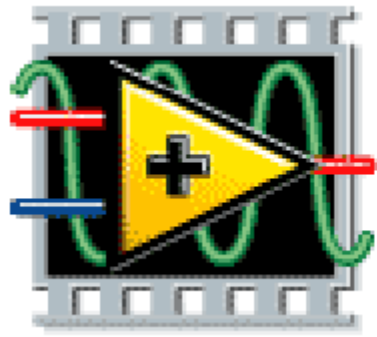► PID control

► Robust stabilization against external forces
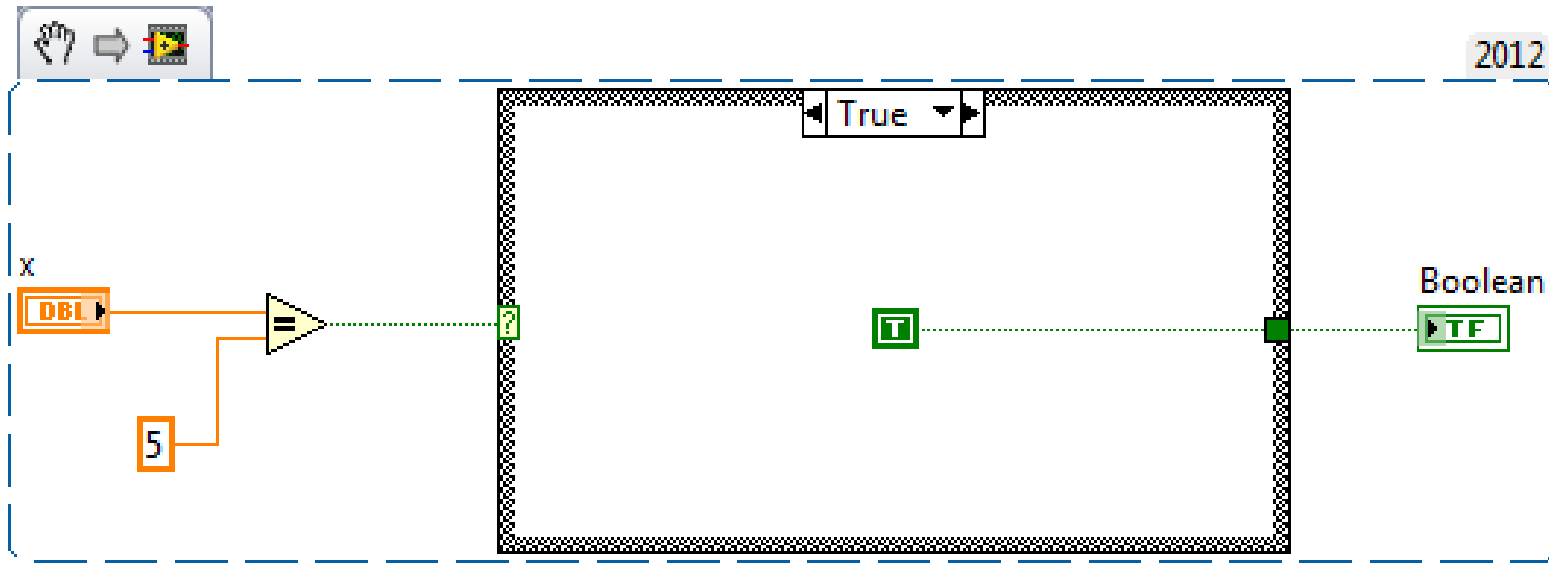
Self Balancing Robot

Rover Vehicle for NICA

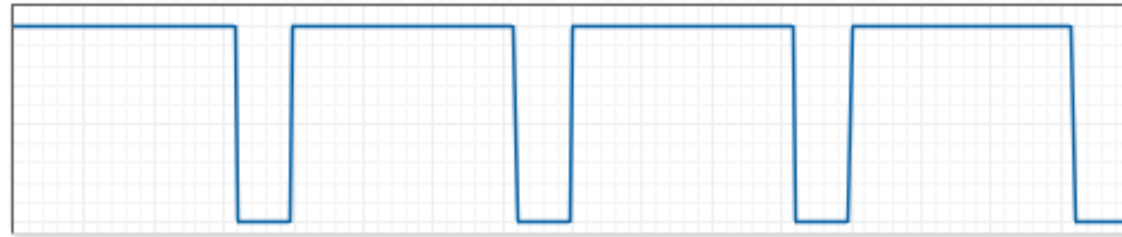# Laboratory Virtual Instrument Engineering Workbench

DC Motors and PWM

Duty cycle:

◉ Set using input to Express VI

○ Set constant:

[0.8]

Output preview:

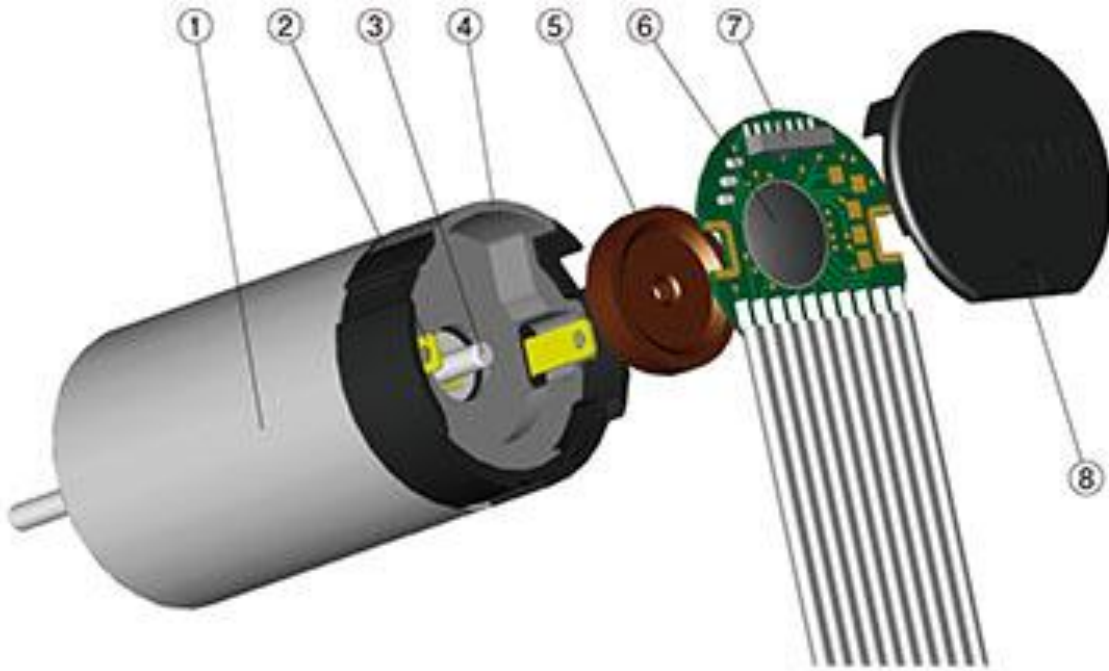▶ $f_{PWM} = \dfrac{f_{clk}}{N \times (X+1)}$

where

f_{PWM} is the desired PWM frequency

f_{clk} is the base clock frequency

N is the clock divisor

X is the number of counts before changing the signal
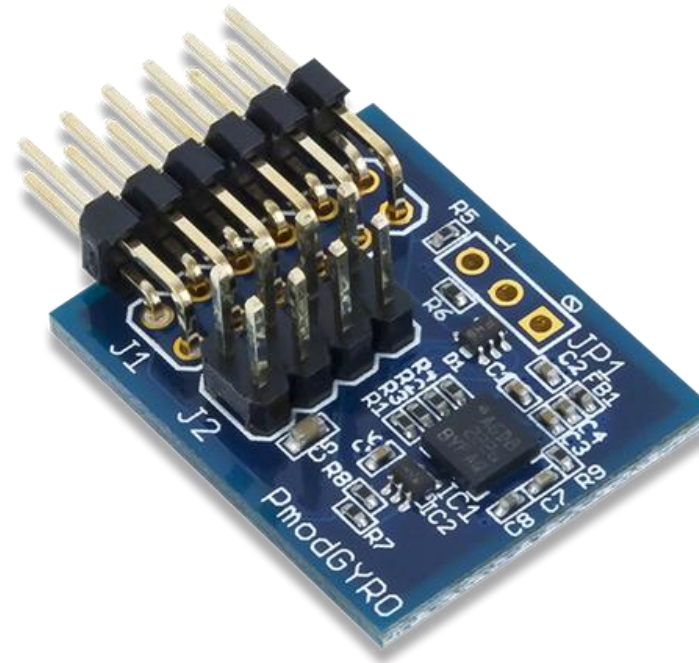
DC Motor Encoders

Magnetic encoder

- (1) Motor
  (2) Motor terminal
  (3) Motor shaft
  (4) Magnetic shield
  (5) Magnetic wheel
  (6) ASIC
  (7) MR sensor
  (8) Cap

Sensors for balancing

MyRio (with onboard accelerometer)
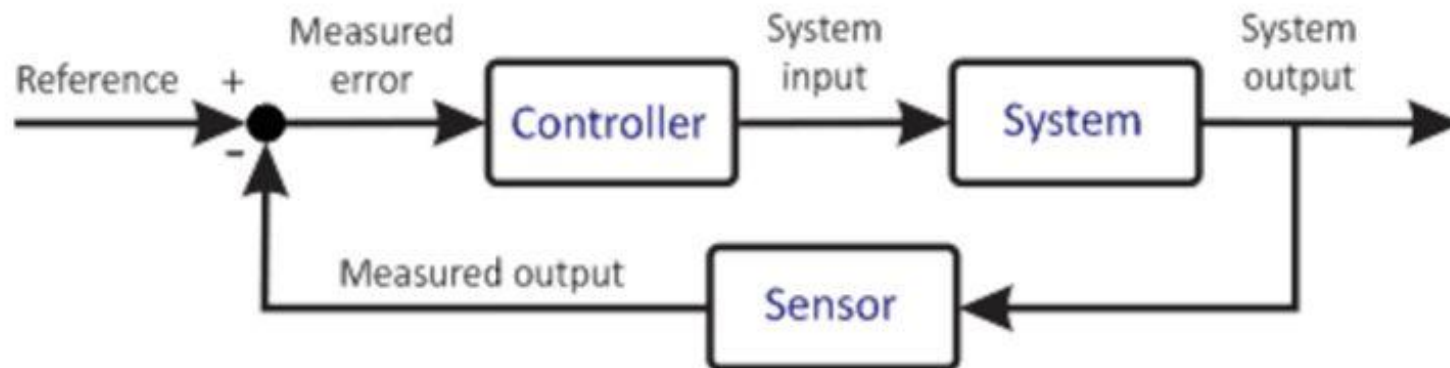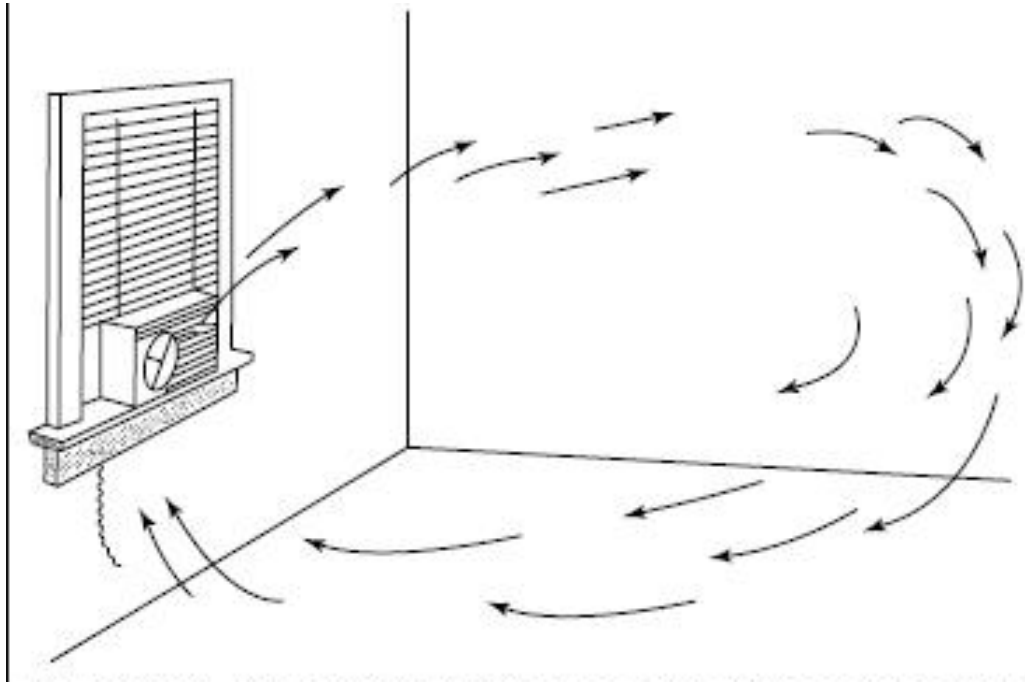
measures

static and dynamic acceleration

Gyroscope
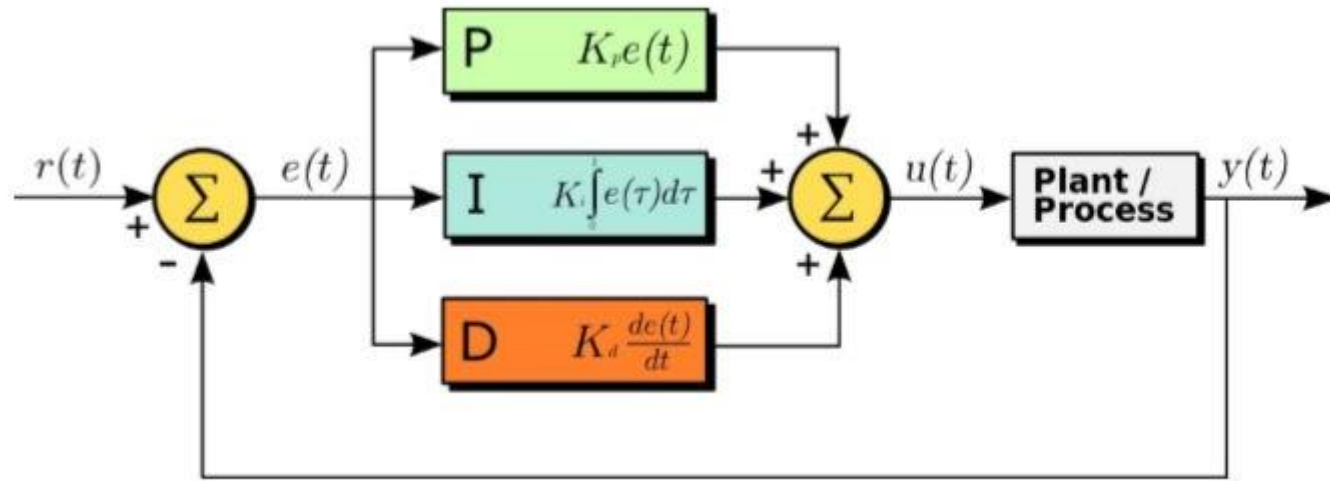
measures rotational velocity

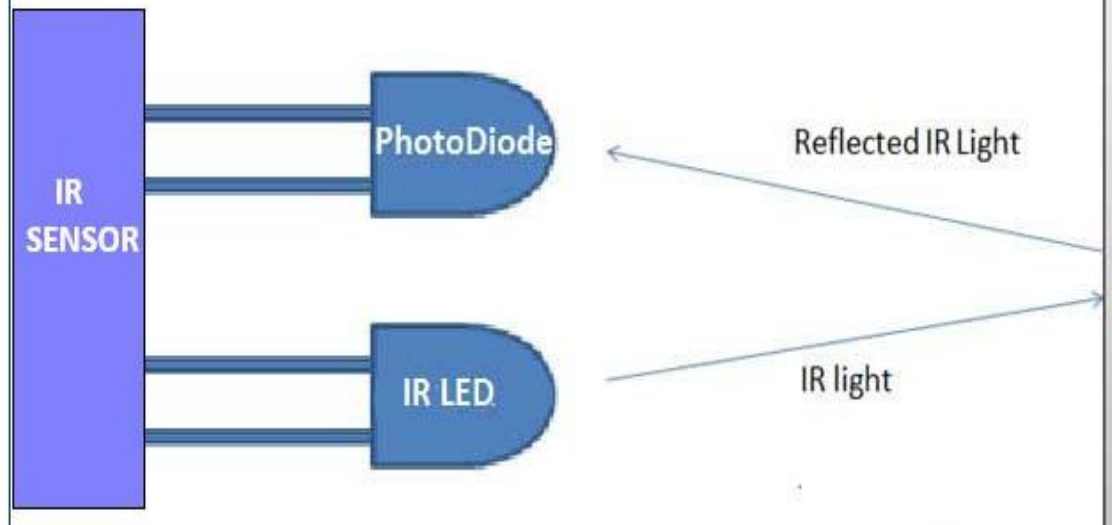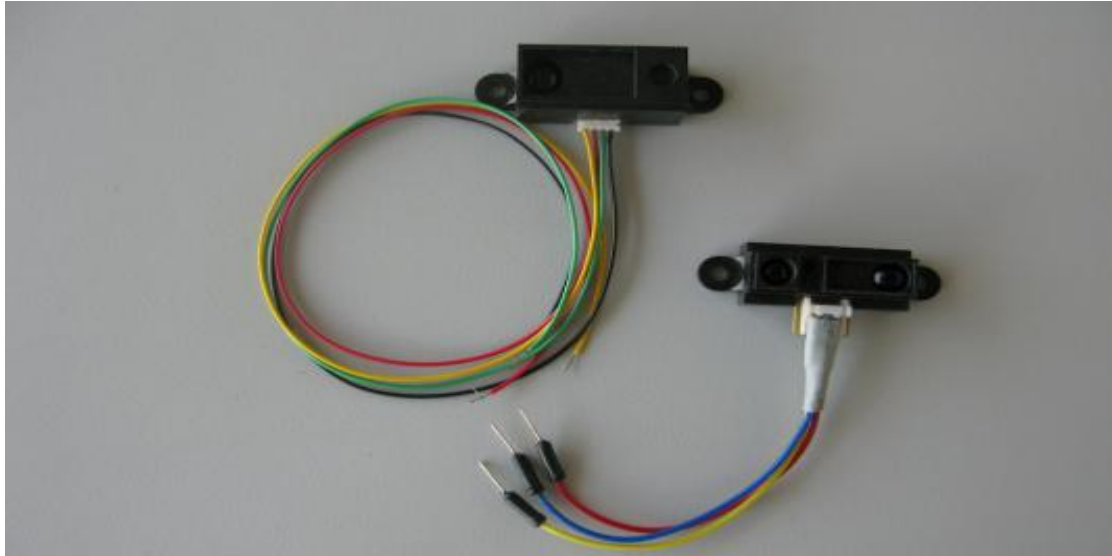communicates with myRIO using the I2C (Inter-integrated Circuit)
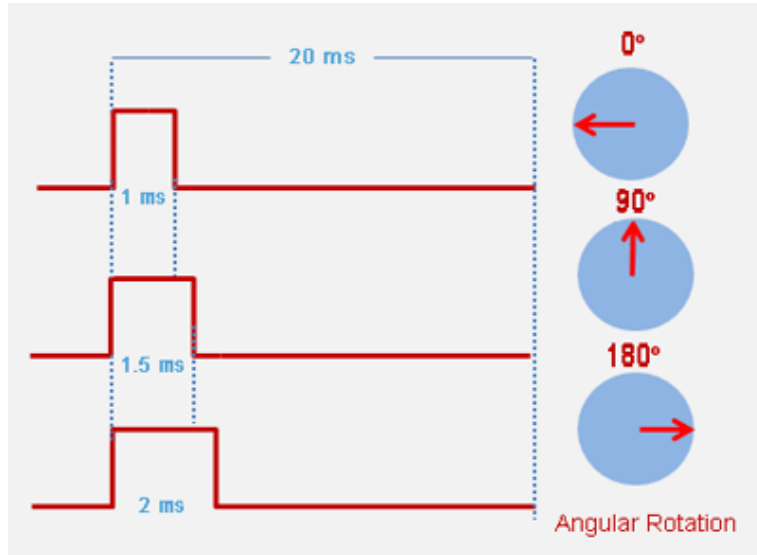
Control System

PID Controller

$$C(t) = K_p E(t) + K_I \int_{-\inf}^{t} E(s)ds + K_d \frac{dE}{dt}(t)$$

Infrared Sensor

- ▶ Infrared range 700 nanometers (nm) to 1 mm
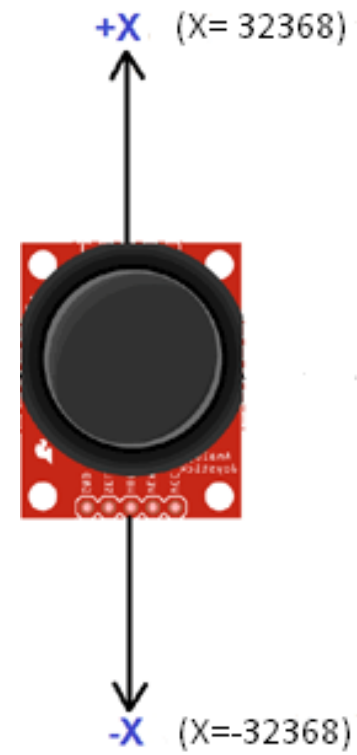- ▶ Analog to digital conversion
- ▶ 10-80 cm range

Servo Motor Controlled Pincher

- Checking the pulse in every 20 milliseconds
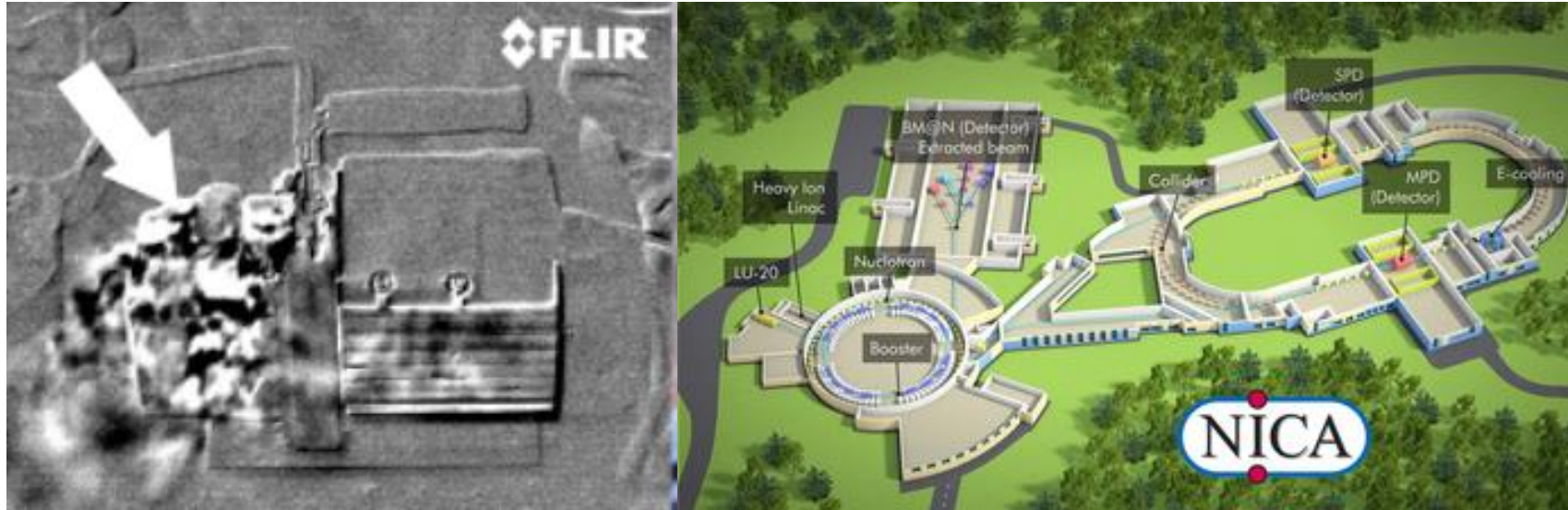- Rotation from 0 to 180 degrees

Remote controlling

+X (X= 32368)

-X (X=-32368)

Future Work: Gas Leak in the NICA Collider

Frion is leaking from car air conditioner

Thank you for your attention