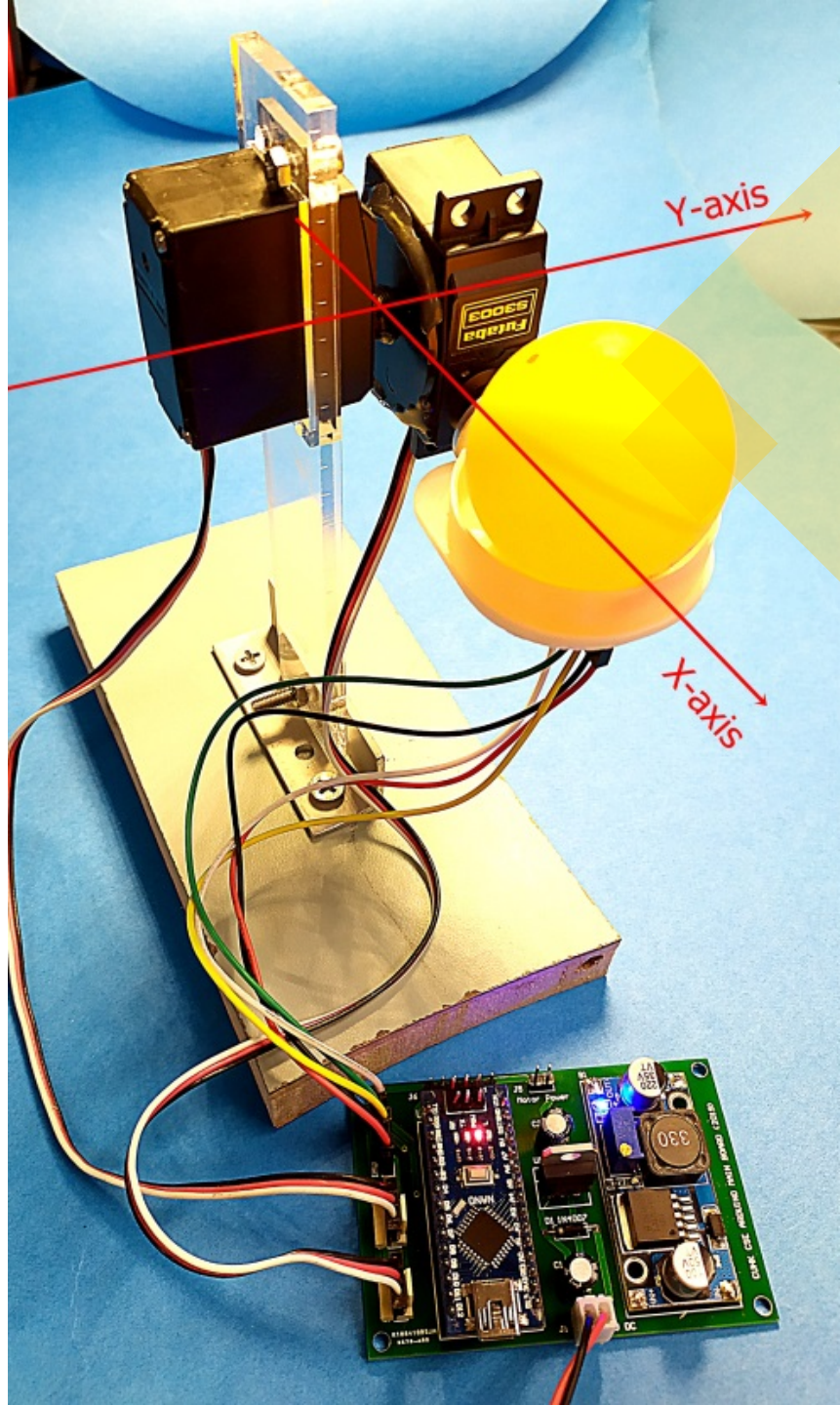
Lab 6: A self-balancing platform

Baotong Lu

btlu@cse.cuhk.edu.hk

Introduction

- Develop a self-balancing platform
- Materials used
  - 2-axis tilt sensor: MPU6050 (GY-521) IMU module
  - 2 servo motors
  - Arduino Nano
- Your task
  - Implement the PID controller [1] on Arduino Nano



[1] CENG4480 Lecture 07: PID control
http://www.cse.cuhk.edu.hk/~byu/CENG4480/2019Fall/slides/L06-PID.pdf

Demo Video

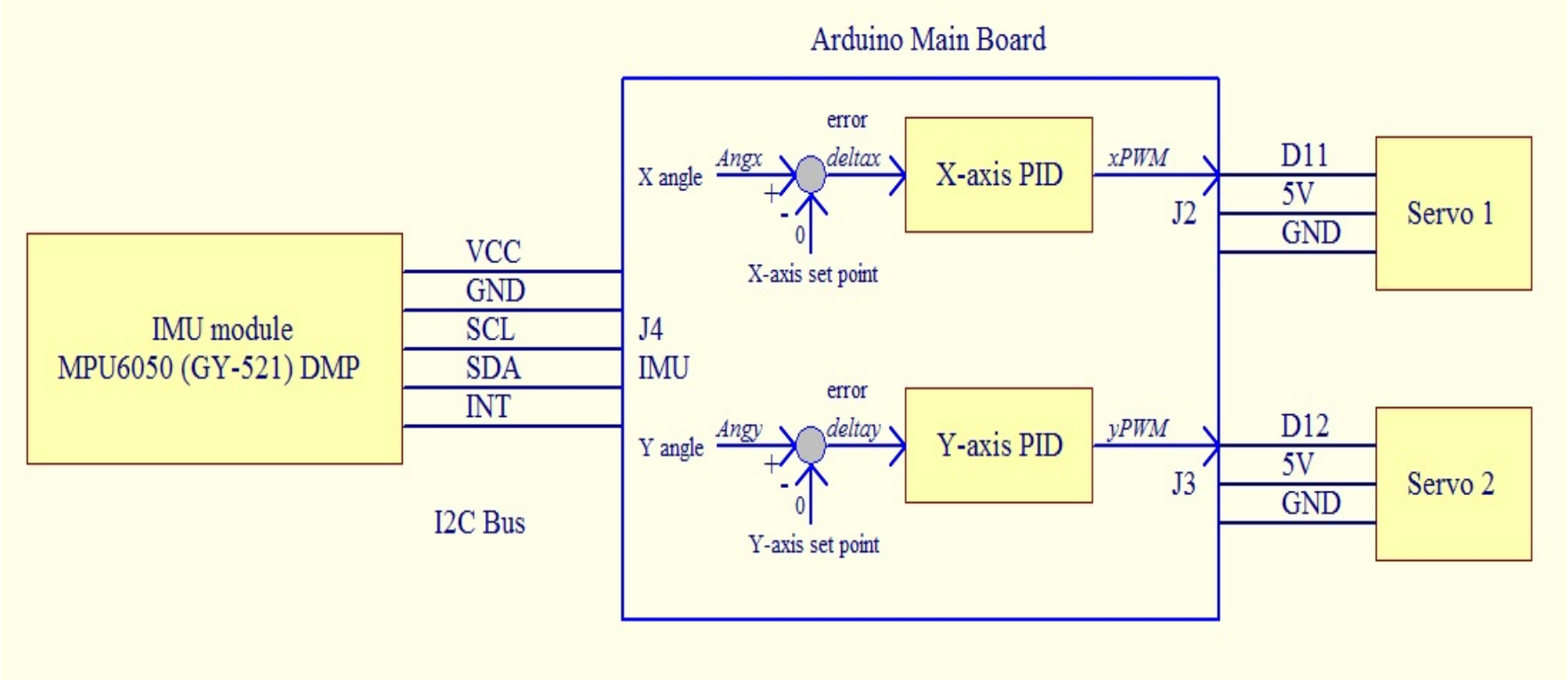
- What you will do: https://gocuhk-my.sharepoint.com/:v:/g/personal/mingyeewong_cuhk_edu_hk/ESwnLi3Idy9Dqq9Wk_VJBTEBzEjNi89wgyPrm51cCCilUA?e=rfg3qc

Policy of Lab Materials

- No service of package delivery
- Hong Kong local students
  - Go to lab to do the experiment
  - Get the lab materials provided by us
- Mainland students & Oversea students
  - Purchase the materials by yourself
  - Purchase links are available on website

Block Diagram of Self-Balancing Platform

- Sensor -> PID Control -> Servos

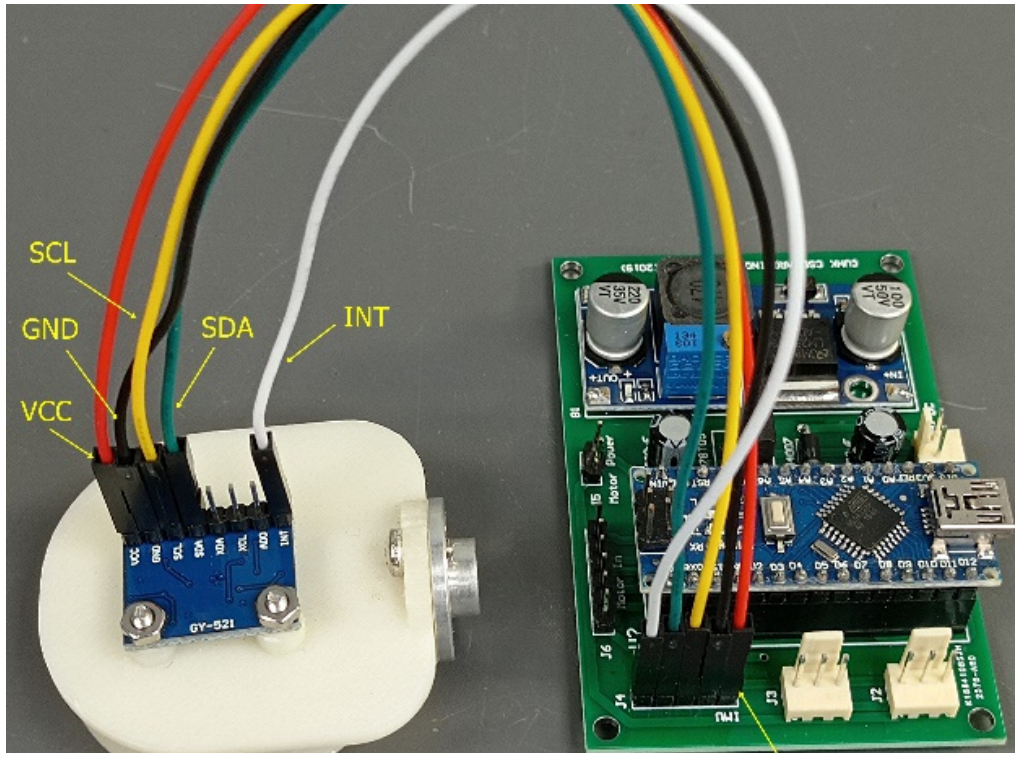


Objectives

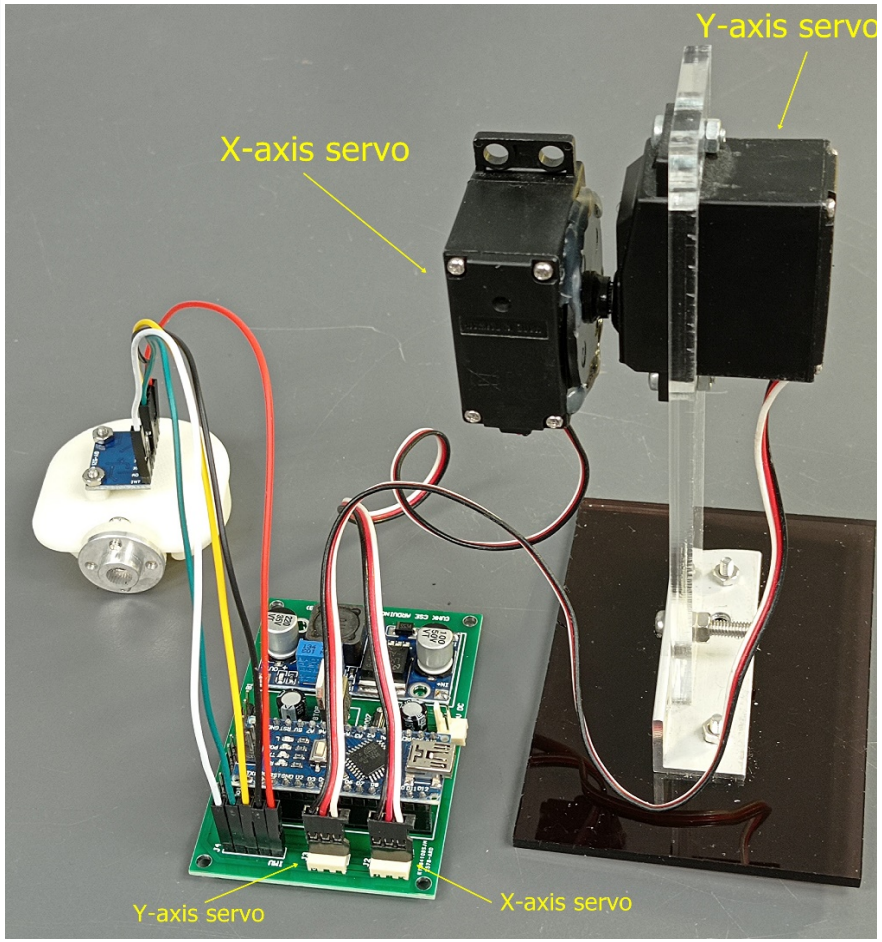
- To learn how to implement PID controller on embedded system
- To learn how to use MPU6050 (GY-521) IMU module Digital Motion Processing data to measure the tilt angles

Procedure 1

- **Connect MPU6050 (GY-521) IMU module to Arduino main board**
  - Detailed connection policy is on lab report



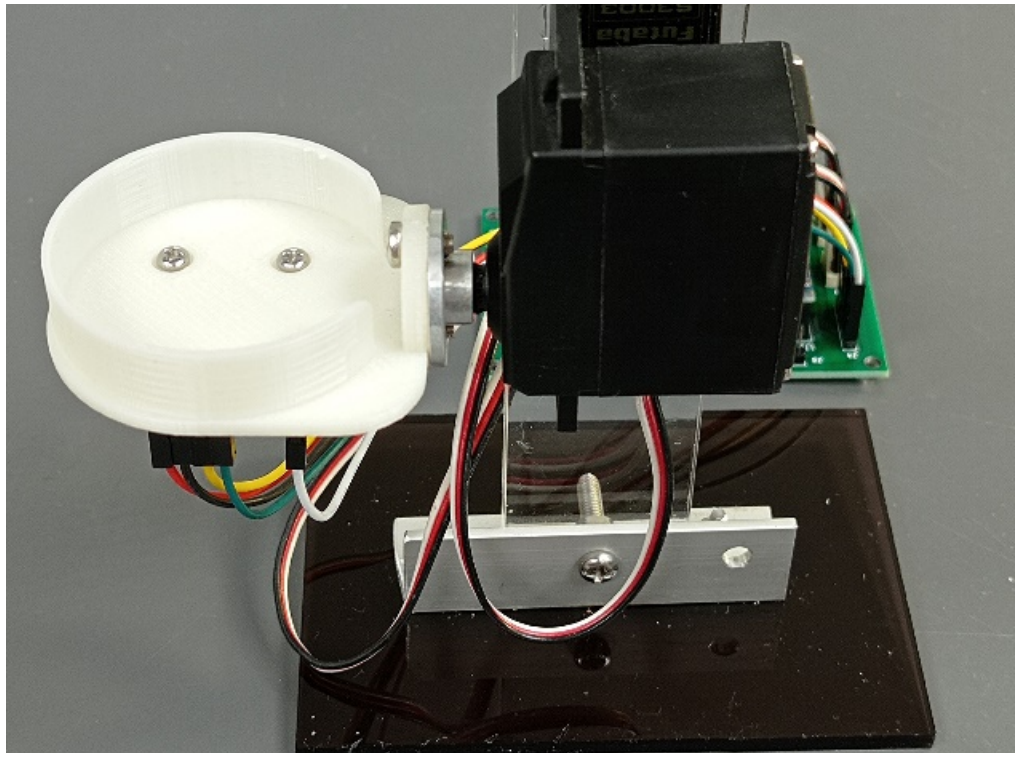
Procedure 2



- **Connect 2 servo motors to the Arduino main board**

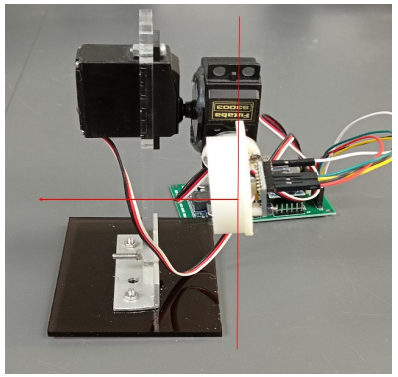
Procedure 3

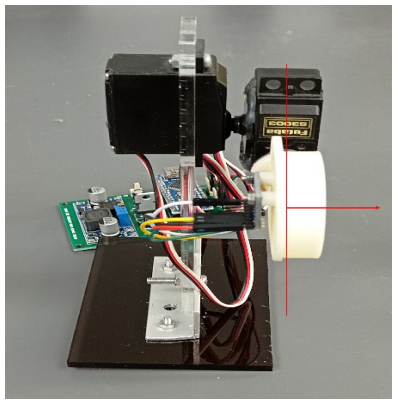
- **Attach the platform with IMU on the X-axis servo**

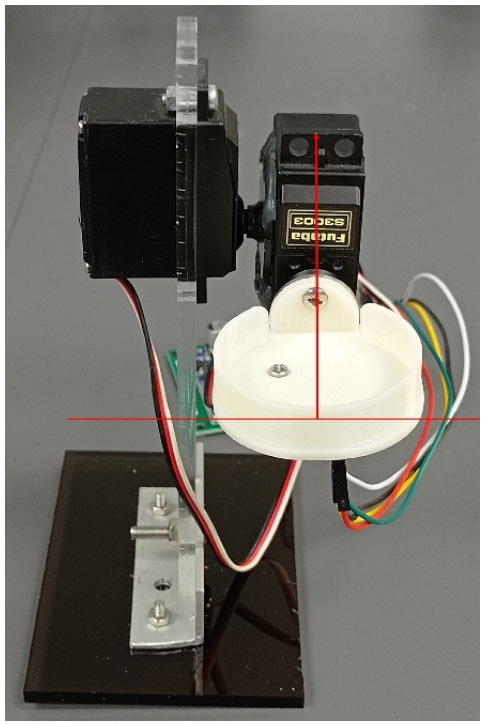


Procedure 3

- The platform should be able to rotate 180 degree from left hand side to right hand side







Following Procedures

- **Download the Lab6_given.ino to Arduino**
- **Write the Y-axis PID codes in the Lab6_given.ino to complete the system. (X-axis PID is provided in Lab6_given.ino)**
- **Fine tune the PID controller constants to reach its optimal state.**
- **Demonstrate your system to TAs.**

Requirement

- ***You are required to move the platform without dropping the ball from -60 to 60 degrees against the X-axis and Y-axis as fast as you can.***
- ***Submission***
  - Record a demo video of playing your self-balancing platform [**meet the above requirement**]
  - You are required to submit both demo and your code [**in a zip file**] to blackboard before deadline.