Robotics 311 : How to build robots and make them move

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ROB 311 – Lecture 22

- Today you have time to catch up on your ball-bot

- Everyone should be able to

    - Balance

    - Rotate

    - Accept PS4 controller commands

    - Save and stream data for plotting

    You should know how
    to do all of these

- Also, everyone should calibrate their IMU

Announcements

- HW5 posted today

- You should get midterm grades this week

Balance and Rotation Controller

- Your ball-bot should be able to balance for extended periods of time
- You should be getting a feel for the gains and how they change as your battery voltage lowers
- You should have added the PS4 Controller to your balance controller script
- You can add Integral / Derivative terms to your controller
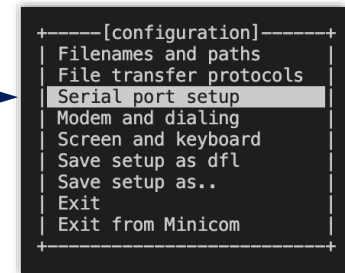- You should be plotting your controller effort in real time
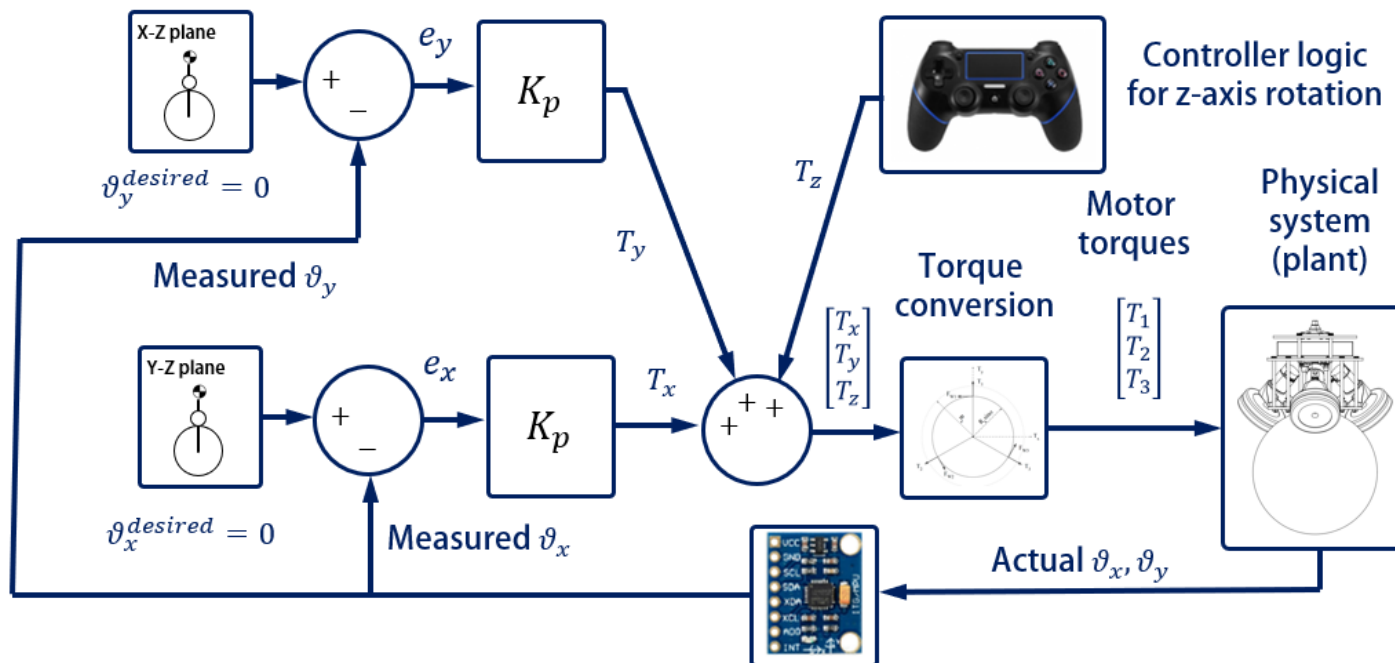
IMU Calibration

- Using your SSH connection to your RPi, type `sudo apt-get install minicom`

- Minicom allows us to read data being sent from the Pico and display on your RPi

- First, we need to create a new firmware file to flash to the Pico

- Download test_dmp.c from Canvas

- Replace the existing test_dmp.c script in `~\rob311\mbot-omni-firmare\src\test_dmp.c`

- Change directory to ~\rob311\mbot-omni-firmware\build\ and execute

  - `cmake ..`

  - `make -j4`

- Change directory to `~\rob311`

- Type `sudo nano picoload` to edit the picoload bash script

- Edit line 4 from:
  `sudo cp /home/$USER/rob311/mbot-omni-firmware/build/src/bballbot.uf2 /mnt/pico/`

- To:
  `sudo cp /home/$USER/rob311/mbot-omni-firmware/build/src/test_dmp.uf2 /mnt/pico/`

ROBOTICS

IMU Calibration

- Put the Pico into bootloading mode

  - Press and hold white reset button when

  - plugging in micro-USB

- Run picoload from the `~/rob311` directory
  `./picoload /dev/sda1`

- You should see 'Loaded UF2!'
  with no errors

- Next, we need to edit the minicom configuration

- `sudo minicom -s` will open the minicom setup

- Enter serial port setup and press 'A'
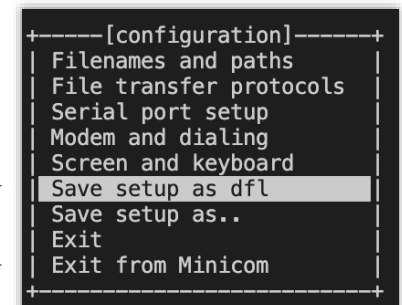
- Change A- Serial Device to:
  `/dev/ttyACM0`

- Press enter

- Select 'save setup as dfl'

- Then select 'Exit from Minicom'

ROBOTICS

IMU Calibration

- Run minicom from the command line
  `minicom`

- Unplug and re-plug the Pico USB from the RPi

- It will print calibration instructions to the terminal through minicom

```
Welcome to minicom 2.8

OPTIONS: I18n
Port /dev/ttyACM0, 15:48:33

Press CTRL-A Z for help on special keys

Initializing...
Calibrating Gyro... Please Hold Still!
Gyro Cal Complete!

Orient Z pointing up and hold as still as possible
When ready, press any key to sample accelerometer
█
```

Walk through 6 different orientations and save the calibration file

- When it finishes, your IMU is calibrated and will save its data automatically

- Re-flash your Pico with your original firmware bballbot.UF2

  - Edit Picoload script and put your Pico in boot loading mode

ROBOTICS