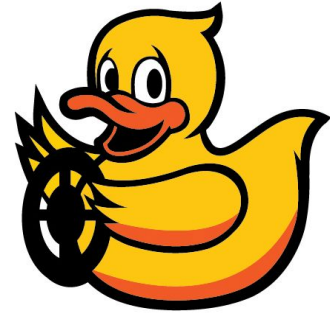# s Lab 05 - March 4

Goals for this lab:

1) **Everybody gets their dedicated wifi working**
2) **Everybody calibrates the wheels of their robot**
3) **Everybody calibrates the camera of their robot (intrinsic and extrinsic)**
4) **Everybody gets their robot to follow a lane and views the output from the lane filter**

- Main channel for this event is: **#lab05-mar4**
  - Other relevant channels:
    - #m04-pa-lanes
- Important documents for this lab:
  - Setup Step 1.7 - Setting up the Buffalo access point
  - Setup Step 2.2.1 Wheels Calibration
  - Setup Step 2.2.2 Camera Calibration
  - Appearance Specification
  - The progress spreadsheet

Editing policy: Staff and students: you are welcome to edit and add materials into this document, or any of the setup (or other) docs, but please **put it in dark purple like this**, and then it will be turned into black by the instructors after the change is announced. This will avoid us getting confused regarding what is the starting version and what are the changes.

Reminder: Color key: blue is what students should read; orange is important/needs attentions; **red** is urgent / past due; purple is the status survey; green is done (yay!), **dark purple are changes to the instructions (by students and staff)**

Prelab

Run the following three commands on your duckiebot:y
duckiebot $ sudo ntpdate -u us.pool.ntp.org
duckiebot $ sudo apt-get install libblas-dev liblapack-dev libatlas-base-dev gfortran -yl
duckiebot $ sudo pip install scipy --upgrade
sudo add-apt-repository main
(note that this 2nd command takes a while (like 2hrs) to complete)

sudo add-apt-repository universe
sudo add-apt-repository restricted
sudo add-apt-repository multiverse

sudo apt-get update
Note: if you have not done this by the time you get to the lab don't try and do it we will fix it

Exercise -1

ssh into your duckiebot and run the following command to update and -dist-upgrade to fix the wifi dongle issue

```
duckiebot $ sudo apt-get update
duckiebot $ sudo apt-get dist-upgrade
```

Exercise 0 - Branch for this module

1) make a branch M04_PAI-<handle> (if you haven't already)
   a) git pull
   b) git checkout M04_PAI
   c) git branch M04_PAI-<handle>
   d) git checkout M04_PAI-<handle>
   e) <do some work>
   f) git add + git commit that file (otherwise your work so far)
   g) git push --set-upstream origin M04_PAI-<handle>

Make sure you are on the right branch and have built the latest code both on your laptop and on your robot.

- **Status update! Please edit column C in the lab 05 status**
  - Are you stuck? Please put your name and problem here:
    -
Suggestion box / tips and tricks (please write your name and things that you found useful to get through the exercise):

Exercise 1 - New networking setup

New equipment handed out:
- Buffalo access point (corresponding to your specific robot)
- USB splitter
- 1ft ethernet cord
- **STOP! If you got these things please go and update row 50-52 in the What's in the boxes? checklist**

1) First, receive the equipment and update the spreadsheet.
2) **Reverse / remove any weird hacks that you might have done in the past few weeks to get your Wifi to work.**
3) Follow the steps in Setup Step 1.7 - Setting up the Buffalo access point
4) **Note: Never plug the Buffalo into the PI - it will fry the USB ports on the PI.**
   Plug the male side of the USB splitter into the battery (into the port where your PWM HAT is powered from - **not the one where your PI is powered from**)
5) Plug the PWM Hat power connector into one of the female ends of the splitter
6) Plug the Buffalo USB power into the other female end of the splitter. You should see it light up.
7) Use the ethernet cord to connect the Buffalo access point to the PI.
8) Connect the power the PI.
9) Use your laptop to connect to the network <robot>-5 or <robot>-2.

- **Status update! Please edit column D in the lab 05 status**
  - Are you stuck? Please put your name and problem here:
    -

Suggestion box / tips and tricks (please write your name and things that you found useful to get through the exercise):

Exercise 2 - Wheel calibration

Follow the steps in Setup Step 2.2.1 Wheels Calibration

Once you have generated your car's calibration submit a pull request

- **Status update! Please edit column E in the lab 05 status**
  - Are you stuck? Please put your name and problem here:
    -

Suggestion box / tips and tricks (please write your name and things that you found useful to get through the exercise):
Don't forget to catkin_make

Exercise 3 - Intrinsic Camera Calibration

Follow Section 1 and 2 in Setup Step 2.2.2 Camera Calibration

Once you have generated your car's calibration submit a pull request

- **Status update! Please edit column F in the lab 05 status**
  - Are you stuck? Please put your name and problem here:

-

Exercise 4 - Extrinsic Camera Calibration

Follow Section 3 in Setup Step 2.2.2 Camera Calibration

Once you have generated your car's calibration submit a pull request

- **Status update! Please edit column G in the lab 05 status**
    - Are you stuck? Please put your name and problem here:
        - Robert: My camera calibration is not working, the homography test shows that the coordiates are off: point 5 is at x=0.2. Same problem for two other people (mfe and wubella)
        - Giulia: I think the test file (test 3) the example ground return values are in the wrong order (the first 3 listed are for 4, 5, 6 and the final 3 listed are for 1, 2, 3)

Suggestion box / tips and tricks (please write your name and things that you found useful to get through the exercise):

vmlane - If it can't see the checkboard try shading it (put a piece of paper above to shade the light)

Exercise 5 - Lane Filter Visualization

If you have not upgraded your scipy call someone over or post something on slack in #l05-mar4

laptop $ roslaunch duckietown lane_filter.launch veh:=${VEHICLE_NAME}

in a new tab open rviz.
Click Add
Click By Topic

find -> /lane_filter_node

  -> belief_img

expand and click on Image

You might want to look at some of the other stuff available in the topics.

- **Status update! Please edit column H in the [lab 05 status](#)**
  - Are you stuck? Please put your name and problem here:
    -

Suggestion box / tips and tricks (please write your name and things that you found useful to get through the exercise):

Exercise 6 - Autonomous Lane Following

place your robot on the road in the middle of the lane.

Run:

```
laptop $ roslaunch duckietown lane_controller.launch
veh:=${VEHICLE_NAME}
```

- **Status update! Please edit column I in the [lab 05 status](#)**
  - Are you stuck? Please put your name and problem here:
    - Brandon - the robot is having a lot of trouble with only one corner of the road. It's fine with every other corner, so I have no idea what it is going on to make this one corner impossible to navigate
    -

Suggestion box / tips and tricks (please write your name and things that you found useful to get through the exercise):

Timeline

Thursday 11:59
- Branch merging complete and lab branch setup
- Make Pontiac ready (either solve network problem or upgrade backup SD)

Friday 9:15
- LP arrive at 226 and pack the cart

Friday 9:30

CC, SY, LP arrive at 32-226 and go to Beaverworks

Friday 9:40
- Setup network and switches
- Setup 5 different lane stations in duckietown (4 tiles in a row with white and yellow lines that conform to appearance spec)

10:10
- Lab starts

11: 10
- If all the buffalos are not setup by this time, abandon and start to do camera calibration

Equipment Checklist

- Network
    - all the switches we can find
    - 5 super long (orange?) ethernet cable
    - 30 long (orange) ethernet cable
    - 30 short (green) ethernet cable
    - 1x airport express
    - 1x extra airport express
- Power
    - all the power strips and power extenders we can find
- New Equipment to distribute:
    - 30 Buffalos
    - 30 usb switches
    - 30 1ft ethernet cables
- Infrastructure:
    - mats (how many?)
    - tape (how much?)
- Duckietops for loan
- Extra mouse
- Robots? Megaman + Pontiac + ?
- The SD Card Cloner

- Some back up SD cards and wifi adapters