How To: For Operating the TurtleBot and companion Robotic Operating System software

**A) Installation and Set Up**
Needed:
 TurtleBot
 Laptop PC that runs Ubuntu 12.04 Precise Pangolin that can fit on top of TurtleBot
 Any PC that runs Ubuntu 12.04 Precise Pangolin to act as a workstation for the TurtleBot
 (Note: Since 3D Modeling is a part of the TurtleBot’s camera system, these PCs should be decently powerful. Maybe 2-3 years old at most)

Recommended:
 Since static IP addresses and a solid network are key to this project, it would be a good idea to find some way to create a small network that only the two PCs used for this project are on. You can do this with either a wireless router or a wireless hotspot.

Installation of The TurtleBot:
 I have included printouts of the installation guides found on the ROS’s website that I used to install ROS Hydro onto both the Workstation and TurtleBot laptops. It is important to install the software on both machines first both plugging anything in. The following is an outline of the order that you should follow if you use the printed version of the guide. Alternatively, all this information can be found at: <http://wiki.ros.org/Robots/TurtleBot> (Make sure to use the Hydro version)

1. Ubuntu Install of ROS Hydro (This is the deb install method)
2. Installation (Even though you will be using a Create base, still install the kobuki step)
3. Post-Installation Setup
4. Create Setup
5. Workstation Installation
6. Network Configuration

From here, you now have everything set up to start using the TurtleBot.

Plugging in the TurtleBot:
 To plug the TurtleBot into the laptop, simply plug in both the blue USB cable that is connected to the TurtleBot itself and the black USB cable that is connected to the Kinect into the laptop.

Turning on the TurtleBot:
 The Power Button is the left most button on the array of buttons on the top of the Create itself.

Installing SSH onto both PCs:
 Once all the TurtleBot software has been installed, you will need to install SSH server software onto both the laptop and the Workstation. To do this, enter the command “sudo apt-get install openssh-server” into the Terminal and follow the given instructions.

**B) Using the TurtleBot** Whenever you are planning on using the TurtleBot, it is a good idea to open up two things before you start anything else: The TurtleBot Dashboard and the Keyboard Teleop. Launching these two programs can be done by following the steps found in the “TurtleBot Bringup” and “Keyboard Teleop” respectively.

In order to do the following activities, please look at the included guide.
 Viewing what the robot is seeing: See “3D Visualization” (I would recommend doing this first)
 Making a map: See “SLAM Map Building with TurtleBot”
 Having the TurtleBot move autonomously: See “Autonomous Navigation of a Known Map with TurtleBot”

Since you are using a Create Base, you will need to calibrate the gyro sensor that is found on the TurtleBot’s power board. I never got it to work, but you can try to follow the included guide “Create Odometry and Gyro Stablization”.

From what I have given so far, that was as far as I could get with this project.

**C) Troubleshooting**

I don’t know what issues you may face, but here are some of the issues I found and how I managed to fix them.

**The Kinect does not seem to be fully powered.**
 The Kinect needs power from both the laptop and the TurtleBot to run properly. You need to tell the TurtleBot through software to allow the Kinect to get power. The command to do this is “rosrun create\_node kinect\_breaker\_enabler.py”. Also, make sure that the Power Board is securely in its slot.

**The 3D Visualization does not work as it cannot detect the camera.** I had to add the parameter “depth\_registration:=false” to the end of the command “roslaunch turtlebot\_bringup 3dsensor.launch” in order to get it to work properly.

**D) Hints on how to get started**

 Here are some hints that I can give you in case you want to know where to start.

* Look at the work done by Joe Stawicki ’13 and Brandon Fox ’14 to see how they went about their projects.
* Stick to ROS Hydro and Ubuntu 12.04, going forward will only hurt your progress
* Even though the advice given might not be helpful, check out answers.ros.org to see if maybe someone had a similar problem that you are currently having.
* If you are having an issue that you can’t seem to fix, a good night sleep or taking an hour break helps more than you would think