**INSTALLATION GUIDE FOR ROS AND GYM-GAZEBO TO RUN TURTLEBOT SIMULATOR:**

**Special note:** In case of an error you are possible unable to resolve, try as much as possible not to remove ROS and Gazebo and reinstall them again. This might corrupt your files/duplicate them/create complications. If need be to uninstall them, simply deleting those folders from the system might not fully remove all the source files. The files need to be deleted from the command prompt and you need to check that all the source files have been removed and/or are inactive on the system.

**Important Pointers:**

- Ensure that Gazebo version 8 is used

- ROS-Kinetic installation by default installs gazebo7. After installing ROS, gazebo7 needs to be deleted and gazebo8 needs to be installed.

- ROS does not allow 2 versions of gym-gazebo (7 and 8) to stay on the system so ensure that 7 is completely removed before 8 is installed

- Keep checking at every stage of installation for the versions of ROS and Gym-Gazebo to prevent any errors due to wrong versions.

**1. ROS KINETIC INSTALLATION:**

Link to install ROS-Kinetic:

http://wiki.ros.org/kinetic/Installation/Ubuntu

**2. GAZEBO INSTALLATION**

Remove Gazebo7 and install Gazebo8:

***Part 1: Removing Gazebo7***

type sudo apt remove gazebo7. We cannot use sudo apt remove ros-kinetic-gazebo\* because that is the ros-gazebo interface, not the gazebo simulator itself.

Note: after removing Gazebo7, type gazebo and terminal should say no module found.

***Part 2: Installing Gazebo 8***

(<http://gazebosim.org/tutorials?cat=install&tut=install_ubuntu&ver=8.0>)

After installing Gazebo8, type gazebo and terminal should open Gazebo. The bottom right corner of the orange box must say version 8.something.

***Part 3: Installing ROS-Kinetic dependencies***

Follow the bottom section of this link: <https://medium.com/@abhiksingla10/setting-up-ros-kinetic-and-gazebo-8-or-9-70f2231af21a>

**3. OPENCV3**

Installing OpenCV3 from sources (Python 3 needed for OpenCV3 and Python 2 for OpenCV2).

- Ubuntu by default has Python2 and Python3

sudo apt-get install ipython

type ipython (takes you into ipython environment)

type the following:

import cv2

print cv2.\_\_version\_\_ --> should give 3.3.1-dev --> means OpenCV3 is installed

If OpenCV3 is not installed, install it from google FROM SOURCES

**4. OPENAI GYM**

Installing OpenAI Gym:

git clone https://github.com/openai/gym && cd gym

pip install -e .

If an error about the Python version appears,

pip install --upgrade pip

sudo apt install python3-pip

pip install --user -e .

**5. GYM-GAZEBO**

Gym-Gazebo Installation:

<https://github.com/erlerobot/gym-gazebo> - refer to INSTALL.md for installation guidelines: available at this link

<https://github.com/erlerobot/gym-gazebo/blob/master/INSTALL.md>

Ensure that you're following the installation guidelines for your Ubuntu operating system version.

Before installing, make sure that the pre-requisites and dependencies are available properly and are the right versions.

Special Note: OpenCV must be built from source.

While installing Gym-Gazebo, these steps need to be taken special care of:

* cd gym\_gazebo/envs/installation - SUPPOSED TO BE cd gym-gazebo/gym\_gazebo/envs/installation
* bash setup\_kinetic.bash - for this step, the catkin workspace is supposed to build it from 0 to 100% and every now and then it is supposed to say fetching dependencies, building packages, etc. If this does not happen, redo this step.
* After building is done, in envs/installation/catkin\_ws/build and envs/installation/catkin\_ws/devel, files must be present. If these 2 folders are empty, the build is unsuccessful and must be done again.

**Debugging guidelines for errors that will occur during installation:**

These errors occur when you type bash setup\_kinetic.bash

1. multiple packages found: ecl\_core and ecl\_navigation - ecl\_mobile\_robot,

This happens because there are two folders named ecl\_mobile\_robot. To solve this, we temporarily remove ecl\_mobile\_robot from gym\_gazebo/envs/installation/catkin\_ws/src/ecl\_navigation

1. non-catkin packages found.

This error occurs because the packages needed for this repository are not traditional catkin packages. To resolve this, follow this link:

<https://blog.csdn.net/qq_20989743/article/details/79936639>

Once you resolve this error, bring the ecl\_mobile\_robot folder back to the ecl\_navigation folder

1. The next error would be package mav\_msgs not found. This might appear somewhere in the middle and your code might continue running, but you need to resolve this to prevent more errors appearing. To solve this, visit this link: <https://github.com/ethz-asl/mav_comm>, download the entire git repository, and transfer the mav\_msgs folder to gym-gazebo/gym\_gazebo/envs/installation/catkin\_ws/src

Once we bash the setup file for kinetic, we need to bash the setup file for turtlebot. To do this, type bash turtlebot\_setup.bash

1. An error that might occur while doing is this: [rospack error]: package turtlebot\_simulator not found OR package turtlebot\_gazebo not found. To resolve this, visit the following link:

<http://wiki.ros.org/turtlebot_simulator>, download this repository, and replace the one in the src folder using this downloaded folder. You should be able to rerun the bash files successfully now.

**Running the control algorithm:**

After building, we need to run the python file to ensure the installation is successful and the simulation works.

When you run your python file, you're supposed to see EP1, time value; EP2, time value; etc. on the current terminal.

If you scroll up your execution on this terminal, at the top you will see 2 addresses named: ROS\_MASTER\_URI and GAZEBO\_MASTER\_URI. We copy the GAZEBO\_MASTER\_URI and type export (copied URI) into a new terminal. Then we type gzclient. If everything so far has been done correctly, gazebo will open and you should be able to see the simulation working.

If everything is working correctly,

The turtlebot must move at a reasonably quick speed. You can see a blue layer, which is the camera/laser scan.

After a certain number of episodes, the simulation graph will appear displaying the turtlebot's rewards and learning.

**Error:** an error which might occur here is about the robot description. To solve this, visit this link: <http://www.yanglajiao.com/article/zhangdadadawei/78906103>

To solve it, you need to add .py to the xacro in the kobuki.launch.xml file.

**SPECIAL NOTE:**

If you change anything or install a package that was reported by your terminal as missing, you need to bash the .bash file and source the setup turtlebot bash file again in the same terminal to reflect the changes you made.

Ubuntu Help:

Ctrl + Shift + C, V, X for copy, paste, cut

Ctrl + C to stop a running process

sudo apt-get install (package name)

sudo apt-get remove (package name)

sudo apt-cache search (package name) - search possibly missing packages; beware of \_ and - --> Switching them could help you

find what you're looking for.

ROS:

to kill processes, Ctrl + C might not work always. In such a case, try using Ctrl + Z. Additionally, also type

killall -9 rosout roslaunch rosmaster gzserver nodelet robot\_state\_publisher gzclient to ensure all running processes have been killed.