The Shell script user has to execute in the beginning will create a separate workspace in the home folder and download the required files from GitHub to start the activities in the beginning of the activity list.

1. Run your first node

**Task**: Open a new terminal window and run the first ROS node in the terminal. (hint: rosrun pkg\_name node\_name.py)

**Device response**: The LCD screen will print the numbers from 1 to 10 on it.

*[Students are used to run a program and see the output on screen. This activity gives the insight that the node running on the terminal is not a process that is local to the PC but can be used to operate actuators separated from the working machine via ROS framework.]*

1. Run multiple nodes

**Task**: Open 2 terminal windows and execute 2 nodes in parallel.

**Device response**: The servo motor will do sweep action continuously. LCD will print the numbers from 1 to 10.

*[Instead of using a single large program, multiple nodes can be and will be used to control a single robot]*

1. System stability of a robot when using ROS

**Task**: Run a 2 ROS nodes and stop the execution of the ultrasonic sensor node. Then publish a message manually to the same topic

**Device response**: Print the ultrasonic sensor’s distance measurement on the LCD screen. When sensor node is terminated, last received message will keep displayed on the screen. Student will publish manual messages to the same topic which will be again displayed on the LCD.

*[This shows that distributed nature of the ROS help to increase the overall system stability]*

1. Hardware and software abstraction

**Task**: Run a ROS node in a terminal which will take a number between 0 to 5.

**Device response**: The number will correspond to the revolutions per second of the wheel. A PID controller will try to adjust the speed of the wheel according to the user input

*[The modular architecture helps to implement abstraction in hardware and software basis making it easier for the ROS user to create the program without worrying about the hardware and software implementations]*