INTRODUCTION TO ROBOTICS AND INTELLIGENT MOBILITY

ROS INSTALLATION

Name: Vasundhara B, Priyamvadha P
Roll No: 3122 21 5002 119, 3122 21 5002 080
Class: IT – B
Year: III

Aim:

The aim of this assignment is to successfully install ROS2 (Robot Operating System 2) and configure the development environment to enable the seamless creation and deployment of robotic applications. This includes setting up ROS2 on the target operating system, establishing the necessary environment variables, and verifying the installation for future robotics software development.

Pre-requisite: Ubuntu 20.04 installed.

Problem Description:

ROS2 is a framework for building robotic systems that provides a collection of tools, libraries, and conventions for developing complex and distributed robotic applications. Installation and environment setup are crucial initial steps to start working with ROS2 effectively.

- Improved Performance and Scalability: ROS2 offers better performance and scalability compared to ROS1. It provides enhanced support for real-time systems and multi-robot systems.
- Middleware Implementation: ROS2 uses DDS (Data Distribution Service) as its default middleware, offering better communication between different components of a robot system.
- Platform Independence: ROS2 aims to be more platform-independent, allowing developers to use it on various operating systems like Linux, Windows, and macOS.
- Enhanced Security Features: ROS2 provides improved security features, including better access control and encryption, ensuring a more secure communication environment.

UBUNTU INSTALL OF ROS

1. Installation

1.1 Adding ROS Repository to sources.list:

```
sudo sh -c 'echo "deb http://packages.ros.org/ros/ubuntu $(lsb_release -sc) main" > /etc/apt/sources.list.d/ros-latest.list'
```

This command adds the ROS repository link to the sources list (sources.list.d directory), enabling your system's package manager (apt) to fetch ROS packages and updates from the repository.

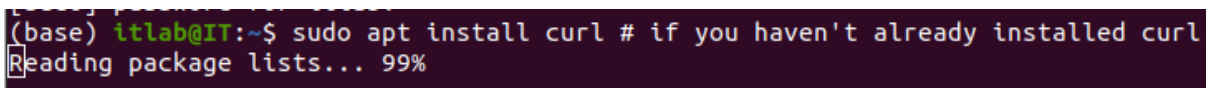
1.2 Setting up Keys

```
sudo apt install curl # if you haven't already installed curl
curl -s https://raw.githubusercontent.com/ros/rosdistro/master/ros.asc | sudo apt-key add -
```

The command → sudo apt install curl, installs the curl command-line tool if it's not already installed. curl is a utility used to transfer data from or to a server.

The command → curl -s https://raw.githubusercontent.com/ros/rosdistro/master/ros.asc | sudo apt-key add - fetches the ROS repository key from the specified URL and adds it to the system's list of trusted keys (apt-key).

The repository key is used to verify the integrity and authenticity of the packages obtained from the ROS repository. Adding the key ensures that the packages fetched are from a trusted source (ROS repository).



```
(base) itlab@IT:~$ sudo apt install curl # if you haven't already installed curl
Reading package lists... Done
Building dependency tree
Reading state information... Done
curl is already the newest version (7.68.0-1ubuntu2.19).
0 upgraded, 0 newly installed, 0 to remove and 17 not upgraded.
```

```
(base) itlab@IT:~$ curl -s https://raw.githubusercontent.com/ros/rosdistro/maste
r/ros.asc | sudo apt-key add -
OK
(base) itlab@IT:~$
```

1.3 Installation

- `sudo apt update`

This command updates the local package index with the latest package information from the repositories specified in the /etc/apt/sources.list file.

apt update does not upgrade any packages but ensures that the package manager has the latest information about available packages and their versions.

```
(base) itlab@IT:~$ sudo apt update
Hit:1 https://packages.microsoft.com/repos/vscode stable InRelease
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://packages.ros.org/ros/ubuntu focal InRelease [4,679 B]
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:6 http://packages.ros.org/ros/ubuntu focal/main amd64 Packages [789 kB]
Get:7 http://packages.ros.org/ros/ubuntu focal/main i386 Packages [57.7 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [2,8
19 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu focal-updates/main i386 Packages [877
 kB]
Get:11 http://in.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages
 [1,109 kB]
Get:12 http://in.archive.ubuntu.com/ubuntu focal-updates/universe i386 Packages
[746 kB]
Fetched 6,739 kB in 8s (843 kB/s)
Reading package lists... 23%
```

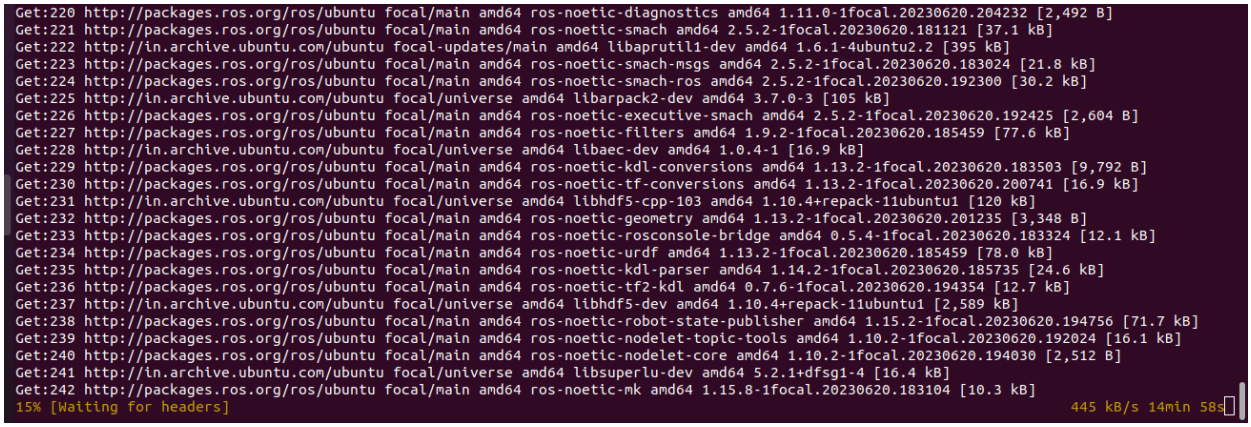
```
(base) itlab@IT:~$ sudo apt update
Hit:1 https://packages.microsoft.com/repos/vscode stable InRelease
Hit:2 http://in.archive.ubuntu.com/ubuntu focal InRelease
Get:3 http://packages.ros.org/ros/ubuntu focal InRelease [4,679 B]
Get:4 http://security.ubuntu.com/ubuntu focal-security InRelease [114 kB]
Get:5 http://in.archive.ubuntu.com/ubuntu focal-updates InRelease [114 kB]
Get:6 http://packages.ros.org/ros/ubuntu focal/main amd64 Packages [789 kB]
Get:7 http://packages.ros.org/ros/ubuntu focal/main i386 Packages [57.7 kB]
Get:8 http://in.archive.ubuntu.com/ubuntu focal-backports InRelease [108 kB]
Get:9 http://in.archive.ubuntu.com/ubuntu focal-updates/main amd64 Packages [2,8
19 kB]
Get:10 http://in.archive.ubuntu.com/ubuntu focal-updates/main i386 Packages [877
 kB]
Get:11 http://in.archive.ubuntu.com/ubuntu focal-updates/universe amd64 Packages
 [1,109 kB]
Get:12 http://in.archive.ubuntu.com/ubuntu focal-updates/universe i386 Packages
[746 kB]
Fetched 6,739 kB in 8s (843 kB/s)
Reading package lists... Done
Building dependency tree
Reading state information... Done
17 packages can be upgraded. Run 'apt list --upgradable' to see them.
(base) itlab@IT:~$
```

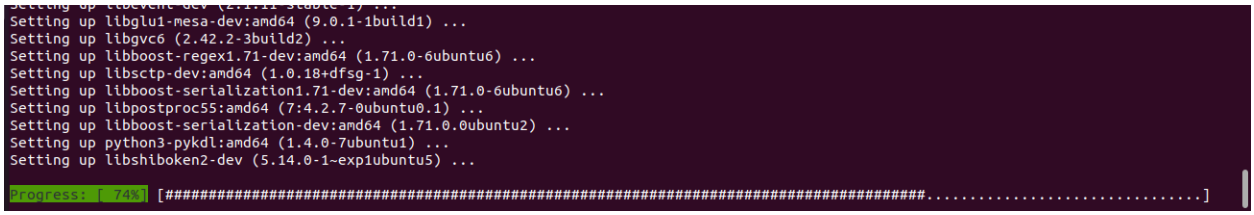
```
sudo apt install ros-noetic-desktop-full
```

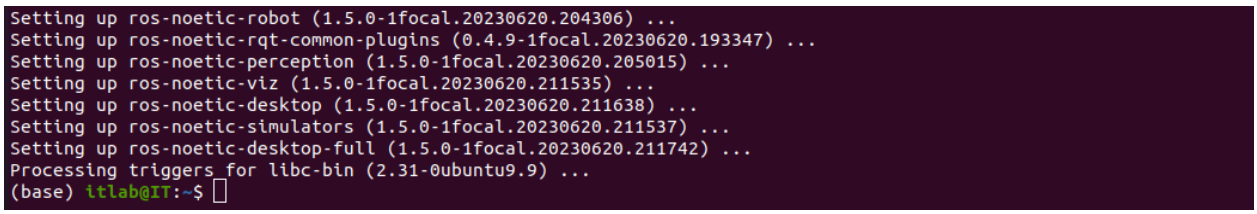
This command installs the ROS Noetic Desktop Full version, which is a complete ROS installation including the most commonly used packages and tools.

sudo apt install is used to install packages, and ros-noetic-desktop-full is the specific package name for the complete ROS Noetic desktop version.

```
(base) itlab@IT:~$ sudo apt install ros-noetic-desktop-full
Reading package lists... Done
Building dependency tree
Reading state information... Done
The following additional packages will be installed:
  blt cmake cmake-data comerr-dev cython3 default-libmysqlclient-dev
  docutils-common fltk1.3-doc fluid fonts-lato fonts-lyx freeglut3
  freeglut3-dev gazebo11 gazebo11-common gazebo11-plugin-base google-mock
  googletest graphviz hddtemp hdf5-helpers i965-va-driver ibverbs-providers
  ignition-tools intel-media-va-driver javascript-common krb5-multidev
  libaacs0 libaec-dev libann0 libaom0 libapr1 libapr1-dev libaprutil1
  libaprutil1-dev libarmadillo-dev libarpack2-dev libass9 libassimp-dev
  libassuan-dev libavcodec-dev libavcodec58 libavdevice-dev libavdevice58
  libavfilter-dev libavfilter7 libavformat-dev libavformat58 libavresample-dev
  libavresample4 libavutil-dev libavutil56 libbdplus0 libbluray2
  libboost-all-dev libboost-atomic-dev libboost-atomic1.71-dev
  libboost-atomic1.71.0 libboost-chrono-dev libboost-chrono1.71-dev
  libboost-chrono1.71.0 libboost-container-dev libboost-container1.71-dev
  libboost-container1.71.0 libboost-context-dev libboost-context1.71-dev
  libboost-context1.71.0 libboost-coroutine-dev libboost-coroutine1.71-dev
  libboost-coroutine1.71.0 libboost-date-time-dev libboost-date-time1.71-dev
  libboost-dev libboost-exception-dev libboost-exception1.71-dev
  libboost-fiber-dev libboost-fiber1.71-dev libboost-fiber1.71.0
  libboost-filesystem-dev libboost-filesystem1.71-dev libboost-graph-dev
  libboost-graph-parallel-dev libboost-graph-parallel1.71-dev
```





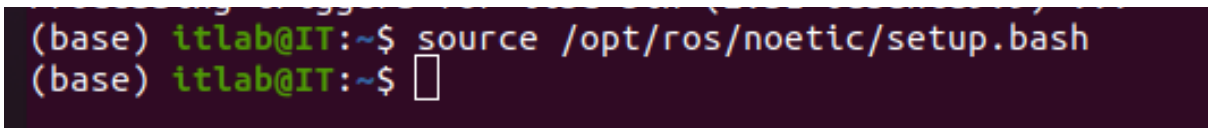


1.4 Environmental Setup

```
source /opt/ros/noetic/setup.bash
```

This command sources the ROS Noetic environment setup script (setup.bash) located in the /opt/ros/noetic/ directory.

Sourcing this script initializes the ROS environment variables in the current terminal session, setting up the required environment for using ROS commands and tools.



2. Starts the ROS Master

```
roscore
```

roscore is the main command to start the ROS Master, which is a collection of nodes that facilitate communication between ROS nodes in a ROS system.

Running roscore initializes the ROS Master, enabling communication among ROS nodes in a ROS network.