**Department of Electrical Engineering**

**Faculty Member: Date:**

**Semester:**  **Group:**

# EE381 Robotics

**Lab 12: C++ Programming in ROS**

***<Open-ended Lab>***

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|  |  | **PLO5-CLO4** | | **PLO5-CLO5** | **PLO8-CLO6** | **PLO9-CLO7** |
| **Name** | **Reg. No** | **Viva / Quiz / Demo** | **Analysis of Data in Lab Report** | **Modern Tool Usage** | **Ethics** | **Individual and Team Work** |
|  |  | **5 Marks** | **5 Marks** | **5 Marks** | **5 Marks** | **5 Marks** |
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## Introduction

This laboratory exercise will focus on designing and simulation a robot simulation that performs a specified task while employing nodes driven by C++ programs.

## Objectives

* Write C++ program script files
* Implement C++ nodes in ROS

## Lab Conduct

* Respect faculty and peers through speech and actions
* The lab faculty will be available to assist the students. In case some aspect of the lab experiment is not understood, the students are advised to seek help from the faculty.
* In the tasks, there are commented lines such as #YOUR CODE STARTS HERE# where you have to provide the code. You must put the code between the #START and #END parts of these commented lines. Do NOT remove the commented lines.
* Use the tab key to provide the indentation in python.

**Theory**

In robotics, the two most popular languages for programming robots are C++ and Python. For prototype development and design concepts, python is used due to its user-friendly nature. For practical implementation, C++ is used as the code is compiled and thus runs much faster on the machine. A major issue with C++ programming is its’ high difficulty. In ROS, there is extensive support for both Python (rclpy) and C++ (rclcpp) as well as limited support for other programming languages.

Common terminal commands for ROS 2 are provided below:

**colcon build --packages-select <package\_name>**

build a specific package whenever a node is created or modified

**. install/setup.bash**

make the terminal “aware” of the workspace (notice the dot and space)

**ros2 pkg create --build-type ament\_python <package\_name>**

create a new package (must be done in src directory)

**ros2 pkg create --build-type ament\_python <package\_name> --dependencies rclpy std\_msgs geometry\_msgs sensor\_msgs**

create a new package with dependencies

**ros2 run <package\_name> <node\_name>**

execute a node in the terminal

**Open-Ended Lab Details \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_**

*Design and implement a ROS implementation that solves a specified problem with the constraint of using C++ programming in the nodes.*

Note that the problem to be solved, as well as the solution to be designed are both open-ended in nature. Students are expected to come up with their own creative ideas and implementations for the lab.

Specify the complete details of the problem and how it is to be solved.

***### PROBLEM SPECIFICATION DETAILS START HERE ###***

*### PROBLEM SPECIFICATION DETAILS END HERE ###*

Provide all relevant codes, screenshots/videos and explanations of your work.

***### CODES START HERE ###***

*### CODES END HERE ###*

***### SCREENSHOTS START HERE ###***

*### SCREENSHOTS END HERE ###*

***### EXPLANATION-CONCLUSION START HERE ###***

*### EXPLANATION-CONCLUSION END HERE ###*