Universidad Católica Boliviana San Pablo - Ingeniería Mecatrónica - Ingeniería Biomédica

Second test - Robotics

Name: _____ **ID:**_____ **Signature:** _____

17 de abril de 2020

1. Introduction

This first test has the objective of proving if students have acquired skills regarding to inverse kinematics and programming in ROS environment.

2. Instructions

- The test will last 120 minutes. After that, checking time will be 30 minutes. During this period, students are not allowed to modify their programs.
- It is completely prohibited to talk with classmates.
- It is possible to browse on internet for programming issues.
- The names of files must be as this document indicates.
- In case of transferring any type of file to another classmate, the student will not be able to enroll in Robotics next semester.

3. Exercise

3.1. Architecture

Figure 1 shows all nodes, topics and types of messages involved in the architecture. The recommended language for this test is Python. Consider the following details:

- Labels within circles are the names of the nodes.
- Names on the arrows show the topics and type of message.
- You have to implement the node:**inverse_kin.py**.

IMPORTANT: The node created by you must be in a package called `second_test`. Moreover, all nodes must be executed by a file called `second_test.launch`.All the needed files are stored in Canvas-folder `second_test`.

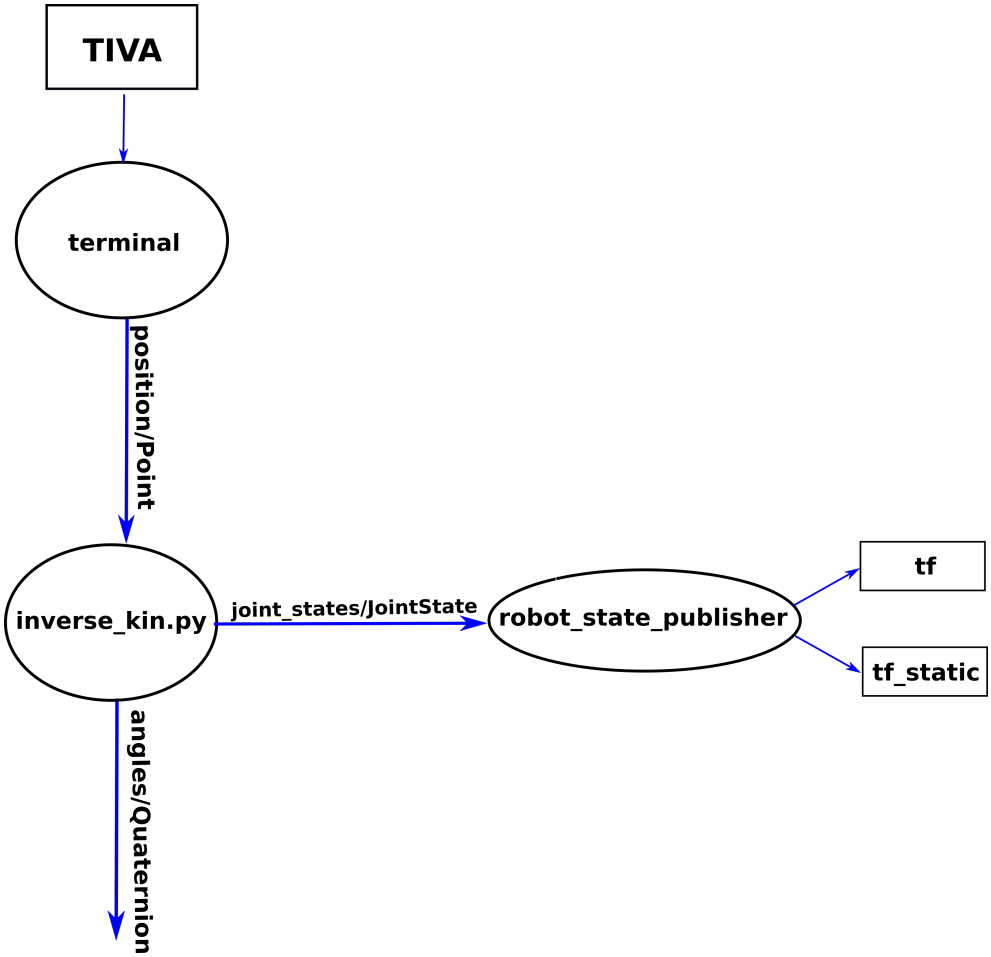

Figura 1: Architecture

3.2. Nodes description

3.2.1. inverse-kin.py

This node receives messages from **position** topic in order to perform the inverse kinematics. The calculated angles should be published to topic **angles** with a type of message **Quaternion**.

To perform inverse kinematics, refer to file `puma560_robot.urdf`.This robot has 4 degrees of freedom. The robot is shown in figure 2.

4. Inverse Kinematics

Finally, complete the table 1 with a precision of 4 decimals.Create a excel file or any text editor you prefer and copy it the package folder.

5. Evaluation

- It is fully functional, naming nodes and packages correctly **100 pts**
- It is fully functional, but it did not follow all instructions **90 pts**

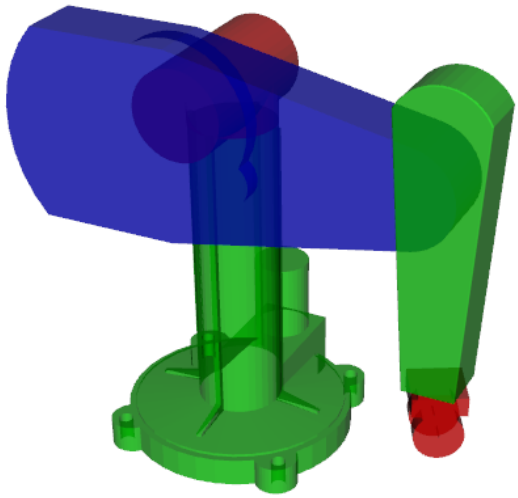

Figura 2: Robot model

Cuadro 1: Positions for inverse kinematics

N	**P $_x$**	**P $_y$**	**P $_z$**	**theta 1**	**theta 2**	**theta 3**	**theta 4**
1	-0.55283	-0.63787	0.44971				
2	0.34755	0.67971	1.4613				
3	0.50061	0.6632	0.64719				
4	0.057782	0.58108	0.55897				
5	0.063784	0.13876	0.64413				
6	-0.26787	-0.19346	0.17942				
7	-0.4564	0.37351	0.070282				
8	-0.5496	0.56143	0.64373				
9	-0.041545	-0.15535	-0.1711				
10	-0.080908	-0.12916	0.65919				

- It is relatively functional **60 pts**
- It does not work **30 pts**
- The student does not take the test or skips it **0 pts**