

Lab Preparation Document

Course: 2IRR10

Group Name: Q3 Survivors

Lab Session Number: 4

Date: 21. 5. 2025

What are the specific objectives of this lab session?

(Describe what your group aims to accomplish in this session. Be specific about tasks such as setting up hardware, testing communication protocols, or implementing a feature like obstacle avoidance.)

In this lab session, we aim to create a truly bidirectional communication between the turtlebot and the Unity environment. Since the last time we managed to connect these two, we would now like to implement some very basic scripts in Unity to also send data from Unity to the turtlebot, and not just the other way around. To be more precise, we want to implement the basic publisher and subscriber with some standard messages as well as Unity/ROS2-related messages, such as geometry. If everything goes well, we would also like to control the turtlebot using the scripts from Unity.

In case we still have some time left after trying all mentioned above we will test our path finding algorithms. Firstly using static data and then we will explore the options of using data from the simulation/turtlebot as an input to our algorithm.

What steps will your group take to achieve these objectives?

(Outline the key steps you plan to follow in the lab, including any setup, coding, testing, or debugging activities.)

In order to achieve these objectives our team will follow these steps:

1. Copy the prepared scripts to a USB stick and transfer them to the lab laptop or optionally clone our github repository to the laptop
2. Establish the connection between the turtlebot and the unity environment.
3. Iteratively add the scripts to the unity environment.
4. Test if the script works as intended.
5. In case it works well we move on to testing the next script, otherwise troubleshoot and note down what was the issue.
6. If all of the purely "static" scripts work try to implement the one for moving the robot.

What potential challenges or risks do you anticipate in this session, and how will you address them?

(Identify possible technical difficulties, hardware limitations, or software bugs that might arise, and propose strategies to manage them.)

Probably the largest challenge of this lab session is going to be software bugs, because there is only so much we can test virtually and at home. Moreover none of us are really familiar with the specifics of C#, therefore even some relatively easier syntax bugs could arise and hinder our progress.

Another issue connected to this could be that we get stuck on some specific error. When searching for learning material for these concepts, we found that the online resources are quite limited, meaning that it is likely that there won't be that much support for all of the error encounters either (Stackoverflow etc.).

To address these issues we will probably heavily rely on the documentation of both the turtlebot and Unity-ROS as those are the two most official resources we can find. Otherwise carefully reading and understanding the error messages is also going to be crucial.

What tools, resources, or prior knowledge will you need for this lab session?

(List any specific software, hardware components, ROS packages, or documentation you will use. Also, mention if you need to review any concepts beforehand.)

We will mostly need to be quite comfortable with the ROS concepts as well as the usage of C# in Unity. We will be modifying the examples from:

https://github.com/Unity-Technologies/Unity-Robotics-Hub/tree/main/tutorials/ros_unity_integration
as well as from:

<https://github.com/Unity-Technologies/ros2cs>

Therefore, understanding what each of the examples is supposed to test will be critical.

Apart from this, we will obviously need all of the knowledge from the previous lab sessions. to mitigate the errors we have already encountered.

How does this lab session contribute to the overall progress of your project?

(Explain how the work in this session connects to previous work and supports the final implementation of the twin system.)

This lab session will be truly crucial for our overall progress of the project, as it will allow us to finally test some fragments of the actual proof of concept such as sending data from the unity environment to the turtlebot. It will also be important, because it will allow us to explore the foundation of scripting in the Unity engine and the challenges connected to that. This will be extremely useful, as having a good foundation will undoubtedly save us quite some time in the near future.