Robotics Developer

MASTERCLASS 2025

- SPRING BATCH -

• STUDENTS GUIDE •

Powered by The Construct

Where Your **Robotics Career** *Happens*

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THE MENTORS

EXPERTS

Ricardo Tellez, CEO

Alberto Ezquerro,
Head of Education

Miguel Angel Rodriguez,
Head of Research

Rodrigo Gonzalez,
ROS Developer

THE MENTORS

EXPERTS

Bayode Aderinola,

ROS Web & Support Engineer

Girish Kumar,

Teacher Assistant

YOUR TUTOR

During the Masterclass program you will have a tutor responsible for guiding you through the whole process.

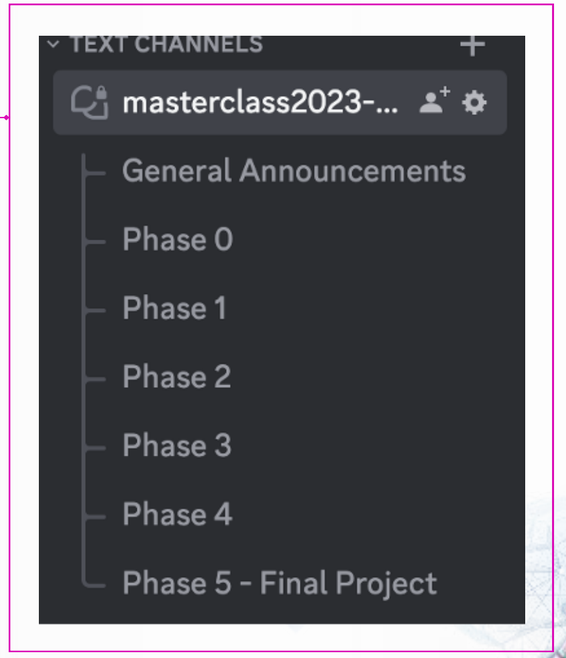
Your tutor will assign you tasks, evaluate your progress and push you to complete the program successfully.

You will also have a monthly meeting with your tutor to discuss your status and progress. You will agree with your tutor on the best day/time to have this monthly meeting.

SUPPORT

All Masterclass students have access to a Discord server where they will be able to interact with other students and with the Experts.

The Discord server is organized in different categories:



Depending on the current Phase of the Masterclass you are in, you have to place your questions/comments in the corresponding Discord channel.

Discord will also be used as the main channel to establish communication with your tutor. You will also find here general announcements (ie. special events, statements...) of the Masterclass.

STUDY PLAN

The Masterclass is designed so that you can complete it at your own pace. However, the recommended (and fastest) pace is to complete it in 6 months.

To complete it in 6 months, you should dedicate, at least, 35 hours per week to the Masterclass. This is an average of 7 hours per day. A recommended schedule for each day is shown below:

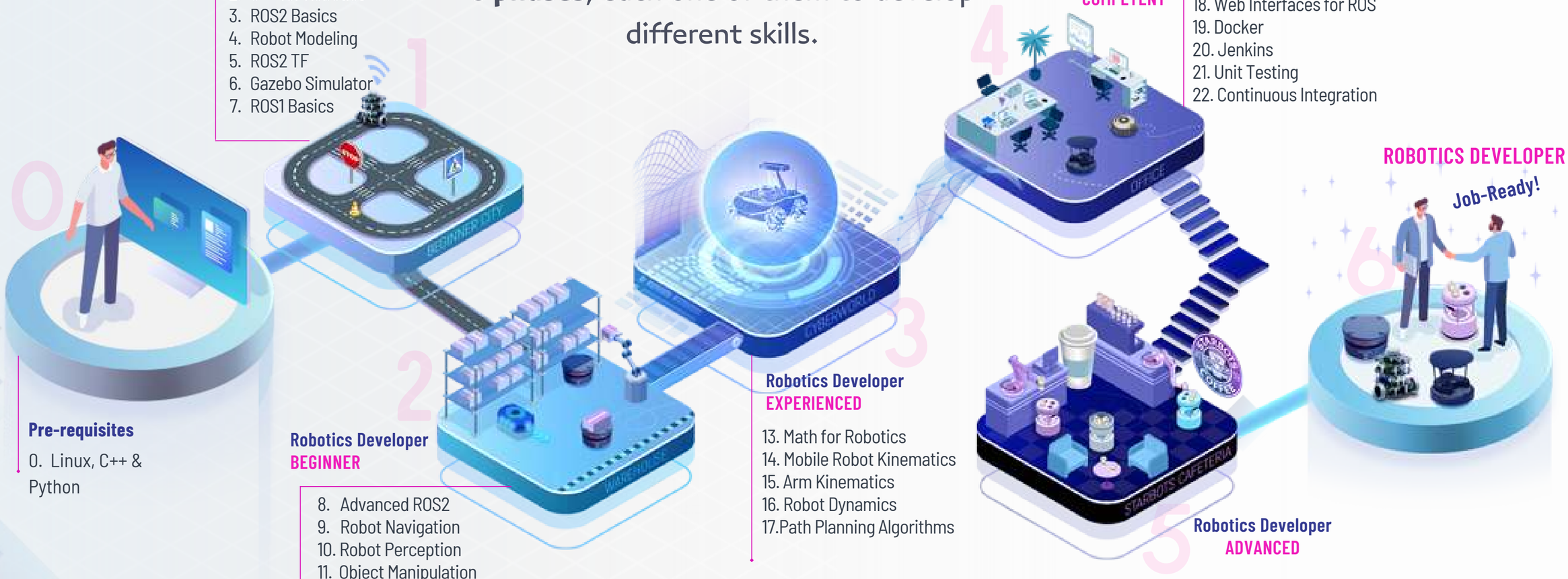
TIME	TASK
9 h - 13 h	Work on Course
13 h - 13:30 h	Lunch Break
13:30 h - 16:30 h	Work on Project

STEP-BY-STEP

MASTERCLASS PHASES

ROBOTICS DEVELOPER PATHWAY

The Masterclass program is divided into **6 phases**, each one of them to develop different skills.



Pre-requisites

0. Linux, C++ & Python

Robotics Developer
NOVICE

1. Git
2. C++ for Robotics
3. ROS2 Basics
4. Robot Modeling
5. ROS2 TF
6. Gazebo Simulator
7. ROS1 Basics

Robotics Developer
BEGINNER

8. Advanced ROS2
9. Robot Navigation
10. Robot Perception
11. Object Manipulation
12. Build Robot Controllers

Robotics Developer
EXPERIENCED

13. Math for Robotics
14. Mobile Robot Kinematics
15. Arm Kinematics
16. Robot Dynamics
17. Path Planning Algorithms

Robotics Developer
COMPETENT

18. Web Interfaces for ROS
19. Docker
20. Jenkins
21. Unit Testing
22. Continuous Integration

Robotics Developer
ADVANCED

ROBOTICS DEVELOPER

PHASE 0: Prerequisites Check

Learn the foundations to start programming. This phase will provide you with the minimum required knowledge in order to complete more complex courses. This Phase must be completed before starting the Masterclass.

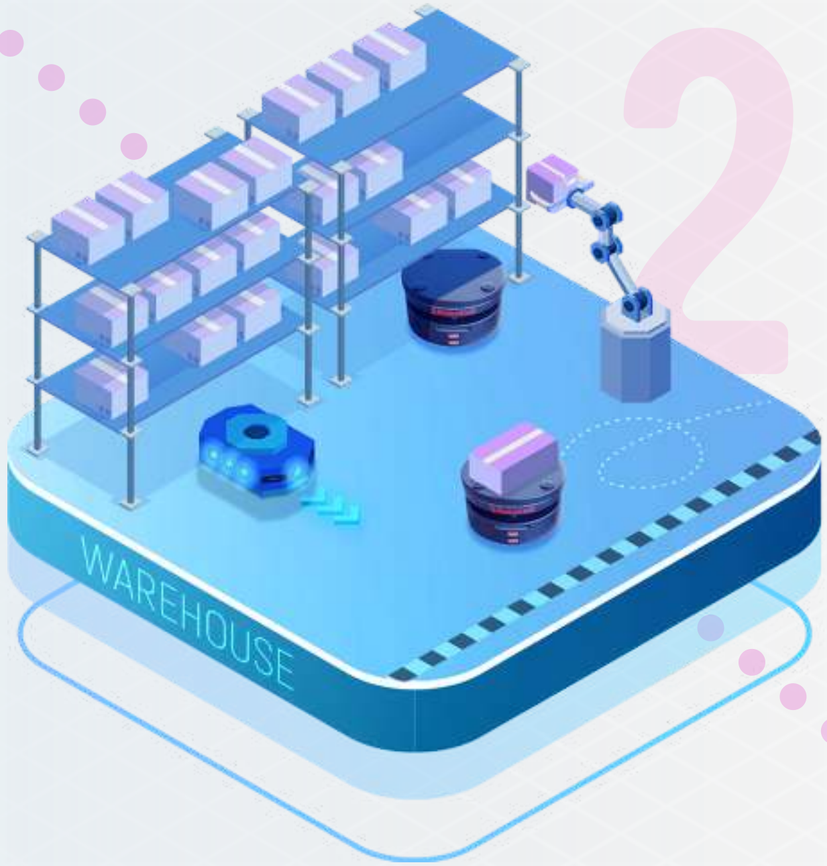
- **Courses:**
  - *Linux for Robotics*
  - *Python3 for Robotics*
  - *C++ for Robotics*

PHASE I: Learn the Fundamentals

Boost your robotics programming skills by practicing key robotics concepts such as autonomous navigation, manipulation or perception. Also, boost your ROS2 programming skills.

- **Courses:**
  - *ROS1 Basics (C++)*
  - *Git and GitHub Basics*
  - *Advanced Modern C++*
  - *ROS2 Basics (C++)*
  - *URDF for ROS2*
  - *TF for ROS2*
  - *Gazebo Simulator*

PHASE II: Build Robotics Programming Skills



Boost your robotics programming skills by practicing key robotics concepts such as autonomous navigation, manipulation or perception. Also, boost your ROS2 programming skills.

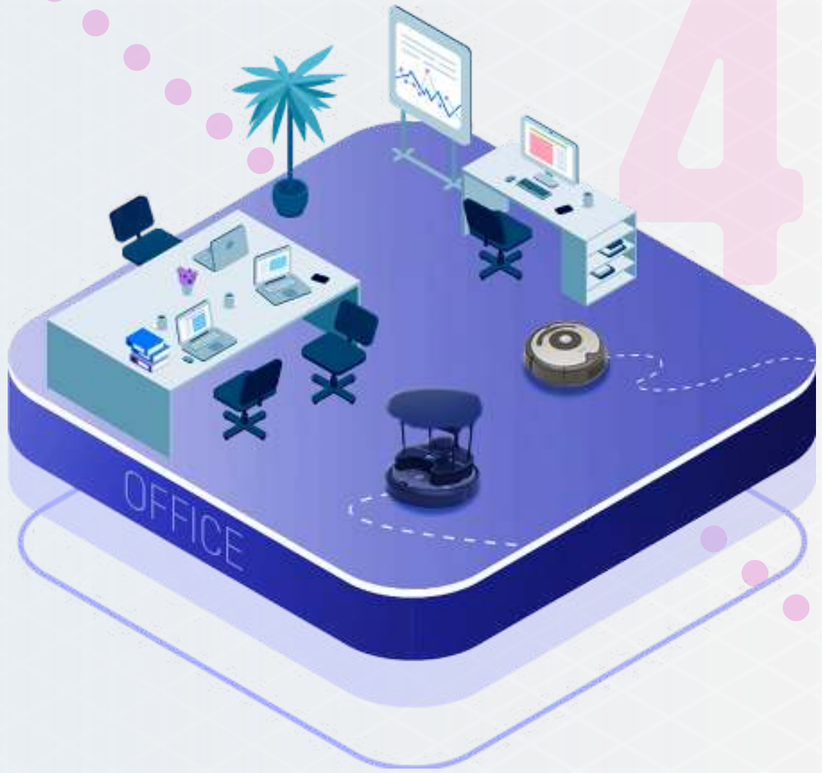
- **Courses:**
  - *ROS2 Intermediate*
  - *ROS2 Navigation*
  - *ROS2 Manipulation*
  - *ROS2 Perception*
  - *ROS2 Control*

PHASE III: Robotics Theory

Strengthen your foundation by learning robotics theory. Understand the physics and mathematical principles behind any robotic system, from simple kinematics to advanced planning and control algorithms.

- **Courses:**
  - *Basic Math / Probability*
  - *Mobile Robotics Kinematics*
  - *Arm Kinematics*
  - *Robot Control*
  - *Path Planning Algorithms*

PHASE IV: DevOps for Robotics Projects



Learn to use and apply the most important tools and procedures for developing robotics projects. You will learn how to apply continuous integration techniques in real-world scenarios, so you're better prepared to bear the day-to-day work of a robotics developer.

- **Extra Project:** *Build and program your own personal robot. More info in page 17.*
- **Courses:**
  - *Web Programming (HTML, CSS, JavaScript)*
  - *Continuous Integration and Testing*
  - *Jenkins*
  - *Docker*

PHASE V: Final Project

Put all your skills and knowledge to the test. Design, develop and present, from zero, a complete robotics project applying everything you have learned during the program.

This will lay the cornerstone for your career as a robotics developer.

PHASE VI: Internship (optional)

Job-Ready

The Robotics Developer Masterclass offers you practical work in one of the world's leading robotics companies.

You will learn from industry practitioners, and enhance your knowledge with relevant work assignments that can help you prepare for your future career as a real Robotics Developer.

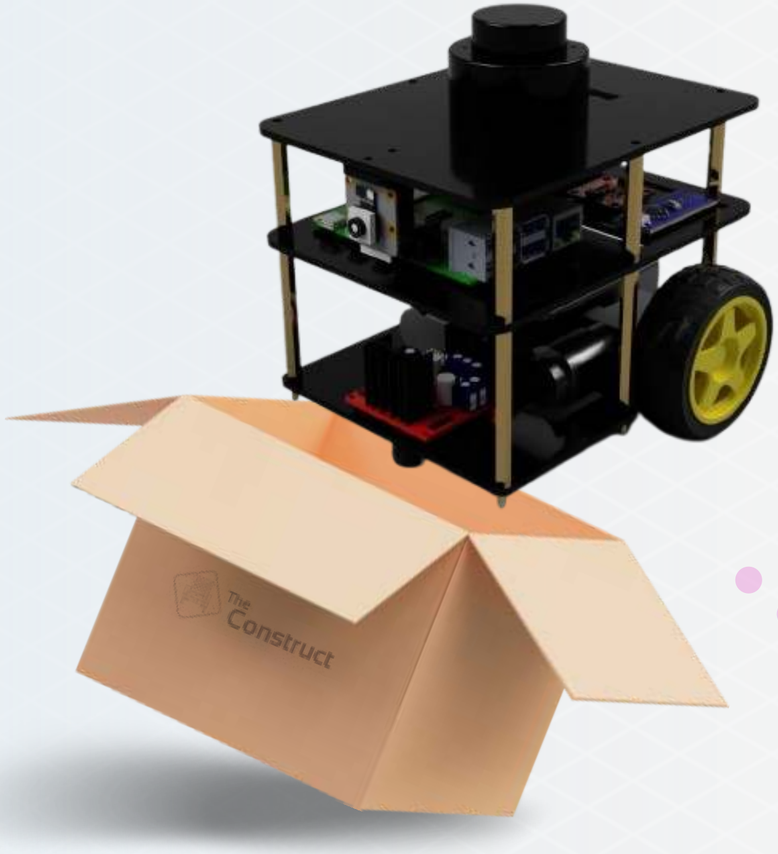
EXTRA: Expert Talks

Every month, a different ROS/robotics expert will deliver a talk.

During these talks, the expert will provide highly valuable knowledge based on his own experience over the years as a robotics developer.

These talks will be held on Zoom, and students will be allowed to participate by asking questions to the expert.

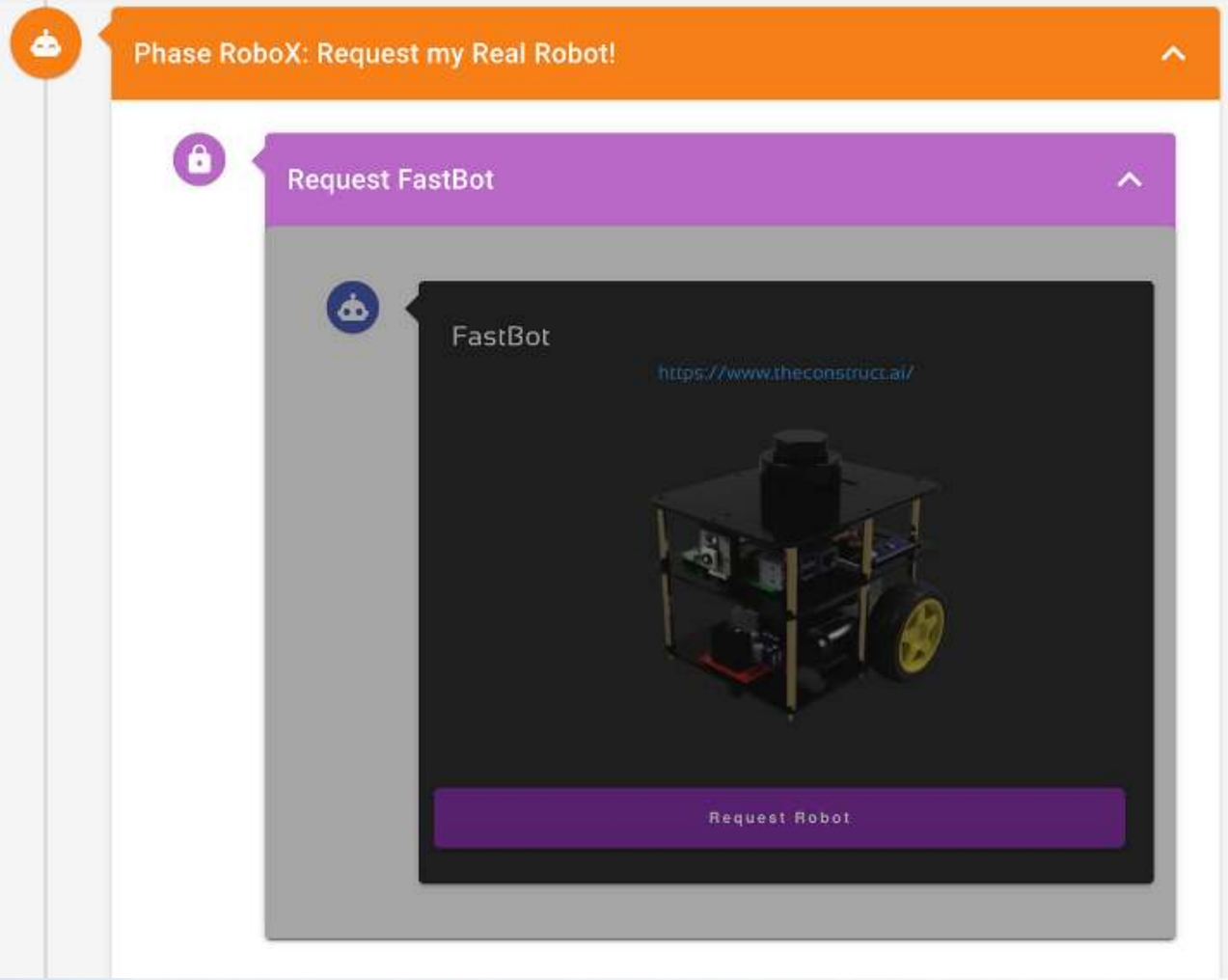
EXTRA: Build your personal robot



For Phase 4 of the Masterclass, you will receive a FastBot robot. You will have to build and program the robot.

Building and programming a real robot will provide you with very important experience and will strengthen your skills as a robotics developer.

EXTRA: Build your personal robot



After completing Phase 2 of the Masterclass, you will unlock the section that will allow you to request your robot!

EXTRA: C++ Live Training

Additional C++ live training sessions will be delivered every week.

The goal of these extra training sessions is to assist you in the process of learning C++, as well as provide you with extra material in order to boost your C++ skills.

EXTRA: Open Hour Sessions

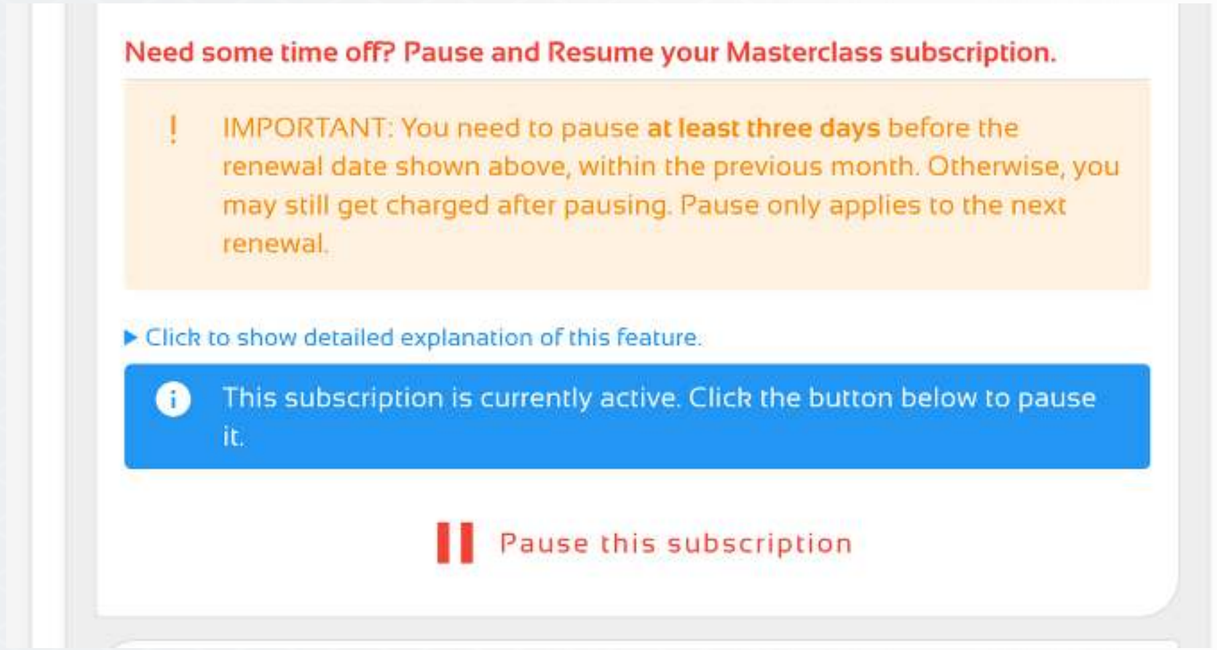
Additional C++ live training sessions will be delivered every week.

The goal of these extra training sessions is to assist you in the process of learning C++, as well as provide you with extra material in order to boost your C++ skills.

MANAGE YOUR SUBSCRIPTION

You can pause your Subscription to the Masterclass at any moment. If you do so, you will lose access to the Masterclass material until you resume your subscription again.

To do so, click the ***PAUSE*** button that you will find on your Subscription page.



THE CONSTRUCT

THE PLATFORM

The **HOME page** of The Construct's Masterclass provides you with direct access to all the areas of the platform:

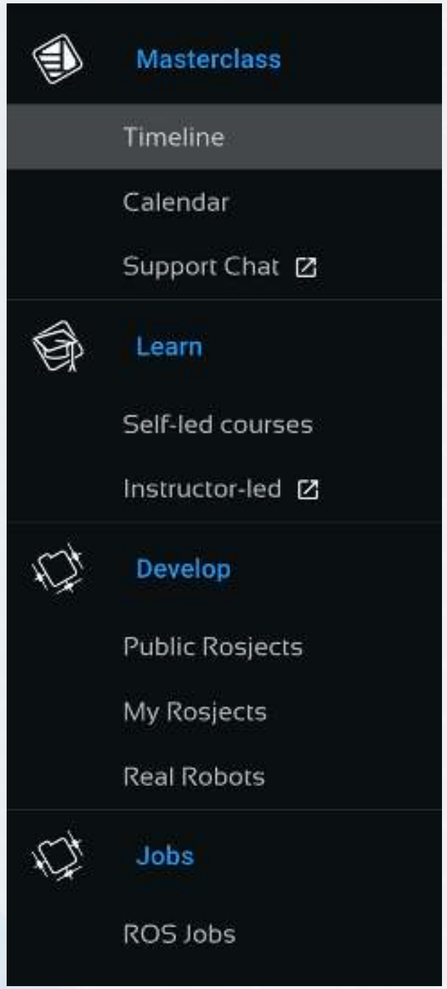
THE PLATFORM

1. The **Main Menu** will allow you to access all the different areas (more on next page)
2. Quick **Search** Bar
3. The **User Profile** area
4. This area will show your **Progress** through the different phases of the Masterclass
5. **To-Do Courses:**

   In this section, you have direct access to all the courses and projects in the current Masterclass phase. More information in the section *Manage Your Work*
6. Check your current **Phase Scores**
7. Check the **Notifications** for the Masterclass

THE CONSTRUCT

THE PLATFORM



Masterclass:

- **Timeline:** *Access the Masterclass home page*
- **Calendar:** *Check upcoming Masterclass events*
- **Support Chat:** *Open Discord*

Learn:

- **Self-led courses:** *Access to the courses and open classes*
- **Instructor-led:** *Access to special workshops and trainings*

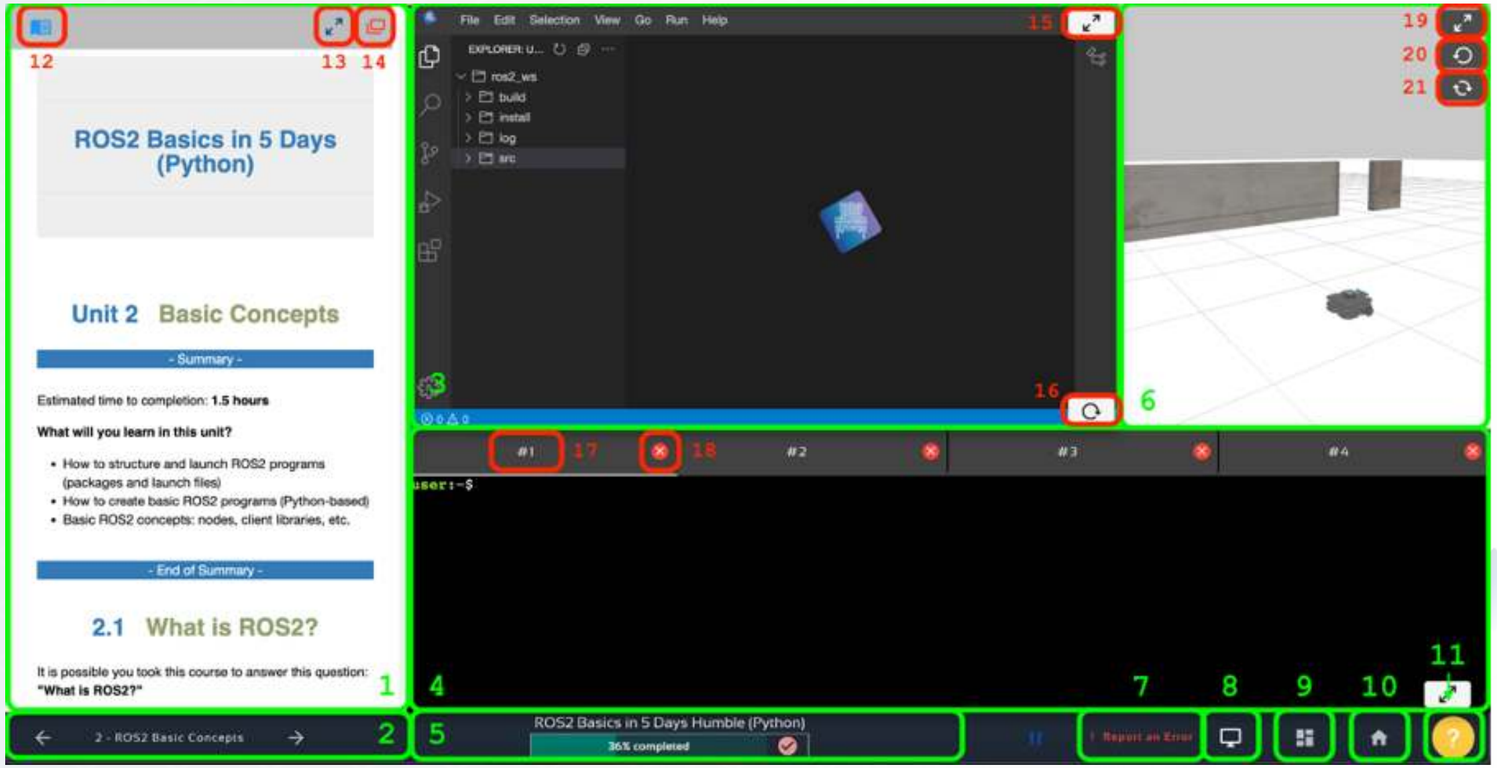
Develop:

- ***Public Rosjects:*** *Access to all the public rosjects*
- ***My Rosjects:*** *Access to your personal rosjects. Here you will have direct access to all the Checkpoints of the MasterClass*
- ***Real Robots:*** *Access to the Real Robot Labs*

ROS Jobs: Check open robotics job positions

THE PLATFORM

The **Course page** will be shown every time you work on a course:



THE CONSTRUCT

THE PLATFORM

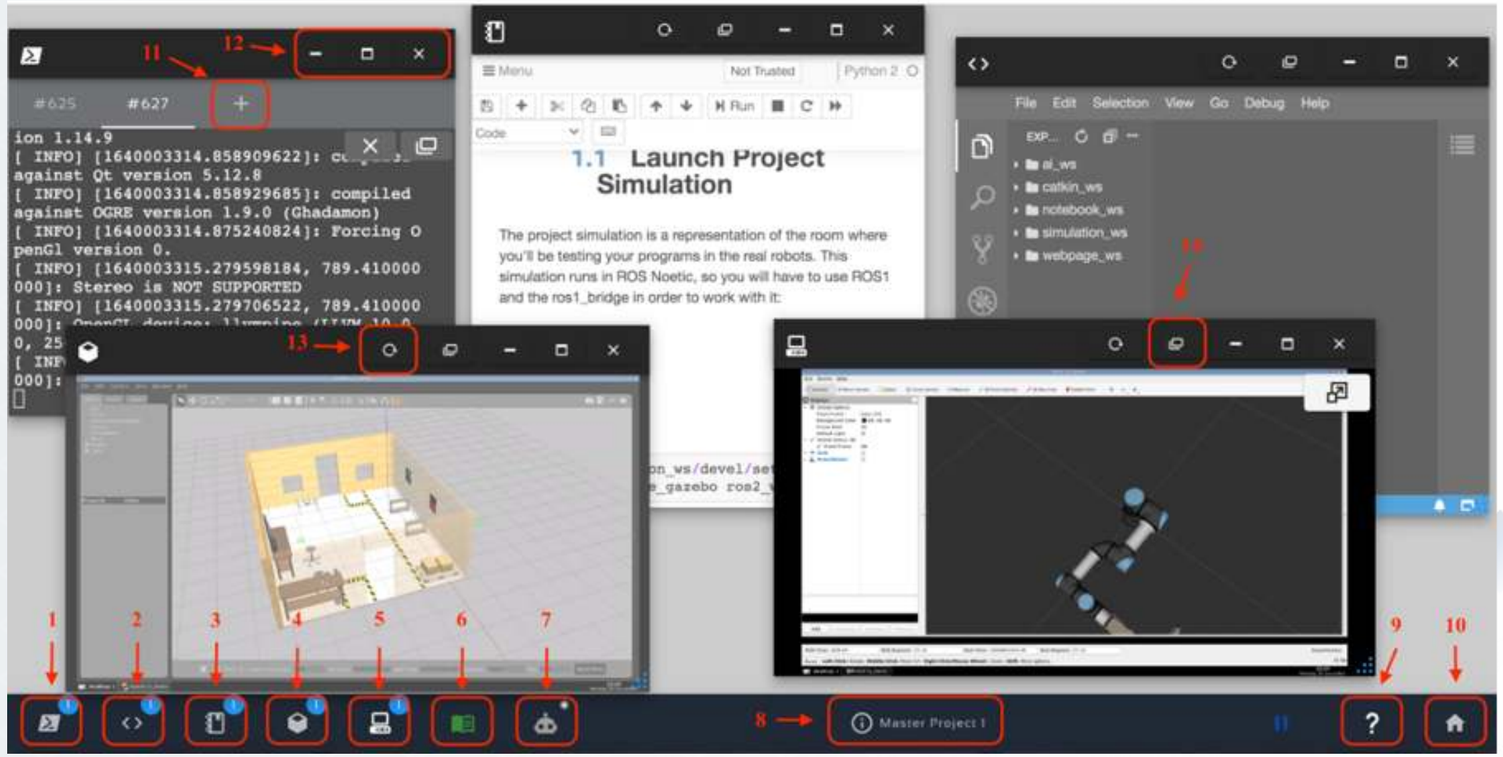
1. **Jupyter Notebook:** *Here you will find instructions to follow to complete the courses.*
2. **Unit Management:** *Allows you to change between Units.*
3. **IDE:** *Development Environment to edit your programs in a graphical way.*
4. **Web Shells:** *Four different Linux shells to type commands.*
5. **Progress Bar:** *Visualize your progress throughout the course.*
6. **Gazebo Simulation:** *Simulated environment to interact with a robot.*
7. **Report an Error:** *Use this button to report an error in the platform.*
8. **Graphical Tools:** *Opens an extra window that allows you to visualize graphical applications such as RViz or rqt.*
9. **Page configuration:** *Allows to rearrange the main windows.*
10. **Home Page:** *Go back to the HOME page.*
11. **Forum:** *Access the course forum page.*

THE PLATFORM

12. **Notebook Pre Visualizer:** *Allows you to pre-visualize other notebooks from the same course or other courses.*
13. **Resize Notebook:** *Allows you to maximize/minimize the notebook window.*
14. **Detach notebook:** *Opens the notebook in another browser tab.*
15. **Resize IDE:** *This allows you to maximize/minimize the notebook window.*
16. **Reload IDE:** *Reload the IDE application.*
17. **Rename Shell:** *This enables you to give a specific name to the Shell.*
18. **Reload Shell:** *Reloads the Shell.*
16. **Reload IDE:** *Reload the IDE application.*
17. **Rename Shell:** *This enables you to give a specific name to the Shell.*
18. **Reload Shell:** *Reloads the Shell.*

THE PLATFORM

The **rosject page** will be shown every time you work on a Project.



THE CONSTRUCT

THE PLATFORM

1. **Web Shell:** *Open a new Web Shell.*
2. **IDE:** *Open the IDE.*
3. **Jupyter Notebook:** *Open the Jupyter Notebook.*
4. **Gazebo:** *Open the Gazebo window.*
5. **Graphical Tools:** *Open the Graphical Tools window.*
6. **Notebook Pre Visualizer:** *Open the notebook Pre Visualizer tool.*
7. **Real Robot Connection:** *Connect to a Real Robot.*
8. **Rosject Data:** *Main Rosject data. It contains the Save Rosject button.*
9. **Forum:** *Go to the forum page.*
10. **Home:** *Go back to the HOME page.*
11. **New Web Shell:** *Open an extra Web Shell.*
12. **Minimize / Maximize / Close:** *Minimize, Maximize or Close the window.*
13. **Reload application:** *Reloads the application.*
14. **New tab:** *Move the application to a different browser tab.*

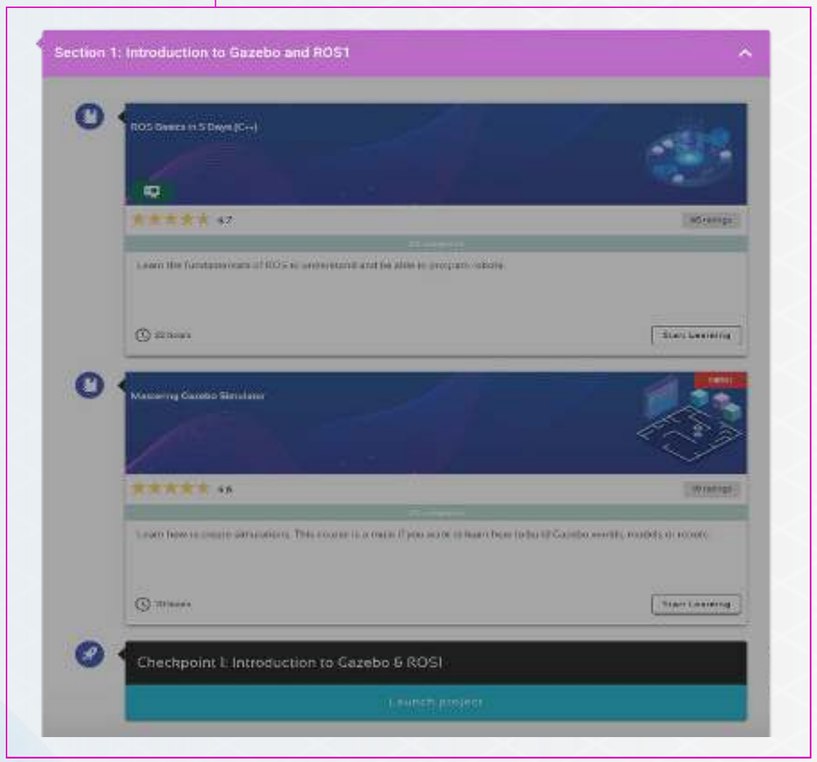
MANAGE YOUR WORK

In your homepage timeline, you will have direct access to all the **Phases** of the Masterclass.

Each Phase is composed of different **Sections**.

MANAGE YOUR WORK

Each Section is composed of 1 or more courses, and a **Checkpoint**.



By default, Sections will be **LOCKED**. This means you won't be able to access the courses or checkpoint inside it. In order to unlock them, you have to complete them. As you complete each Section, the next one will be unlocked.

In order to complete a Section, you will have to successfully pass its corresponding Checkpoint.

When you complete all the Sections inside a Phase, the Phase will be considered as completed, and you will get a score for it.

YOUR MARKS

Your final grade for the Masterclass will be computed based on the scores you get for each Phase. You can check your current **Phase Scores in the Scores area**:

In order to get a Phase score, you need to complete all the Sections inside that Phase. The Phase score will be computed as an **average** of each Section score.

Your scores for *Master Class: Class of 2023*

Phase	Grade Weight	Grade
Phase 1 (Learn the Fundamentals)	18.00%	8.75
Phase 2 (Build Robotics Programming Skills)	18.00%	0
Phase 3 (Robotics Theory)	18.00%	0
Phase 4 (DevOps for Robotics Projects)	18.00%	0
Phase 5 (Final Project)	28.00%	0
TOTAL Grade Achieved	**100.00%**	**1.57**

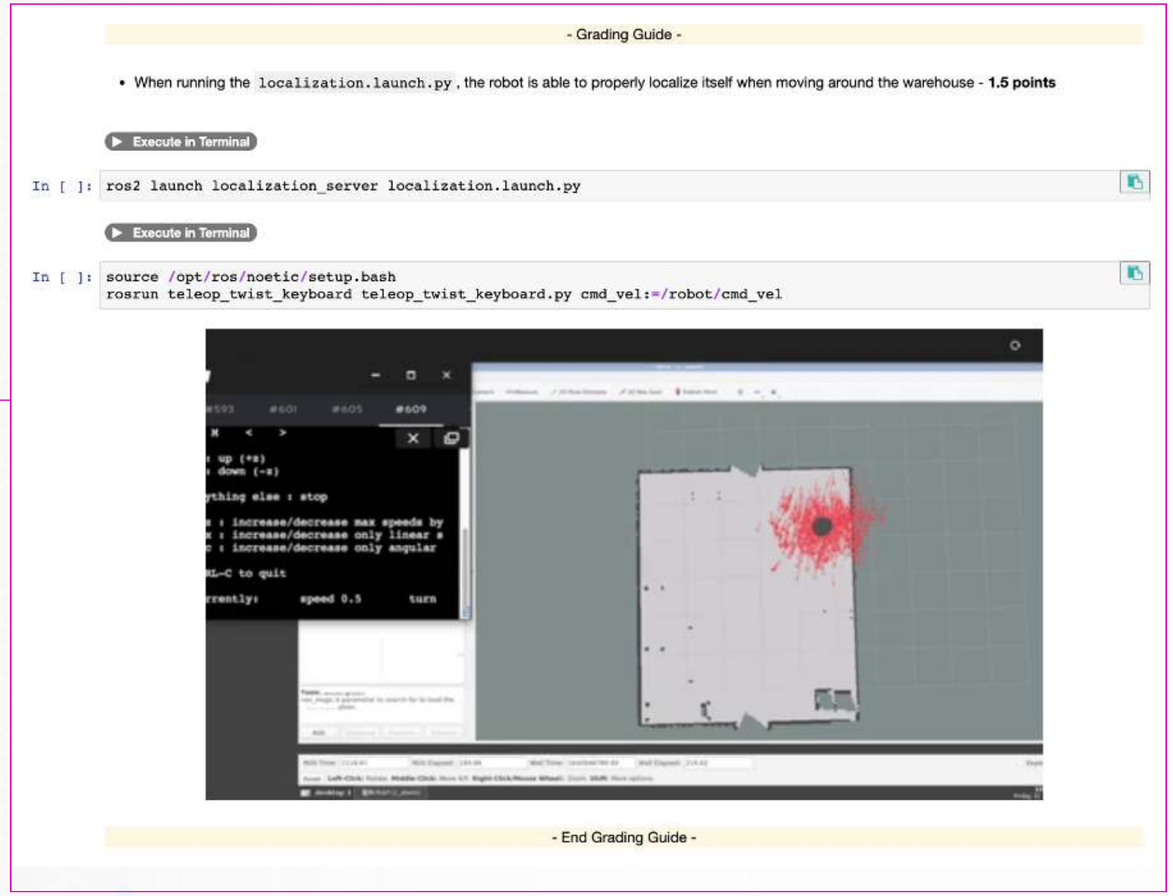
YOUR MARKS

The score of a Section will be defined by the Checkpoint project.

Checkpoints are small robotics project that will test everything you've learned during a specific Section. Inside a Checkpoint, you will be requested to complete different tasks.

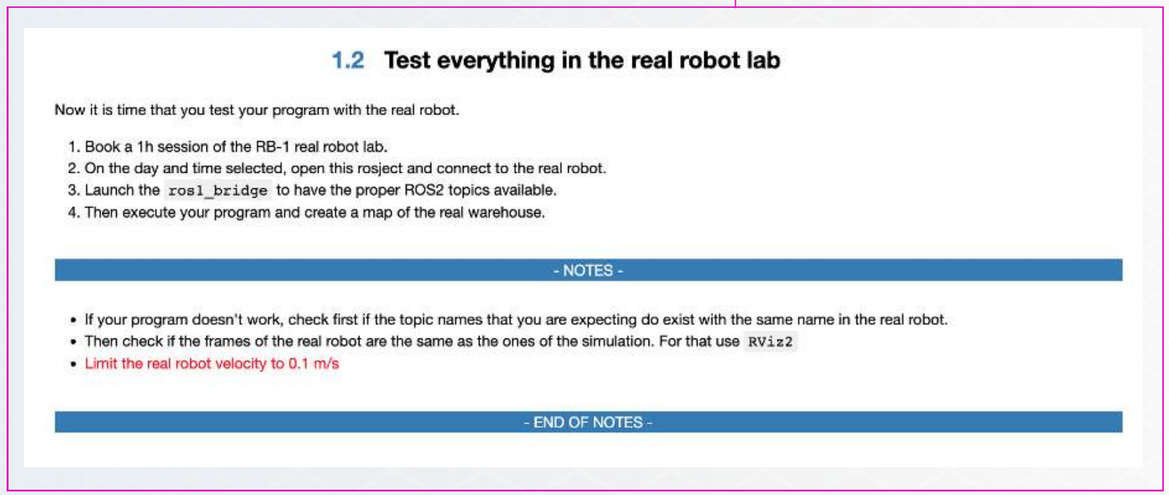
Inside each Checkpoint you will find **Grading Guides**.

These **Grading Guides** indicate what is the expected result of an specific task, and how much points you will be granted if it's completed correctly.



YOUR MARKS

In some Checkpoints, you will find **sections** like the following:



1.2 Test everything in the real robot lab

Now it is time that you test your program with the real robot.

1. Book a 1h session of the RB-1 real robot lab.
2. On the day and time selected, open this rosject and connect to the real robot.
3. Launch the `ros1_bridge` to have the proper ROS2 topics available.
4. Then execute your program and create a map of the real warehouse.

- NOTES -

- If your program doesn't work, check first if the topic names that you are expecting do exist with the same name in the real robot.
- Then check if the frames of the real robot are the same as the ones of the simulation. For that use `RViz2`
- Limit the real robot velocity to 0.1 m/s

- END OF NOTES -

Whenever you find these sections inside a Checkpoint project, you will have to **test that your programs work in the real robot**.

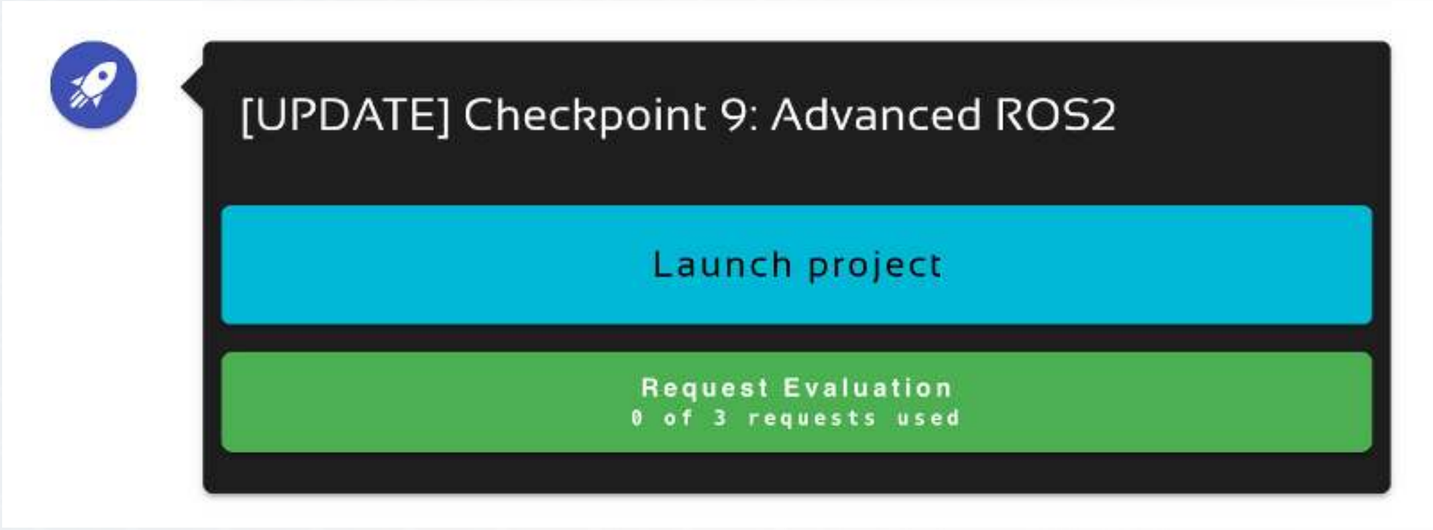
In fact, the evaluation of the Checkpoint will be made using also the real robot. You can find more details about the Real Robot Labs in the next sections.

YOUR MARKS

When you are finished with a Checkpoint and it’s ready to be evaluated, click on the ***Request Grading*** button.

A reviewer will evaluate it within the following 24 hours and provide you with a score.

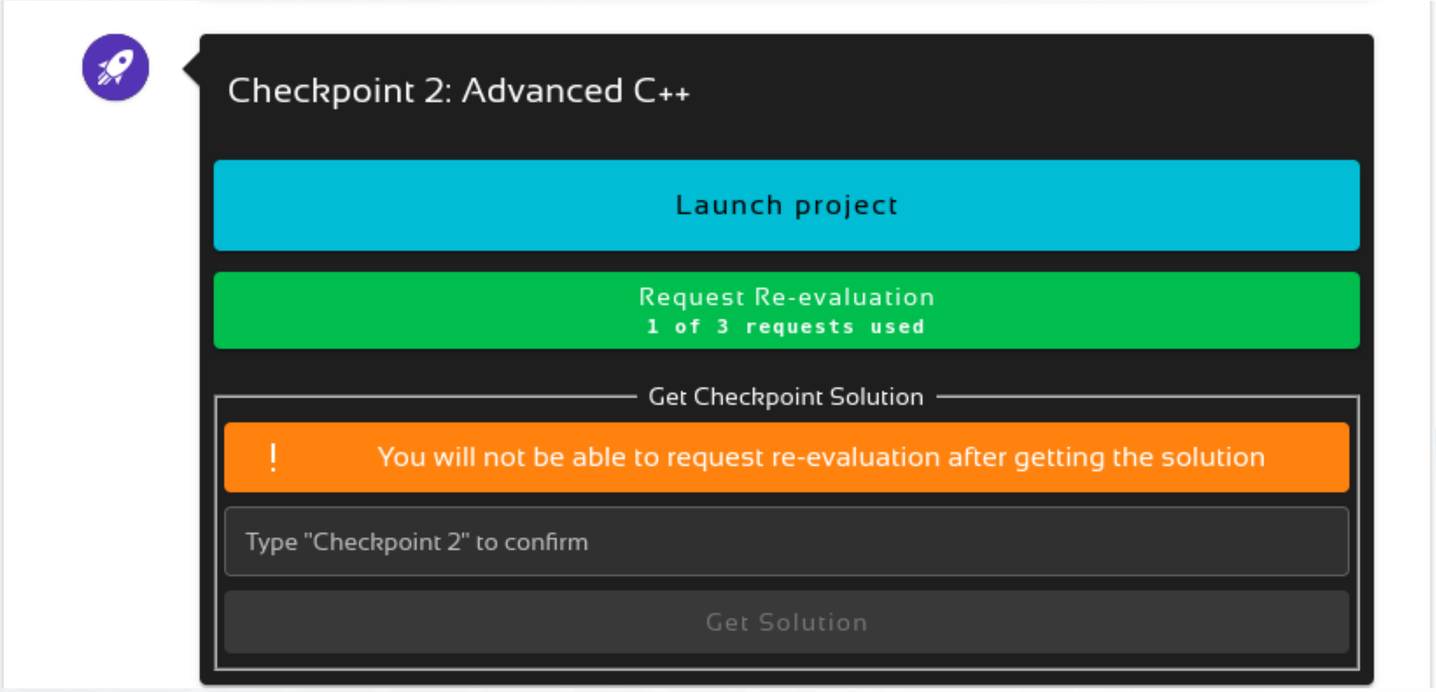
You will have 3 trials to send a checkpoint for grading if you want to improve your mark. After that, your mark will not be updated again.



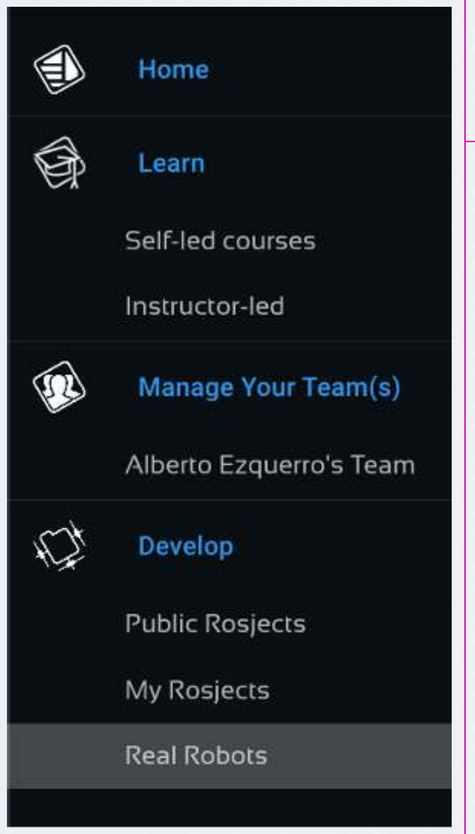
YOUR MARKS

After requesting a 1st evaluation, you will have the possibility to get the Checkpoint solution.

But be aware that ***once you check the solution, you will not be able to send your Checkpoint for grading anymore***.



REAL ROBOT CONNECTION

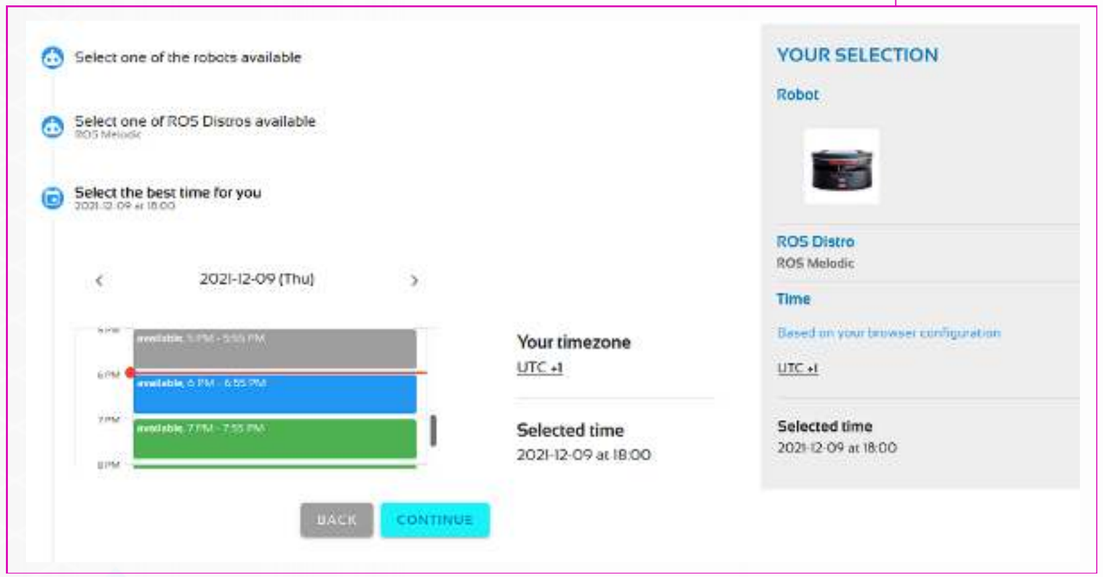


In order to use the real robots, you need to first reserve a slot from the **Real Robots tab** in the home page:

Here you will have access to all the available **Real Robot Labs**.

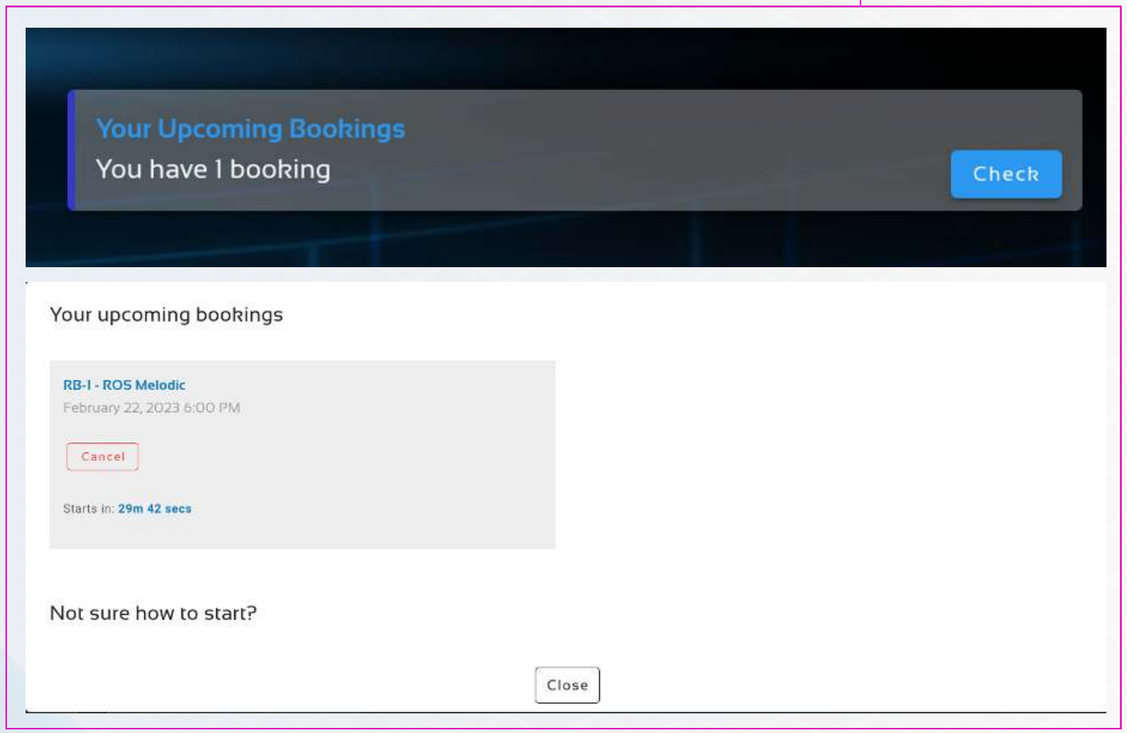
REAL ROBOT CONNECTION

Just **select** the desired robot **and book** the time slot that suits you better.

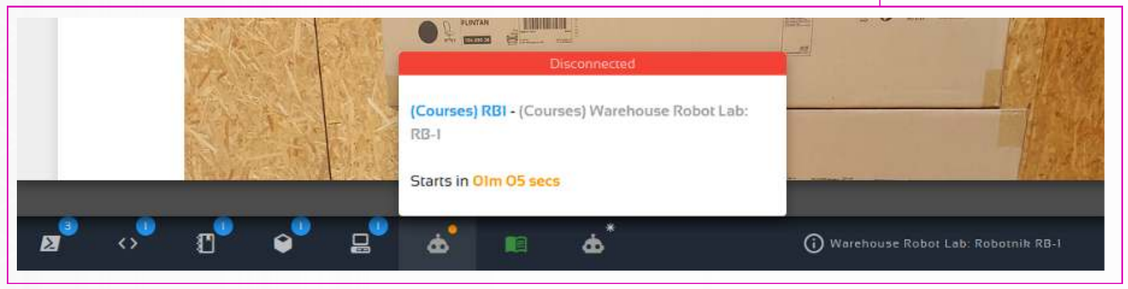


REAL ROBOT CONNECTION

Once your booking has been registered, you will be able to check it in the **Upcoming Bookings** section:

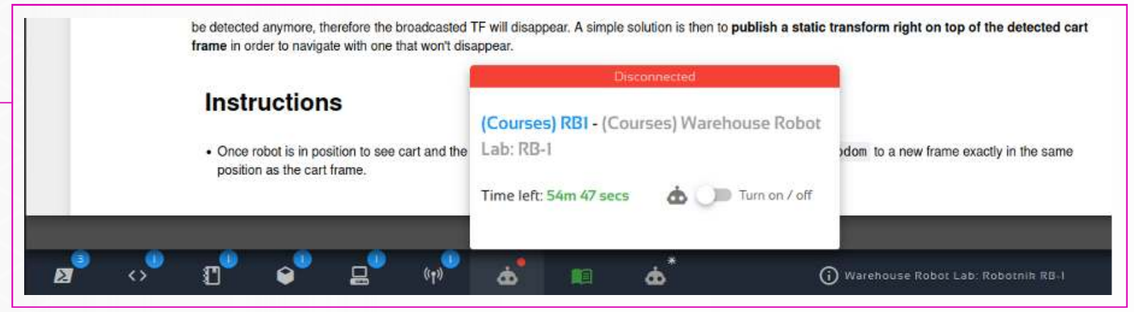


To connect to the real robot you will have to be inside a rosject. When you are in a rosject, you can see how long until your reservation starts on the **bottom panel**:



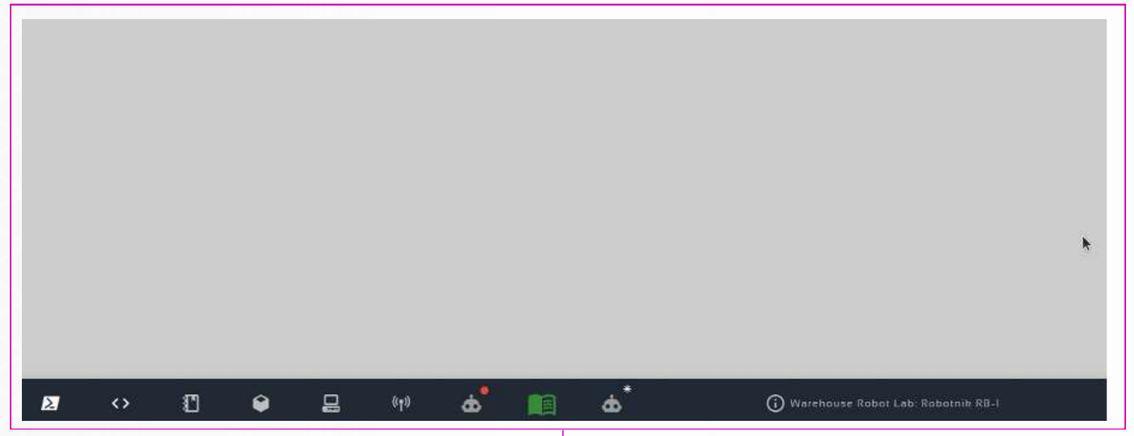
REAL ROBOT CONNECTION

Once your time slot arrives, the dot above the robot icon will turn red, indicating that you can now connect:



Once you connect to the real robot, every shell that you have running will get killed. So don't worry if your nodes or simulation go away, this means that the terminals are pointing now to the real robot instead of the virtual machine.

Click on the turn on button, and wait until the connection is established. You will see the camera streams appear along with a virtual joystick. Wait a few seconds until the middle circle of the joystick turns gray and move it to see if the robot moves.



If it does, it means **you are connected!** and are ready to get working.

FINAL PROJECT

- The Final Presentation of the project will be done on a **YouTube Live Stream**, with three experts of the team acting as evaluators:
  - **30 minutes for the presentation**
  - **15 minutes for Q&A from the experts**
- The Final Project will be based on the **Starbots Coffee** *(an automated cafetería environment which involves different robots)*. Several Project options will be available to choose between them.

- The Final Project selected will be discussed and agreed upon between the student and the tutor.
- Calls for the Final Project presentation will be open every month. So, in case you miss one, you have to wait 1 month for the next call.

DEADLINE

- The Masterclass has a maximum deadline of 24 months, including the inactive (subscription paused) periods.
- If you have not completed the Masterclass within this period, you will be kicked off the program.

COPYING POLICY

- The Masterclass has a very strict policy against copying. If we detect that any student has copied from another student, they will be immediately removed from the program.
- If you are struggling with any aspect of the course, we encourage you to seek help from instructors or peers rather than resorting to copying. The Masterclass is designed to support your growth, and we are here to help you succeed.
- We believe that true learning comes from personal effort and integrity. Copying undermines both your own progress and the integrity of the Masterclass community

· STUDENTS GUIDE ·

Robotics Developer

MASTERCLASS 2025

- SPRING BATCH -

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The Construct
ROBOTICS INSTITUTE

Where Your
Robotics Career
Happens