Test Project

Module C – Prototyping

Duration – 3 Hours

Autonomous Mobile Robotics

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1. Introduction

1. A hotel service robot delivering food, drinks, and supplies to different areas requires a simple and reliable method to identify operational locations such as pickup stations, delivery points, charging areas, and return stations. Installing complex localization systems or indoor positioning infrastructure would significantly increase the cost and complexity of the system.
2. To provide a cost-effective solution, the customer has selected a color-coded floor system. Different operational areas are identified using colored tape, tiles, or floor mats. A downward facing color sensor mounted on the robot detects each colored zone and instructs the robot to perform the required action.
3. Your task is to prototype an attachment that enables the common base robot to detect these color-coded operational zones.
4. The operational zones are defined as follows:

COLOUR	OPERATIONAL AREA	FUNCTION	DIE		
Red	Kitchen Pickup Station	Load food and drinks.	1		
Green	Dining Table Delivery	Deliver customer orders.	2		
Blue	Dish Return Station	Collect dirty dishes and trays.	3		
Yellow	Charging Dock	Recharge the robot.	4		
Orange	Beverage Pickup Station	Load drink orders.	5		
Purple	Host Stand / Waiting Area	Deliver menus, drinks, or collection orders.	6		

2. Description of project and tasks

READ THE ENTIRE DOCUMENT BEFORE PROCEEDING.

Workplace safety procedures and protocols must be always demonstrated.

If you are advised of a safety infraction during this module, 0.5 of a mark will be deducted for each infraction. On the 3rd infraction, the Competitor will be stopped, and the evaluation will be based on work already completed.

Experts will not intervene unless there is a safety concern.

2.1 Required Components

The list of required components to complete the task.

- Competitor robot built on C1
- Prototyping kit
- learn.studica.com docs (found on computer)
- Git repo Studica Robotics ROS2 (found on computer)

NOTE: Competitors are allowed to use their supplied laptops for processing. No extra time or appeals can be made if the Wi-Fi between the robot and computer is interrupted or dropped.

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2.1 Control Mode

Competitors are required to use autonomous control during this module.

2.2 Schedule

The total duration of this module is **3 hours**.

TIME	ACTIVITY
00:00 – 02:30	Complete the Prototyping Module.
02:30 – 02:45	Evaluation – Teams 1 & 2 (Courts 1 & 2).
02:45 – 03:00	Evaluation – Teams 3 & 4 (Courts 1 & 2).

Competitors should refer to the official competition schedule to determine the start and finish time of their allocated session.

Before the evaluation period begins, competitors must:

- stop all work on the robot;
- clean and organize the workstation;
- prepare for rotation to the next module.

During the evaluation period, competitors are **not permitted** to modify the robot or perform any additional work.

Only the robot presented at the start of the evaluation period will be assessed.

2.3 Task

Competitors are required to install and commission the **Colore** color sensor on the common base robot. Wiring documentation is provided in the local Studica Learn documentation, and the required ROS2 driver and example code are available in the pre-installed Studica Robotics repository.

The prototyping court contains **six pathways**. Each pathway contains **six colored markers**.

Before each evaluation run, the roll of the die determines the target color for each of the six pathways that the robot must detect.

The robot shall autonomously:

- navigate each search corridor(pathway),
- identify the required colored marker,
- stop (minimum 3s) and indicate successful detection using the buzzer and light tower;
- continue to the next pathway and
- return to the home location after completing all six pathways.

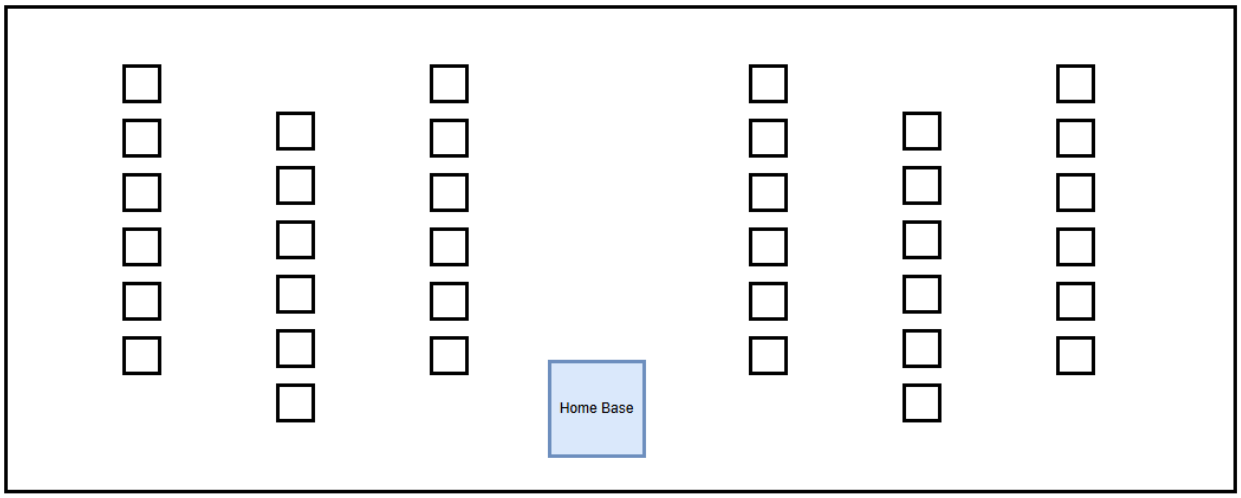
2.3.1 Court Information

The prototyping court measures **2 m × 4 m** and contains internal walls that simulate a realistic operating environment.

The court contains **six pathways**, each representing an operational inspection area. Each pathway contains **six colored markers**.

The **home location** is positioned at the center of the court and serves as both the starting and finishing location for the evaluation run.

During the evaluation, competitors must use the prototyping court to demonstrate the autonomous operation of their robot in accordance with the task requirements.



This is sample court layout

2.3.2 Light Tower Requirements

During the evaluation run, the robot shall indicate its operating status using the light tower as follows:

ROBOT STATUS	LIGHT TOWER REQUIREMENT
Robot stationary	Solid green
Robot moving	Flashing yellow
Robot detects and stops on the correct row color	Buzzer Sounds first the light Flashes green
Robot reaches the designated end location (Home Base Area)	Solid red

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2.3.3 Evaluation Procedure

At the start of the evaluation:

1. The competitor places the robot in the home location.
2. The die is rolled to determine the target **color** for each of the six pathways.
3. The competitor configures the robot with the selected **color** sequence using any preferred method that complies with the competition rules.
4. Once the competitor confirms that the robot is ready, the experts give permission to begin the evaluation.
5. The competitor presses the **Start button** to begin the autonomous run.
6. The robot autonomously completes the search task.
7. The evaluation time ends when the robot returns to the home location, stops, and displays a solid red light. If the robot returns to the home location but the solid red light is not displayed, the competitor must immediately notify the experts so that the completion time can be recorded.

3 Instructions to the Competitors

3.1 Preparation Period

During the preparation period, competitors may use the prototyping courts to develop, test, and optimize their solution before the evaluation run.

The prototyping courts are shared resources and may be used simultaneously by multiple teams. Competitors are expected to communicate and cooperate to ensure safe and efficient use of the courts.

3.2 Workstation Preparation

Before the evaluation period begins, competitors must:

- stop all development and testing;
- clean and organize the workstation; and
- prepare for rotation to the next competition module.

3.3 Evaluation Procedure

1. The competitor places the robot in the home location.
2. The die is rolled to determine the colored guide path for the evaluation run.
3. The competitor configures the robot for the selected colored guide path using any preferred method that complies with the competition rules.
4. Once the competitor confirms that the robot is ready, the experts give permission to begin the evaluation.
5. The competitor presses the **Start** button on the robot control panel to begin the autonomous run.
6. No further interaction with the robot is permitted unless instructed by the experts.
7. The evaluation time ends when the robot displays a solid red light at the designated end location. If the robot reaches the designated end location but the solid red light is not displayed, the competitor must immediately notify the experts so that the completion time can be recorded.

During the evaluation period, competitors are **not permitted** to modify their robot or perform any additional work, while seated at their workbenches.

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4 Equipment, machinery, installations, and materials required

4.1 Equipment provided by Competition Organizer

- All equipment, tooling, and materials in the Infrastructure List – see AMR Discussion Forum and Technical Description; ;
- Prototyping kit; .

4.2 Equipment and material not permitted

- Non worldskills supplied Laptops or portable computers;
- Tablet's e.g. Android, IPAD etc.;
- Memory sticks/ Digital Storage;
- Digital music Player;
- Electronic organizer/diaries;
- Wireless communication devices;
- None approved SD Cards – approval by Experts or delegate is required for all SD Card images;
- Any additional software not supplied by Competition Organizers unless approved by Experts;
- Purchased items modified in any way prior to the Competition;
- Equipment that is similar or operates in similar manner as supplied equipment. Example – if a metal cut-off saw is provided by Competition Organizers, then no team may provide their own metal cut-off saw;
- All raw materials, components, parts, purchased item, tools and equipment not permitted in the Technical Description and List of Materials Allowed and Not Allowed of the skill.

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