

Problem Statement and Goals

2-D Localizer

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Table 1: Revision History

Date	Developer(s)	Change
17 January 2024	Aliyah Jimoh	Initial Draft

1 Problem Statement

Mobile robots can be used to travel certain terrain or complete difficult tasks that could jeopardize the safety of the operators. Using sensors to let the robot know where it is, make it actively react or change its trajectory can help ensure the safety of the robot itself.

1.1 Problem

With environments that are enclosed or indoors, it would be hard to get a GPS signal to locate the robot or see if the task has been completed. Testing the robot's trajectory and algorithm in the actual site without having any way to truly replicate it could risk the robot malfunctioning or having errors making it difficult for retrieving it. This project would like to propose a 2-D localization simulator that shows the robot's location along with the robot being capable of self perception.

1.2 Inputs and Outputs

1.2.1 Inputs

- Room size
- Coordinates of sensors
- Predicted trajectory of robot

1.2.2 Outputs

- Estimated locations of robot through sensors with noise
- Estimated locations through the robot

1.3 Stakeholders

- Dr. Matthew Giamou (ARCO Lab)
- Roboticists who would want to set up tests for enclosed environments like caves, work cells, etc.

1.4 Environment

This simulation can be accessed through any operating system which includes Windows 11 and higher, MacOS, and Linux operating systems.

2 Goals

1. The simulation will operate through the sensors' interactions.
2. The localizer will make the the robot percept its location.
3. The simulation will have a visual representation of how the robot interacts with the sensors along with showing how it is located.

3 Stretch Goals

1. The localizer will be developed to show a table of the robot's trajectory compared to the sensors' feedback.
2. It will then be set up to output an animation on how the robot interacts in the specified room.
3. The simulation will be set up to help users input their algorithms and coordinates if it were to be calculated by other means.

4 Challenge Level and Extras

This project is expected to to have a general challenge level which can be seen from the implementation and the topic. The tasks required for this simulation like setting up the robot's movement, seeing the trajectory, coordinating the sensors' measurements, and finding a way to animate the whole output would definitely add difficulty to this project, however, this is not a niche topic meaning that there can be papers or libraries available to draw inspiration from.