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Introduction

Research Question

- Describe problem: Arena with unknown layout containing "victims"
- Propose solution: Want to implement technical solution that can navigate arena and detect victims
- Motivation: Describe real world analogy of searching for survivors after disaster

Objectives

- We want to develop a robot that solves the problem proposed in the research question - it must be able to explore an unknown arena and detect the "victims" inside it
- Requirements: Needs to be able to move around, detect obstacles and detect colors
- Evaluation of performance: Robot must be able to count the number of victims detected (should be accurate), the average linear speed (should be high) and the number of collisions (should be low/accurate)

Equipment

TurtleBot

- Short description of what a turtlebot is
- Why a turtlebot is useful for us and what we want to do
- Brief description of its different components

Raspberry PI

- Purpose: Computer that is part of the turtlebot, and handles everything it does
- Runs with ubuntu as its operating system

Lidar

- Purpose: It is used for detecting the obstacles in the arena
- Technical abilities - how does the lidar detect obstacles, and what data does it generate?
- Limitations of the lidar - how much and what can it measure?

Colour Detector

- Functionality: Describes how much red, blue and green it is seeing
- Setup with raspberry PI
- Getting data from colour detector in python

Robot Operating System

- Description of ROS and what it can do

- Description of publisher/subscriber architecture
- Description of how ROS will be used in our project

Methodology and Experiments

Obstacle Detection

- How are objects detected: How close do they have to be, and what regions are scanned?
- How is the data from the lidar treated?
  - Some data must be removed because it is faulty
- how do you decide an object is located in a region of the scannings?

Navigation

- Description of the general navigation technique - how is the turning direction decided?
  - How do you make sure you explore many parts of the arena?
- Challenges with edge cases: What happens when a dead end is reached or you are in a corner?
- Challenges with narrow openings: Detecting whether you should go through or not

Movement

- The robot should move in such a way that linear speed is optimized while still avoiding objects
- When should the robot start turning?
  - Cost/benefit of turning early
  - When should the robot have no linear speed?
- Dynamically setting angular and linear speed as a function of distance
- Description of how the linear speed is tracked

Victim/Colour Detection

- Challenges of detecting specific colour
  - Setting thresholds for when a colour is found
- Challenges of running over victim too quickly without detecting it
- Making sure to only increase counter by one when victim is detected

Collision Detection

- Challenges with lidar readings - won't read below 15 cm
  - Couldn't distinguish between almost colliding and colliding
- Alternative solution: Using fewer lidar readings as indicator of collision
  - Testing for threshold indicating collision
- Challenges of only detecting a single collision when colliding

Results

Capabilities of the Robot

- Brief and general of the robot's abilities/final behaviour
- Test results from running different courses
  - How many victims were found?
    - How many should it have detected?
  - How many collisions were detected?
    - How many actually happened
  - What was the average linear speed?
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Errors

- Wrong behaviours we have observed in the robot
- What scenarios does it struggle with?
  - Navigation, obstacle detection and movement
  - Detection of victims and collisions

Discussion

Review of the Robot

- Is the robot functional?
- Have the requirements described in the intro duction been met?
  - Where have they not been met?
- What are the short comings of the robot

Improvements

- What features needs to be improved/fixed?
- How can the robot be made better?
  - Making sure to explore the entire arena
  - Not detecting the same victim twice
  - Better collision detection

Conclusion

- Summing up the report, with focus on the results and discussion sections

References