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C951 Task 2

INTRODUCTION

Real-time search-and-rescue robots are increasingly used to supplement the efforts of the first responders in areas affected by natural disasters. They are used to spot-check the situational awareness of people in distress, survey the extent of flood or tornado damage, evaluate the number of people that had not been evacuated from their neighborhoods, clean debris, and create passable routes.

For this task, you will use the Coppelia Robotics virtual robot and its environment to demonstrate how such robots may be used in disaster recovery. Your first step is to familiarize yourself with this technology by reviewing the information in the “Coppelia Robotics Resources Page” and “CoppeliaSim User Manual” provided in the Web Links section.

For the next step, you will thoroughly describe a disaster situation similar to the ones mentioned above. Next, you will create a virtual prototype of an autonomous robotic recovery system that demonstrates goal-seeking behaviors in navigating through a predefined area. The robotic recovery system will solve a disaster recovery problem of your choice by using the Coppelia Robotics BubbleRob and its environment as the starting point of your prototyping. You will also add sensors to the robot. These sensors will collect vital information to aid in the disaster recovery effort for the scenario you described.

REQUIREMENTS

*Your submission must be your original work. No more than a combined total of 30% of the submission and no more than a 10% match to any one individual source can be directly quoted or closely paraphrased from sources, even if cited correctly. The similarity report that is provided when you submit your task can be used as a guide.*

*You must use the rubric to direct the creation of your submission because it provides detailed criteria that will be used to evaluate your work. Each requirement below may be evaluated by more than one rubric aspect. The rubric aspect titles may contain hyperlinks to relevant portions of the course.*

*Tasks may****not****be submitted as cloud links, such as links to Google Docs, Google Slides, OneDrive, etc., unless specified in the task requirements. All other submissions must be file types that are uploaded and submitted as attachments (e.g., .docx, .pdf, .ppt).*

Using the CoppeliaSim virtual robot, create a virtual prototype of an autonomous robotic recovery system that demonstrates goal-seeking behaviors in navigating through a predefined area by doing the following:

**A.  Describe the disaster recovery environment you chose and the two obstacles you have added to the environment.**

The disaster recovery environment consists of an unidentified survivor located in a single room with a single entry point. The room contains notable levels of harmful gas preventing rescuers from entering. Multiple obstacles including immovable columns and movable spheres increase the level of difficulty required to complete the rescue.

**B.  Explain how the robot will improve disaster recovery in the environment from part A after you have added the two obstacles from part A.**

Employing the Disaster Recovery Bot may improve rescue efforts greatly by decreasing the risk to first responders and decreasing the time required to locate survivors. The Bot can serve as eyes and ears when the rescue environment has been identified as hazardous and/or toxic without risk to rescuers. By using the Bot’s onboard cameras, the location of obstacles and survivors may be identified from a safe location. Once a survivor is located, coordinates that location can be transmitted to an awaiting rescue team. Should the Bot become damaged, disabled, or unable to navigate the environment any further, its last known coordinates can be communicated to the rescue team, alerting them that the path may be impassable. Communication can be established once the survivors are found by using onboard speakers and microphones. The Disaster Recovery Bot can also provide life-saving emergency supplies to survivors awaiting rescue.

**C.  Justify the modifications you made to CoppeliaSim’s robot architecture, including two sensors you chose to add, and explain how these sensors will aid the disaster recovery effort.**

The Disaster Recovery Bot uses two proximity sensors, each with different purposes. The first sensor is a close-range proximity sensor designed to locate obstacles. Once an obstacle is within sensor range, the Bot begins an obstacle avoidance routine. After completing the routine, forward trajectory resumes if the sensor shows no obstacles in its range. If the sensor detects an obstacle still in range, the obstacle avoidance routine repeats until no obstacles are detected in range. This enables the bot to avoid obstacles while navigating the environment.

The second proximity sensor is designed to locate survivors. Once a survivor is within range of the sensor, an alert is sent to the rescue team notifying them that the target has been located.   
  
Navigating hazardous environments, minimizing risks to first responders, and increasing the ability to help survivors during a disaster all greatly improve the amount of assistance first responders can provide during the most challenging of disastrous events.

**D.  Describe how the robot maintains an internal representation of the environment.**

E.  Explain how the robot implements the following **four** concepts to achieve its goal:

•   reasoning

•   knowledge representation

•   uncertainty

•   intelligence

**F.  Explain how the prototype could be further improved, including how reinforced learning and advanced search algorithms can improve the prototype’s performance and learning.**

**G.  Submit the robot code that you created.**

Please see attached/linked files.

H.  Provide a Panopto video recording that describes the robot and demonstrates its functionalities to stakeholders who are nonpractitioners and include each of the following:

•   a statement of the disaster recovery problem

•   a summary of the environment and the obstacles

•   a summary of the robot’s goal and objectives

•   a description of the robot and its architecture

•   a demonstration of how the robot meets its disaster recovery goals

•   an assessment of the robot’s capabilities

•   an explanation of how to improve the prototype

*Note: For instructions on how to access and use Panopto, use the "Panopto How-To Videos" web link provided below. To access Panopto's website, navigate to the web link titled "Panopto Access," and then choose to log in using the “WGU” option. If prompted, log in using your WGU student portal credentials, and then it will forward you to Panopto’s website.*

*To submit your recording, upload it to the Panopto drop box titled "Intro to Artificial Intelligence NIP2 | C951 (student creators) [assignments]." Once the recording has been uploaded and processed in Panopto's system, retrieve the URL of the recording from Panopto and copy and paste it into the Links option. Upload the remaining task requirements using the Attachments option.*

I.  Acknowledge sources, using in-text citations and references, for content that is quoted, paraphrased, or summarized.

J.  Demonstrate professional communication in the content and presentation of your submission.

**File Restrictions**

File name may contain only letters, numbers, spaces, and these symbols: ! - \_ . \* ' ( )  
File size limit: 400 MB  
File types allowed: doc, docx, rtf, xls, xlsx, ppt, pptx, odt, pdf, txt, qt, mov, mpg, avi, mp3, wav, mp4, wma, flv, asf, mpeg, wmv, m4v, svg, tif, tiff, jpeg, jpg, gif, png, zip, rar, tar, 7z