Performance Assessment 2:

Disaster Recovery bot

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C951 Introduction to Artificial Intelligence

## A. Disaster Recovery Environment:

The disaster recovery environment was created to represent the aftermath of a disaster event for a building such as an earthquake, fire, or terrorist attack. The outer parameter walls represent the building area for the BubbleRob to search (Ash, 2022). The white pillars represent the building columns, rectangular objects represent file cabinets, and, finally, green spheres present survivors needing to be rescued.

## B. Improved Disaster Recovery:

The aftermath caused by a disaster to a building creates a disaster recovery environment with many dangerous obstacles such as damaged columns, file cabinets, and other debris within the building walls. This is the main reason for a disaster recovery robot to be used to perform preliminary search prior to any human rescuers to go inside the building. This is beneficial for safety of rescuers and thorough search for any survivors. Once a survivor is detected, the recovery robot resends a signal notification message with coordinates of the survivor to the rescue team on the console window of the Coppellasim.

## C. Architecture:

The original BubbleRob often got stuck when one of its two wheels got too close to an obstacle in the disaster environment. Two added proximity sensors cover different angles of the robot and fixed the

Issue by providing wider range of object detection. The sensors allowed the robot to perceive different obstacles and made proper course corrections prior to the robot’s wheels getting too close to the objects. The robot needed a sensor to detect survivors. Hence, a dedicated wide proximity sensor was added to scan for survivors. This required for robot’s Lua script to be modified to print a message with coordinates on the console when a survivor was found.

## D. Maintaining Internal Representation of Environment:

The prototype performs basic internal representation of environment and maintenance of its reasoning through its ability to navigate the disaster recovery environment. The instructions and functions in the Lua script allowed the prototype robot to act properly when an impassible object is detected via its proximity sensors. The prototype robot internalized its ability to distinguish obstacle objects from a survivor and whether to send a message when a survivor was found. The robot has no prior knowledge or the building layout or the any potential dangers inside the building, it was equipped to deal with this uncertainty with proximity sensors to avoid any dangers to itself and human rescuers. The robot’s ability to maintain internal representation of environment is measured by its ability to achieve its objective and goal of finding survivors. The robot simply reacts based on its sensors and perform actions based on the current perception of an object. It does not have any reasoning based on previous experience.

## E. The Four Concepts to Achieve its Goal

### Reasoning:

The robot has several reasoning abilities. It can reason whether an object is a survivor or not before sending a message to the rescue team. It can reason which path to take to find survivors within certain proximity.

### Knowledge Representation:

The robot doesn’t keep track of its traveled area. Therefore, it will often re-traverse its previous paths multiple times. This proves a limitation in its knowledge representation. However, it’s able to detect difference between human and obstacle objects.

### Uncertainty:

The robot’s travel course is uncertain and not planned. However, it has built in sensors and prescribed scripts to behave in a certain way when it’s faced with an uncertainty such as meeting an object.

### Intelligence:

Its intelligence to detect a proper object and traverse the dangerous environment is critical to achieving its goal. The hardware and software combination allows the robot to have a certain intelligence to travel through the building and find survivors.

## **F**. **Improving the Prototype**

The robot prototype can be improved by increasing the range and numbers of the proximity sensors such as in the back. Additional proximity sensors enable the robots to scan objects without directly facing obstacles or survivors. Also, adding mapping function for the previously traveled path can decrease the total time spent to find survivors. This can be implemented via negative reward feedback and upgrading the robot from a simple reactionary agent to a Q-learning agent. This will utilize comparison values to chose best course of action without knowing its full search environment.

## H. Panopto Video Recording

Video Link: <https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=246dcb64-0076-425b-9096-af6800f40fae#>

## I. References

Ash, J.(2022, December). C951 Task 2 Getting Started with CoppeliaSim. Retrieved December 09, 2022, from <https://wgu.hosted.panopto.com/Panopto/Pages/Viewer.aspx?id=fac0a84e-e077-4e42-974e-acd30172e7c0>