C951 Task 2

NIP2 TASK 2: DISASTER RELIEF ROBOT

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

The disaster recovery environment is a room that someone has become entrapped in due to an earthquake. A man is now stuck inside of a room with two chairs and a table. The two chairs and the table are the objects added, while the man is sitting on the chair but is also enabled to collide and be recorded by the bot.

**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.**

The robot will improve disaster recovery from the objects I have added by learning how to navigate a room with larger objects in it. Additionally, there are spaces between the legs of the chairs and table that are much smaller spaces that the robot must be able to navigate. It will be able to get itself out of tight spaces when needed. The robot is also small enough to be inserted into a small hole so it can scan the room instead of doing large demolition or removal of pieces before we know we need to get inside of the room.

**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.**

Modifications made to the robot architecture within the sim include the vision detection sensor and a proximity detection sensor. The vision detection sensor is a forward-facing sensor that detects and records the inside environment. This allows the robot to relay information about the inside room that is not visible or known about outside of the walls. The second sensor added was a proximity sensor that allows the robot to detect walls and even low hanging ceilings. Since an earthquake has hit, we must know if the ceiling lost integrity and collapsed. Also, we need the bot to be able to move freely throughout the room so it can record what it finds, so using the proximity sensor will make it easier for the bot to keep from getting stuck in tight spaces.

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

The robot maintains and internal representation of the environment by keeping a graph of its experiences. The vision sensor keeps a log of when the bot was moving straight and at what distance it was from the original position. Any deflections in the graph means that it had changed direction and came in contact with an object.

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

**•   reasoning**

**•   knowledge representation**

**•   uncertainty**

**•   intelligence**

Reasoning - The bot was made to aide disaster relief efforts. Supplying vital information about situations to those looking to perform a rescue.

Knowledge representation – We know that: an earthquake occurred, building integrity may be compromised, someone may be in the room, small spaces are likely. The bot was designed to fit into small and tight spaces, navigate possible debris or low ceilings, record information about the room, and supply vital info to outside parties. Most of this information is relayed through graph that can be mapped out to show the design of the room.

Uncertainty – We are unsure if someone is in the room or the actual layout of the environment. The robot was made to record information inside the room and navigate objects inside of the room without getting stuck.

Intelligence – Using sensors and the ability for it to record parts of the room, we can relay it to outside parties so the rescue can begin. The robot was also coded so that it is not only moving back and forth, but changes angles slightly to make sure the entire room will be swept over time. The speed can also be changed to expedite the process.

**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.**

The prototype can be further improved by being able to detect people and movement. As of now, the bot can determine the layout of the room to see how impacted it is through the earthquake. Another improvement could be making the prototype more resistant to environmental conditions. An earthquake could cause leaks or flooding so it would be wise to make the robot more prepared to withstand these conditions.

For reinforced learning, the bot could be able to self-manage speeds by learning the dimensions of the room quicker. Once the bot knows the outside area, it could sweep the area faster. Alternatively, it would slow down when encountering a known object.

An advanced algorithm to determine the precise shapes of the objects in the room would be very beneficial. As of now, we know that there will be objects. We do not know their exact shapes or size so having an algorithm determine that would be a major improvement.