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**INTRODUCTION TO ARTIFICIAL INTELLIGENCE — C951**

**Assessment 2: Disaster Recover bot**

**A**. **Problem:**

The disaster recover environment I have created represents the aftermath of a tornado. The outer walls represent the area assigned the BubbleRob to search in. The brown pillars represent trees. I have added cuboids to represent fallen debris and a yellow sphere to represent a survivor that needs to be rescued.

**B**. **Improved Disaster Recovery**:

The destruction caused by a tornado creates an environment with many dangerous obstacles such as loose and fallen debris. This is one of the reasons why having a robot scan the area before human rescuers arrive is beneficial in improving disaster recovery. The robot will improve the recovery effort by using its proximity sensors to perform a thorough search for survivors. Once a survivor is detected the robot will send a notification message along with coordinates to rescue personnel (console window). The robot’s attached camera can also provide visual detail on the scanned environment and send it to rescue crews. Rescue crews can then use this footage to evaluate the environmental hazards before dispatching a human to aid the survivor.

**C**. **Architecture**:

The BubbleRob often got stuck when one of its wheels would get to close to obstacles in the environment. I added two additional proximity sensors to cover different angles of the robot. These sensors provide a wider range for object detection. These sensors allow the robot to perceive obstacles and make appropriate course corrections before they get to close to the wheels. The bot needed a way of detecting survivors, so I added a wide proximity sensor that is dedicated to scanning for survivors. I modified the robot’s Lua script to print a message with coordinates to the console window when survivors are detected.

**D**. **Goal Seeking:**

The prototype performs basic reasoning through its ability to navigate the disaster recovery environment. The Lua script provides instructions on how the prototype should act when impassible obstacles are detected by its proximity sensors. The prototype exhibits knowledge by its ability to distinguish obstacles from being a survivor or not and sending a message when a survivor is found. The prototype has no prior knowledge of the environment and doesn’t know if there will be a survivor in the search area or not. The prototype is equipped with proximity sensors to handle this uncertainty. The prototype’s intelligence is measured by its ability to achieve its goal. The prototype is considered a simple reflex agent because it achieves its goal by performing actions based on the current percept the proximity sensors detect. It does not reason based on previous percepts.

**E**. **Advantages and Limitations**

Advantages:

The robot has several advantages. It can be deployed to disaster environments that dangerous and would put the lives of human rescuers at risk. It can provide humans with visual detail of all obstacles the robot scans so human rescuers are aware of environmental hazards before they enter the area themselves. The robot sends a notification message along with coordinates when a survivor is detected. This can be sent to human rescuers to help them locate survivors and rescue them quickly when time is crucial.

Limitations:

There are multiple limitations to the robot. It doesn’t keep track of areas that it has scanned and will often traverse over its pervious path multiple times. This increases the time it takes for the bot to cover a search area. It doesn’t keep a history of percepts which can potentially cause survivors to be missed. Because there are no rear or side sensors the bot could potentially become damaged if it runs into an obstacle when backing up to correct its course.

Criteria for assessing success:

* The robot must be able to traverse throughout the disaster recovery environment without getting stuck.
* The robot must reverse and correct its path when one of the proximity sensors is triggered.
* The robot must be able to detect a survivor (sphere) when survivor is withing range of the disc proximity sensor.
* The robot must send a message to the console window along with coordinates when a survivor is detected.

**F**. **Testing and Implementation Plan**

The robot will be first tested by running it in CoppeliaSim software in multiple distinct environments modeled to represent tornado disaster recovery scenarios. This will allow development of the robot’s logic to be improved if it fails a scenario. Once the robot has passed the series of test scenarios in CoppeliaSim, it will undergo a series of real-life scenario tests. After the robot has finished all testing, it will be massed produced and distributed to rescue teams in tornado risk states across the United States.

**G**. **Improving the Prototype**

The bot prototype can be further improved by increasing the range of the proximity sensors. Additional sensors could also be added so the bot doesn’t have to be directly facing objects to scan them. To improve the robot so that it avoids traversing over previously explored areas unsupervised learning and reinforcement learning could be implemented. This can be implemented through negative reward feedback and upgrading the robot from a simple reflex agent to a Q-learning based agent. This way it could compare utility values to choose best action without knowing the search environment.