C951 – Task 2

A. Disaster Environment

This environment represents a single house where an earthquake has caused debris to fall and obstruct vision. The person in need of help is located in the room behind fallen objects. Two additional obstacles have been added to the environment: a collapsed piece of furniture blocking part of the doorway and scattered debris across the floor.

B. Improved Disaster Recovery

This robot enhances disaster recovery by searching buildings that may be unsafe for rescue personnel. After adding the two obstacles, the robot uses its sensors to navigate around the collapsed furniture and scattered debris, allowing it to continue its search. This minimizes risk to responders by providing real-time information about the environment without requiring them to enter hazardous areas.

C. Architecture

The robot's architecture was modified to include a vision sensor for detecting obstacles and a detection sensor for locating the person in need. The vision sensor enables the robot to avoid obstacles like the collapsed furniture and debris, while the detection sensor helps it identify the target person. These two sensors work together to allow the robot to efficiently navigate and complete its search in the disaster environment.

D. Internal Presentation of the Environment

The robot uses its front-mounted camera to present its internal view of the environment. This camera allows the robot to navigate the space using a basic 'bump and continue' strategy, adjusting its course when it encounters obstacles. The robot does not maintain a permanent internal map but relies on real-time sensor feedback to respond to obstacles and adjust its path.

E. Reasoning, Knowledge Representation, Uncertainty, and Intelligence

a. Knowledge: The robot's knowledge is based on inputs from two sensors: one for detecting obstacles and one for locating the person in need of rescue. This real-time knowledge is momentary, but it enables the robot to navigate its environment and perform object detection effectively.

b. Reasoning: The robot uses a rule-based algorithm for navigation. It follows a simple decision-making process that directs it to avoid obstacles and continue exploring the area, allowing it to systematically search for the person in need of rescue

c. Uncertainty: The robot's inability to map the environment introduces uncertainty, as it cannot predict what lies ahead. This uncertainty is mitigated by its 'bump and continue' strategy, which enables the robot to react to obstacles as they are encountered and continue moving through the rooms.

d. Intelligence: The robot demonstrates basic reactive intelligence by responding to real-time sensor inputs. While it lacks advanced learning capabilities, its simple algorithm allows it to function efficiently within the disaster environment, continuing to search for the person without getting stuck.

F. Further Improvements

The robot could be improved by enabling it to build a map of the environment as it searches, allowing it to track areas it has already covered. Reinforcement learning could be used to enhance the robot's decision-making abilities, enabling it to learn from previous encounters with obstacles. Over time, the robot would optimize its pathfinding strategy, becoming more efficient at navigating through complex environments and avoiding repeated mistakes. For example, the robot could prioritize areas where obstacles are less likely or modify its bump-and-turn strategy based on past successes.

Additionally, advanced search algorithms like A* or D* could significantly improve the robot's performance. A* would allow the robot to calculate the most efficient route from one point to another, minimizing the time and energy spent navigating the environment. D* would enable the robot to dynamically adapt to changing conditions, such as new obstacles, by recalculating only the affected portions of the path rather than starting from scratch. These algorithms would ensure that the robot systematically explores the entire environment while avoiding redundant paths and efficiently reaching its target

G. Recording: Attached

H. Sources

No sources used for this project