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Introduction to Artificial Intelligence – C951

TASK2

(- *DISASTER RELIEF ROBOT*-)

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

In this variation of the BubbleRob tutorial, I've chosen a simulated urban environment that closely mimics disaster scenarios. Among the 18 cylinders present, 16 represent buildings, rubble, and debris, while the remaining two conceal improvised explosive devices (IEDs). These hidden IEDs introduce a critical challenge to recovery efforts, demanding careful detection and neutralization to ensure the safety and success of the mission.

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.***

My robot plays a pivotal role in enhancing disaster recovery within this environment. It autonomously navigates through the cluttered terrain, pinpointing and identifying the concealed IEDs. By doing so, it mitigates the risks associated with explosive hazards, facilitating safer and more efficient operations for recovery personnel. Moreover, its adeptness in traversing complex terrain and accessing hard-to-reach areas bolsters the overall effectiveness of the recovery mission.

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.***

To equip my robot for its task, I've tailored CoppeliaSim's architecture with two specialized sensors: a proximity sensor and a nose sensor. The proximity sensor aids in obstacle detection and navigation through cluttered spaces, while the nose sensor is finely tuned to sniff out chemical traces emitted by explosive devices. These sensors empower the robot to detect and circumvent obstacles while identifying potential threats, such as hidden IEDs, thereby augmenting the disaster recovery endeavor.

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

My robot maintains a detailed internal map of its surroundings by amalgamating data from its sensors and employing mapping algorithms like simultaneous localization and mapping (SLAM). Continuously updating this digital map enables the robot to keep abreast of obstacles, terrain nuances, and the locations of detected hazards such as IEDs.

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

- *Reasoning:* It employs logical deductions to interpret sensor inputs, make decisions, and prioritize tasks based on mission objectives and perceived risks.
- *Knowledge Representation:* A rich repository of environmental information informs its decision-making, encompassing maps, obstacle data, hazard types, and safety protocols.
- *Uncertainty:* By acknowledging and managing sensor uncertainties, it employs probabilistic techniques to evaluate data reliability and make informed decisions in ambiguous situations.
- *Intelligence:* Demonstrating autonomy in mission planning and execution, my robot adapts to evolving conditions, learns from experience, and improves its performance over time.

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.

To elevate the prototype further, reinforcement learning, and advanced search algorithms can be integrated. *R. Moni* (2019) states that RL is like teaching your dog or cat to do tricks, providing a reward when the tricks are performed. Reinforcement learning enables the robot to refine its decision-making through iterative learning, while advanced search algorithms optimize path planning and navigation, ensuring more efficient obstacle avoidance and route selection.

G. Submit the robot code that you created.

- See code files in folder.

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:***

- See Panopto Video Recording.

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Bibliography

1. R. Moni, “Reinforcement Learning algorithms — an intuitive overview,” *Medium*, Feb. 18, 2019. https://smartlabai.medium.com/reinforcement-learning-algorithms-an-intuitive-overview-904e2dff5bbc (accessed Apr. 02, 2024).

2. E. Rohmer, S. P. N. Singh, and M. freese, “BubbleRob tutorial,” *manual.coppeliarobotics.com*. https://manual.coppeliarobotics.com/en/bubbleRobTutorial.htm (accessed Apr. 05, 2024).