Disaster Bot: Integrating Robotics for Efficient Disaster Response and Management

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Abstract:

Natural disasters such as earthquakes, tsunamis, hurricanes, and wildfires pose significant challenges to disaster response and management. Traditional rescue operations often involve high risks to human responders and limited accessibility in hazardous environments. The Disaster Bot, an innovative robotic system, integrates a hybrid approach combining a robust robotic tank with a flexible vine robot, enhancing mobility, reach, and efficiency in search and rescue operations. The tank base provides stability and power to traverse rough terrains, while the vine robot extends into confined spaces, enabling better access to victims in collapsed structures or remote locations. The system incorporates advanced sensing technologies, autonomous control mechanisms, and computer vision algorithms to improve navigation, obstacle avoidance, and decision-making in real time. Experimental validation demonstrates enhanced mobility, increased reach, and effective maneuverability in disaster environments. Future work includes optimizing the vine robot's design, refining control algorithms, and conducting real-world field tests to enhance autonomy and scalability. The hybrid robotic system offers a significant advancement in disaster response, with potential applications in infrastructure inspection, hazardous material handling, and even medical and space robotics.

Keywords:

Disaster response, Hybrid robotic system, Vine robot, Search and rescue, Autonomous navigation.