

Development Of Voice-Controlled Robot Using IOT And AI In Hazardous Situation

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Abstract

In recent years, the integration of Artificial Intelligence (AI) and the Internet of Things (IoT) in robotics has revolutionized the field of disaster management and hazardous environment monitoring. This project presents the development of a voice-controlled robot capable of detecting fire, toxic gases, and abnormal temperature levels in real-time using an array of IoT-based sensors. The robot is equipped with AI-driven voice recognition capabilities, allowing for remote and hands-free operation, which is crucial in emergency or inaccessible environments. The robot functions as a mobile monitoring unit, continuously scanning its environment for signs of danger. Gas sensors, temperature sensors, and flame sensors are interfaced with a microcontroller (such as Arduino) and wirelessly transmit data to a cloud platform for real-time alerts and analysis. AI-based pattern recognition helps in identifying critical situations based on sensor data trends, enabling predictive alerts and swift action. The integration of voice control enhances user interaction, especially in scenarios where manual control may be difficult or unsafe.

Keywords- Voice-Controlled Robot , Internet of Things (IoT) , Artificial Intelligence (AI) , Hazardous Environment , Robotics, Smart Robot, Autonomous Robot, Human-Robot Interaction.

1. Introduction

Voice Controlled Robotic Vehicle Project An introduction to developing a voice-controlled IoT robot for hazardous situations highlights the growing need for automated systems that can operate in dangerous environments without human presence, improving safety and efficiency in sectors like disaster response and industrial maintenance. This introduction would focus on the convergence of Internet of Things (IoT), Artificial Intelligence (AI), and voice recognition technology to create intelligent robots. The project aims to use voice commands for intuitive control, IoT for remote monitoring and data collection, and AI for advanced decision-making, allowing the robot to perform tasks safely and effectively in dangerous settings like toxic areas, collapsed structures, or fire zones.

2. Related Work

1. "Human Voice Controlled Robot Embedded with Real Time Obstacle Detection and Avoidance" (JETIR, 2023) Integrates voice recognition with real-time obstacle detection. Demonstrates how spoken commands (e.g., move forward, stop, turn) can be used to control a mobile robot while simultaneously avoiding obstacles using ultrasonic or IR sensors. Highlights the safety-critical role of obstacle avoidance in voice-controlled robots, showing how speech commands must work in tandem with autonomous perception to prevent collisions.

2. "Voice Controlled Vehicle Using IoT" (Conference Paper, 2021) Applies IoT technology to voice-controlled vehicles. Shows how voice commands, captured through a smartphone or remote interface, can be transmitted via IoT protocols (like Wi-Fi/MQTT) to control robotic vehicles. Important for hazardous situations where remote operation is needed; demonstrates how IoT integration extends

the range and flexibility of voice-controlled robots beyond line-of-sight.

3. "Voice Controlled Intelligent Fire Extinguishing Robotic Vehicle" (IRJET, 2021) Specialized robot for firefighting applications. Uses voice commands to guide the robot towards fire sources and integrates a fire detection and extinguishing mechanism (flame sensors + extinguishing module). Shows the application of voice-controlled robots in hazardous environments (fires), combining speech-based teleoperation with task-specific actuation (fire suppression).

3. Methodology

The methodology for developing a voice-controlled robot using IoT and AI for hazardous situations involves the following key steps:

1. Voice Command Acquisition – Speech commands are captured via a microphone module or a smartphone app linked to the IoT platform.

2. AI Speech Recognition – Commands are processed using AI-based speech-to-text engines (Google Speech API, Vosk, or TensorFlow-based offline models) to ensure accuracy even in noisy conditions.

3. Command Interpretation – The processed text is mapped to predefined robot actions, such as movement, stopping, or activating tools. IOT Communication – Commands are sent securely to the robot via MQTT or HTTP over Wi-Fi, ensuring low-latency control.

4. Robotic Control & Navigation – The robot's microcontroller drives motors and actuators through motor driver circuits (L298N/L293D) and uses sensors (ultrasonic, gas, temperature) for obstacle detection and environmental safety.

5. Hazard Data Feedback – IoT sensors collect environmental readings (temperature, gas levels, radiation, etc.) and send them to a cloud dashboard for live monitoring.

4. Applications

1. Disaster Response: The robot can be used to survey damage, detect survivors, and provide critical information to emergency responders in the aftermath of natural disasters such as earthquakes, hurricanes, or floods.

2. Chemical Spill Response: The robot can be equipped with sensors to detect chemical spills and provide real-time data to response teams, enabling them to take necessary precautions and mitigate the damage.

3. Fire Response: The robot can be designed to navigate through smoke-filled areas, detect hotspots, and provide critical information to firefighters, enabling them to respond more effectively.

4. Nuclear Facility Maintenance: The robot can be used to perform maintenance tasks in nuclear facilities, reducing the risk of radiation exposure to humans.

5. Search and Rescue: The robot can be used to locate and rescue people trapped in hazardous environments, such as collapsed buildings or mines.

6. Environmental Monitoring: The robot can be equipped with sensors to monitor environmental parameters such as air quality, water quality, and noise pollution in hazardous environments.

7. Industrial Inspection: The robot can be used to inspect industrial equipment and facilities, detecting potential hazards and providing real-time data to maintenance teams.

8. Military Operations: The robot can be used in military operations to survey enemy territory, detect explosives, and provide critical information to troops.

5. Conclusion

A conclusion for a project on a voice-controlled IoT robot for hazardous situations highlights the project's success in demonstrating the feasibility of human-robot interaction and remote operation in dangerous environments through voice commands, AI-driven environmental awareness, and IoT connectivity. Key findings include the robot's ability to execute commands and navigate autonomously by avoiding obstacles, showcasing its potential for applications in industries like mining, defense, and disaster response to enhance worker safety and efficiency. Future developments could involve integrating more advanced AI for deeper environmental analysis, expanding control range via better IoT platforms, and incorporating image processing for more sophisticated tasks, ultimately moving towards truly intelligent, multi-functional robotic systems.

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