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Task Oriented Autonomous Wheeled Robot for Service and Rescue

Prof. Yashaswini R[1]

Abhishek R[2], Lohith C[3], Pavan S[4], Dhanaraj E[5]

Associate Professor, Electronics and Communication, East West Institute of Technology, Bangalore, India [1]

Student, Electronics and Communication, East West Institute of Technology, Bangalore, India[2-5]

Abstract: This project presents a modern approach for surveillance at remote and border areas using multifunctional robot based on current IOT technology used in defence and military applications. This robotic vehicle has ability to substitute the soldier at border areas to provide surveillance and services. The robotic vehicle works both as autonomous and manually controlled vehicle using internet as communication medium. This multi-sensory robot used to detect and diffuse the bombs, used to detect injured soldier and carry the injured person to base station, at remote and war field areas and to charge the equipment's. Conventionally, wireless security robot is obsolete due to limited frequency range and limited manual control. These limitations are surmounted by using IOT technology which has limitless range. It can eliminate the need of deploying humans at hostile conditions at all the times. Moreover, in case if something suspicious is detected by the system, it must be able to take the necessary decisions and hence actions along with issuing alert messages for the human controllers. This robotic vehicle is designed for reconnaissance live update as well as surveillance under certain circumstances.

Keyword: IoT Technology, Multi Sensor Robot, Surveillance, Wi-Fi, Live update.

I. INTRODUCTION

Robots are mechanical devices, that are capable of performing the difficult and complex tasks on their own and also based on the commands. Ensuring security across border region is considered as an important aspect for any country. It provides protection to the country at the same time it increases huge expenses for a country.

Many systems are developed by researchers to provide a solution for efficient monitoring of borders. A mechanized robot controlled by embedded system is reported. This system employs a group of sensors and a web camera; data from these sensors transmitted wirelessly to a mobile application. The robot consists of Wi-Fi enabled communication between the robot and the user.

Landmine and PIR sensor transmitter the information, it can used to carry the injured soldier to base station, it provides necessary services to soldiers, and to charge the equipment's using solar panel, The mobile application is responsible for controlling the motion of the robot.

II. METHODOLOGY

Our project basically consists of ESP32 Wi-Fi module and microcontroller. Pick and place system that consists of a ESP camera the robotic arm used to carry the injured person to base station.

There are various sensors such as: PIR Sensor: Detects only the living objects, Metal detector: searches for underground mines, L293D IC: for driving the dc motors for motion control. ESP32 module collects data from these sensors and sends to TCP UDP app in your smartphone. Through the TCP UDP app the motion of the robot can be controlled. When the PIR sensor is triggered, the ESP32 cam takes a picture and sends it to TCP UDP app as a notification.

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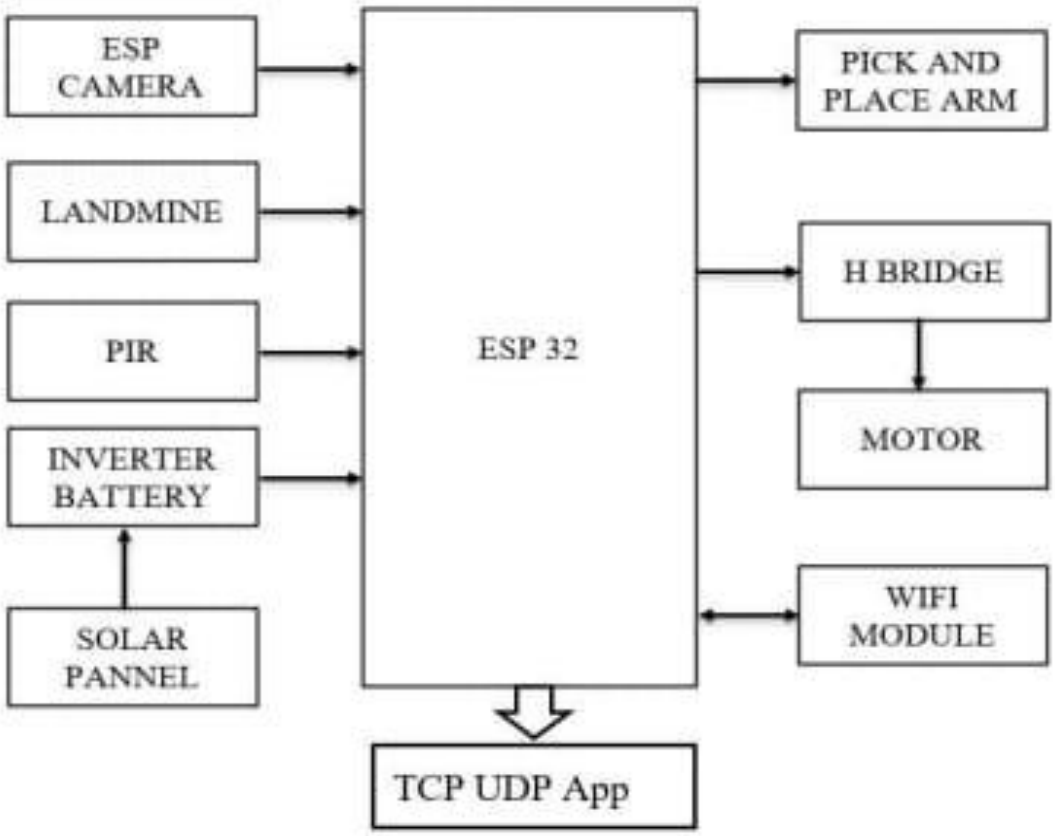

Figure 1: Block diagram of Multitask and Rescue Robot.

Training the Model

(i) **Design of the robot**: Provide a detailed description of the robot's design, including the size, shape, number of wheels, and type of sensors used. Explain how the design was chosen to meet the requirements of the task at hand.

(ii) **Software development**: Describe the software development process, including the programming of the robot's sensors, actuators, and control systems. Explain how the software was designed to achieve the required functionality, such as obstacle avoidance, path planning, and localization.

(iii) **Testing and validation**: Explain how the robot was tested and validated in both simulated and real-world scenarios. Provide details of the test environments, such as the type of terrain and obstacles encountered. Describe how the robot's performance was evaluated and any metrics that were used.

(iv) **Performance evaluation**: Provide a detailed analysis of the robot's performance during testing and validation. Explain how well the robot performed in meeting the requirements of the task, such as speed, accuracy, and reliability. Compare the robot's performance with existing autonomous wheeled robots in the field.

(v) **Improvement and optimization**: Describe any improvements or optimizations that were made to the robot's design or software during the development process. Explain how these changes improved the robot's performance and functionality.

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III. REQUIREMENTS SPECIFICATIONS

(i) Hardware Requirements:

a) ESP32 Wi-Fi & Micro controller module: ESP32 is a series of low-cost, low-power system on a chip microcontroller with integrated Wi-Fi and dual-mode Bluetooth.

b) ESP32 -Cam: The ESP32-CAM is a small size, low power consumption camera module based on ESP32. It comes with an OV2640 camera and provides onboard TF card slot.

c) PIR Sensor: A passive infrared sensor (PIR sensor) is an electronic sensor that measures infrared (IR) light radiating from objects in its field of view.

d) Motor Driver: A motor driver is a device or group of devices that can coordinate in a predetermined manner the performance of an electric motor.

e) DC Motors: A DC motor is any of a class of rotary electrical motors that converts direct current (DC) electrical energy into mechanical energy.

f) Metal Detector: A metal detector is an instrument that detects the nearby presence of metal. Metal detectors are useful for finding metal objects on the surface, underground, and under water.

g) H-Bridge: A H-bridge is an electronic circuit that switches the polarity of a voltage applied to a load. These circuits are often used in robotics and other applications to allow DC motors to run forwards or backwards.

h) Solar Inverter: A solar inverter or PV inverter, is a type of power inverter which converts the variable direct current (DC) output of a photovoltaic (PV) solar panel into a utility frequency alternating current (AC).

i) Pick and Place Robotic Arms: Pick and place robotic arms are rapidly changing the dynamics found in the workplace. This is mainly because they are replacing human hands in handling repetitive tasks and other operations that don't require human intervention.

(ii) Software Requirements:

a) Arduino IDE: The Arduino integrated development environment (IDE) is a cross-platform application (for Microsoft Windows, macOS, and Linux) that is written in the Java programming language.

b) TCP UDP Application: TCP is a connection-oriented protocol, whereas UDP is a connectionless protocol. A key difference between TCP and UDP is speed, as TCP is comparatively slower than UDP.

c) Embedded C: Embedded C is a set of language extensions for the C programming language by the C Standards Committee to address commonality issues that exist between C extensions for different embedded systems.

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IV. RESULT ANALYSIS

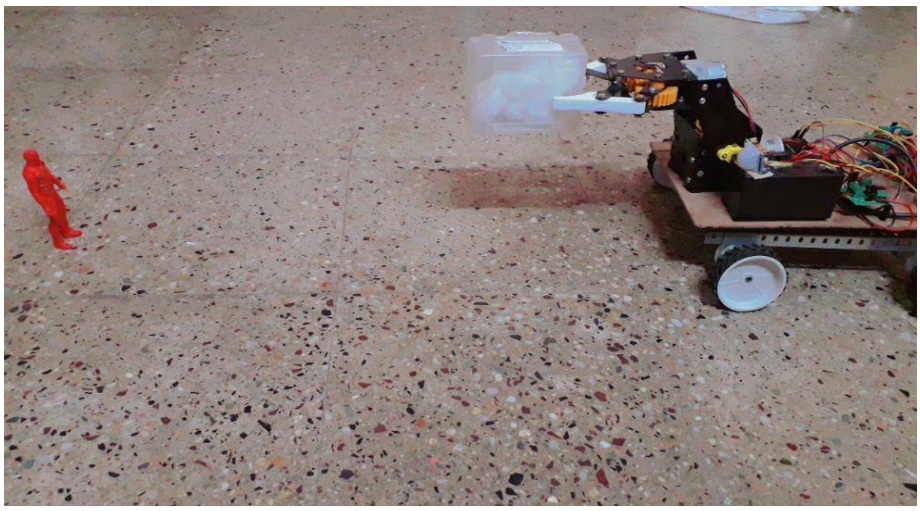

Figure 2: Result showing providing service

The Army Robot is highly favourable in circumstances where it is impossible for human beings to reach or monitor. the implementation of our system is purely driven by usage of PIR sensors, Metal detector, DC motors and camera etc.

Overall, this robot is a multifunctional device that reduces the strain on humans during calamities. The multitasking and rescue robot system provides a helping hand to our security forces in detection of intruders and trespassers.

V. CONCLUSION

Developing a task-oriented autonomous wheeled robot for service and rescue is a challenging but rewarding endeavor. Through the use of advanced sensors, algorithms, and control systems, such a robot can navigate complex environments, avoid obstacles, and execute a variety of tasks to assist in search and rescue operations or provide essential services in various industries. As technology continues to advance, we can expect to see more innovative and sophisticated robots being developed for an increasingly wide range of applications. The task-oriented autonomous wheeled robot for service and rescue is just one example of how robots can be used to improve our lives and solve real-world problems

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