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OBSTACLE AVOIDING ROBOTIC VEHICLE

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Abstract:The project is design to build an obstacle avoidance robotic vehicle using ultrasonic sensors for its movement.A Raspberry pi is used to achieve the desired operation. A robot is a machine that can perform task automatically or with guidance. Robotics is a combination of computational intelligence and physical machines (motors). Computational intelligence involves the programmed instructions. The project proposes robotic vehicle that has an intelligence built in it such that it directs itself whenever an obstacle comes in its path. This robotic vehicle is built, using a raspberry pi. An ultrasonic sensor is used to detect any obstacle ahead of it and sends a command to the microcontroller. Depending on the input signal received, the micro-controller redirects the robot to move in an alternate direction by actuating the motors which are interfaced to it through a motor driver.

***Index Terms* – Raspberry-pi, Ultrasonic Sensor, Bluetooth Module, Motor Driver**

I.INTRODUCTION

The aim of this project is to design and develop an obstacle-avoiding robotic vehicle utilizing the capabilities of Raspberry Pi 4. With a focus on autonomy and environmental adaptability, the vehicle will navigate through predefined paths while dynamically avoiding obstacles in its path. This endeavour merges hardware integration, software development, and algorithmic innovation to create a robust and versatile robotic platform. By harnessing the power of Raspberry Pi 4, coupled with motor drivers and ultrasonic sensors, the vehicle will exhibit intelligent decision-making capabilities, enhancing its efficiency and efficacy in real-world scenarios.

Central to this project is the integration of Raspberry Pi 4 as the brain of the robotic vehicle, orchestrating its movements and responses. The hardware setup encompasses the incorporation of motor drivers for precise control over wheel movements, as well as the mounting of ultrasonic sensors to facilitate obstacle detection and avoidance. Simultaneously, software development involves the implementation of algorithms for sensor data processing, enabling the vehicle to make informed decisions based on real-time inputs. Leveraging the versatility of Python programming language and the capabilities of a real-time operating system, the software stack will be tailored to ensure optimal performance and responsiveness.

Furthermore, this project involves crafting and integrating navigation algorithms, enabling the vehicle to independently navigate through its surroundings while sidestepping obstacles. Stringent testing protocols will be implemented to assess the durability of the vehicle's navigation and obstacle evasion systems across various environments. Extensive documentation will accompany the project, covering hardware schematics, software architecture, assembly guidelines, and testing methodologies.

II. LITERATURE SURVEY

[1]Voice Controlled Robot with Real Time Barrier Detection and Advertising

The study proposes a voice-controlled robot with real-time obstacle detection capabilities and integrated advertising features. User voice commands initiate the robot's movements and activities. Utilizing sensors, the robot identifies barriers or obstacles in its path, adjusting its route to navigate safely. Concurrently, it scans its surroundings for advertising opportunities through image recognition technology. Upon recognizing suitable advertising spaces, the robot showcases targeted advertisements on its built-in display screens or through audio announcements. An algorithm prioritizes navigation, ensuring safe traversal while optimizing advertising exposure. This system offers functional assistance and advertising services across various environments
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[2] A Review on Spider Robotic System

The research introduces a voice-controlled robot equipped with live obstacle detection abilities and built-in advertising functionalities. User commands activate the robot's movements and tasks. Leveraging sensors, the robot detects barriers or hindrances in its path, modifying its trajectory for safe navigation. Simultaneously, it surveys its environment for advertising prospects via image recognition technology. Upon identifying suitable advertising spaces, the robot presents tailored advertisements on its integrated display screens or via audio announcements. A prioritization algorithm ensures safe navigation while maximizing advertising visibility. This integrated system provides both practical assistance and advertising capabilities across diverse settings.

[3]Model Predictive Local Motion Planning with Boundary State Constrained Primitives

The innovative concept of Model Predictive Local Motion Planning with Boundary State Constrained Primitives combines model predictive control (MPC) with boundary state constraints to advance motion planning in robotics. This approach utilizes predictive modelling to anticipate future states of a robotic system and generate optimal trajectories while respecting predefined boundary constraints. By integrating primitives, representing fundamental motion elements, with boundary constraints, the system can efficiently navigate intricate environments while ensuring safety and feasibility. This method shows great potential across various applications, including autonomous vehicles and robotic manipulation tasks, where precise and adaptable motion planning is crucial. Its capability to dynamically consider constraints makes it highly suitable for dynamic and uncertain environments, presenting a flexible solution to the complexities of robotic motion planning.

[4] The Various Types of sensors used in the Security Alarm system

Security alarm systems rely on a range of sensors to detect and respond to potential threats. These include motion sensors for detecting movement, door and window sensors for monitoring entry points, and glass break sensors sensitive to the sound of breaking glass. Contact sensors detect openings and closures, while vibration sensors signal tampering or forced entry. Pressure sensors monitor changes in pressure, and smoke, heat, carbon monoxide, and flood sensors provide early warning of hazards like fires or flooding. Outdoor sensors, such as motion detectors, extend coverage to outdoor areas, ensuring comprehensive security against diverse risks.

[5] Deep Visual MPC Policy Learning for Navigation

Deep Visual MPC-Policy Learning for Navigation represents a pioneering approach that marries deep learning techniques with model predictive control (MPC), facilitating autonomous navigation in intricate surroundings. This method harnesses the power of deep neural networks to analyze visual data captured by onboard cameras and construct predictive models of the environment. By fusing MPC with policy learning, the system can swiftly formulate optimal control strategies in response to real-time visual inputs, enabling agile and adaptable navigation. This innovative methodology holds tremendous potential across a spectrum of robotic applications, spanning from autonomous vehicles to drones, where precise perception and rapid decision-making are indispensable for navigating safely and efficiently amidst diverse and dynamic environments.

III. EXISTING SYSTEM

The current methodology for controlling robots relies on Zigbee communications, allowing effective control but with limitations due to short-range constraints. Algorithms enable motor control based on sensor data, facilitating navigation and obstacle avoidance. Calibration optimizes performance, while thorough documentation ensures replicability and troubleshooting. Techniques include sensor integration for obstacle detection, motor control for manoeuvring, and proximity sensing to trigger avoidance manoeuvres. Various obstacle avoidance algorithms are employed, often utilizing feedback control for smooth movement. Despite its effectiveness, drawbacks such as short-range communications and the need for manual control exist. However, through rigorous testing, calibration, and comprehensive documentation, developers can create obstacle-avoiding robotic vehicles capable of navigating diverse environments while minimizing collisions.

IV. PROBLEM DEFINITION

In the current system, robot control relies on Zigbee communications, which, while effective, come with inherent limitations. Zigbee's short-range communication capability restricts the spatial freedom of robots, particularly in scenarios requiring broader operational areas, thus impeding adaptability to larger environments. This constraint poses a significant challenge, hindering the seamless navigation and operation of robots in expansive spaces. Moreover, the reliance on manual control exacerbates this issue, as it necessitates constant human intervention to ensure proper functioning and navigation of the robots. Consequently, the system's efficiency and scalability are compromised, limiting its potential applications in various real-world scenarios. The short-range nature of Zigbee communications not only constrains the operational range of the robots but also undermines their autonomy and flexibility, thereby impeding their ability to navigate dynamically changing environments autonomously. Thus, addressing these drawbacks is crucial for enhancing the system's performance, expanding its utility, and unlocking its full potential in diverse operational contexts.

V. PROPOSED SYSTEM

In the envisioned robotic system, an ultrasonic sensor serves as a crucial component for obstacle detection. Positioned strategically on the robot, it utilizes ultrasonic waves to assess distances and identify obstacles along the robot's path. This sensor feeds real-time feedback to the robot's control system, empowering it to make informed decisions regarding its movement. To bolster adaptability and control, a Bluetooth communication interface has been integrated. This interface allows users to wirelessly transmit commands to the robot, directing it to execute specific actions or alter its trajectory in response to dynamically detected obstacles. Concerning hardware implementation, the ultrasonic sensor is securely affixed, and its orientation is adjusted by a servo motor, ensuring precise obstacle detection and response.

VI. CONCLUSION& FUTURE SCOPE

The proposed modular design strategy for implementing the firefighting robot demonstrates its effectiveness in aiding people during critical situations. Capable of moving in multiple directions and equipped with obstacle avoidance capabilities, it significantly reduces human efforts and helps protect property. Looking ahead, employing Raspberry Pi 4 or similar platforms in obstacle-avoiding robotic vehicles holds immense promise. Future advancements may focus on enhancing sensing capabilities with technologies like LiDAR and thermal imaging, integrating machine learning for intelligent navigation, and implementing multi-agent systems for collaborative tasks. Additionally, advancements in autonomous navigation, IoT integration, and swarm intelligence can further improve functionality and scalability. Emphasizing energy efficiency, sustainability, and enhancing human-robot interaction will be crucial for developing more capable and widely applicable robotic systems in the future.

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