**SONIC BOT : A Framework and Execution of a Next-gen Frugal Commando Built on WLAN**

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**ABSTRACT**

An important step in integrating voice recognition, mobile control, and the Internet of Things (IoT) into robotic systems is the Sonic Bot project. Using Google's voice recognition engine, Sonic Bot, a platform that is small and flexible, can react to user orders sent through an Android application. Firebase is a real-time cloud database that transmits the commands. A NodeMCU microcontroller receives the commands, decodes them, and moves the robot. To identify obstructions in its path, this bot has an ultrasonic sensor. The bot simulates intelligent behavior by doing a U-turn on its own when it detects an obstruction within a predetermined distance in order to prevent collisions. The voltage sensor, which continuously checks the battery level, is another important component. This voltage data is returned to the Android app, where the SpeedView library uses a gauge that resembles a speedometer to graphically depict it. In order to improve user awareness and avoid system shutdown due to power depletion, an LED indicator is also used as part of a low battery warning system.

Keywords: Automated Guided Vehicle, Industrial automation, Indoor Logistics, Robustness, Energy Consumption.

1. **INTRODUCTION**

The development of intelligent, effective systems has expanded thanks to robotic automation and the Internet of Things (IoT). Voice-activated bots are accessible and user-friendly, especially for surveillance, personal help, and home automation. Through smartphone integration and Internet of Things connectivity, Sonic Bot improves interaction by bridging the gap between user voice commands and real-time robotic control. The Sonic Bot is introduced in this study with a focus on the issue it attempts to solve, its novel aspects, and its applicability in the present technological environment. Smart automation solutions driven by artificial intelligence (AI) and the Internet of Things (IoT) have become increasingly popular in recent years. At the vanguard of this technological revolution, robotics has an impact on a wide range of industries, including manufacturing, healthcare, transportation, and residential settings. The creation of voice-controlled robotic systems, which use natural language processing to streamline human-machine interaction, is one of the newest trends.

1. **LITERATURE REVIEW**

A voice-activated robotic assistant was created by Nashit et al. (2021) especially to help senior citizens with their everyday tasks. According to the study, speech interfaces greatly improve accessibility for senior citizens, particularly those who struggle with dexterity or mobility. The prototype robot demonstrated encouraging outcomes in task execution, voice recognition accuracy, and user happiness when tested in home-like simulations. In addition to confirming that such robotic systems can lessen caregiver strain and encourage independent living, the study emphasized the significance of intuitive, natural language-based engagement in enhancing elder care.[1] In their paper that was published in Robotics and Autonomous Systems, Li et al. (2022) concentrated on developing natural language processing (NLP) methods to enhance the functionality of robotic systems that are controlled by voice. The creation of an improved NLP framework that can precisely understand intricate and context-sensitive human commands was the main result of the study. To enhance intent identification and contextual comprehension, the suggested system included deep learning models, such as transformer-based architectures. Significant gains in response time, command accuracy, and the robot's capacity to manage unclear or multi-intent requests were demonstrated by the experimental results. The study showed that improving the intuitiveness of human-robot interaction, particularly in dynamic or real-world settings, requires strong NLP integration. [2] For autonomous robots working in noisy surroundings, Echeverria, Martinez, and He (2023) created and assessed a system that combines real-time voice command processing with noise cancellation. Their study showed that using directional microphone arrays and adaptive filtering methods greatly improved the precision and clarity of voice command recognition. The study demonstrated that, even in the presence of dynamic noise situations such background chatter or mechanical noises, real-time processing could be preserved without sacrificing system latency. Consequently, the suggested solution made it possible for people and robots to engage more consistently and responsively, especially in service and healthcare applications where background noise is frequent. [3] In order to facilitate real-time data interchange and predictive maintenance in industrial settings, Yao, Zhang, and Chen (2021) investigated the incorporation of IoT technology in autonomous robots. According to the study, IoT-enabled robots were able to efficiently gather, send, and evaluate operational data, which reduced unplanned downtime and allowed for the early identification of any problems. The suggested method made use of edge computing and cloud-based analytics to expedite maintenance scheduling and decision-making. The outcomes showed increased overall productivity, decreased maintenance costs, and improved operational efficiency, underscoring the usefulness of IoT frameworks in maximizing robotic performance in intricate industrial settings. [4] In order to address last-mile logistics, Patel, Sharma, and Huda (2022) demonstrated the design and practical application of IoT-enabled autonomous delivery robots. Their study showed that including IoT elements like GPS, RFID, and cloud connectivity greatly enhanced delivery tracking, route optimization, and navigation accuracy. The robots might make decisions dynamically depending on traffic and environmental data in real time. According to the study's findings, these technologies improved delivery dependability and efficiency while also lowering operating expenses and the need for human intervention in logistics and urban mobility applications. [5] A thorough analysis of current developments in healthcare IoT robots, with an emphasis on teleoperated surgical systems, was carried out by Nguyen, Khan, and Lee (2023). The study demonstrated how precision, real-time feedback, and remote operability have all increased as a result of IoT integration with robotic surgery platforms. Improved data synchronization between robotic instruments and surgeons, decreased command execution latency, and increased patient safety via ongoing monitoring were among the main conclusions. According to the poll, IoT-enabled surgical robots are revolutionizing healthcare by facilitating expert intervention across geographic boundaries and simplifying intricate procedures with data-driven assistance. [6] Feng, Liu, and Wu (2021) combined ultrasonic sensor data with sophisticated algorithmic processing to create an effective obstacle avoidance system for mobile robots. The suggested approach made use of path-planning algorithms and real-time distance measurements to accurately identify and steer clear of both static and dynamic impediments. According to the study, the robot's capacity to adapt to complicated settings was enhanced by the integration of sensor fusion and decision-making algorithms, which also decreased collision rates and increased navigation efficiency. Their results confirmed the feasibility of sensor-based, low-cost systems for inside and outdoor autonomous mobility. [7] Zhang, Wang, and Liu (2022) investigated the use of deep learning methods for autonomous robots to avoid obstacles. Their study presented a model based on convolutional neural networks (CNNs) that can accurately recognize and forecast obstacles by interpreting real-time visual input. The model showed good generalization across many contexts, including cluttered and low-light conditions, after being trained on a variety of datasets. The results showed that deep learning outperforms conventional rule-based and sensor-only systems in dynamic and uncertain contexts by greatly improving the robot's situational awareness and decision-making skills. [8] Using real-time data from existing sensors, Ming, Zhao, and He (2021) suggested a battery health monitoring and power management system for mobile robots. The study presented a method that can precisely estimate the state-of-health (SoH) and state-of-charge (SoC) of batteries, enabling predictive maintenance and dynamic power allocation. According to experimental results, the method greatly increased the operating reliability of mobile robots, decreased energy waste, and prolonged battery life. The study made clear how vital intelligent energy management is to maintaining robot performance, especially in mission-critical or long-duration applications. [9]

**3. PROPOSED METHODOLOGY**

The Sonic Bot is a voice-activated, intelligent robot that makes use of contemporary technology including voice recognition, obstacle avoidance, the Internet of Things, and battery monitoring. The Sonic Bot can function independently, carry out duties in response to voice instructions, and offer real-time status information via an Android application thanks to the integration of various parts into a coherent system. The hardware and software components of the suggested system are described in detail in this section, along with how each component interacts with the others to produce the intended functionality.

**3.1 System Overview**

Using voice instructions and an Android app, the Sonic Bot is a small robotic platform that can be operated remotely. It combines a number of sensors and microcontrollers to guarantee battery management and autonomous navigation. With real-time data monitoring and obstacle recognition, the system is built to manage jobs in dynamic situations and adjust to shifting conditions.

**Key Features of the Sonic Bot:**

* Voice Command Control: This method controls the robot's movements and operations by using Google Voice Commands through an Android app.

• Obstacle Avoidance: outfitted with an ultrasonic sensor to identify obstructions and perform an autonomous U-turn upon detection.

• Battery Monitoring: Using a voltage sensor, this device continuously checks the battery level and notifies the user via an Android app.

• LED Low Battery Indicator: Notifies the user when the robot's battery drops below a predetermined point.

• Real-Time statistics Display: For convenient monitoring, the Android app uses a Speed View Gauge to show statistics like battery level and obstacle detection status.3.2 System Architecture

The **Sonic Bot System** consists of three major components:

**Hardware**:

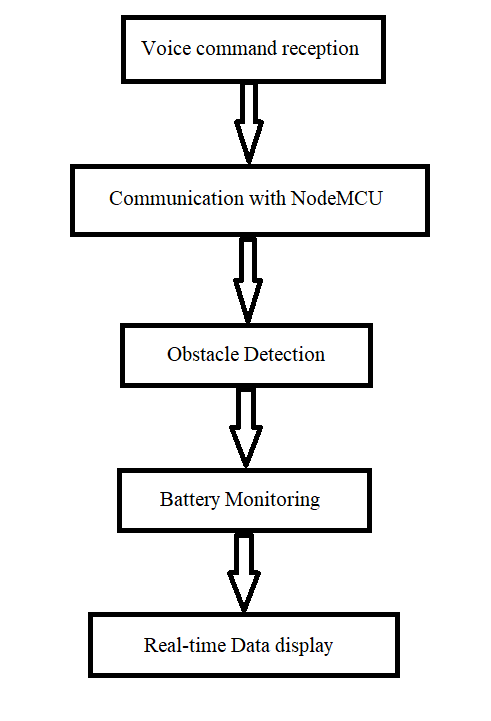
* NodeMCU Microcontroller: This serves as the robot's brain, tying the hardware parts and Android app together. It transmits sensor data back to the app, receives commands, and interacts with Firebase.
* Ultrasonic Sensor: This sensor, which is mounted on the robot, measures the distance between the robot and objects in its path and detects impediments. The robot makes a U-turn if it detects an object within a predetermined distance.
* Voltage Sensor: Provides the NodeMCU with real-time voltage data while keeping an eye on the battery level.
* Motors and Motor Driver: In charge of moving the robot, reacting to voice orders, and performing U-turns and other maneuvers as required.
* LED Indicator: When the battery is low, a red LED is utilized to show it.

**Software**:

* Android App: Created with Android Studio, this application enables voice commands to be used to control the robot. Additionally, it receives real-time data, including the battery level and the status of obstacle detection, and uses the Speed View Gauge to display it for simple visualization.
* Firebase Cloud Database: The Android app and the NodeMCU communicate in real time via Firebase. Sensor data is transmitted from the NodeMCU to Firebase for app display, and commands are sent from the app to Firebase and collected by the NodeMCU.
* Arduino IDE: The Arduino IDE is used to program the NodeMCU, writing code to read sensor data, control motors, and receive voice commands.

**3.3 Detailed System Workflow**

The proposed system works as follows:



A diagram of a robot

AI-generated content may be incorrect.A diagram of a robot

AI-generated content may be incorrect.

Fig.1 SONIC BOT WITH SENSORS Fig.2 SONIC BOT WIHOUT SENSORS

**6.CONCLUSION**

To sum up, Sonic Bot is an important development in the fusion of robotic automation and voice control. The project effectively delivers a smooth and user-friendly experience for users to operate the bot with basic spoken instructions by utilizing the capabilities of Firebase, NodeMCU, and Google Voice instructions. The bot's autonomous skills are further enhanced by its capacity to use an ultrasonic sensor to identify obstructions, make U-turns when detected, and use a voltage sensor to monitor its battery levels. The inclusion of SpeedView offers a visually appealing method of tracking the bot's battery level, while the Android app functions as a robust interface that gives customers real-time updates and control options. Furthermore, the LED indication ensures that customers are always aware of the bot's operational state by providing a straightforward yet efficient warning for low battery levels.

The bot's activities and status are updated in real-time thanks to the seamless data synchronization made possible by Firebase between the bot and the mobile app. Sonic Bot is a great illustration of how contemporary technologies like the Internet of Things, machine learning, and cloud services can collaborate to create a useful, user-friendly robotic system because of its voice control, autonomous navigation, and ongoing monitoring. All things considered, the Sonic Bot project demonstrates our progress in building intelligent, interactive robots that are practical and accessible to regular people.

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