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Night Vision Security Patrolling Robot with Sound Sensing

Akshay Padale[1], Abhay Jadhav[2], Aditya Jadhav[3], Prof. Miss. Gaikwad S. A[4]
Students, Department of E & T C[1,2,3]
Lecturer, Department of E & T C[4]
S.P.I.T Polytechnic, Aahilyanagar, India

Abstract: *This project presents a Raspberry Pi-based automated system designed to integrate night vision and audio sensing capabilities for versatile applications such as surveillance and robotics. The system employs a night vision camera for visual data acquisition and a microphone for sound sensing, enabling real-time monitoring and intelligent responses to environmental stimuli. The Raspberry Pi serves as the central processing unit, seamlessly interfacing with the camera, microphone, and motor driver. The motor driver controls DC motors with specifications of 12V and 30 RPM, facilitating precise mechanical movements required for system operation. Powered by an efficient power supply, the system ensures consistent functionality even in resource-constrained environments. The modular design allows adaptability for a wide range of applications, including home security, autonomous robotics, and remote surveillance in low-light conditions. With the integration of a motor driver, the system enables automated movements, making it suitable for mobile applications such as patrolling robots or automated guided vehicles (AGVs). This project emphasizes the practicality and scalability of utilizing Raspberry Pi for cost-effective and efficient solutions in fields requiring simultaneous video and audio processing. Future enhancements could include adding artificial intelligence (AI) for object and sound recognition, wireless connectivity for remote monitoring, and advanced motor controls for more complex operations. The proposed system is a promising step toward accessible and adaptable technologies that combine vision, sound, and mobility in a compact and easy-to-deploy platform. This work contributes to the growing field of IoT-enabled smart systems and robotics by demonstrating an efficient multi-functional solution.*

Keywords: Camera, DC motar, Rasberry Pi, AI

I. INTRODUCTION

With the growing advancements in technology, the demand for automated systems that integrate multiple sensory inputs is rapidly increasing. Systems capable of processing real-time video and audio data while controlling mechanical components have become pivotal in numerous fields, including surveillance, robotics, healthcare, and industrial automation. These systems not only enhance operational efficiency but also address critical needs in monitoring, security, and autonomous operations. The integration of sensory data, processing units, and actuators has ushered in a new era of intelligent systems capable of decision-making and interaction with their environment. This project demonstrates such a system by utilizing the Raspberry Pi platform to create an innovative multi-functional device

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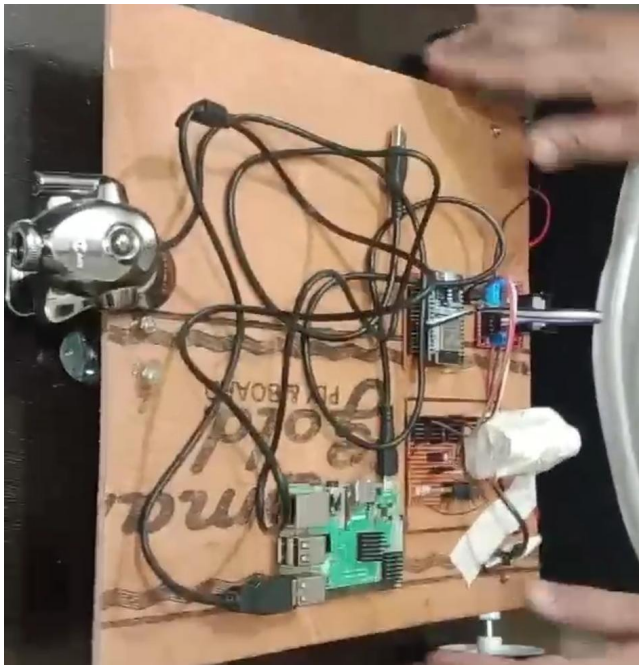
A. Figure Captions



B. Table Captions

Component	Specification/Description	Purpose
Raspberry Pi	Model 3B+/4 (or Arduino/ESP32 as alternative)	Acts as the main processing unit for controlling the robot and peripherals.
Bluetooth Module	HC-05 or HC-06	Enables wireless communication between the robot and a smartphone or PC.
Motor Driver	L293D or L298N	Controls the direction and speed of DC motors based on input commands.
DC Motors	12V, 30 RPM	Drives the wheels for robot mobility.
Battery	12V rechargeable or Lithium-Ion	Powers the robot, motors, and other components.
Voltage Regulator	5V/3.3V regulator (e.g., LM7805 or AMS1117)	Ensures stable voltage supply to the Raspberry Pi and sensors.
Night Vision Camera	IR-enabled camera module (e.g., Raspberry Pi Camera V2 or ESP32-CAM)	Captures video and images in low-light or dark conditions.
IR Sensors	Reflective IR sensors	Detects paths and obstacles for navigation.
Sound Sensor	Analog or digital sound detection module	Detects unusual noises and triggers alerts.
Buzzer	5V piezoelectric buzzer	Provides audible alerts for detected anomalies.
Wheels	Rubber or plastic wheels	Provides mobility to the robot.
Chassis	Acrylic, aluminum, or plastic	Forms the base structure for mounting components.
Mobile Device	Smartphone or PC with Bluetooth app	Used to send manual movement commands via Bluetooth.

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II. CONCLUSION

The Night Vision Patrolling Robot represents a significant step toward automating surveillance and security tasks. By integrating night vision capabilities, sound sensors, and real-time monitoring, the system provides an efficient and cost-effective solution for various applications, including residential, commercial, industrial, and military environments. Its modular design and manual Bluetooth control ensure ease of use, adaptability, and affordability, making it accessible to a wide range of users.

This robot enhances security by operating effectively in low-light conditions, detecting anomalies, and providing real-time alerts through IoT-based communication. The addition of user-friendly features, such as manual navigation via Bluetooth, further expands its usability for targeted patrolling and inspection tasks.

Despite its current advantages, the system has scope for future enhancements. Advancements in AI, IoT, and power management could make the robot more autonomous, efficient, and capable of handling complex environments. Integration with other technologies, such as drones and advanced sensors, can broaden its applications to areas like disaster response, healthcare, and smart cities.

In conclusion, the Night Vision Patrolling Robot demonstrates a promising blend of robotics, IoT, and surveillance technology, paving the way for safer and smarter environments. Its ability to adapt and evolve with technological advancements ensures its relevance in addressing present and future security challenges.

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