



International Journal of Advanced Research in Education and Technology (IJARETY)

Volume 11, Issue 6, November-December 2024

Impact Factor: 7.394



Surveillance Robot using IoT

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ABSTRACT: The project involves the creation of a surveillance robot leveraging a Raspberry Pi Zero W as its core component and programmed using Python. Equipped with ultrasonic and sound sensors, the robot autonomously detects potential threats. Upon detection of an object by the ultrasonic sensor or sound by the audio sensor, the robot activates its camera to record video footage. This footage is then transmitted to a website portal for remote viewing and analysis. The portal integrates an AI module trained to identify violence and weapons within the video content. Leveraging machine learning techniques, the AI module enhances the robot's surveillance capabilities by providing real-time detection and alerting functionality. Through this integrated system, the surveillance robot offers a comprehensive solution for monitoring and responding to security threats in various environments.

KEYWORDS: Surveillance robot, Raspberry Pi Zero W, Python programming, ultrasonic sensor, sound sensor, camera, video capture, website portal, AI module, violence detection, weapon detection, machine learning, security threats.

I. INTRODUCTION

evolving security concerns, the development of innovative surveillance solutions has become increasingly imperative. Our project endeavors to address this need through the creation of a sophisticated surveillance robot, empowered by cutting-edge technology and artificial intelligence (AI).

This surveillance system aims to enhance security measures by leveraging the capabilities of the Raspberry Pi Zero W, a versatile single-board computer, in conjunction with sensors and AI algorithms. By integrating hardware and software components seamlessly, our project seeks to provide a comprehensive solution for real-time monitoring, threat detection, and response in diverse environments.

The primary aim of our project is to design and implement a surveillance robot equipped with advanced sensing capabilities and AI-driven analysis for detecting potential security threats. This includes the development of a hardware platform capable of capturing and processing sensor data, as well as a software framework for analyzing video footage and identifying suspicious activities. By website portal accessible to authorized users, providing a centralized platform for monitoring and analysis.

Overall, our project aims to develop a state-of-the-art surveillance system that combines hardware innovation, software expertise, and AI-driven intelligence. enhance security measures and promote safety in various environments. Through the integration of cutting-edge technology and thoughtful design, we aspire to contribute to the advancement of surveillance technology and its applications in safeguarding communities and assets. harnessing the power of AI technology, our project aims to enhance the surveillance robot's ability to recognize and respond to security incidents proactively. Additionally, we aim to provide a user-friendly interface for remote monitoring and management, enabling stakeholders to access real-time information and take appropriate action as needed.

The surveillance robot will be built around the Raspberry Pi Zero W. compact yet powerful computing platform known for its versatility and affordability. Key components of the robot include ultrasonic and sound sensors for detecting objects and audio cues, respectively, as well as a camera for capturing video footage. These sensors will work in tandem to monitor the robot's surroundings continuously, triggering the camera to record video when potential threats are detected.

The recorded video footage will be processed using AI algorithms specifically trained for violence and weapon

detection. By analyzing the video content in real-time, the AI module will be able to identify suspicious behaviors and objects, alerting users to potential security risks. The surveillance robot will transmit the processed data to a

II. SURVEY AND SPECIFICATION

1. IOT Based Surveillance Robot The main objective. behind this paper is to develop a robot to perform the act of surveillance in domestic areas. Nowadays robot plays a vital role in our day to day life activities thus reducing human labor and human error.[1] Robots can be manually controlled or can be automatic based on the requirement. The purpose of this robot is to roam around and provide audio and video information from the given environment and to send that obtained information to the user.

2. Intelligent surveillance robot: Security robot has become one of the most important research topics over the past decades. A number of robots have been designed to safeguard human life and wealth. This paper focuses design and implementation of mobile robot with three. subsystems: The obstacle avoidance, face recognition and detection leakage of combustible gases. [2] In the first subsystem, an implementation of artificial neural network. on field programmable analog array has been used to control the motion of the robot.

3. Surveillance Robot controlled using an Android app: The robotics and automation industry which is ruled the sectors from manufacturing to household entertainments. It is widely used because of its simplicity and ability to modify to meet changes of needs. The project is designed to develop a robotic vehicle using android application for remote operation attached with wireless camera for monitoring purpose. [3] The robot along with camera can wirelessly transmit real time video with night vision capabilities. This is kind of robot can be helpful for spying purpose in war fields.

4. Surveillance Robot in Hazardous Place Using IoT Technology: This paper deals with human surveillance through the technology based on IoT featuring robotics using an Arduino UNO microcontroller that is controlled by a smartphone and a PC. The objective is to develop a spy robotic car which is suited to provide an act of continuous surveillance in hazardous environment. [4] The robot is capable to record the real-time streaming in day time and night time as well through wireless camera. Those movements of the robot are controlled manually at the user and usability. Additionally, the testing phase involves optimizing the performance of the surveillance robot and AI module, fine-tuning parameters, and addressing any identified bottlenecks or limitations.

Finally, once the surveillance robot and AI module have been thoroughly tested and validated, the project concludes with the deployment and dissemination phase, The surveillance robot is deployed in the target environment, whether it be public space, commercial facility, residential property, where it begins actively monitoring for security threats. Additionally, the findings, methodologies. and insights gained from the project are documented and disseminated through reports, presentations, and open- access repositories, contributing to the wider body of knowledge in the field of surveillance technology and AI- driven-security systems.

III. DISCUSSION AND METHODOLOGY

The methodology for developing the surveillance robot and its integrated AI module involves a systematic approach encompassing several key phases. Initially, the project requires comprehensive research to understand the requirements, existing technologies, and potential challenges associated with surveillance systems. This includes reviewing relevant literature, studying available hardware and software platforms, and identifying suitable methodologies for sensor integration, data processing, and AI-driven analysis.

Following the initial research phase, the project proceeds to the design and planning stage, where the architecture and specifications of the surveillance robot are defined in detail. This involves selecting the appropriate hardware components, such as the Raspberry Pi Zero W, ultrasonic sensor, sound sensor, and camera, based on factors like performance, cost, and compatibility. Additionally, the design phase includes outlining the software architecture, defining the communication protocols, and establishing the overall system requirements.

With the design in place, the project moves on to the implementation phase, where the surveillance robot and its AI module are developed according to the established specifications. This involves writing code in Python to interface with the hardware components, capture sensor data, and control the robot's behavior based on predefined rules and algorithms. The implementation also includes integrating existing AI models or developing custom machine learning

algorithms for violence and weapon detection, using frameworks like TensorFlow or PyTorch.

Once the implementation is complete, the project enters the testing and evaluation phase, where the surveillance robot undergoes rigorous testing to assess its performance, reliability, and accuracy. This includes testing individual components, such as the sensors and camera, as well as testing the integrated system in simulated and real-world environments. The AI module is evaluated based on its ability to accurately detect violence and weapons in the surveillance footage, considering factors like detection rate, false alarm rate, and computational efficiency.

Throughout the testing phase, feedback is collected from users and stakeholders to identify any issues or areas for improvement. This feedback is used to refine the system and make necessary adjustments to enhance its functionality through the software pipeline, where it is analyzed by the AI module for violence and weapon detection.

The AI module employs pre-trained machine learning models or custom algorithms to analyze the video footage and identify potential instances of violence or the presence of weapons. This analysis involves object detection to identify relevant objects, such as firearms or aggressive gestures, as well as action recognition to identify violent behaviors or activities. The results of the analysis, including detected objects, actions, and associated confidence scores, are then passed back to the Raspberry Pi Zero W for further processing.

IV. CONCLUSION

In conclusion, the Surveillance Robot project represents significant leap forward in the realm of autonomous surveillance, effectively addressing the evolving challenges of security in diverse environments. The integration of cutting-edge technologies such as Raspberry Pi and IoT has resulted in the creation of a versatile and adaptive system capable of real-time monitoring, prompt response to security threats, and efficient data transmission for remote user interaction. The project's methodology, encompassing rigorous testing, deployment, and iterative refinement, has culminated in the development of a reliable and scalable surveillance solution. The bidirectional dataflow, orchestrated seamlessly within the system, ensures continuous communication between the robot, its sensors, and the central control interface. The user-friendly graphical user interface provides a practical means for users to monitor and control the robot remotely, enhancing the overall usability of the surveillance system. The project's focus on data security measures underscores its commitment to ensuring the confidentiality and integrity of sensitive information collected during surveillance operations.

ACKNOWLEDGMENT

We would like to express our sincere gratitude to Prof. P. M. Dharmadhikari, Principal of Sandip Polytechnic, Nashik, for their support, which made this research possible. We are also thankful to Prof. V.S.Patil, H.O.D of Electrical Engineering Department for providing the necessary resources and facilities to conduct this research. Special thank you to Prof. Deepak Shivaram Suryawanshi and staff members, technical staff members of Electrical Engineering Department for their valuable and technical support and insightful discussions, which greatly enhanced the quality of this work. Finally, we would like to thank our colleagues in the Electrical Department for their continuous encouragement and constructive feedback throughout the research process. At last but not least thanks to all my friends and the people who are directly or indirectly related to our paperwork planning References

REFERENCES

- [1] V R Ratnaparkhe , Ashish U Bokade Video surveillance robot control using smartphone and Raspberry pi -IEEE Conference Publication IEEE Journals & Magazine Posted: 2016-04-01
- [2] ANDREAS L. OPDAHL, AND CSABA VERES, Named Entity Extraction for Knowledge Graphs: A Literature Overview , 2019.
- [3] OHIZAH ABD RAHMAN 1, KHAIRUDDIN OMAR, Application of Methods in robot: A Systematic Review, Department of Marketing, Department of Radiology, University of California,2020
- [4] Chang yong Yoon³ , Mignon Park⁴ , Hyukmin Eum , Jeisung Lee Human action recognition for night vision using temporal templates with infrared thermal camera -IEEE Conference Publication IEEE Journals & Magazine Posted: 2013-10-01
- [5] <https://www.hindawi.com/journals/acisc/2022/9970363/>
- [6] <https://en.m.wikipedia.org/wiki/PatrolBot>
- [7] <https://towardsdatascience.com/k-means-clusteringfrom-a-to-z-f6242a314e9a>

International Journal of Advanced Research in Education and Technology

ISSN: 2394-2975

Impact Factor: 7.394