

PIR Triggered Security Alert System using Raspberry PI

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Abstract— Security is a crucial aspect of surveillance systems used in homes, offices, industries, and public places. These systems rely on IoT technology, GSM, and sensor networks. We have designed a user-controlled security system that allows the user to manage all operations in case of theft or any other security breach at their premises. The PIR sensors detect human movement, and when a person is detected within a specific interval, the system triggers an alert and sends a message to the user via SMS through the GSM module. Additionally, when the security system is activated, the Pi camera captures visual evidence, enabling prompt action and simultaneously sends an alert SMS. Our comprehensive security alert system uses PIR sensors, Pi cameras, GSM, and Raspberry Pi to provide maximum protection.

In response to these challenges, the concept emerges to create a user-friendly, cost-effective alert system to protect his or her premises to make sure our area is under our control as there is full-time surveillance at the premises. This kind of system is used for highly safeguarding bank locker premises, ATMs, or personally authorized centers, and even as a home security alert system with flexibility, low cost, and low power consumption. The programming supported both the working of the GSM module and system functionality with code written in Python programming language and saved in a .py file. With the Raspberry Pi 3 B+ module as a central processor, all the necessary functions take place.

Index Terms— PIR Sensor, Pi camera, Raspberry pi, Access control, GSM module, SMS alert, Servo motor, Buzzer, ATM's .

I. INTRODUCTION

In the era of fast-growing technology in today's Society, any offensive or unauthorized violation can happen at any time so securing the need for it plays a most important role in today's world and the person who owns it should have complete control under him to make sure his owning area or home any other place is under secured surveillance and a door security for it. So, we designed and developed a pir-triggered security alert system using Raspberry Pi and GSM module to take action in case of theft or anything illegal activities at the owner's premises. Here, the PIR sensors, operate on the principle of recognizing the infrared radiation that is emitted by objects in their naturalistic range of vision, have been popular in the motion detection field. Their simplicity, low power consumption, and high reliability make them ideal candidates for triggering security alerts upon detecting suspicious movements. Raspberry Pi, is a credit card-sized single-board computer system which is renowned for its flexibility and affordability, serves as an excellent platform for integrating PIR sensors and orchestrating

security functionalities.

The security system is triggered when a person is detected within a specific time frame. This triggers the system to send a message via SMS through the GSM Module, notifying of the intruder's presence. The Pi camera also captures the event, allowing necessary action to be taken with an alert SMS. Overall, this literature survey provides a valuable resource for designing and implementing PIR-triggered security alert systems using Raspberry Pi 3 B+ with GSM module integration. By synthesizing insights from various sources and disciplines, we aim to create robust, scalable, and responsive security solutions that can protect lives and property in an increasingly interconnected world.

II. LITERARY SURVEY

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III. PROPOSED MODEL

Traditional security measures encompass physical barriers such as locks, keys, and alarm systems, each serving a crucial role in restricting access and alerting to potential intrusions. Locks act as primary deterrents, while keys enable access and activate alarm systems in case of breaches. However, conventional security systems face several challenges, including limited detection scope, reliance on manual operation, and difficulties in remote monitoring. These limitations highlight the need for advanced security solutions capable of real-time monitoring and automated responses to evolving threats. The proposed security alert system using Raspberry Pi aims to address these challenges by leveraging the platform's capabilities in conjunction with additional components. The system integrates a PIR sensor for motion detection near entry points, a GSM module for instant SMS alerts to users, and a camera for live video feed confirmation. This comprehensive approach ensures efficient detection, prompt notifications, and visual confirmation of security breaches, enhancing overall security effectiveness. The integration of PIR sensors allows for motion detection near entry points, initiating responses upon detecting suspicious activity. The GSM module enables instant communication by sending SMS alerts to designated users, ensuring timely notifications of security breaches. Moreover, the inclusion of cameras provides visual confirmation through live video feed, offering users comprehensive insights into the nature of detected events. By harnessing the computational power and versatility of Raspberry Pi, coupled with additional components like PIR sensors, GSM modules, and cameras, the system aims to enhance security efficacy significantly. It effectively highlights the limitations of conventional approaches and underscores the potential of leveraging modern technologies like Raspberry Pi to address these challenges.

IV. SYSTEM ARCHITECTURE

The system interacts with all the components and firstly it interfaces PIR sensor detects motion near the main door. Raspberry Pi processes the signal and triggers the GSM module. GSM module sends an SMS alert to the user's phone, upon motion detection. The SMS includes a live camera link, allowing the user to access the live video feed. The user views the live video feed and decides whether to grant access or take further action. The user can

send a command through SMS to open the door remotely if necessary, using predefined commands or authentication mechanisms.

The Overall Implementation takes place in this way to meet the output results Setting up Raspberry Pi and connecting components: Users need to configure the Raspberry Pi and connect the PIR sensor, GSM module, and camera according to the provided instructions. Configuring PIR sensor for motion detection: Users need to adjust the sensitivity and detection range of the PIR sensor to suit their specific requirements. Integrating GSM module for SMS alerts: Users can easily configure the GSM module to send SMS alerts to predefined phone numbers when motion is detected. Installing and configuring the camera for live video feed: Users need to install and configure the camera to provide a live video feed accessible via the provided link.

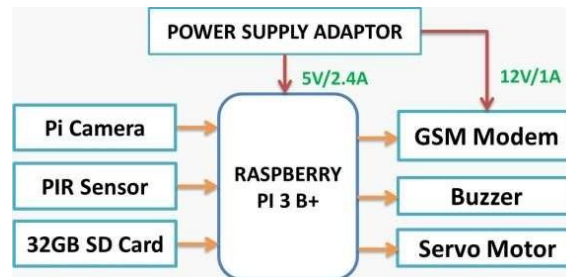


Figure. 1. Block Diagram Security Of Alert System

V. HARDWARE

Setting up Raspberry Pi and connecting components: Users need to configure the Raspberry Pi and connect the PIR sensor, GSM module, and camera according to the provided instructions. Configuring PIR sensor for motion detection: Users need to adjust the sensitivity and detection range of the PIR sensor to suit their specific requirements. Integrating GSM module for SMS alerts: Users need to configure the GSM module to send SMS alerts to predefined phone numbers when motion is detected. Installing and configuring the camera for live video feed: Users need to install and configure the camera to provide a live video feed accessible via the provided link.

- **Raspberry Pi:** A credit card sized computer which is capable of running various applications and interfacing with external hardware components.

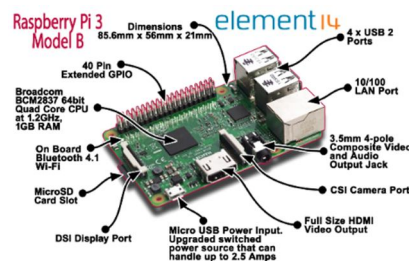


Figure. 2. Raspberry Pi Hardware Layout

- **PIR Sensor (Passive Infrared Sensor):** Detects changes in infrared radiation emitted by moving objects, triggering the system when motion is detected.



Figure. 3. Passive Infrared Sensor

- **GSM Module:** A communication device that enables the Raspberry Pi to send SMS alerts to predefined phone numbers.



Figure. 4. Gsm Module Sim900a

- *Pi Camera:* An external camera connected to the Raspberry Pi, providing live video feed for remote monitoring and surveillance.



Figure. 5. Pi Camera Module

- *Integration of components to create a comprehensive security system:* The components work together seamlessly to detect motion, notify the user, and provide visual confirmation through live video feed.

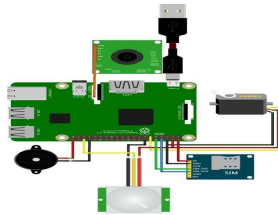


Figure. 3. Security Alert System Connections

VI. EXPERIMENTAL RESULTS

The overall experimental setup of the system is mounted on a sturdy wooden plank, providing a stable foundation for the hardware components. These components include in the Raspberry Pi module, PIR sensor, vibration sensor, door lock (servo motor), pi camera, buzzer, GSM module, and a relay driver circuit. The PIR sensor proved to be highly accurate in detecting various types of motion, providing reliable detection capabilities. Sensors are interfaced with the Raspberry Pi to provide digital output, facilitating seamless data collection and processing. Upon detection of motion by the PIR sensor, a signal is promptly transmitted to the controller, triggering the webcam to capture a snapshot. This image is then stored onto the memory card of the Raspberry Pi, ensuring secure storage of visual data. Additionally, the stored photo is forwarded via SMS to the user, enabling remote access and visual verification of detected events. Based on the live necessary actions can be take like opening or closing the door or forward to police force in case of theft for security with YES or NO commands.



Figure. 4. Resulted Output When Motion Detected (Live Link)

VII. ADVANTAGES OF PIR TRIGGERED SECURITY ALERT SYSTEM

- Real-time monitoring and alerts
- Remote access and control via mobile phone
- Enhanced security with motion detection and live video feed
- Convenient and user-friendly interface for access control

VIII. CONCLUSION

Summary of the project objectives and achievements: The project aimed to design and develop a security alert system using Raspberry Pi to overcome the limitations of traditional security measures. By leveraging the capabilities of Raspberry Pi and other components, the system provides real-time monitoring, remote access, and enhanced security features. Importance of developing advanced security systems: In today's rapidly evolving security landscape, it is crucial to adopt advanced and proactive security measures to protect homes and properties effectively. Acknowledgment of contributions and future prospects: Acknowledge the efforts of the project team and stakeholders in designing and developing the security alert system. Highlight the potential for further research and development in the field of smart security systems.

FUTURE SCOPE

The future scope of this project includes exploring Potential enhancements and future developments: Integration of facial recognition technology for access control: Enhance security by implementing facial recognition technology to identify authorized individuals. Implementation of cloud storage for captured images and videos: Store captured images and videos in the cloud for easy access and backup. Addition of voice recognition for command authentication: Improve user authentication and security by implementing voice recognition technology for command authentication. Incorporation of machine learning algorithms for advanced threat detection: Enhance the system's ability to detect and respond to.

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