Real Time Home Monitoring and Automation over Internet Protocol

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Abstract— **This paper describes an intelligent security system using a Raspberry Pi, a camera module, and an ultrasonic sensor to detect objects, measure their distance, and send an image of the detected object via email or Telegram. When an object enters a predefined range, the ultrasonic sensor measures its distance from the camera. If the object is within a set threshold, the Raspberry Pi captures an image and sends it to a designated recipient, either via email or Telegram. This system can be applied in surveillance, automation, and security, offering an affordable, reliable, and effective way to monitor environments in real time with remote alerts.**

Index Terms— *Python, Raspberry pi, Internet of things, Windows operating system.*

1. INTRODUCTION

In recent years, advancements in technology have paved the way for affordable and effective security systems that can enhance safety in various environments. One such system is an object detection and alert system using the Raspberry Pi, a versatile and low-cost microcomputer. This project leverages the capabilities of the Raspberry Pi, coupled with a camera module and an ultrasonic sensor, to create a real-time intelligent security system that can detect objects, measure their distance, and send alerts when needed.

The core of this system relies on two key components: the ultrasonic sensor and the camera module. The ultrasonic sensor is used to measure the distance between the object and the sensor, allowing the system to detect objects that come within a predefined range. Once an object is detected within the threshold, the Raspberry Pi triggers the camera to capture an image of the object. The captured image is then sent to the designated recipient via email or Telegram, ensuring that alerts are delivered instantly and remotely.

This object detection and alert system is highly applicable in fields such as surveillance, home automation, and security. It offers a reliable solution for monitoring environments where constant human surveillance may not be feasible. With the growing demand for smart security solutions, this system provides an affordable yet efficient means of real-time monitoring, allowing users to stay informed of any potential intrusions or unexpected events.

Moreover, the integration of the Raspberry Pi makes it an accessible option for individuals and small businesses looking to implement a smart security system without significant investment.

2. OBJECTIVE

The objective of this project is to develop an intelligent security system using a Raspberry Pi, camera module, and ultrasonic sensor. The system aims to detect objects within a predefined range, measure their distance, and capture an image when the object is detected. The captured image will be sent to the designated recipient via email or Telegram, ensuring real-time alerts. This system seeks to provide an affordable, efficient, and reliable solution for surveillance and security applications.

3. LITERATURE SURVEY

3.1 REAL TIME OBJECT DETECTION USING RASPBERRY PI

With the hurried improvement of innovations, for example, advanced cells, autopilot vehicles, and automatons, always inserted gadgets have been competent with PC vision work. For example, Autopilot innovation need vehicles can keenness condition, break down scene and respond likewise; Artificial Intelligence (AI) redesigning and different capacities in the cell phone need to exactly find the

article position in the picture; Object recognition may be the most mutual one that is embraced as an essential useful module for scene parsing in inserted applications, and consequently it has been the region of expanding interest. Continuous scene parsing through item recognition running on an inserted gadget is exceptionally testing, because of restricted memory and processing intensity of installed gadgets. To manage these difficulties, we overhaul a lightweight system without outstandingly diminishing recognition exactness. Hence the system is developed with hardware using Raspberry Pi! This redefines the object recognition system by a simple hardware technique using Raspberry Pi. This is finally done with a simple setup in the end with the hardware connection which gives the object detection for around a wide region of 2D-3D view. During most recent couple of years Object detection has gotten perhaps the most sizzling zone of PC vision, and numerous scientists are hustling to get the best object detection model. Because of that many best class models are a work in progress, for example, RCNN, RetinaNet, and Yolo and we've proposed it with the Raspberrypi

4. EXISTING SYSTEM

An IoT-based real-time home monitoring system using GSM technology focuses on ensuring the security and automation of a residential environment. The system typically involves a combination of sensors, microcontrollers, and GSM modules to provide remote monitoring and control of home appliances and security features. The system may also feature control functionalities, allowing users to remotely turn on or off lights, fans, and other electrical devices via SMS commands. The use of a microcontroller, such as Arduino or PIC, helps process data from sensors and manage communication between the GSM module and connected devices.

5. METHODOLOGY

5.1 Proposed System

The proposed system consists of a Raspberry Pi integrated with a camera module and an ultrasonic sensor to create a real-time object detection and alert system. The ultrasonic sensor continuously monitors the environment for objects within a predefined range. Once an object is detected, the system measures its distance and, if the object is within the set threshold, the Raspberry Pi triggers the camera to capture an image. This image is then sent via email or Telegram to a predefined recipient, providing instant alerts. The system is designed to operate autonomously, offering a simple and cost-effective security solution. It can be deployed in various applications such as home security, surveillance, and automation, where remote monitoring and real-time alerts are essential for safety and efficiency.

BENEFITS:

Utilizes low-cost components like Raspberry Pi, making it a budget-friendly option for home and business security.
Sends instant notifications with images of detected objects via email or Telegram, ensuring timely responses to potential threats.
Allows users to monitor environments from anywhere, providing peace of mind and enhanced control over security systems.
Simple setup process with minimal hardware requirements, making it accessible for non-experts and suitable for various applications.

WORKING PROCESS

1. Object Detection: The ultrasonic sensor continuously emits ultrasonic waves and measures the time taken for the waves to reflect back, allowing the Raspberry Pi to calculate the object's distance from the sensor.
2. Distance Measurement: When an object is detected within a predefined distance threshold (e.g., 1 meter), the Raspberry Pi triggers the camera module to capture an image.
3. Image Capture and Notification: Once the camera captures an image, the Raspberry Pi processes the image and sends it via email or to a designated Telegram channel. This is achieved by interfacing the Raspberry Pi with email protocols or using the Telegram bot API.
4. Remote Alerts: The image and distance data are sent to the user in real-time, allowing immediate access to the visual and quantitative information on the detected object.
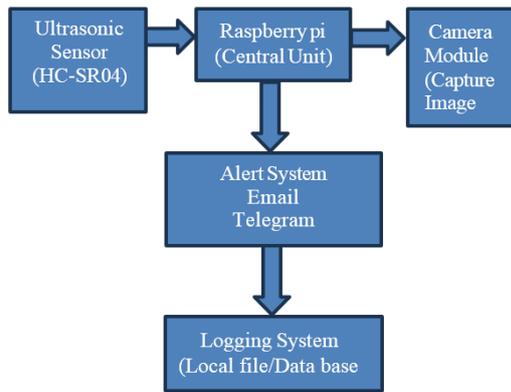
Figure 1 System architecture

The methodology Figure1 The system starts by initializing all components, including the ultrasonic sensor, camera module, and alert system. The ultrasonic sensor continuously measures the distance to nearby objects by emitting ultrasonic waves and calculating the time taken for the echo to return. If an object is detected within a predefined range (e.g., 50 cm), the Raspberry Pi triggers the camera module to capture an image of the object. The image is saved locally on the Raspberry Pi.

1. System Initialization

The Raspberry Pi boots up and initializes the ultrasonic sensor, camera module, and alert system.Required Python libraries (e.g., RPi.GPIO, picamera, smtplib, telegram-send) are loaded.

2. Object Detection

The ultrasonic sensor continuously measures the distance to nearby objects. It sends ultrasonic waves and calculates the time taken for the echo to return, determining the distance of the object.

3. Distance Check

The Raspberry Pi processes the distance data from the ultrasonic sensor. If an object is detected within a predefined range (e.g., 50 cm), the system triggers the next step.

4. Image Capture

The Raspberry Pi activates the camera module.The camera captures an image of the detected object and saves it locally on the Raspberry Pi (e.g., /home/pi/intruder.jpg).

5. Alert Generation

The system prepares an alert message (e.g., "Intruder Detected!") and attaches the captured image.

The alert is sent via:

Email: Using the smtplib library to send the image and message to a predefined email address.

Telegram: Using the telegram-send library to send the image and message to a Telegram chat. multiple convolutional layers to extract features, such as the shape of the mouth or the position of the eyebrows.

6. Logging the Event:

The system logs the event details (timestamp, distance, image filename) in a local file or database for future reference. This helps in tracking and analyzing security events over time.

7. System Loop

The system continuously monitors for objects by repeating the above steps. It remains in a standby state until another object is detected within the specified range.

Advantages

1. Real-time monitoring and instant alerts via email or Telegram for quick threat response.
2. Captures high-quality visual evidence for identification and proof.
3. Built with affordable components like Raspberry Pi, ultrasonic sensors, and a camera module.
4. Cost-effective and easy to implement, even for users with minimal technical expertise.
5. Scalable and modular, allowing for additional features like motion detection or face recognition.
6. Logs all events with timestamp and distance, enabling historical data analysis for security management.
7. Supports remote monitoring, ensuring users stay informed from anywhere.
8. Energy-efficient design for minimal power consumption.
9. Customizable detection range for tailored security needs.
10. Uses open-source tools, offering flexibility for future enhancements.
11. User-friendly, portable, and low-maintenance, making it suitable for various applications.
12. Educational value, demonstrating IoT and automation concepts.
13. Provides a comprehensive, reliable, and affordable security solution adaptable to specific requirements.

6.RESULTS AND OUTCOMES

1. with out detection
2. 2.with detection

3. System Initialization:

Result: The Raspberry Pi boots up and initializes all components (ultrasonic sensor, camera module, and alert system).

Outcome: The system is ready to monitor the environment for objects.

4. Object Detection:

Result: The ultrasonic sensor continuously measures the distance to nearby objects.

Outcome: Objects within the predefined range (e.g., 50 cm) are detected accurately.

5. Distance Check:

Result: The Raspberry Pi processes the distance data from the ultrasonic sensor.

Outcome: If an object is within the specified range, the system triggers the camera module.

6. Image Capture:

Result: The camera module captures an image of the detected object.

Outcome: The image is saved locally on the Raspberry Pi (e.g.,

/home/pi/intruder.jpg).

7. Alert Generation:

Result: The system prepares an alert message (e.g., "Intruder Detected!") and attaches the captured image.

Outcome: Alerts are sent via:

Email: The recipient receives an email with the image and message.

Telegram: The recipient receives a Telegram message with the image and alert text.

8. Event Logging:

-Result: The system logs the event details (timestamp, distance, image filename) in a local file or database.

Outcome: A historical record of security events is maintained for future analysis.

9. System Loop:

Result: The system returns to its monitoring state and continues checking for objects.

Outcome: The system operates continuously, ensuring real-time detection and alerting.

In conclusion, the object detection and alert system using Raspberry Pi offers a practical, cost-effective integrating a camera module and ultrasonic sensor, the system can detect objects within a specific range, capture images, and send alerts via email or Telegram. This system provides an efficient way to enhance security in various environments, from homes to businesses, without the need for expensive equipment. The ability to receive immediate notifications and images of detected objects ensures users can quickly simplicity of the system's setup and operation makes it accessible for individuals with basic technical knowledge. Overall, this project demonstrates the potential of affordable technology in building intelligent, reliable, and scalable security systems for everyday use.

7.FUTURE SCOPE

The future scope of this object detection and alert system includes expanding its capabilities with machine learning algorithms for more advanced object recognition and tracking. Integration with other IoT devices, such as smart locks or alarms, can enhance the security features. Additionally, the system can be further improved with cloud storage for image backup and better data analysis. Incorporating features like facial recognition or motion detection could make the system even more intelligent and responsive.

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