

Intrusion Eye Detector

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Abstract

Uncertainty about security risks and illegal access are becoming more prevalent in a variety of settings, such as private homes, business buildings, and critical government buildings. Conventional security systems, which may not offer real-time warnings or prompt reactions, frequently rely on passive monitoring, including CCTV cameras and motion sensors. Artificial intelligence (AI) and computer vision-based intelligent systems are becoming more and more popular as a means of improving security and monitoring. These cutting-edge technologies enhance safety and lower possible risks by actively detecting, monitoring, and reacting to security breaches in real time. To address these challenges, this research work proposes an advanced "Intrusion Eye Detector" system that integrates computer vision, real-time surveillance, and remote alert capabilities for enhanced security. The system utilizes a webcam to detect intruders and employs human pose detection to identify unauthorized individuals with greater accuracy. Once an intrusion is detected, the system sends an image-based SMS notification to the system owner, allowing for quick response and immediate action. Additionally, it features voice alerts to warn individuals on-site and deter potential threats. To ensure crucial evidence is captured, the system includes functionalities for taking screenshots and recording videos, which can be stored for future reference. Furthermore, cloud storage integration allows for secure image backup, and remote monitoring is enabled through an SMS notification containing a URL link to the uploaded image. This combination of real-time detection, automated alerts, and cloud-based evidence storage makes the Intrusion Eye Detector a highly efficient and reliable security solution.

Keywords: Video processing, facial recognition, pose estimation, Twilio API for alerts, intruder detector

INTRODUCTION

Unauthorized entry and security breaches are serious risks to high-security, commercial, and residential sectors. Static cameras and motion sensors are two examples of traditional surveillance systems that frequently fail to identify unlawful entrance, particularly when people try to avoid detection by moving strategically or by using low-activity areas. Intelligent, automated systems that can offer real-time monitoring, cloud-based evidence storage, and immediate warnings are becoming more and more necessary as security threats change in order to improve safety and reaction times. To address these challenges, this study presents an advanced Intrusion Eye Detector, an intelligent security system that integrates real-time alerting, human pose detection, and cloud storage capabilities. Unlike conventional surveillance solutions, the proposed system actively detects human movement by utilizing a webcam to capture images, which are then analyzed using a pose detection algorithm [1]. Upon detecting an unauthorized entry, the system triggers an audio

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alert, sends an SMS notification with an image of the detected intrusion, and records video footage for further analysis. Additionally, to ensure secure evidence retention, the system stores images in the cloud, allowing for remote access and later review. By combining computer vision with automated alerting and cloud integration, the Intrusion Eye Detector offers an efficient and proactive security solution, reducing response times and strengthening surveillance measures.

Instantaneous alerting and real-time monitoring are essential components of contemporary surveillance systems. Conventional security systems frequently use motion sensors or static cameras, but these may not be able to identify unwanted entry, particularly in places with little movement or when individuals are trying to evade detection. Thus, to improve security, sophisticated techniques combining real-time alerting, cloud integration, and human pose detection are required [2].

The integration of these techniques into a cohesive intrusion detection system is the main goal of this project. In order to detect human movement, the suggested system uses a webcam to take pictures, which are then processed using a pose detection algorithm. The system provides an audio alert and sends an SMS notification with an image of the incident when it detects an intruder. The system also captures video and saves pictures to the cloud for later analysis [3].

SYSTEM ARCHITECTURE

The well-organized system architecture of the Intrusion Eye Detector combines many parts to provide automatic warning and real-time security monitoring. To improve surveillance and intrusion detection, the system makes use of cutting-edge technology including posture detection, video recording, cloud storage, and rapid notifications. Each part is essential to quickly alerting system users and effectively recognizing illegal users. The following are the system's primary architectural components:

The armature of the Intrusion Eye Sensor consists of several factors:

- *Pose Detection Module:* The Pose Detector from the cvzone library is used by the Pose Detection Module to examine every camera frame and recognize the postures of people's bodies. It examines if a person is an unauthorized invader and decides whether they are in the camera's range of view. The technology guarantees precise intrusion detection by continually monitoring human movement. This real-time analysis is an essential part of the Intrusion Eye Detector system since it allows for instant notifications and improves security by differentiating between legitimate activities and possible threats [4].
- *Real-Time Video Recording:* The system utilizes OpenCV to continuously capture video footage, ensuring real-time surveillance. Each recorded video is saved with a timestamp, allowing users to review past incidents accurately. This feature provides essential evidence for security analysis, enabling authorities to verify intrusions and take appropriate action. The recorded footage serves as a reliable reference for monitoring suspicious activities and enhancing security protocols. This ensures that all incidents are documented and accessible for future investigation and threat assessment [4].
- *Screenshot Capture:* The system captures a screenshot of the current frame upon detecting an intruder and stores it locally. To ensure remote accessibility and security, the image is then uploaded to Cloudinary, a cloud storage service. This prevents data loss, ensuring that evidence remains available even if the intruder damages or disables the local hardware. By enabling remote access from any location, the system enhances security monitoring, allowing users to retrieve crucial evidence anytime, strengthening overall surveillance and response efficiency.
- *SMS announcement:* The system utilizes the Twilio API to send an instant SMS alert once the image is successfully uploaded to the cloud. The SMS contains a link to the uploaded image, allowing the recipient to immediately assess the situation and respond accordingly. This feature ensures quick decision-making and remote monitoring, enabling security personnel or users to take necessary action without delay. By providing real-time alerts, the system enhances situational awareness and improves the efficiency of intrusion detection and response [5].

- *Voice Alert*: The Voice Alert feature enhances security by providing immediate on-site warnings. Using text-to-speech (TTS) capabilities, the system announces, "Intruder Detected!" through speakers or an attached audio system. This instant feedback alerts individuals in the monitored area, prompting them to take immediate action. Additionally, it serves as a deterrent, discouraging unauthorized access and enhancing overall security. By integrating real-time audio alerts, the system ensures quick response and strengthens intrusion detection effectiveness in both residential and commercial environments.

METHOD AND TOOLS

To provide precise intrusion detection and real-time warning, the Intrusion Eye Detector combines a number of cutting-edge techniques and technologies. To improve security and offer smooth monitoring, the system combines computer vision, cloud storage, automatic notifications, and voice alarms. In order to identify illicit movement and guarantee a prompt reaction, each component is essential.

To achieve effective intrusion detection, the system utilizes Pose Detection through the cvzone library, which analyzes body positions and verifies human presence based on key body features like the head, shoulders, and limbs. For secure and remote access to captured images, Cloudinary is incorporated, allowing images to be stored safely in the cloud, ensuring availability even if the local system is compromised [6, 7]. The Twilio API facilitates instant SMS notifications, sending alerts with an image URL to a designated phone number when an intrusion is detected. Additionally, pyttsx3, a text-to-speech library, generates a "Intruder Detected!" voice alert, immediately warning individuals in the vicinity.

By combining these tools, the Intrusion Eye Detector ensures a reliable, real-time, and efficient security solution, enhancing surveillance and response capabilities.

- *Pose Discovery (cvzone)*: This point analyzes body position and detects mortal movement using the Pose Detector from cvzone. The presence of a mortal figure can be vindicated with the help of this algorithm, which recognizes important bodily corridor like the head, shoulders, and branches [8].
- *Cloud Storage (Cloudinary)*: The system incorporates Cloudinary, a media asset operation platform, for safe image storehouse. Because the uploaded prints are kept in a pall terrain, they can be penetrated from a distance and are defended in the event that the original system is compromised [9].
- *SMS and announcement (Twilio)*: To shoot SMS announcements, the system makes use of Twilio's API. A Twilio number is used to configure the API, and when an intrusion is detected, a communication containing the image URL is transferred to a pre-specified phone number [10].
- *Text- to- Speech (pyttsx3)*: By turning the textbook "Meddler Detected!" into speech, the pyttsx3 library generates voice cautions. People who are close to the meddler will incontinently be advised by this.

WORKFLOW

- *Webcam Initialization*: First, the system sets the webcam feed's resolution to the necessary 640×480. After that, it continuously records webcam frames.
- *Pose Detection*: The PoseDetector processes every frame. When the system detects a human figure, it does the following: sets off the intruder alert and marks the detection area. Takes a picture and adds it to Cloudinary. Provides the recipient with an SMS with the image link. Sets off a voice alert to let people in the vicinity know.
- *Video Recording*: The system simultaneously records the video in AVI format at a frame rate of 20 frames/sec using the proper codec. This offers a video record of the incident, which may be helpful for analysis after the fact.
- *Thresholds and Flags*: The system has flags to make sure that an SMS is sent and a screenshot is only taken once per detection in order to prevent redundant actions. This stops the same event from receiving more than one notification.

RESULTS AND DISCUSSION

Pose detection, cloud storage, real-time surveillance, and SMS-based alerts are all skillfully combined in the suggested Intrusion Eye Detector to create a single, all-inclusive security solution [11]. Real-time intruder detection is possible, screenshots can be used as proof, and the user can receive voice and SMS alerts.

- *Real-time Monitoring:* In the event of an intrusion, prompt action can be taken thanks to the system's real-time frame processing capability.
- *Cloud Integration:* Even in the case of physical damage to the local hardware, the evidence is safe and available thanks to the cloud storage of images.
- *Scalability:* Additional features, like multi-camera integration or facial recognition, can be easily added thanks to the modular design.

LIMITATIONS AND FUTURE WORK

- *Dependence on Webcam Quality:* The resolution of the webcam affects the detection quality. Missed detections can occur from cameras with low resolution.
- *Pose Detection Accuracy:* The PoseDetector performs best in well-lit areas, but it may lose accuracy in dimly lit areas or when the intruder avoids particular poses.

Future Work

By incorporating more sophisticated methods, the system can be improved in the future, including:

- *Facial Recognition:* To confirm if the person being detected is an authorized person or an intruder.
- *Motion Detection:* By including a motion detection system, pose detection will only be activated in response to notable movement.
- *Multi-Camera Setup:* Combining several cameras to provide thorough coverage of the region.
- *AI-based Alerts:* To cut down on false positives, machine learning models are used to distinguish between people and animals or objects.

CONCLUSION

The Intrusion Eye Detector is a cutting-edge, real-time security system that improves surveillance by skillfully combining computer vision, posture detection, cloud storage, and automatic alarms. This system actively detects unwanted entrance and provides rapid warnings and reaction methods, in contrast to standard security systems that rely on passive monitoring. It correctly detects the presence of humans by pose detection, and it records important evidence with real-time video and screenshots. Adding cloud storage improves security and dependability by ensuring that data is still available even in the event that the local system is hacked. Moreover, the Twilio API-based SMS alerts allow remote monitoring by instantly notifying users with an image link of the detected intrusion. The text-to-speech voice alert system further strengthens security by providing immediate on-site warnings, deterring intruders, and prompting quick action. These features make the Intrusion Eye Detector an efficient, scalable, and adaptable solution for residential, commercial, and high-security environments. While challenges such as webcam resolution dependency and pose detection accuracy remain, future advancements can improve the system by integrating facial recognition, motion detection, and AI-based alerts. The ongoing evolution of AI and surveillance technologies will further enhance the effectiveness of intrusion detection, ensuring greater safety and security in the years to come.

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