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Research Article

Crime Vision: Intelligent Intrusion Detection System

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Abstract With the rapid growth of urban infrastructure and increasing demand for security, traditional surveillance systems have become inefficient and error-prone due to reliance on human monitoring. This research proposes an automated intrusion detection system using computer vision techniques. The system processes real-time video input from webcams or CCTV cameras and detects motion using background subtraction and contour analysis. A user-defined restricted zone is configured within the frame, and when any object enters this zone, the system triggers alerts, logs events, and saves intrusion images as evidence. The proposed system improves accuracy, reduces human effort, and provides a cost-effective and scalable security solution for homes, offices, and industries.

Keywords - Intrusion Detection, Computer Vision,OpenCV,Surveillance System, Motion Detection, Security Automation

INTRODCTION

In today's rapidly evolving world, ensuring security has become a major concern across various environments such as homes, offices, and industries. Traditional surveillance systems rely heavily on human monitoring, which is often inefficient and prone to errors due to fatigue and lack of attention. With the advancement of technology, computer vision has emerged as an effective solution for automated surveillance. This project introduces a Crime Vision Intelligent Intrusion Detection System that uses realtime video processing to detect unauthorized entry into restricted areas. By automating detection and alert mechanisms, the system enhances security, reduces human effort, and provides a reliable and cost-effective monitoring solution.

SYSTEM ARCHITECTURE

The Crime Vision Intelligent Intrusion Detection System uses a modular architecture for efficient real-time surveillance. It starts with the video input layer, which captures live video from a webcam or CCTV camera. The processing layer applies background subtraction, noise reduction, and thresholding to detect motion accurately. The detection layer extracts contours of moving objects, while the zone analysis layer checks if these objects enter a predefined restricted area. When an intrusion is detected, the alert layer generates warnings and logs events with timestamps. Simultaneously, the storage layer saves intrusion images as evidence, ensuring reliability, scalability, and effective security monitoring.

WORKING METHODOLOGY

The working methodology of the Crime Vision

Intelligent Intrusion Detection System is based on realtime video processing. The system captures video frames from a webcam or CCTV camera and applies background subtraction using the MOG2 algorithm to detect motion. The working methodology of the Crime Vision Intelligent Intrusion Detection System is based on real-time video processing. The system captures video frames from a webcam or CCTV camera and applies background subtraction using the MOG2 algorithm to detect motion.

IMPLEMENTATION

The implementation of the Crime Vision Intelligent Intrusion Detection System is carried out using Python and the OpenCV library for real-time video processing. The system captures video frames continuously using the VideoCapture module from a webcam or CCTV camera. Each frame is processed using the MOG2 background subtraction algorithm to distinguish moving objects from the static background. To improve accuracy, noise reduction techniques such as median filtering and thresholding are applied. The system then extracts contours representing moving objects and filters them based on a minimum area threshold to eliminate noise and small disturbances. For each valid contour, the centroid is calculated and tested against a predefined restricted zone using polygonbased methods. If an intrusion is detected, the system triggers an alert by displaying a warning message, logs the event with a timestamp, and saves the corresponding frame as evidence. This implementation ensures efficient and reliable real-time fig 1.1 intrusion detection.



Fig 1.1: Architecture of Crime Vision Intrusion Detection System

ROLE OF COMPUTER VISION

Computer Vision plays a vital role in the Crime Vision Intelligent Intrusion Detection System by enabling automated analysis of video datainreal time. It allows the system to capture, process, and interpret visual information from surveillance cameras without human intervention.Using techniques such as background subtraction, image filtering, and contour detection, computer vision helps identify moving objects accurately within a video frame. It also supports feature extraction and object tracking, which are essential for detecting unauthorized movement. By applying polygon-based zone analysis, the system determines whether an object enters a restricted area and triggers alerts instantly. Unlike traditional monitoring, computer vision ensures continuous observation without fatigue or errors. It improves detection speed, accuracy, and reliability while reducing manual effort. Overall, computer vision transforms passive surveillance into an intelligent system capable of making real-time decisions, thereby enhancing security and safety across various environments.

ADVANTAGES

The Crime Vision Intelligent Intrusion Detection System offers several advantages that make it an effective solution for modern surveillance needs. One of the key benefits is real-time monitoring, which allows immediate detection of unauthorized intrusions without delay. The system significantly reduces the need for continuous human supervision, thereby minimizing errors caused by fatigue and improving overall efficiency. It is cost-effective as it uses open-source technologies like Python and OpenCV, making it accessible and easy to implement. The system is also highly scalable and customizable, allowing users to define restricted zones based on their specific requirements. Additionally, it provides automatic alert generation, event logging, and image capture as evidence, which enhances security and accountability. Its ability to operate continuously with consistent performance makes it reliable for various environments such as homes, offices, and industries

APPLICATIONS

TThe Crime Vision Intelligent Intrusion Detection System offers several advantages that make it an effective solution for modern surveillance needs. One of the key benefits is real-time monitoring, which allows immediate detection of unauthorized intrusions without delay. The system significantly reduces the need for continuous human supervision, thereby minimizing errors caused by fatigue and improving overall efficiency. It is cost-effective as it uses open-source technologies like Python and OpenCV, making it accessible and easy to implement. The system is also highly scalable and customizable, allowing users to define restricted zones based on their specific requirements. Additionally, it provides automatic alert generation, event logging, and image capture as evidence, which enhances security and accountability. Its ability to operate continuously with consistent performance makes it reliable for various environments such as homes,
offices, and industries

FUTURE ENHANCEMENTS

The Crime Vision Intelligent Intrusion Detection System can be further enhanced by integrating advanced technologies to improve its accuracy and functionality. Future improvements may include the use of deep learning algorithms for object classification, enabling the system to distinguish between humans, animals, and other objects to reduce false alarms. Integration with facial recognition can help identify specific individuals and enhance security. The system can also be extended to send real-time alerts through mobile notifications, emails, or IoT-based alarm systems. Cloud storage integration can be implemented for secure and remote access to recorded data. Additionally, developing a mobile or web-based interface will allow users to monitor surveillance remotely. Real-time multi-camera support and improved night vision capabilities can further enhance system performance, making it more robust and suitable for real-world applications.

CONCLUSION

The Crime Vision Intelligent Intrusion Detection System provides an efficient and automated solution for modern surveillance challenges. By leveraging computer vision techniques, the system is capable of detecting unauthorized intrusions in real time with high accuracy. It reduces dependency on manual monitoring and minimizes human errors, thereby improving overall security. The integration of motion detection, restricted zone analysis, alert generation, and evidence storage makes the system reliable and practical for various applications such as homes, offices, and industries. Additionally, its cost-effective and scalable design ensures easy deployment and adaptability. With further enhancements, the system can evolve into a more advanced and intelligent security solution, contributing significantly to safer environment

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