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SMART CCTV USING PYTHON

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ABSTRACT

The main goal of my project is to create a smart cctv that contains multiple specifications to do multiple actions. This is a python GUI application which can run on any operating system, uses web cams and has number of features that are not on the normal cctv. We have built using latest programming language and highly evolving computer science field which is "Computer Vision". Which means my project allows computer to watch or in other words it gives vision capability to computers. For this we are using python language as it is very new and also comes with so many features like we can do machine learning, computer vision, and also make GUI applications. My execution is many bases of capturing the images, some of the formats like monitoring feature, identifying the family member, detects for noise, and it acts like an eye which will always monitor the room visitors. We have built this structure using waterfall model, this model considers that one phase can be started after completion of the previous phase. That is the output of one phase will be the input to the next phase. Thus, the development process can be considered as a sequential flow in the waterfall.

INTRODUCTION

The smart CCTV project is an innovative surveillance system designed to revolutionize traditional security monitoring by incorporating advance technologies for motion detection and real-time image analysis. With its intelligence features and user-friendly interface, the system aims to enhance security measures and provide a reliable solution for effective surveillance. Smart CCTV is an innovative and highly sophisticated surveillance system that aims to redefine the concept of security monitoring. In today's fast-paced and ever-evolving world, traditional CCTV systems often fall short in effectively addressing modern security challenges. The Smart CCTV system addresses these limitations by leveraging cutting-edge technologies, such as computer vision, image processing, and intelligent algorithms, to provide an advanced and proactive security solution. The Smart CCTV System comprises a comprehensive set of hardware and software components that work together seamlessly to create a robust surveillance infrastructure. At its core, the system utilizes a high-quality CCTV camera capable of capturing clear and detailed video footage. The camera is connected to a computer system equipped with powerful processing capabilities, enabling real-time analysis of the video feed.

One of the key features of the Smart CCTV System is its advanced motion detection capabilities. By employing sophisticated computer vision algorithms, the system can accurately detect and track any movement within the camera's field of view. This includes both large-scale motion, such as a person entering a room, as well as subtle motion, such as a slight change in object position. The system's motion detection algorithms can differentiate between authorized movements and potential security threats, triggering alerts only when necessary. Upon detecting motion, the Smart CCTV System initiates intelligent image capture to document the detected activity. When motion is detected, the system captures a series of high-resolution images that provide visual evidence of the event. These images are automatically saved to a designated storage location, ensuring that critical evidence is preserved for later analysis or reference. The system also supports the option of recording video footage to provide a comprehensive record of the monitored area. To facilitate immediate response and proactive security measures, the Smart CCTV System is equipped with real-time alerting capabilities. When motion is detected, the system can generate instant notifications and alerts, which can be delivered to designated devices or

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personnel via various communication channels, such as email, SMS, or mobile applications. This enables timely actions to be taken to address potential security breaches or emergencies.

The Smart CCTV System features a user-friendly interface that allows users to easily configure and customize the system according to their specific needs. The interface provides intuitive controls for adjusting motion detection sensitivity, defining monitored areas, setting up alert preferences, and managing image capture settings. Additionally, the system offers remote access capabilities, enabling users to monitor the camera feed and receive alerts from anywhere via secure connections.

LITERATURE SURVEY

1. According to A. Ross, K. Nandakumar, and A. Jain "A Survey of Surveillance Technologies: Biometric Recognition, Video Surveillance, and Privacy Issues" Proceedings of the IEEE, 2006

Biometric recognition, or simply biometrics, is the science of establishing the identity of a person based on physical or behavioural attributes. It is a rapidly evolving field with applications ranging from securely accessing one's computer to gaining entry into a country. While the deployment of large-scale biometric systems in both commercial and government applications has increased the public awareness of this technology, "Introduction to Biometrics" is the first textbook to introduce the fundamentals of Biometrics to undergraduate/graduate students. The three commonly used modalities in the biometrics field, namely, fingerprint, face, and iris are covered in detail in this book. Few other modalities like hand geometry, ear, and gait are also discussed briefly along with advanced topics such as multibiometric systems and security of biometric systems. Exercises for each chapter will be available on the book website to help students gain a better understanding of the topics and obtain practical experience in designing computer programs for biometric applications.

2. According to A. Al-Fahoum and M. Khdour "A Survey of Video Surveillance Systems and Techniques" International Journal of Advanced Computer Science and Applications, 2011

Video surveillance is increasing significance approach as organizations seek to safe guard physical and capital assets. At the same time, the necessity to observe more people, places, and things coupled with a desire to pull out more useful information from video data is motivating new demands for scalability, capabilities, and capacity. These demands are exceeding the facilities of traditional analog video surveillance approaches. Providentially, digital video surveillance solutions derived from different data mining techniques are providing new ways of collecting, analysing, and recording colossal amounts of video data. This paper addresses some of the approaches for video surveillance system secure connections.

3. According to Authors: T. B. Moeslund, A. Hilton, and V. Krüger "Computer Vision for Visual Surveillance: An Introduction" Springer, 2013

A number of significant research advances are identified together with novel methodologies for automatic initialization, tracking, pose estimation, and movement recognition. Recent research has addressed reliable tracking and pose estimation in natural scenes. Progress has also been made towards automatic understanding of human actions and behavior. This survey reviews recent trends in video-based human capture and analysis, as well as discussing open problems for future research to achieve automatic visual analysis of human movement.

4. According to S. B. Karthikeyan and V. Vaidehi "A Survey of Computer Vision Techniques for Object Detection in Video Surveillance" International Journal of Advanced Research in Computer Science and Software Eng, 2014

A well-known result in Coding Theory is that using the complete weight enumerator of a code, the complete weight enumerator of the dual code can be obtained. In this article, it is established that an associated matrix of coefficients is a generalized Hadamard matrix. The complete weight enumerator of the dual code can be expressed in terms of generalized Krawtchouk polynomials. Orthogonality conditions and recurrence relations satisfied by these polynomials are presented.

EXISTING SYSTEM

Multiple surveillance cameras are strategically placed in desired locations to capture video footage of the monitored area. The cameras may vary in types such as fixed, pan-tilt-zoom (PTZ), or dome cameras. Ed. The captured video footage is typically recorded and stored on a local recording device, such as a digital video recorder (DVR) or network video recorder (NVR). This allows for later review, analysis, and retrieval of the recorded data. The surveillance system allows real-time monitoring of the video feeds from the cameras. Security personnel or operators can view the live video streams on monitors at a central control room or via remote access. Many surveillance systems incorporate motion detection algorithms to identify changes in the video frames. When motion is detected, the system can trigger alerts or activate specific actions, such as sounding an alarm or recording the event. The recorded video footage can be analysed for security purposes, such as investigating incidents, identifying individuals, or detecting suspicious activities. This often involves manual review by security personnel. Traditional surveillance systems rely heavily on manual monitoring and analysis. Although motion detection and event-triggered actions are present, the system's level of automation is limited.

Closed-Circuit Television (CCTV) Systems: CCTV systems are widely used in various settings, including public spaces, commercial buildings, and residential areas. These systems consist of cameras that capture video footage and transmit it to a centralized monitoring location for real-time viewing and recording.Access control systems are used to regulate entry and exit points in buildings or restricted areas. They often involve the use of identification methods such as keycards, biometrics (fingerprint or facial recognition), or PIN codes to grant or deny access. These systems may include features like door locks, turnstiles, or gates. IDS systems monitor physical spaces or networks for unauthorized access or malicious activities. They use a combination of sensors, alarms, and software to detect and alert security personnel about potential security breaches.Fire detection and alarm systems are designed to detect signs of fire, such as smoke or heat, and alert occupants or emergency responders. These systems include smoke detectors, heat sensors, fire alarms, and sprinkler systems to prevent and mitigate fire incidents.Perimeter security systems protect the outer boundaries of a property or facility. They may include features such as fences, barriers, surveillance cameras, motion sensors, and lighting to deter and detect unauthorized entry or potential threats. Video analytics systems utilize advanced computer vision algorithms to analyze video data in real-time. These systems can automatically detect and track objects, recognize patterns, monitor crowd behavior, and generate alerts based on predefined rules or anomalies in the video feed.Alarm monitoring systems receive and process signals from various security devices, such as intrusion alarms, fire alarms, or panic buttons. These systems provide centralized monitoring and response coordination to ensure prompt actions in case of emergencies.

PROPOSED SYSTEM

In this paper, we further study the above problems of secure and efficient re-encryption for de-duplication storage. Our contributions are threefold:

- The system will be capable of detecting and tracking motion in the surveillance footage. It will utilize computer vision algorithms to identify and highlight areas where motion is detected, allowing security

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personnel to quickly identify potential threats or suspicious activities. The system will have the ability to recognize and classify objects captured by the CCTV cameras.

- This feature can be used to identify specific objects of interest, such as vehicles, people, or specific items, enabling efficient monitoring and identification of potential security risks. The proposed system will generate real-time alerts based on predefined rules or events.
- For example, it can send alerts when unauthorized access is detected, when a specific object or person enters a restricted area, or when unusual behavior is observed. These alerts can be delivered to security personnel through various channels, such as mobile devices or email, facilitating quick response and intervention. The system will incorporate advanced video analytics capabilities to extract meaningful insights from the surveillance footage.
- This can include crowd behavior analysis, abnormal event detection, or pattern recognition to identify potential security threats or anomalies that may require immediate attention.The proposed system will be designed to seamlessly integrate with existing security infrastructure, such as CCTV cameras, access control systems, or alarm monitoring systems. This integration will enable a centralized and comprehensive security management platform, streamlining operations and enhancing the effectiveness of security measures.The system will provide secure storage for captured video footage and associated metadata. It will enable efficient retrieval and playback of recorded videos for post-incident analysis, investigations, or evidence gathering purposes.
- The proposed system will feature an intuitive and user-friendly interface that allows security personnel to easily navigate through the system, access live and recorded video feeds, configure settings, and review alerts and notifications.
- The interface will be designed to provide a clear and comprehensive overview of the security status and facilitate quick decision-making.

SYSTEM DESIGN

The camera devices capture video footage of the monitored area. These can be traditional CCTV cameras or IP cameras that provide live video streams.The motion detection module analyzes the video frames received from the cameras to detect any motion or changes in the scene. It applies algorithms to compare consecutive frames and identify regions where motion is detected.The object recognition module processes the video frames to identify specific objects or patterns of interest. This can include recognizing known objects, detecting faces, or identifying suspicious activities.The system has a recording and storage component to store the captured video footage for future reference or evidence. This can include local storage or cloud-based storage solutions.When motion or suspicious activities are detected, the system generates alerts or notifications to notify the appropriate personnel. This can be in the form of visual alerts on a monitoring interface, email notifications, or text messages.The monitoring interface provides a user-friendly dashboard for security personnel to monitor the live video feeds, view recorded footage, and receive alerts. It allows them to take necessary actions based on the detected events. The system may incorporate data analytics capabilities to extract insights from the collected video data. This can involve analyzing patterns, identifying trends, or generating reports for further analysis or decision-making.

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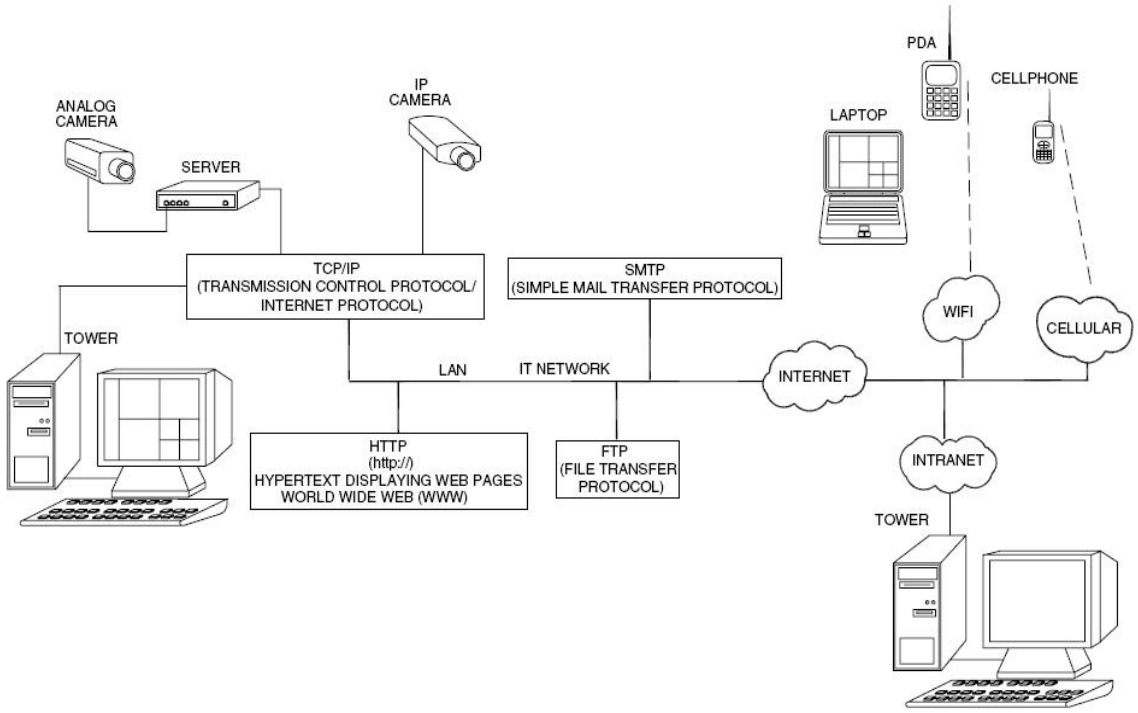

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MODULES IMPLEMENTATION

In this project, we have designed these modules to implement the project. Those are:

- **Detecting faces in the frames**

This is done via Haarcascade classifiers which are again in-built in openCV module of python. Cascade classifier, or namely cascade of boosted classifiers working with haar-like features, is a special case of ensemble learning, called boosting. It typically relies on Adaboost classifiers (and other models such as Real Adaboost, Gentle Adaboost or Logitboost). Cascade classifiers are trained on a few hundred sample images of image that contain the object we want to detect, and other images that do not contain those images.

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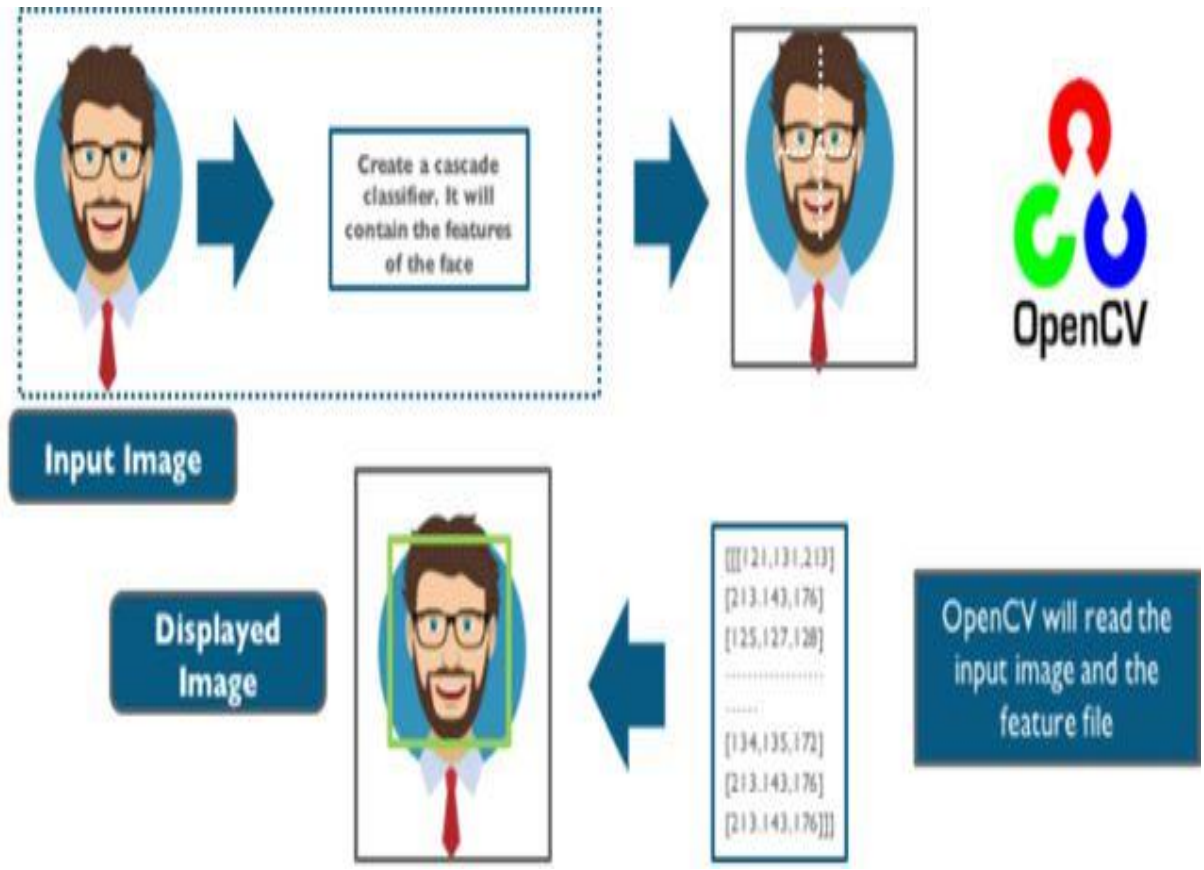

Figure 1 IMAGE CAPTURING

- **Using LBPH for face recognition**

Initially, a dataset of face images needs to be collected for training the LBPH algorithm. This dataset should include images of individuals whose faces will be recognized by the system. The dataset should capture variations in pose, lighting conditions, and facial expressions.The collected face images undergo preprocessing steps to enhance the quality and normalize the images. This can involve techniques like face alignment, normalization, and image resizing. Preprocessing ensures consistency and improves the accuracy of feature extraction.LBPH is applied to extract features from the preprocessed face images. The algorithm analyzes the texture patterns of each pixel in the image by comparing it with its neighboring pixels. It assigns a binary code to each pixel based on the comparison results, creating a local binary pattern representation.LBPH is applied to extract features from the preprocessed face images. The algorithm analyzes the texture patterns of each pixel in the image by comparing it with its neighboring pixels. It assigns a binary code to each pixel based on the comparison results, creating a local binary pattern representation.The calculated histograms are used to train the LBPH model. The
model learns the patterns and variations in the face images of each individual in the dataset. This training phase helps the model to recognize and differentiate between different faces.

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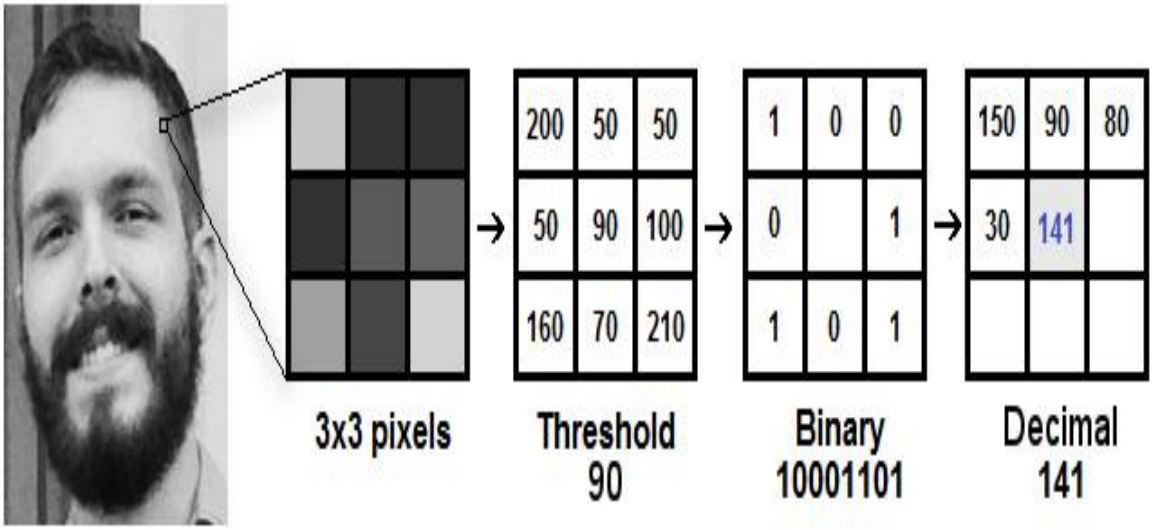

Figure 2 FACE RECOGNITION

- **Detect for Noises in the frame**

The system continuously acquires video frames from the CCTV cameras. Each frame represents a snapshot of the surveillance area.Before noise detection, the acquired frames may undergo preprocessing steps to enhance their quality and reduce noise. This can involve techniques such as denoising filters (e.g., Gaussian blur, median filter) or image enhancement algorithms to improve the clarity of the frames.There are multiple approaches to detect noises in a frame. One common method is to analyze the statistical characteristics of the image or video frames. This can include measuring the pixel intensity distribution, detecting sudden changes or outliers, or identifying regions with abnormal variations.Once the noise detection algorithm identifies potential noise regions or pixels, a thresholding technique can be applied to distinguish noise from the actual scene content. By setting an appropriate threshold, the system can determine which pixels or regions are considered as noise.After noise detection, the system can employ noise removal or filtering techniques to mitigate the impact of noise on the captured frames. Various filtering methods like median filtering, bilateral filtering, or adaptive filtering can be used to reduce the

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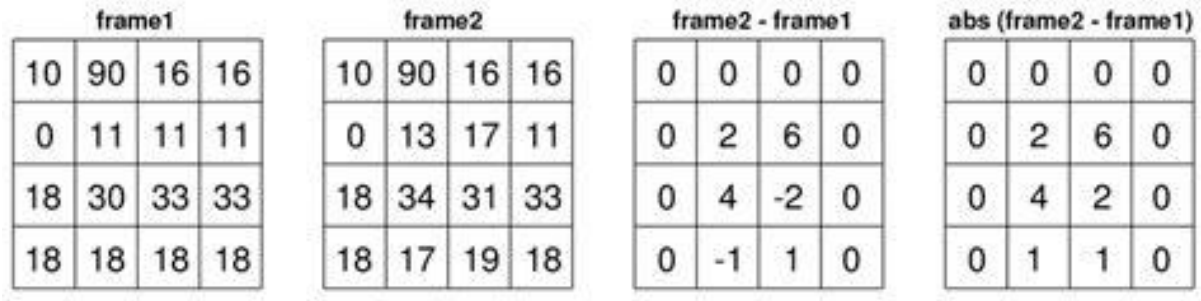
noise while pr When significant noise or disturbances are detected in the frame, the system can generate alerts or notifications. These alerts can be sent to the operator or security personnel to take necessary actions, such as investigating the cause of the noise or inspecting the surveillance area.serving important image details.



frame1

10	90	16	16
0	11	11	11
18	30	33	33
18	18	18	18

frame2

10	90	16	16
0	13	17	11
18	34	31	33
18	17	19	18

frame2 - frame1

0	0	0	0
0	2	6	0
0	4	-2	0
0	-1	1	0

abs (frame2 - frame1)

0	0	0	0
0	2	6	0
0	4	2	0
0	1	1	0

Figure 3 DETECT NOISES

CONCLUSION

The Smart CCTV system is a comprehensive solution designed to enhance surveillance and security capabilities. It utilizes advanced technologies and algorithms to provide intelligent monitoring, motion detection, face recognition, and noise detection functionalities. By integrating these features, the system enables real-time analysis of video streams, automatic event detection, and accurate identification of individuals. The project incorporates modern computer vision techniques and machine learning algorithms to achieve its objectives. It leverages the power of image processing, pattern recognition, and data analysis to deliver robust and efficient surveillance capabilities. The system's modular architecture allows for scalability and customization based on specific requirements and environments. By implementing the Smart CCTV system, it becomes possible to automate surveillance processes, minimize human intervention, and improve the overall efficiency and effectiveness of security operations. The system's ability to detect motion, recognize faces, and identify noises enables quick response to potential threats, accurate monitoring of activities, and timely alerts to security personnel. Furthermore, the project promotes the use of open-source libraries, such as OpenCV and scikit-learn, facilitating ease of implementation, collaboration, and future enhancements. The availability of the project on platforms like GitHub encourages community engagement, knowledge sharing, and potential contributions from developers and researchers. Overall, the Smart CCTV system addresses the limitations of traditional surveillance systems by harnessing the power of computer vision and machine learning. It offers a sophisticated and intelligent solution for surveillance, empowering security personnel with advanced tools to ensure the safety and security of monitored areas.

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