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Smart Security Camera using Machine Learning

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Abstract: *Numerous applications have been found for video surveillance. Smart video surveillance systems can improve situational awareness at various scales of time and space. It describes a remote control and surveillance architecture based on mobile devices. To record camera photos and detect intrusion using an image comparison technique, this project uses the Opency library. The streamed video is sent from the server to the remote administrator over the phone after the comparison is completed and an intrusion is discovered. Afterward, admin can take the necessary action. Automatic video analytics are used in smart surveillance to increase the efficiency of security measures. By automatically identifying the individual's deviant conduct, this system complements the existing video surveillance systems while also introducing intelligent analysis of single person activity to improve home security. By sending an SMS, the user is informed and the pertinent data is recorded. The user is able to watch the specific video. This system keeps the home secure, which lowers the frequency of burglary cases and improves social stability.*

Keywords: Video Surveillance, Open CV, Surveillance engine

I. INTRODUCTION

In recent years, there has been a lot of interest in the difficult field of machine learning and human behaviour comprehension. One of the themes of active image processing research is video surveillance. Analog CCTV systems were used in the beginning of video surveillance to record information and keep tabs on individuals, events, and activities. Existing digital video surveillance systems simply offer the technology needed to record, store, and broadcast video; they completely rely on human operators to identify threats. Monitoring surveillance footage manually is a lot of work.

It is challenging to manually analyse real-time footage and find multiple actions. This led to the development of an intelligent video surveillance system. For security reasons, the analytics program analyses video flow images to automatically identify items (people, equipment, and vehicles) and events of interest. Real-time video surveillance systems recognize events in the video stream that pose a security risk and sound an alarm. Video surveillance is the practice of keeping an eye on or studying a specific location for security and commercial reasons. Concerns about security and crime prevention are what drive the installation of surveillance cameras.

1.1 Motivation

Shopping malls, public spaces, workplaces, banks, and ATMs all have video surveillance equipment. Today, network surveillance research is constantly expanding. The instability episodes that are taking place all over the world are the cause. As a result, a smart surveillance system is required for intelligent monitoring. This system must be able to gather datain real time, transmit it, process it, and comprehend the information linked to the targets of the monitoring. The video data can be examined using forensic techniques following a crime. As a result, these systems provide high levels of security in public areas, which is typically a very difficult problem. Video cameras are now reasonably priced, which has led to an increase in the use of video surveillance systems. Applications for video surveillance systems are

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numerous, including traffic monitoring and human activity detection. We show how a real-time activity analysis system for video surveillance systems may be used to generate real-time alerts and real-time content-based searches based on events that occur in the monitored area.

1.2 Mechanism

The intelligent video surveillance system has a three-tier design that consists of a database server, an application server, and clients. The GSM modem-equipped server device is what makes up the application server. Only the browser is required on the client side device. It will use the server's IP address and port number to connect. The http server module and the image processing module make up the majority of the server side device. The http protocol is used to connect two devices. So, a http server is needed. It will come with a built-in server-side device. This's primary functions are to manage incoming requests, validate them, and produce a response. The module for image processing's job is to find intrusions.

II. LITERATURE SURVEY

R. Chandana, Dr. S. A. K. Jilani, Mr. S. Javeed Hussain[1]This study introduces a face-identification and face-recognition intelligent system with applications in private security, home surveillance, and person tracking. When a person is unrecognised or unknown, the real-time video stream is processed, motion is detected, and dual-axis pan-tilt servos track that person with a camera. This is how an automatic face recognition handles security issues. Additionally, cell phone notifications are issued and such strange acts are video captured with synchronisation with cloud storage. If the anonymous face observed is not already in the database, a database file is created in the absence of the internet with an audio notification to the security room. For voice communication and light activation, speech recognition and relay are also implemented. [9] Priya B. Patel, Viraj M. Choksi, Swapna Jadhav, M.B. Potdar, proposed system would be able to process the live stream from the CCTV camera and generate output that would alert the operator to any potential danger that appears to have occurred or is currently occurring. This method employs a deep learning architectural approach with Convolutional Neural Networks. As a result, the surveillance camera system can detect an individual and identify and recognise the items he or she is carrying based on the level of danger. Similarly, the system can identify and categorise acts in the video feed as natural, suspicious, or malicious (based on the threat level), and send an alert to the appropriate human operator. As a result, the system will be able to assist businesses in overcoming obstacles.[3] The sensors and embedded devices are managed by the user, who sends signals with their smartphones to manage and control all activities from remote locations.[4] Security and automation systems have grown in popularity, and their demand will continue to rise in the future. They are affordable for people of all income levels and lifestyles.[5] The following key ideas should be included in a well-designed and implemented security system. To begin, the system should be designed in such a way that it is aware of the perpetrator. The home owner should receive an instant text alert in order to take appropriate action. Finally, an active device should be used to record all of these events, which could later be used to carry out searches for thieves and stolen items. This type of alert mechanism will be used as a cellular device, similar to a portable. [7] To notify the owner, cloud message or SMS services will be used. As a precaution, the mechanism for alerting owners and other people is used. To alert, the shortmessage service [SMS] concept is used.[6] Chinmaya proposed a smart surveillance system based on the RP-3 model and face recognition. Which provides energy to manage by turning on the system, which is primarily created at the occurrence of each signal. The system will recognise the movement and, based on the detected movement, the machine will turn on the camera, take a photo of the trespasser, and send a notification to the owner's phone if the person is not identified by the system.

III. PROPOSED METHODOLOGY

The objective of the theme is to make smart security system using inbuilt camera of devices. Next, look through the directory/project structure and install libraries/packages to build the project with text input. Upload images/videos when security camera is triggered. Send images/video clips directly to your smartphone via SMS. The security camera supports cloud services, so security system can send TXT/MMS notifications, images, and video clips when the

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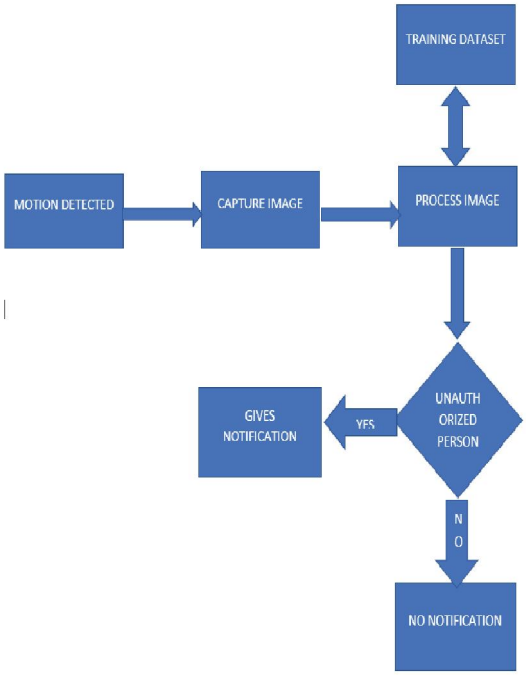
security camera is triggered. We'll also take a quick look at Amazon AWS/S3 and Twilio. Using the two services together, you can: Upload images/video clips when the security camera is enabled. Send images/video clips directly to your smartphone via SMS And finally, we're going to put everything together to get the security camera to work. our project uses two cloud services: Twilio and AWS S3.

Twilio is an SMS/MMS messaging service. S3 is a file storage service that supports video messaging. We will make a camera capable to monitor with open CV. The security camera can record a video clip when the camera is activated, upload the video clip to the cloud, and then send a TXT/MMS message containing the video itself. For example, you can also deploy it to an open/closed mailbox.

The security camera will be able to record a video clip when the camera is activated, upload the video clip to the cloud and then send a TXT/MMS message that includes the video itself. This method can be easily extended to work with other forms of detection, including simple motion detection and home monitoring, object detection, and more. pyimagesearch/notification/twilionotifier.py:

Contains the Twilio Notifier class for sending SMS/MMS messages. Annotated JSON configuration. explore.py: The focus of project is this driver script. It monitors for major changes in lighting, starts recording video, and alerts me when someone steal whatever else in system. Now that we understand the directory structure and the files in it, let's move on to our machine setup and learn about S3 Twilio. From here, we'll start looking at the four main files for project. Installing package/library prerequisites for the project requires you to install some Python libraries on your system



In imutils: A collection of useful functions and classes. twilio: The Twilio package allows you to send text/picture/video messages. boto3 : The boto3 package interacts with the Amazon S3 file storage service. Videos are stored in S3. json-minify: Annotated JSON files are accepted (because everyone loves documentation!). To install these packages, recommend setting up your own Python virtual environment by following the pip OpenCV installation instructions. Then you can pip install all the packages you need: → Run Jupyter Notebook in Google Colab → Run Jupyter Notebook in Google Colab Create Security Camera Secure Security system with OpenCV $ work on your environment name, e.g. cv or py3cv4 $ pip install opencv-Contrib - python $ pip install imutils $ pip install twilio $ pip install boto3 $ pip install json-minify Now your environment is set up and you just need to use the work on command

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whenever you want to activate it. Let's take a look at S3, boto3 and Twilio! we will use S3 to store video files generated by security camera. S3 sorted by "panel". Containers for files and folders. It can also be configured with custom permissions and security options. A package called boto3 helps you migrate files security system to AWS S3. Before exploring boto3, you need to set up an S3 bucket. Continue to create groups, resource groups, and users. Twilio, a phone number service with an API, allowing voice, SMS, MMS, and more. Twilio will act as a bridge between the Security system and our mobile phone. Download important video clips and text them Once our security cameras are activated we will need methods to: Upload images/videos to the cloud (because of the Twilio API cannot direct attachments") Use the Twilio API to actually send text messages. here. Finally, we're going to put all of this together and get the Security system security camera to work!

IV. SOFTWARE IMPLEMENTATION

This Device is comprised of a series Python programming from searching to find the detection of motion to engendering as associate degree alert. Different Python files or libraries are used to control passive infrared sensors, which are used to detect motion. Python is also employed in a device that uses a camera to take pictures and processes the pictures. The Open CV library, which interfaces with Python, is used to process the acquired image after that.

4.1 Amazon AWS S3

Amazon Simple Storage Service (Amazon S3) is an object storage service that offers industry-leading scalability, data availability, security, and performance. Customers of all sizes and industries can store and protect any amount of data in virtually any use case, including Data lakes, cloud-native applications, and mobile apps. With affordable storage classes and easy-to-use management features, you can optimize costs, organize data, and configure fine-grained access controls to meet your specific business, organizational, and compliance needs.

4.2 Twilio

Twilio offers a complete solution for building telephony communications. Over 1 million developers and leading brands are already using Twilio to create innovative communication solutions. The Twilio Communications API enables voice, messaging, and video calling within the web and mobile apps. This allows developers to easily communicate between different apps

4.3 PHP

Sensors which are connected to cloud need some values and commands which are made in php, php is easy to use and widely accepted, also it is and opensource language. A PHP class script to actually process the image and save it to the database

4.4 Python

Python is an interpreted, object-oriented, high-level programming language with dynamic semantics. Its built-in high-level data structures, combined with dynamic typing and binding, make it very attractive not only for rapid application development but also for use as a script or glue language to wire together existing components. target.

4.5 Jupyter Notebook

An entire Jupyter Notebook is a JSON-based document containing input and output cells. These cells can contain code, text, math functions, and graphs. Jupyter Notebooks are saved with the extension format. ipynb. Jupyter(.ipynb) also provides the ability to convert documents into standard formats such as HTML, presentation slides, PDF, Markdown, and Python.

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4.6 Open CV

OpenCV is a huge open-source computer vision, machine learning, and image processing library that plays a big role in the real-time operations that are so critical in today's systems. With it, you can process images and videos to identify objects, faces, or someone's handwriting.

4.7 PCA Algorithm

A statistical approach used to reduce the number of variables in face recognition. This involves extracting the most relevant information (features) contained in images (faces). In this process, each image in the training set can be represented as a linear combination of weighted eigenvectors called eigenfaces.

These eigenvectors are obtained from the covariance matrix of the training image set, called basis functions. Weights are determined after selecting the set of most relevant eigenfaces. Recognition is performed by projecting a new image (test image) into a subspace spanning the edge surface. B. Euclidean distance.

In PCA, faces are represented as having an equal effect on input mixtures of weighted eigenvectors called eigenfaces. These eigenvectors are obtained from the covariance matrix of training images, called the underlying objective. The number of eigenfaces receiving will be the same as the number of frames in the training put. Her face on her own uses thecovariance matrix to better estimate the bit-to-bit similarity of her images among the images in our knowledge. These eigenvectors formed the new face space in which the image is displayed.

4.8 LDA Algorithm

Linear Discriminant Analysis (LDA) finds the vectors that best discriminate between classes in the underlying space. A between-class scattering matrix SB and a within-class scattering matrix SW are defined for all samples in all classes. The goal is to maximize SB while minimizing SW. That is, the ratio det|SB|/det|SW|. Maximize. This ratio is maximized when the column vector of the projection matrix is the eigenvector of (SW^-1 × SB). The linear discriminant analysis attempts to explicitly model the differences between data classes. LDA is a powerful face detection technique that overcomes the limitations of the principal component analysis technique by applying a linear discriminant criterion. This criterion attempts to maximize the ratio of the determinant of the between-class scattering matrix for projection samples to the determinant of the within-class scattering matrix for projection samples. Linear discriminant groups images of the same class and separates images of different classes from the images.

V. ARCHITECTURAL FLOW OF SYSTEM

The architectural flow of the device installs the system's processing and operation, which will cause the stealer to cease. This is how the work model operates:

1. The admin (owner of laptop) has the access of the system.
2. If some tries to hack the laptop, automatically surveillance starts and the person's face is scanned.
3. Since the database contains all the information of admin, the scanned face as well as the admin image will be compared.
4. If the image are identical, the system will work smoothly.
5. If image contradicts, immediately the alert message appear on the admin's mobile application, asking whether to deny or allow.
6. The mobile application will split up into two sections:
    a. The person sitting Infront of the laptop will be detected.
    b. The screen recording of the system the person is viewing will be captured.
7. Depends on the user, whether to deny or allow. If denied, the laptop will automatically shut down.
8. The laptop will function smoothly, if the administrator grants authorization.
9. This is how the entire system works.

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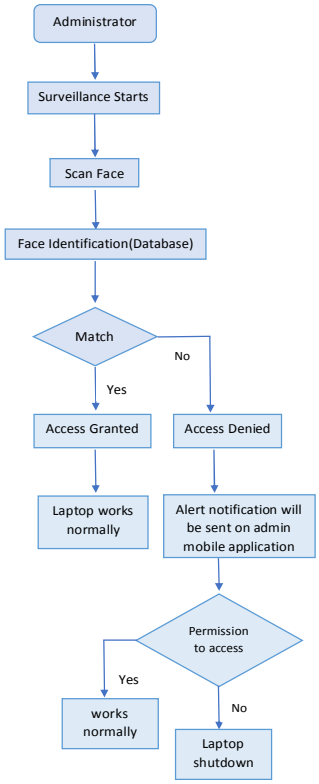

VI. CONCLUSION

A person can defend himself and his family with the help of the system in the project "Smart Security Camera using Machine Learning." We have created and put into place a security system that is economical. This system's proposed features include security and monitoring. Making a smart security system using a device's built-in camera is the theme's goal. The project can then be built using text input by looking through the directory/project structure and installing libraries/packages. whenever a security camera is triggered, upload pictures or videos. Directly SMS-send photos and videos to your smartphone. The security system can transmit TXT/MMS notifications, pictures, and video clips when the security camera is triggered since the security camera supports cloud services. The device provides us with accurate data for monitoring the area. Its inexpensive system and minimal reliance on human power.

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