SARVANTHARAYAMI:A REAL TIME FACE RECOGNITION VIA CCTV IP FOR CRISIS PREVENTION AND MISSING PERSON RECOVERY

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ABSTRACT

Sarvantharayami, it is a security purpose work although it may not prevent the real-time crisis from happening, but we can track the cases easily. As we, all know that "Prevention is better than cure." As it is very much familiar to our project the idea, where our project gives real-time or precaution of human crisis from their criminal history background stored in the database by using the technique of face recognition that is the most famous in the machine learning or computer vision concept. We are also working on finding the missing people by storing their information with image in the database. The motive of the project is to Convert our normal camera data into real-time insights for a safer and smarter world, thereby helping the society in solving many problems.

Keywords: Image Processing, OpenCV, Face recognition, Preventing proactive crisis, Missing person recovery, Security, Multi camera support, IP address configuration, Face extraction

I. INTRODUCTION

For our project, the core concept is to recognize faces from the video and images of the camera. Face recognition is a step further to face detection. In face detection, we only detect the location of the human face in an image but in face recognition, we make a system that can identify humans. Face recognition is a broad challenge of verifying or identifying people in pictures or videos.

We all know that nowadays cities are covered with CCTV cameras. In many places like the shopping mall, temples, schools, colleges, hotels, restaurants, museums, and even home and roads are surrounded by CCTV cameras.

This surveillance camera system is for security purposes but even though it will not prevent any real-time crisis or crime from happening. so we got an idea that, if can we check the human criminal background [like he is terrorist or he is an escaped prisoner or he is unauthorized person for that place] from CCTV camera on life and also if we can check that person or child is missing from CCTV camera in real-time then it helps a lot. If we get a 1% chance to save people/nation then we must try our level best.

Face recognizers generally take face images and find the important points such as the corner of the mouth, an eyebrow, eyes, nose, lips and other parts. Coordinates of these points are called facial-features points, there are 66 points. In this way, a different technique for finding feature points give different results.

II.EASE OF USE

A. User-Friendly Interface

One of the key goals of Eyes on the crowed is to make it accessible and simple to use for a wide range of people, including those without technical skills. The web programme has a simple, straightforward interface that effortlessly guides users through the process of adding the person to the website for recognition and person

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identification and their recovery, We provide the various forms of services to our users and different sectors are available in our work. The homepage includes simple instructions and in further we allow the users to use the dashboard and the IP configuration page easily as we have a simple design.

B. IP Address configuration

To simplify the user experience, we provide a direct page for the IP address configuration and there the users can configure and can verify the live footages of the camera and we can get the results of the footage on our dashboard where we have different sections like missing person, criminals, wanted persons and etc.,

C. Fast and Accurate Results

Sarvantharayami, rapidly captures the live footages from the camera whose IP address has been configured, the image processing with the help of open cv checks the video frame by frame and it recognises the required person who was uploaded in the system by the users and the results found will be displayed on the dashboard. We can easily distinguish between the different sectors on the dashboard, because we have separate display for the missing person, wanted person and criminals. So it is very accurate in displaying the results.

The main goal is to use cutting-edge facial recognition technology to strengthen security protocols and prevent future emergencies. Rapid identification and tracking of people of interest, such as known criminals or those who might pose a security risk and finding the missing people, is the project's main goal. The goal of the system is to shorten the time it takes for security staff and appropriate authorities to respond by facilitating early detection of suspicious activity through real-time monitoring and analysis.

It is intended to speed up the recovery of people who have been reported missing by integrating facial recognition technology with databases of missing persons. The project also hopes to support law enforcement investigations by providing precise facial recognition data that can be used to identify suspects and collect evidence. Facility security will be bolstered by the integration of access control systems, and ethical issues—such as public awareness and privacy protection—are essential to guaranteeing responsible technology use. The project is also helpful to the society to control the risk of terrorism and also to solve many problems.

III. RELATED WORK

The convergence of image processing and the face recognition techniques are well known and used effectively in our project. This section looks at the numerous studies and advances that have helped to integrate different domains, with a focus on IP address configuration and face detection.

A. Real time Face Detection using OpenCV

Pothuraju Chandrakala, Dr. B.Srinivas, Dr. M.Anil Kumar.[1] presents a method that uses OpenCV and Python to perform facial recognition. The paper proposes a method that can be used to detect the human face in real time. This technology can be used in various applications, such as smartphones and machines and real time applications.

Neel Ramakant Borkar, Sonia Kuwelkar [2] states that the task of Face Recognition Algorithm is to compare two images and determine if they belong to the same person. Face Recognition system is developed to detect and recognize a person that differ in characteristics. The Face Recognition Systems have evolved greatly during the last some decades. Because of this development there is increase in algorithmic complexity which takes long computation time and power. Many algorithms such as Principle Component Analysis, Linear Discriminant Analysis, Independent Component Analysis, Fuzzy Logic, Support Vector machine, Genetic algorithm have been used for face recognition systems.

M Shujah Islam Sameem1, Tehreem Qasim2, Khush Bakhat [10] gives a simple yet efficient face detection and recognition system is proposed in this paper which has the capability to recognize human faces in single as well as multiple face images in a database in real time. Preprocessing of the proposed frame work includes noise removal and hole filling in color images. After preprocessing, face detection is performed by using viola jones algorithm. Detected faces are cropped out of the input image to make computation fast. SURF features are extracted from the

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cropped image. For face matching, putative feature matching is carried out and outliers are removed using M-estimator Sample Consensus (MSAC) algorithm. Single as well as multiple person color images from class persons of Graz 01 dataset are used to evaluate the system.

B. Real time CCTV Face recognition

Ankita Markad, Sakshi Phadke, Parth Shah, Dr. Rajendra Pawar [4] work is to replace the time consuming and inefficient manual approach with a simpler and more efficient automated system, which will boost efficiency. While real-time CCTV face recognition models have showcased remarkable accuracy and speed, there are several key areas like robustness in challenging environments, scalability and bias or fairness that warrant further investigation and development.

Sumantu Powale, Abhijeet Dhanawade, Siddhesh Bagwe, Shreyas Kawale, Nitin L. Chutke, Satishkumar Chavan [7] uses the technique which can even recognize the person with the low-resolution CCTV camera footages. The mounted CCTV camera is at longer distance from subjects which results in capture of smaller i.e. lowresolution facial images. Even though, the better algorithms for person identification have been evolved, face recognition from such poor quality and smaller low resolution facial images is still a technological challenge. Person identification in such scenarios has numerous applications like surveillance in crowded area, identifying and locating criminals, authentication of evidences in CCTV footages, time attendance in premises, etc.

C. Human Tracking CCTV System Using IP-Cameras

Closed Circuit Television (CCTV) technology made a big impact on how crimes were solved. CCTV footages were used as a material to review crime scenes and were used to identify culprits who were then placed as one of those "wanted" persons.

CCTV systems only provide footages and lack the ability to analyse these footages. In this study, an IP camerabased CCTV system with the ability to detect, recognize and track a person of interest was proposed. Initial set-up used five IP cameras to capture the front and side angles of the person of interest. These were also used to identify the direction of heading. The Haar feature-based cascade classifier was used for face detection. The Karhunen-Loeve transform was used for face recognition. And optical flow was used for tracking which was implemented in processing.

Video footages are images displayed at a certain frame rate. Image processing algorithms can be employed to analyze video information. For instance, human faces can be detected using face detection algorithms. This capability can be incorporated in CCTV systems to give it intelligence to detect and recognize people. Moreover, an IP-CCTV could be a better option than ordinary CCTV systems because it provides better picture quality, advanced recording features and can connect to a larger number of cameras since it is based on internet protocol (IP).

IV. METHODOLOGY

The approach for producing Sarvantharayami consists of many essential steps: Problem statement, System design, Data collection, System installation and development, Testing. This section gives a full description of these procedures, assuring a detailed grasp of each one.

A. Problem Statement

Problem statement identification is an important stage in building of any system. The performance of any system is mainly depending on the problem statement we choose to work on. The clarity on the problem statement is much needed for the best outcome of the results and we can also match the results we got and the results we are expecting.

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1) Problem Statement by Observation

A comprehensive collection of the problems we see in our daily life and the observations made by us in our surroundings and the ideas we got based those observations are collectively taken to prepare the problem statement.

The observation procedure consisted of the following steps:

- There are several complaints we are observing in our day-to-day life and the problems related to our government sectors where they sometimes struggle to solve the cases related to criminals

- People are struggling to find the person who are missing from their locality, even the officers struggle to find the person and solve the case frequently.

- The officials and even the security persons of the public properties like malls, temples and bus stops are also struggling to find the thieves and sometimes other persons.

- We cannot check the CCTV camera footages every moment and find the required persons, so it makes delay in solving the cases.

B. System Design

Based on the problem statement we have chosen the system design has to be designed and all the features of the project are mentioned in the system design. Every feature of the project is included in the system design and are implemented to solve the problems that are mentioned in the problem statement.
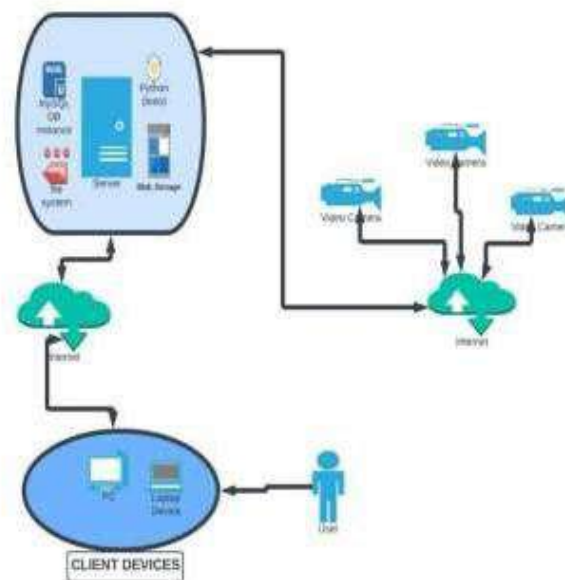

Fig 1: System design of the project showing its working and models of the system.

.The goal of models' classification is to split up the project into the small components and to resolve the problem that is identified in the beginning.

Establish the ease to solve the problem; by designing a good system design we can work on the project easily and can make our work easy. Because a good design of the system will contain all the required functionalities and the

work flow of the system. Every model designed contains the specific features and the functionalities of the system, with the help of those design we can develop those models very easily.
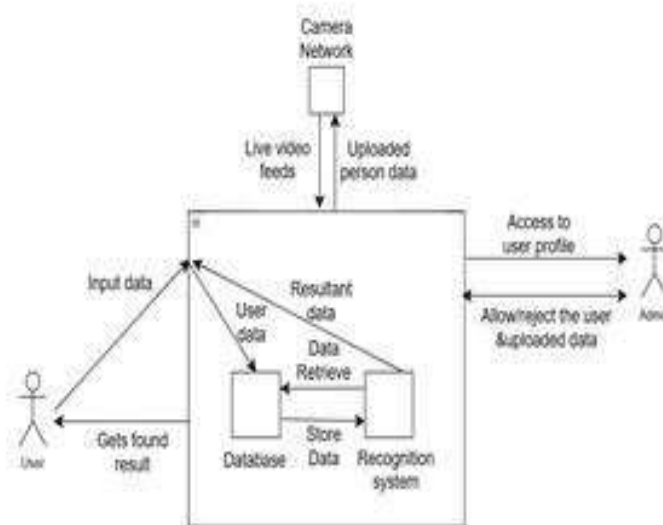

Fig 1: System architecture of the project showing the data flow in the proposed system

The architecture of the project shows the interaction of the users and the key components of the system and how connected with users. The main user can talk along with system through various functionalities provided by system and gets the efficient usage of the project. First through the registration of the person and they get the permission by the admin by the verification of the details they have at the time of registration. Once they uploaded, it gets pushed in the database of the project. To find the person they need to enter the IP address of the camera and need to configure the camera with the website. Once the camera search is activated, the live footages are received in the dashboard of the screen given to the live footages in the website. After getting the live footages, video is checked frame by frame and compared with the data in the database and looks for the match in the database. Once we get the desired output it will be displayed on the dashboard as found person.

C. Data Collection
The data collection is one of the most important factors while designing and developing of any system. Here for our project, we must collect the data of the problems and issues we are facing in our daily life based on the factor of criminal detection or the missing persons recovery.

We must get the details and data of the number of cases that are recorded in any areas or the number of cases that are recorded on any crisis or the issues, based on these events we can collect the data and work on it to resolve the problem by analyzing the data collected.

To collect the data, we can choose various aspects and different sources. Some of the sources are, Police records, Unsolved cases in the history, The missing persons of any community or the family. The collected data is processed and classified based on the requirements of the system and the design. The collected and processed data will be further taken for the consideration of the development and with the help of those data we can build the system according to these data.

Data plays an important role in the development of any systems, because data helps to know the number of requirements of the system and the optimization that needs to be done on the system development. Data also helps to find and decide the correct algorithm that is required for the development of the system and it also helps for

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testing the system based on the given data. With the data that we got we can design the test cases around that data and can make the system more efficient to use and make the system more optimized.

D. System Implementation.

The implementation of Sarvantharayami encompasses a comprehensive integration of face recognition, image processing models within a user-friendly web application framework. The system is built using Flask, a lightweight and versatile web framework for Python, enabling seamless development and deployment of the application. The primary image processing models, based on OpenCV, were developed using the various library. There are many difficulties related to human facial recognition. The beneficiaries of the project are the General public, Emergency response teams, Missing person's families, Government agencies and authorities, private security agencies and watchdog organizations, facility (home or apartment) owners and managers, Communities in high-risk areas. Ultimately, the project's positive impact extends to communities, educational institutions, and regions prone to higher risks, fostering safer living and learning environments for all. The fact that human faces are all relatively similar, yet produce varying facial expressions makes it more difficult to generalize an algorithm. Except in the case of identical twins, the face is arguably a person's most unique physical characteristic. Each face has certain distinguishable facial features. These are the peaks and the valleys that make up the different facial features. Lighting conditions and the angle from which the facial image is taken are other factors to consider. Taking all this into account, it is important to note that humans themselves can distinguish a multitude of different faces quickly and with high accuracy.

The facial recognition software is based on the ability to first recognize faces, which are a technological feat, and then measure the various features of each face. The planned testing approach is to have a database of numerous faces that is used to test the recognition algorithm against certain particular faces. The variables that need to be tested for a face against the database include the size and condition variations, illumination changes, different facial expressions, and the angle from which the image is taken. The approach is like what may be done in real-world applications, where a facial image is acquired, but not necessarily in ideal conditions and needs to be matched against a database of ideal facial images. This algorithm could be used such as surveillance and security systems for, many applications. Face recognition is a widespread technology used for Access Control.

The task is stated as follows, there is a group of authorized people, which a recognition system must accept. All the other people are unauthorized or 'alien' and should be rejected. Security identity, whether in the physical or virtual world, has always been a business-critical issue for the world's leading organizations. Whether access to property, to valuable IP on corporate networks, or simply proving your identity-adequate and robust security is essential. Three main tasks of face recognition may be named:

"Document control", "access control", and "database retrieval". The term "document control" means the verification of a human by comparing his/her actual camera image with a document photo. Access control is the most investigated task in the field. Such systems compare the portrait of a tested person with photos of people who have access permissions to jointly used objects. The last arises when it is necessary to determine the name and other information about a person just based on his/her one casual photo. Because of great difference between the tasks, there is not a universal approach or algorithm for face recognition.

To implement the system, we used some of the major and the most prominent technologies in the current IT trends. With the help of these technologies, we can develop the system easily and very prominently, as they are very easy to use and they are useful to the developers to reduce their work, and it helps them to carry out the development work more effectively in less time.

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Fig 2: Index Page

Some of the prominent technologies used in the development are, Frontend Development: As Shown in Fig 2 A userfriendly interface is created for data input, such as symptom entry via a questionnaire. The frontend is built with HTML, CSS, and JavaScript to provide a responsive and straightforward user experience. The design prioritises usability, allowing users to easily input symptoms and receive results.

Backend Development: The main backend code is using the python as main language and are implemented on the server side with Flask, a lightweight Python web framework. The backend is responsible for data processing, model inference, and communication with the frontend. The Flask framework was chosen because it is simple and excellent at managing web requests and responses. It supports extensions that enhance functionality, making it suitable for both small-scale projects and larger applications. Flask's extensive documentation and active community provide ample resources for learning and troubleshooting, ensuring developers can efficiently create robust web solutions tailored to their specific needs.

E. Software Installation.
The software required for the development are identified and are installed in the system and some required packages for the backend development are also installed to ease the working of backend development.

Some of the most important packages includes, cmake, dlib, face_recognition_model, Flask, Flask-SQLAlchemy, OpenCV-python, colorama, jsonschema, Werkzeug, MarkupSafe, referencing, blinker, pillow, protobuf, typing_extensions and other packages are used. These packages and the software the development of the system became even more easier and helps to reduce the work of the developer with their inbuilt features.

The two important tools and libraries used prominently in the system development are CMake and dLIB. CMake is a tool that is a open source, cross-platform tool that is used to build the C++ programs and to build test and package software designing. The dLIB is a library used for face detection, OpenCV (cv2) for image manipulation and matplotlib for visualization.

The face recognition models are also used in the system development as the Face recognition models are regular convolutional neural networks and they are responsible to represent faces as vectors. We expect that a face pair of same people should be more similar than a face pair of different persons and the Flask_SQLAlchemy which enables developers to perform tasks like defining models, creating queries, and easily managing database migrations and supports multiple database management systems such as SQLite, MySQL, and PostgreSQL.

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The packages related to face recognition and the image processing are installed to ease the work of the development and to get the accurate results from the system. The packages and the software are meant to reduce the work and to make the system more efficient to practice. Thus, the use of these packages is important for the development.

CONCLUSION

In this study, we present Sarvantharayami, a web application that is helpful to prevent the proactive crisis and the work is also helpful to find and recover the missing person. we use the camera's IP Address to configure the camera to our website, so that we can get the live footage of the camera. We can configure any number of the cameras to our website. To work with these cameras, we must connect the cameras and the system in which we are working/using the website, with the matching IP Address we can get the live footages.

It gives and accurate result by checking the video frame by frame and it recognizes the face with the help of the image processing with the OpenCV, where we can expect the most accuracy in the results. We get the footages by configuring the IP addresses of the CCTV camera that needs to be monitored and the results after recognizing the face is displayed on the dashboard. For the developed system we must give the data to the system so that it can process the data and gives the required results to us.

When we upload any person details to search and the IP address that we have configured are stored in the database. Once we activate the camera to search, the session will be triggered to start searching, once the search is activated, we get the live footages in specified layout. But, we need not to watch those footages regularly. In the system, we have a dedicated dashboard to recognize and display the result of the person found or if not found. Once we get the result, we can delete the details of person we found from the database.

It is intended to speed up the recovery of people who have been reported missing by integrating facial recognition technology with databases of missing persons. The project also hopes to support law enforcement investigations by providing precise facial recognition data that can be used to identify suspects and collect evidence. Facility security will be bolstered by the integration of access control systems, and ethical issues—such as public awareness and privacy protection—are essential to guaranteeing responsible technology use. The project is also helpful to the society to control the risk of terrorism and to solve many problems.

FUTUREENHANCEMENT

This work can be further updated or we can add some more features into the system. We can integrate the google maps with the system which helps us to know the exact location where the person was found, it works with the help of IP address in collaboration with the map coordinates. By doing this update in the system we can increase the efficiency of the system and also it will be easy to find the person.

Along with this we can also add the feature that notifies about the found person. In this the idea is give the information about the person found to the nearby police station where he/she was found. In this process, the use of both the Incorporated maps and the notification feature comes in to the picture. With the help of the GPS and maps we can identify the nearby police station and inform them about the person.

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