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Automatic Theft Detection System At Smart Home Using AI

Mohammed Sherooq Ali[1,*], Sreeju A[2], Shifa Reem[3], Jasna[4], Neethu Mathew[5]

[1234] Department of Computer Science Engineering, Eranad Knowledge City Technical Campus(EKCTC), Manjeri, malappuram, Kerala-676122, India
[5] Department of Computer Science Engineering, Eranad Knowledge City Technical Campus(EKCTC), manjeri, malappuram, Kerala-676122, India

*Corresponding Author email: sherooqmohammed123@gmail.com

ABSTRACT

These days there is a huge rise in number of burglary. Due to this security is given high preference and most of the people choose the idea of installation of CCTV. The human monitoring is very inconvenient and requires the need of work force and there is always a chance for human errors, complete focus throughout is not possible pressurizing the need of computerized monitoring with high accuracy. In order to reduce human effort and to ensure better accuracy we propose an automatic theft detection system, that can detect theft and inform authorities automatically.

In this research, we present a complete automatic theft detection system that can detect presence of intruder in the premises. This system captures the image of any person getting into the premises and then extracts various facial parts such as their eyes, nose, mouth. If authenticated as criminal from the database of police then an alert message is sent to the owner and the police. The main concept is to create a safe environment for people to live in.

Keywords – Face recognition, Hog algorithm , Haar cascade, surveillance, intrusion detection.

1. INTRODUCTION

Number of thefts are increasing day by day due to poverty and other issues, this gives rise to the necessity of proper surveillance. This increase makes it difficult to leave in peace ,it is not only possession loss. Robbery leaves the victims in a serious psychological distress. As a person our lives are at risk as we never know whether their next target is us or not. Security and surveillance is therefore a prime concern of an individual. Installation of CCTV helps in surveillance. In recent times the use of CCTV for surveillance has developed to a remarkable level. The CCTV allows use of video cameras to monitor the property and transmit the signal to a monitor[4][9]. There is a high need for residential CCTV than ever before as theft rates are increasing and most of these incidents take place during working hours whilst occupiers are away from their homes. A proper surveillance system provides people a better sense of security and peace of mind, but making it manual makes surveillance unfeasible .A human has to be there who frequently observes these screens and identify the intruder. Employing a person just for surveillance is not a recommended idea. That is where an automatic theft detection system gets a higher value.

The theft detection system can easily find the theft and can easily inform the user and police. The police stores the details of the criminals in the database along with his/her features segmented from the images. Segments include many slices such as their eyes, hair, lips, nose etc. Every time a person enters a premise, the system tracks the person. Human face detection is the prime requirements for smart CCTV system[3]. There are several methods to capture image, The captured image is compared with the database of police. If the person is a relative then no notification is sent. However, if it is a criminal, a message is sent to the local police station and the owner. If the person doesn't belong to the above two categories then footage of the person is collected and a notification is sent to the house owner. The aim of this paper is to create a safe environment for people to leave in.

2. LITERATURE SURVEY

M.T.Bhatti et al.[1] proposed detection of weapons using Deep Learning. CNN based object detector is used for detecting weapons through real time CCTV.

M.Grega et al.[2] automated a method of identifying the harmful weapons like knives and firearms through CCTV and produce Alert message regarding the same.

H. Gupta and P. Chaudhary [3] proposed an detection technique in CCTV for face parts. The paper provides technique for facial detection with high accuracy and less computation time.

A.B.K.H et al.[4] proposed smart cctv surveillance system for intrusion detection with Live Streaming. According to the paper if the intruder's face is not present in the database SMS and Email will be sent to the user with the intruder's face. The user will also have the choice of live stream the incidents.

K. B. Lee[5] proposed an application for detecting object & tracking system that can obtain moving information of target objects. The object tracking algorithm and deep learning is combined for this process.

Meenal et al.[6]The paper proposed a method for electricity theft detection system ,which can detect theft automatically if tapping is done in the transmission line or when additional load is introduced with the help of current transformer .

N.Mucheli et al.[7] proposed smart theft detection system. The system is hidden in electric meters, an automatic message and e-mail will be sent to concerned authorities whenever there is a difference between current crosses threshold value along with location and image of the area.

Pandya et al.[8] the paper presents a method to prevent smart home theft by providing notification of ongoing intrusion. The technique eliminates the need of large amounts of memory for storing data and DVR.

S.Shammi et al.[9] proposed an automated way of vehicle theft detection in parking facilities with help of cctv video stream. Canny edge detection is used for object classification and detecting of complex videos.

T.Sikandar[10] review on human motion detection technique for ATM-CCTV surveillance system. The paper comes to a conclusion that for successful detection of human in ATM requires a combination of several algorithms and that may work better than the existing.

H.Turtiainen et al.[11] came up with the first computer vision object detectors, the goal was to accurately identify CCTV cameras in videos and frames. To build the system several state of the art computer vision frameworks and backbones were used.

VirSinghender et al.[12] proposed a real-time anomaly recognition through cctv using neural network. To handle complexity both normal and anomalies are considered and that will maximize accuracy.

3. ARCHITECTURE

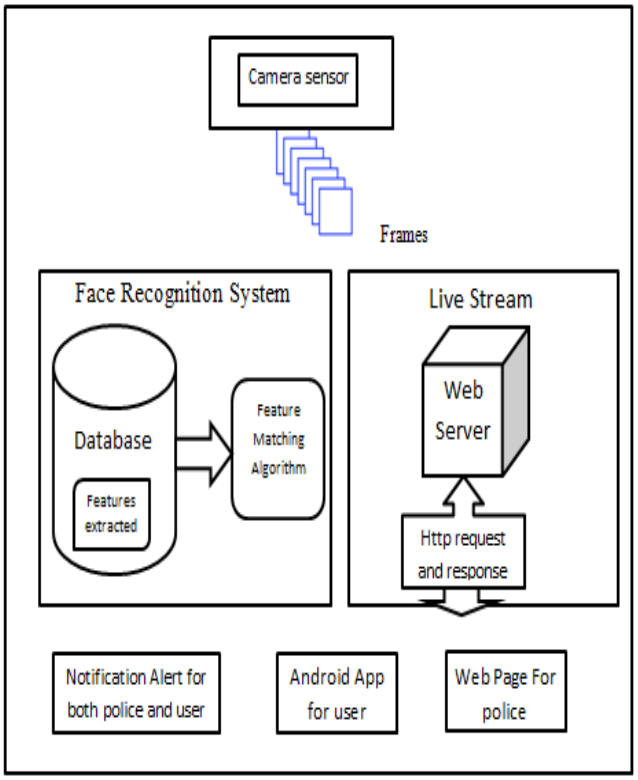

Figure.1 System Architecture

As in the Figure 1 Architecture system consists of CCTV capturing sensor for capturing video in the formation of frame. When a criminal face is recognized, face identification system database, which is extracted based on the features and algorithms that verify for the related traits. A warning notification will be sent to cops and user's (owners). A live telecast of these videos will be broadcast to an external server at the same time. The live telecast will be send to both app for the user and a web page notification will be sending to the police from the web-server.

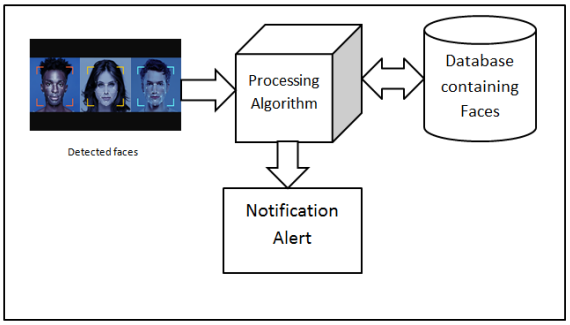

Figure 2 Face Identification Structure

Face identification structure is shown in the figure 2. The working of the algorithm is to find faces with help of histogram of oriented gradients(HOG) algorithm features and we also uses random forest algorithm in machine learning to find the face signs, then we compares these coded formed cctv video and then compare the detected faces with the faces in the database. If a criminal face is discovered, then an alert will be produced on the user's phone and a notification will be sent to the police station through the web-site. If a user or relative is found on camera then there will no issues. If an unknown person is caught on camera then first inform the user and if needed user can manually forward the message to the police. This system can find one or more faces at a time.

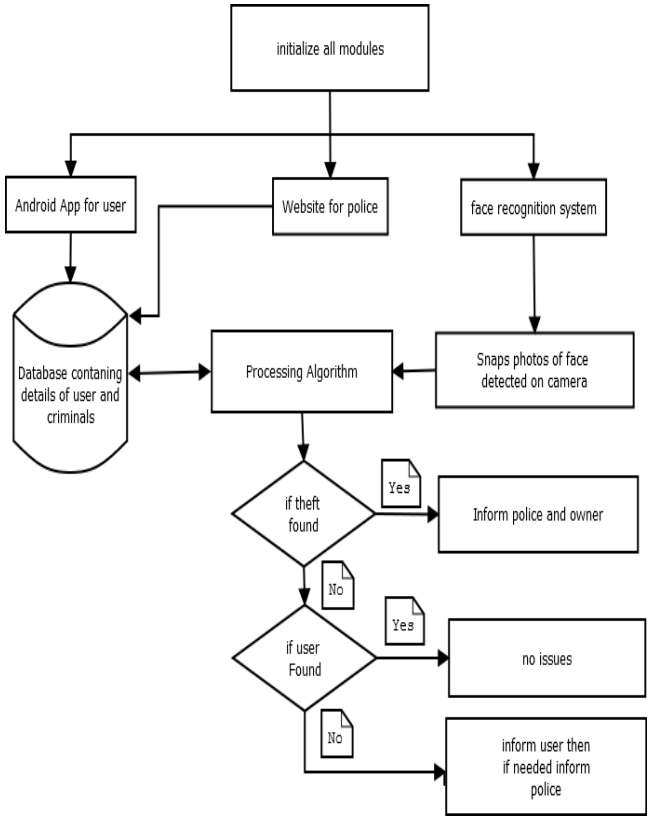

Figure 3 Flow Chart of System Architecture

In this figure 3 here we initialize all the module. The database has contain all faces that we entered and the details of the person. And we process the algorithm by comparing the database and snaped images on the camera. Here we have 3 conditions that are :

- If a user/relative are detected on camera then there will no be any issues.
- If theft is found on the camera then immediately send a notification to the user and police.
- If a criminal or an unknown person is found on camera then it immediately informs the user and if the user has any doubts then the user can inform the police.

4. METHODOLOGY

This system we are going to introduce here the process of detecting thieves and matching processes using machine learning technology. At the starting time, the CCTV camera start recording the video and it will transform into image format. After detecting the face for processing here we using face recognition algorithm. Through the face recognition algorithm we compare the faces with the database whether the face is matching with current face that recorded through the cctv and the face in the database. Whenever the faces matches it produces alarm according to the three conditions that already explained in the figure3. The detected images in the cctv will forward to the user as in the form of images. Only criminal is found then only the system send to police.

Here the faces / images are captured using laptop camera and we can also CCTV camera also. The unknown faces / the new face that captured on camera that can recognized using histogram of oriented gradients(HOG) features and it also record the face or image that detect on the laptop or cctv camera. Using the face identification system we can compare both images that are the person founded on the camera and the person's face that already stored in the database. After the detection of the start processing, then, if a relative or unknown person is found then an notification will be forwarded to the user's phone with images that containing the images of unknown or relative. If a criminal is found, then a notification is send to both police and user. At the same time the user can lively broadcast the images of the criminal through the android phone were we created an application for the user for live broadcast. Here there is an issue that both systems want to connect same local network.

The component and their services:

4.1. Histogram of oriented gradients(HOG) Feature

The HOG feature is used for extracting features from images. It focus on the structure of the object. It can detect any person face at the range of CCCV camera. it count the gradient orientation are calculated in localized portions of an image. It is made up of using gradient and orientation of the pixel values. In here the complete image is break down into small sectors and for each

sectors the gradient and orientation will be calculated. It is very helpful for object detection and recognition. The algorithm is fed into classification algorithm and produce good results. In here we use Support vector machine (SVM) algorithm for image classification. We also random forest method for calculation of features of the faces. Hence the frame work is created.

4.2. Face Recognition

Face recognition is the way for detecting an person details through faces. It can be used to identify peoples at real time. In here we using that is faces is matched with the faces in the database. Then we mark as "theft detected" or "relative or unknown person is detected" for theft detected we red color around the image and for relative detected we give green color around the image. Whenever a face is detected then we recognize the face and compare with the database that we have the details of the user and criminals. If theft is found then we inform the user and police with the red color and mark as theft is detected.

Face detection is an artificial intelligence based computer system that used to identify human face in digital images. In here face detection is applied for various specializations like security, law enforcement and personal safety that deliver monitoring and tracking of people at real-time. For facial recognition we use rainforest algorithm and we also uses machine learning algorithms also which include other non-face object like building, landscapes and other body parts like body shape, hands and feet's. In here it automatically start finding for human eyes it is the one of the easiest thing to find. It also find eyebrows, nose, mouth and the iris. if the system found any facial sign it also check for another things of that detected person's. if a person is found then compare with database and we sent the images of that person to the user with a label that describe about criminal or not. If some criminal come with mask or any other thing the user can check and if needed can send to the police and the police receive with an label that a theft is detected.

In figure 4, this describe about the facial encoding of an human face. In here we are given 97 facial encoding to the human face. We can also use multiple human faces of that person because here we are giving individual encrypting and through this we easily find the persons.

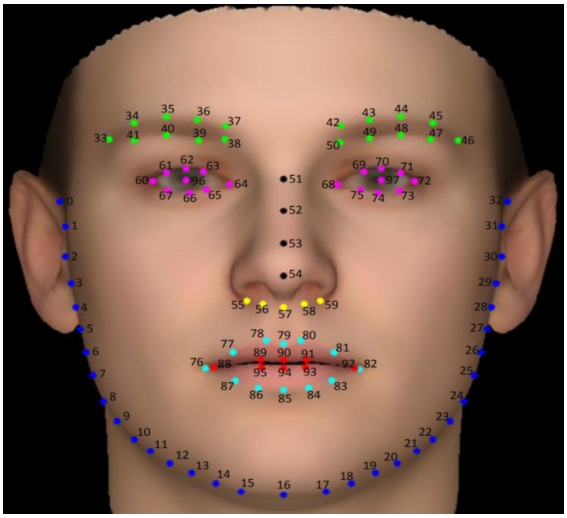

Figure 4 Facial Encoding

4.3. Notification Message Alert System

In this notification alert system, if relative or unknown is detected in the camera the we can immediately inform user through an android application. Also in the android app will get an image of a person, date, time that can be viewed on the view notification side and we can send the unknown person detail to police through the view notification tab. If a criminal is found in the camera range the alert notification will send to both police and owner. the police can view the details through the webpage. On the page, there is a notification tab in that we can see the image of the intruder, time, date. The system uses a local host network for connecting the android app. Here we have two modules. the webpage that will be handled by cops and the android app that will be controlled by the user. In the webpage, the police have the facility to add criminal and manage criminal and also view the notification and in the android app, the user has the facility to relative and see the notification. if a criminal face is detected on camera immediately the message will be forwarded to the webpage for cops and android phone for the user. In this, both police and user can see the face and details of the criminal through the notification tab. If an unknown person is found on camera then firstly it informs the user and the user can see through the notification page and if the user needed can forward the message to the police. If a user is found in the camera then no problem but if needed we can see the person through the notification page.

4.4. Database

Here we are using SQLyog software for database. There is 5 table in database that are criminal, login,

notification, user and relatives. At the notification table there are 3 types of notification that are pending, forwarded and relative. The pending means if an unknown person is found on the camera it will notify at user's app and the user can manually forward it. If the user is not forward then it will be pending. Next forward that means the criminal is found. The last one is relative which means the relatives or user is found.

5. RESULTS AND ANALYSIS

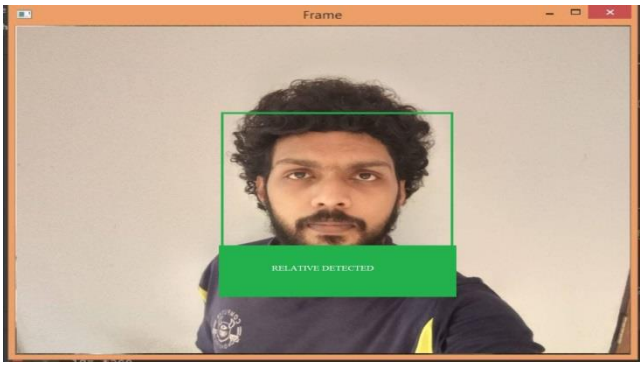

Figure 5 Relative Detected Face

In Figure 5, on the running the cam.py the frame will be loaded in the user android application label define that the relative is detected labeled as in green color. It can easily find the relative and user because we already stored the details and images of the relative and user in the database.

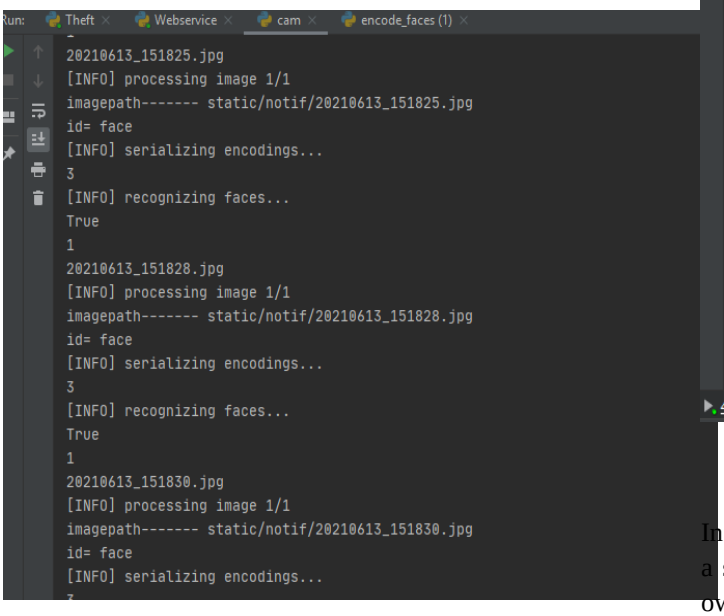

Figure 6 Result of Relative Face Detected

Figure 6, while running the pycharm like this way we will get the output that relative face is detected in the camera.

Figure 7 Theft Face Detected

In figure 7, Here, the frame can show a relative/user, theft and unknown person. Here theft face is marked and named as theft detected. At the same time, criminal or unknown face Is detected then the notification will be sent as soon as possible.

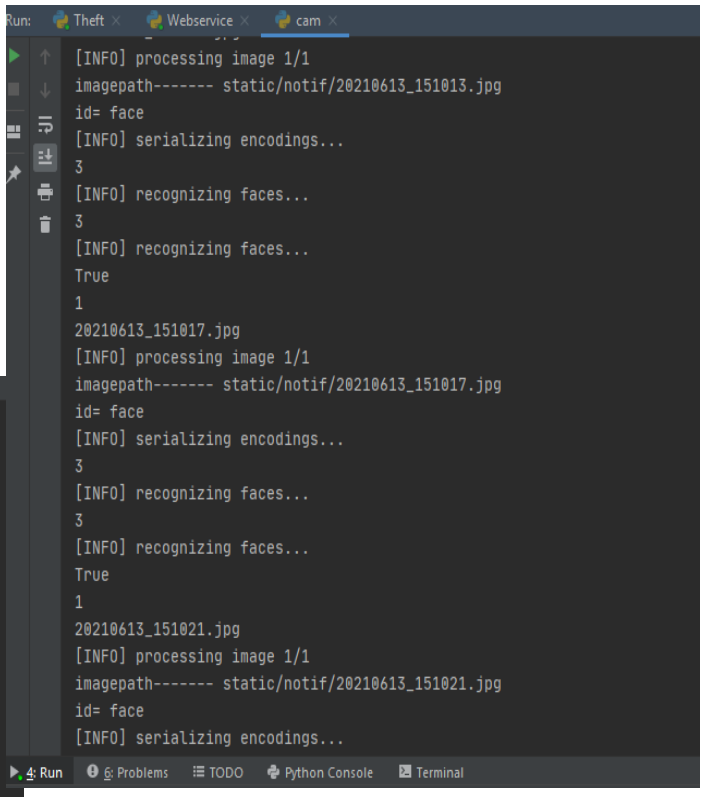

Figure 8 Result Of Theft Detected

In figure 8, if a criminal is detected the notification with a snapshot of the criminal is sent to both criminal and owner.

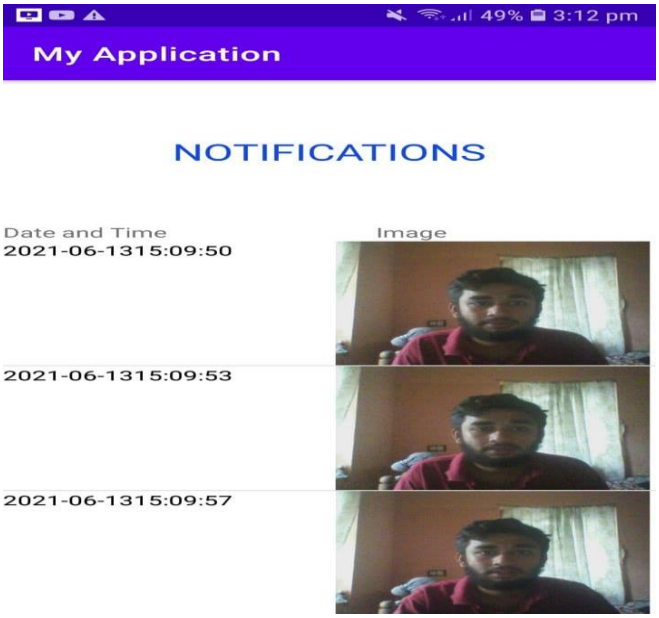

Figure 9 Notification In The Mobile app

In figure 9 the visual of notification from the users android phone

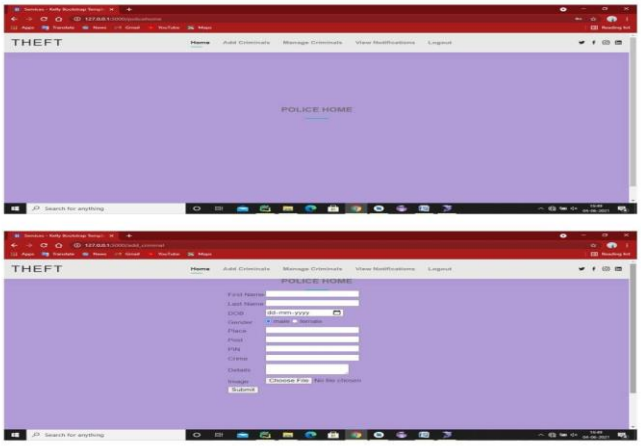

Figure 10 Webpage Of Police

In the figure 10 this a website for the police. In this, the police can add criminal, manage criminal and view notification of the criminal.

In the figure 11 this is an application for the users. In this, the user can add relatives, manage relatives and also notify the relative, criminal and unknown person that detected on the camera.

Figure 11 Home Page Of App

In figure 12, this is an part of android application. It is the starting process to enter into the app because the all system is connected into same network. So entering IP address only we can access the application.

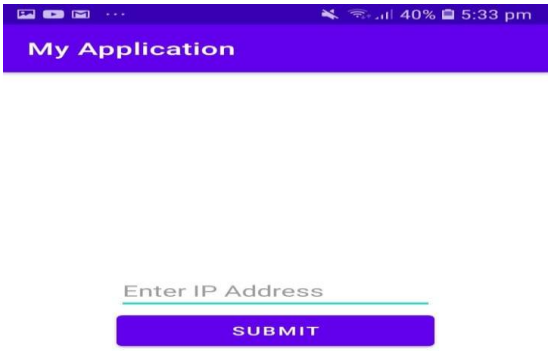

Figure 12 Android App For Login

6. CONCLUSION

Though a significant amount of research has been done in the past to solve security problems ,it will remain challenging due to increased complexity . In this paper we have managed to create an automatic theft detection system. Our objective was to detect the face of the intruder with optimal time and high accuracy, extract the features and compare with the one in the database. If the face match with any image present in the criminal database, an alert message sent to the nearby police station and the owner.

Users using this system need not worry about supervising the camera all the time, instead the system will inform the users about the activities happening.

Proper detection of depends upon certain factors such as brightness and they play a major part in determining the accuracy of the system. It can be usefull in banks, museums and streets at nights.

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