Hawk- Eye

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Abstract – Child abduction has become a major concern among society. Mostly this occurs within the crowded public areas. When an incident of such nature occurs, the most popular mechanism to find the missing child is report to the nearest security post or the police. Either of these law enforcement authorities or agencies uses traditional methods to locate the missing child, which may take hours. It might make risk of that child life. To avoid this matter research groups implemented The Hawk Eye Automatic Facial Recognition System. In this work Hawk Eye implement to use Closed Circuit Television Video (CCTV) which is an important tool for crime prevention and investigation. Hawk Eye use four algorithms; there are two searching algorithms, one for search parent face through the database and the other one for search child from the CCTV, face detection algorithm use to capture the persons who entrance the shopping mall, Storing algorithm for store videos to the database, This Hawk Eye Automatic Facial Recognition System can be used to minimize the rate of children abduction in public locations.

Keywords: Missing, CCTV, Algorithms, Automatic Facial Recognition

I. INTRODUCTION
Child abduction is the abduction or kidnapping of a child by older persons. There are several distinct forms of child abduction. A stranger removes criminal purposes, for child sexual abuse, torture or murder for extortion. As research group see 75% of the victims of child abduction are girls [1].

According to the National Centers for Missing and Exploited Children, every year, more than 58,000 are taken by non-relatives with primarily sexual motives, 115 reported abductions represent case in which strangers abduct and kill children, hold them for ransom, or take them with the intention to keep[2].

In January, 1394 kidnapping took place in 2014, While this indicated a substantial purported decrease the 1698 incidents recorded in 2013, numbers are still far higher than 2007[3].

The terrifying prospect of abduction fills the mind of parents everywhere. They must avoid to taking their children to shopping mall, carnivals and seasonal fairs etc. During the rush hours or the holiday seasons parents missing their children in shopping mall. When an incident of such nature occurs, the most popular mechanism to find the missing child is reporting the nearest security post or the police. Either of these low enforcement authorities or agencies uses traditional methods to locate the missing child, which may take hours. That time period might take child’s life to danger.

To avoid this matter nowadays use Closed Circuit Video (CCTV). CCTV is undergoing immense changes such as, technology platform is moving from to digital, the number and variety of purposes for which it is installed has increased, the number of users interacting with CCTV has increased. CCTV, the mechanisms to find a missing child at a shopping mall should not take hours. They use surveillance cameras face database which gives encourage to recognition from real life surveillance images. But it is not suitable for exploring each individual illumination or expressions. Hawk Eye Automatic Facial Recognition System is more perfect system for problem of the child abduction.

Facial Recognition is a type of biometric software application that can identify a specific individual in digital image by analyzing and comparing patterns. Face recognition system are commonly used for security purposes but are increasingly being used in a variety of other application such as Kinect motion gaming system. Facial recognition systems based on face prints can quickly and accurately identify target individuals when the conditions are favorable [4].

The Hawk Eye system is working as; the whole shopping mall is placing the CCTV cameras. CCTV in the entrance of the shopping mall detects all the faces by face detection algorithms. This video store to facial database through the storing algorithm. If the parent misses their child have to inform to the control room. In the control room admin scan the parent face through the web camera and search in the facial database by using searching algorithm. After the finding the image of the missing child sends a notification to the security guard via android app to security guard’s phone. There can be a situation child has been kidnapped...
Disadvantages are not suitable for exploring each have static images and face database. Recognition from real life surveillance images, they and illumination etc. Advantages are encouraged to images in their database vary in resolution, pose, and individual illumination or expression and all CCTV cameras face database. Video surveillance equipment of varying quality was used for database acquisition and Face database and Principal Component Analysis technologies they used. Face images in their database vary in resolution, pose, and illumination etc. Advantages are encouraged to recognition from real life surveillance images, they have static images and face database. Disadvantages are not suitable for exploring each individual illumination or expression and all CCTV forces to one point and do not provide notification. System with huge amount of data processing obviously does produce unexpected system crashes while running the system. Hawk eye provides an embedded system to the main system which will decrease the memory usage otherwise causes unwanted system crashes [7].

J.D.Woodward et al., discusses about the Biometrics. A more expansive definition of biometrics is any automatically measurable, robust, distinctive physical characteristic or personal trait that can be used to identify an individual or verify the claimed identity of an individual. Biometric facial recognition has the potential to provide significant benefits to society. They used facial expression analysis to do the research. Advantages are attempted to identify a person or verify a person’s claimed identity and use of a large database. Disadvantages are the face can be obstructed by hair, sunglasses, hats, scarves etc. Also changes in lighting or facial expressions can throw off the device, faces change overtime. Probability of tracking a moving object has its complications such as angle of the face shown to the camera will be changed time to time. Hawk eye takes video feed into static images by using image frames and matching them with the given image [8].

John D, et al deliberate 3D face recognition. Face recognition is a natural human ability and widely accepted identification and authentication method. Face recognition methodology has shifted from a purely 2D image based approach to the use of 3D facial shape. 3D facial expression databases, Action units, facial action coding system are technologies they used. Advantages are analyzing the facial behavior in a complete 3D space. Disadvantages are speed is limited and do not have algorithmic biometrics and static images. Huge amount of video feeds need to be compared with the input images to solve the problem accurate and fast algorithm should be implemented within the system. Hawk eye provides the complete algorithmic solution [9].

H.U. Keval and M. A. Sasse converse can research group 1D from CCTV: image quality in digital CCTV and face identification performance. They found that the number of correct identifications decreased by 12 as MPEG-4 quality decreased from 92 to 32 Kbps, and by 4 as Wavelet video quality decreased from 92 to 32 Kbps. To achieve reliable and effective face identification they recommend that MPEG-4 CCTV systems should be used over Wavelet, and video quality should not be lowered during the video compression. They used MPEG-4 and Wavelet digital CCTV.
Advantages are it gives quality level images and do not have significant impact on task performance. Disadvantages are it difficult identifies some ethnicities. The Hawk eye can identify the correct and difficult ethnicities by using high quality CCTV cameras [10].

T. Ahonene et al., discusses Face Description with local Binary Patterns: Application to face recognition. This paper presents efficient facial image representation based on Local Binary Pattern (LBP). The image is divided into several regions. LBP operator has been widely used in different applications such as texture classification, image retrieval etc. They show that facial images can be seen as a composition of micropatterns such as flat areas, spots, lines and edges which can be will described by LBP. They used Local Binary Pattern as the technology. Advantages are computational efficiency and do not need gray-scale normalization. Disadvantages are it changes the appearance of the image. In the Hawk Eye, according use to high methods the appearance of the images will not change [11].

R. Brunelli and T. A. Poggio deliberate Face Recognition: Features versus Templates. Investigated performance of automatic techniques for face recognition from images of frontal views. Two different approaches have been compared in terms of two simple new algorithms that developed and implemented. Geometric Feature-Based Matching, Template Matching are the technologies they used. Advantages are allowed a higher recognition speed and smaller memory requirements. And it can be possible to extract them more precisely. Disadvantages are does not provide a high degree of accuracy and required considerable computational time. The Hawk Eye provides a high degree of accuracy and does not required considerable computational time [12].

B. Fasel and J. Luettin converse Automatic Facial Expression Analysis: A survey. Facial expression analysis system attempt to map facial expressions directly into basic emotional categories. Classify facial actions prior to any interpretation attempts. Automatic facial expression interpretation with regard to the integration of other communication channels such as voice and gestures. Technologies that they were used judgment-based approaches, sign-based approaches. Advantages are more reliable for classify and inherently multi-disciplinary field /Map facial expressions directly. Disadvantages are it cannot detect directly. The Hawk Eye will detect faces directly for facial expression [13].

A. Lanitis and C. J Taylor discuss An Automatic Face Identification using Flexible Appearance Models. The grey-level appearance models are controlled by a small number of parameter which can be used to code the overall appearance of a face for image compression and classification purpose. Performed experiments using face images which display considerable variability in 3D viewpoint. Technologies are Shape and Gray-Level Modeling and Active Shape Models. Advantages are 3S orientation and lighting are minimized and identification information available in face is fully exploited. Disadvantages are errors may be caused by failure of the classification algorithm. The Hawk eye, errors will not caused by the failure of the classification algorithm because system classify the algorithm perfectly [14].

M. S. Bartlett et al., deliberate Automatic Recognition of Facial Actions in Spontaneous Expressions. Spontaneous facial expressions differ from posed expression in both which muscle are moved in the dynamics of the movements. The system automatically detects frontal faces in the video stream and coded each frame with respect to 20 action units. Face Action Coding System they used as the technology. Advantages are increase the effectiveness and because of the 3D alignment of face, spontaneous behavior considerably improved. Disadvantages are difficult to developing detectors. In hawk eye system easy to develop detectors [15].

L.Lenc and K. Pavel converse Automatic Face Recognition System. This is a tool-kit designed for face detection and automatic recognition from real-world photographs. Recognizing people in ordinary photographs that are not acquired in controlled environment. The face of these photographs is often rotated, titled or occluded and the pose is not uniform. Viola-jones algorithm, g++ compiler, Qt library, OpenCV library are the technologies they used. Advantages are Automatic Face Recognition System is very speed than the other systems. Disadvantages are number of incorrectly detected face occurs it difficult to recognition photographs. In the Hawk Eye system detect only the correct photograph that the missing child it easy to recognition [16].

A.M Burton et al., discusses Face Recognition in poor-quality Video. Security surveillance system often produces poor-quality video and it is problem in gathering forensic evidence. The ability of subjects to identify target people captured by a commercially available video security device. Each subject contributed only 10 data points, one for each familiar target person. They used technology as the high quality digital camera.
Advantage is the accuracy was high. Disadvantages are recognition in any condition could be affected by prior exposure to a target person in different condition. The Hawk eye can recognize person in any different condition [17].

F. Ahmad et al., deliberate Image- based Face Detection and Recognition. Face recognition from image or video is a popular topic in biometrics. In public places usually have surveillance cameras for video capture and these cameras have significant value for security purpose. Important role in surveillance system as it does not need the object’s cooperation. They used boosting algorithm, Adaboost, Local Binary Pattern (LBP) as the technologies. Advantages are face based identification over other biometrics are uniqueness and acceptance. Disadvantages are face detection in computer vision and also accuracy and speed of identification is main issues. The Hawk eye is easy to detect faces in computer vision and identification speed and accuracy is high [18].

E. Hjelmas and B. Lee Low converse Face Detection: A Survey. In this research paper present a comprehensive and critical survey of face detection algorithms. Face detection is a first step in face recognition systems. A wide variety of techniques have been implemented simple edge based algorithms to composite high level approaches utilizing advanced pattern recognition methods. They used feature based and image based technical approaches. Advantages are showing good detection results computationally efficient. Disadvantages are it difficult problem to detect such dynamic objects and considering the changes in faces over time. The Hawk eye can detect dynamic object more than easily [19].

P. S. Aleksic and A. K. Katsaggelos discuss Automatic Facial Expression Recognition Using Facial Animation Parameters and Multistream Hidden Markov Models (HMMs). The performance of an automatic facial expression recognition system can be significantly improved by modeling the reliability of different streams of facial expression. In this research paper they presented an automatic Multistream HMM facial expression recognition system and analyzed its performance. They used facial animated parameters, MPEG-4 standard as the technologies. Advantages are providing better control of the information integration process and better recognition performance. Disadvantage is it taken more time to process. The Hawk eye system saves the time and recognition the missing child quickly [20].

III. METHODOLOGY

System development consists of planning, analysis, design and implementation activities, which are performed to build a computer based system. These three steps proceed by system planning and are followed by system maintenance

Requirement Gathering and Analysis

Identify the exact requirements of the Hawk Eye an important task in creating a software program is extracting the requirements or requirements analysis. There can be incomplete, ambiguous or even contradictory requirements at this point. In requirement gathering phase, collect information from the leading shopping mall in Sri Lanka. Through the discussions with selected people such as security officers and gather information about the problem they face. At the same time, found out what were their requirements, the techniques used, how they operate, their strengths and weaknesses and came up a solution that is the system, Hawk Eye which overcomes all prevailing problems in the identify system.

Design

The primary objective of the design phase is to create a design that satisfies the agreed application requirements.

Architecture design – An important step during this stage was the planning about the hardware, software and communication infrastructure of Hawk Eye.
The figure 1 illustrate the system architecture diagram. The whole shopping mall is placing the CCTV cameras. CCTV in the entrance of the shopping mall detect all the faces by face detection algorithms. This video store to facial database through the storing algorithm. If the parent misses their child have to inform to the control room. In the control room admin scan the parent face through the web camera and search in the facial database by using searching algorithm. After the finding the image of the missing child sends a notification to the security guard via android app to security guard’s phone. In this process can find the missing child immediately.

Interface design – Determine the way in which the user will interact with the system and the nature of the inputs and outputs that the system accepted and produces. The interface was created in such a way, where the data was captured and minimized key stroke.

Database and File design – In this stage, the table which was created in the system produces along with the primary keys and relevant validations and constraints. The database was linked with the system developed.

Implementation

The solution which mapped was broken down into several sub-systems. The Hawk Eye notification system was developed as an Android application. Whenever the system captured a stranger abducting a child, are lock down system can lockdown detected area. Hawk Eye take video feed into static images by using image frames and matching them with the given image. The Hawk eye is providing specific are lock down and a criminal investigator system. Whenever the system captured a stranger abducting a child, are lock down system can lockdown detected area. If child has been taken away. The criminal investigator will recognize the criminals face using the witness information. System will have embedded system of the main system in case of high memory usage causes unwanted system crashes.

Testing

After modules are developed by the research group, the will individually be tested. Thereafter, the module will be integrated to a single system and a complete system testing will be performed. Testing and evaluation, simply confirms that the product will work as it is supposed. The unit testing, system testing, were applied to the system to check whether the Hawk eye system working properly.

IV. Findings and Evidence

The following section provides evidence to the implementation results and the solutions provided for the identified research problems

![Figure 2: Live Video feed](image)

The above form will crop the face part from the live video feed at the entrance and will save the face images as below.

![Figure 3: Crop face images](image)

![Figure 4: Find Person](image)

When the open video button is pressed the video can be selected and it will be separated into frames and stored in a folder as colored and grey scale images as shown below.

![Figure 5: Frame of video feed](image)
Figure 6: Load the Find person

When the select face button is clicked the images of the missing persons face can be loaded to the program.

Figure 7: Security guard Application

This application is installed to security guard’s phone, when we find out the image of the missing child. Image send to this application.

Figure 9: Location Application

This is another application that security person have. This application find out the security guard location.

Figure 8: Security guard Application Code

Figure 10: Location Code

Figure 11: Area lock down
V. CONCLUSION

The system provide an efficient and affordable method for real time problem solving. The system has four functionalities, such as face recognition & face detection, lock down system, notification system, tracking system. Attempted to meet main objectives:

I. Hawk Eye can be used to minimize the rate of children abduction in public location.
II. Security based companies can use the application for their needs.
III. An error free and accurate system has been developed.
IV. The application is very user friendly.
V. The application is fully automated and can be used by any person with basic IT knowledge.

In future we hope to study more on the research area and develop the system to be more efficient. The current application only supports android platform, in future we will try to develop the application to support other platforms such as IOS and windows. The algorithms will be further studied and will make the face detection and face recognition more accurate to get results in any kind of surrounding. Further research should be carried out in identifying the best path related to relevant features and optimizing the generated route through them.

REFERENCES


