Student Monitoring System for School Bus Using Facial Recognition

Ciya James
M .Tech Scholar, Department of Electronics and Communication,
Jyothi Engineering college, Thrissur, Kerala
akkaraciya@gmail.com

David Nettikadan
Asst. Professor, Department of Electronics and Communication,
Jyothi Engineering college, Thrissur, Kerala
davidnettikadan@jecc.ac.in

Abstract — **Recent reports confirm the fact that school students are the most vulnerable to social crimes happening across the globe and our country too. Many of these cases happen during their ply from their residence to school and vice versa. In multiple cases these social crimes including sexual harassment happened in their school bus itself. Considering this serious situation, we are proposing a real time monitoring system using image processing techniques. — Identifying a student with an image has been popularized through the mass media like camera. This system monitors the images inside the vehicle and identifies the students and their movements inside the bus. The system recognizes the student faces and their count are also monitored. The system will also raise an alarm to get the attention of the public if it is so essential. Technologies are available in the Open-Computer-Vision (OpenCV) library and implement those using Python. For face detection, Haar-Cascades classifier was used and for face recognition Eigenfaces, and Local binary pattern histograms were used. each stage of the system described by some flowcharts. And also face recognition used in automation attendance system which eliminates most of the drawbacks that the manual attendance systems pose, easy manipulation of attendance records, proxy-attendances, and insecure system.**

Keywords— CV, FR, DCN, Wi-Fi, Raspberry Pi, PCA, Support Value Regression, DCT, OpenCV

I. INTRODUCTION

Face Recognition (FR) and Face Detection are the areas that have gain more importance from ancient time in the field of Computer Vision (CV). The practical applications include automatically tagging your friends' pictures, security in the biometrical area etc. Many research centers and companies have been working on it, because of it's high possibilities. The proposed system keep valid and correct student attendance record, and the student attendance record are verified, maintained and managed on a regular basis. The task of identifying an already detected object referred to a Face recognition. Often the problem of face recognition is confused with the problem of face detection. Face Recognition is used to decide if the "face" is known, or unknown. And it uses database of faces in order to detect this input face. Student attendance system is classified as automated and manual attendance system maintaining each student's record in school bus by the method of manual recording. This method seemed to be difficult in classes attended by a large number of students. Manual recording and calculating the average attendance of each enrolled student is a time consuming

process. Human face detection and recognition technique are the techniques which were used in the monitoring system. The system commonly involves the process of feature extraction from any facial image of student at the time he/she is entering the school bus. If the student is absent or not will also raise an alarm to get the attention of the parents and school. It proceeds to recognized student's attendance and count automatically, upon its successful recognition

In this proposed system implements an attendance system using face recognition which recognizes the face of each student during the entry into the bus. Image capturing and all digitals signal processing will be carried out with the processor available on board. Feature based extraction and detection scheme is planned along with image based solution for the problem of detection and identification of incidents to be reported. Neural network based intelligence that employs statistical methods will also be used in this proposed system.

Facial recognition techniques are classified as verification and identification. In the first method, it compares the given individual with who they say they are and gives a yes or no decision and second one compares the given individual with the database of all other individuals and provides a ranked list of matches[1]. Fig. 1 shows the various stages involved in face recognition.
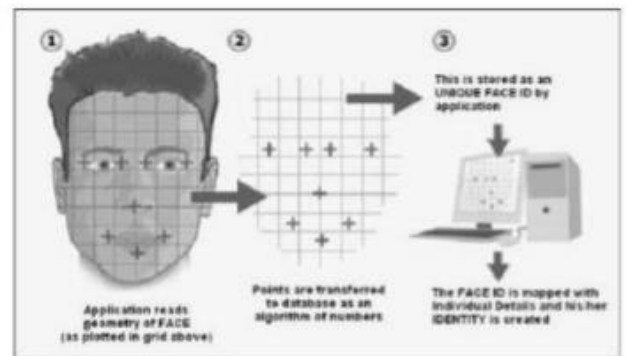

Fig.1: Face Recognition Overview

Computer vision and machine learning algorithms are the methods used by the monitoring system. Deep learning methods are used to find solutions to many possibilities. These solutions can make reducing errors in each stages of process.

There are two methods which can be used as solution to the face recognition problem: feature based and photometric

(view based). For face recognition, many different algorithms were developed from ancient time onwards and three of which have been well studied in face recognition literature. Popular recognition algorithms include: i) Principal Component Analysis using Eigen faces (PCA) ii) Linear Discriminate Analysis iii) Elastic Bunch Graph Matching using the Fisher face algorithm.

Separating image windows into two classes is the method involved in the face detection; one containing faces (tanning the background (clutter). When commonalities exist between faces; they can vary considerably in terms of age, skin color and facial expression they are seemed to be difficult. Further complication of problem occurs by differing lighting conditions, image qualities and geometries, as well as the possibility of partial occlusion and disguise. And also an ideal face detector has the capability to detect the presence of any face under any set of conditions, upon any background. Mainly face detection task involves two steps. The first step involves a classification task, where binary value is outputted with respect to some arbitrary image as input and by looking into these binary values one can identify the presence of image. The second step is the face localization task which take an image as input and output the location of any face or faces within that image as some bounding structure with (x, and y, width, height)[2].

II. RELATED WORKS

Various papers dealing with the face recognition, detection and template matching is discussed in this section. The paper [3] introduces the concept of face recognition attendance system by deep learning approach. For face detection and recognition tasks we develop neural networks, a CNN cascade. Uses for face detection and also that generating face embedding. CNNs achieve the best results for larger datasets, than smaller data set. The main challenge was applying these deep learning methods on smaller datasets. This model could be integrated in another system and supporting for monitoring purposes.

The research paper [4], It approaches about student counting system in classroom and also in a crowded area. Discrete Wavelet Transforms (DWT) and Discrete cosine transform (DCT) used for face recognition task. Informatics area authentication plays major part. These two techniques are used for authentication of user. For video monitoring/surveillance system we are used biometric verification and human face recognition. The study [5], discussing novel deep convolutional network (DCN) that achieves good performance. This detects faces under several conditions. Main difficulty in most existing face detection approaches shows it show that the use of DCN and high run time speed achieves. A system for detecting and counting humans in highly crowded images and video scenes by epsilon- Support Value Regression (SVR)[6].

A new approach automatic students and people counting system based on face detection, where the number of people passing through door is counted by setting a video surveillances camera [7]. The basic thing is to first use the frame difference to. In particularly advanced combining crowd density estimation and the localized in to the of individual peoples place [8].

Counting people in video surveillance is a very tough subject which is discussed in [9]. It becomes more challenging when the task is done in real time. The use of Infra Red (IR) sensors and Channel State Information (CSI) of the WIFI network, which are the classical methods, give the count but have their own range constraints and its limited applicability to controlled environment. Video-surveillance systems are one of the advanced technologies used in the present technology life and it to estimate the density of people in a place for security reasons and to obtain the human statistics. The informatics vision based techniques works well when people are in motion or moving and when a high resolution image with clear background are available. People counting presents image processing and embedding algorithms which are used for crowd estimation and their related applications. This can be revised to form new algorithms with multiple advantages and can be implemented for a specific application like monitoring the crowd in shopping malls, in uncontrolled environments like bus stands and railway stations thereby preventing congestions and provide comfort.

This paper [10] proposes real time object detection through YOLO and also makes some errors in localization. The recent survey shows that in this paper [11] clarifies most important specific objects i.e. face which is narrowed to one specific domain. By increasing use of applications, face detection is becoming challenging. Face detection is the first step for face recognition, face analysis and detection of other features of face. The paper discusses and analyses the various face detection algorithms Viola-Jones, and Neural Network-Based Face Detection and Support Vector Machine-Based face detection. Comparison of these detection algorithms is done based on the precision and recall value which is calculated using some Software which deals with accurate results by taking the values of the bounding boxes around the faces.

This technology studied [12] describes a method which will integrate with the face recognition technology and also detection process using Personal Component Analysis (PCA) algorithm for Student's Attendance System. Based on facial recognition of the person entering to the class room or respected area is used for the marking of attendance. This method involves, group image of the class will be captured and detected faces are segmented from the captured image. A predefined database of all the students of the class is used to compare the segmented faces. Hence message about it will be sent to absentees through SMS using Wi-Fi or a Telegram Module. The system will record the attendance of the students automatically and it will help the faculties to provide the information of the students entering and leaving the classroom.

The paper [13] proposes class room attendance system using face detection and raspberry p . Student attendance is an

important task in class. It is seemed to be wastage of lot of productive time of the class taken, when it is done manually Here implement a practical solution for the problem. This describes the method of detecting and recognizing the face in real-time using Raspberry Pi board and efficient algorithm using open source image processing. This method includes six steps they were Face Detection, Face Preprocessing, Face Training, Face Recognition, template matching and Attendance Database. The dataset is collected to recognize the faces of the students. The system is firstly trained with the datasets collected and it uses a user friendly interface for its proper implementation. This method seemed to be very accurate as compared to others.

This technology can be used for many other applications where face recognition and detection and can be used for authentication. Raspberry Pi with OpenCV usage helps in minimizing the cost of the product and the usability as it can be connected to any device to take the attendance. Face recognition algorithm can be improved by collected data and with respect to the utilization of resources so that the project proposal can recognize more number of faces at a time which can make the system far better and very faster.

III. PROPOSED SYSTEM ARCHITECTURE

This paper proposes a novel monitoring platform for students in their school bus. This system monitors the images inside the vehicle and identifies the students and their movements inside the bus. The system recognizes the student faces and their count are also monitored. In this section, system architecture for the proposed system is described along with a block diagram and detailed description of the face detection recognition and template matching techniques

A. System Architecture

Open Source Computer Vision is a library of programming functions mainly used for machine learning and image processing. And it also aimed for real-time computer vision. The face detection part of the proposed project was made using an OpenCV Library. The OpenCV library proved to be flexible enough for the project as it can accurately and correctly detect a face in real time and highlights it by drawing a rectangle around the faces of the students passing by and also shows name of the student. This happened by in a window formed rectangular shaped from the face recognition so the lecturer can keep track of both students passing by while having their faces detected and the feedback from the recognition part of the system. While faces are being detected, the application takes a snapshot of the live footage every second and then sends it to the recognition system. Low level processing means performing basic operations on images such as reading an image resize, resize, image rotate, RGB to gray level conversion, histogram equalization etc…

The output image obtained after low level processing is raw image. The average level processing means to collect other details not collected earlier and extracting regions of interest from output of low level processed image. The

preprocessing deals with identification of boundaries and features then edges .This process is called segmentation. High processing deals with adding of artificial intelligence to medium level processed signal.

Fig.2 explains about the proposed monitoring system architecture and some fundamental steps. In image processing some of the fundament steps including that are Image acquisition techniques that is to retrieving an image from the given source and .acquisition of digital image. And next should be to improve the image quality so that it results in the success of other processes. Next is partitioning an input image into its constituent parts of objects by the technique of image segmentation. Image segmentation is defined as to convert the input data to from suitable for computer processing. Image description is all about to extraction the features of image and that result in some quantitative information of interest of features that are basic for differentiating one class of objects from another. Finally Image recognition is also related with artificial intelligence and use to assign a label to an object based on the information provided by its image description.
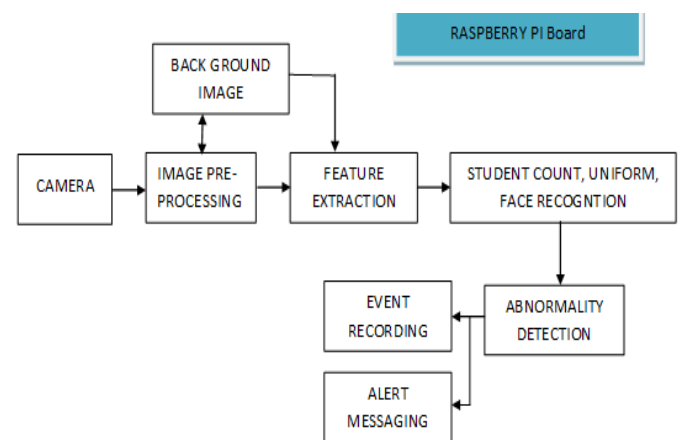

Fig.2: The Proposed Monitoring System Architecture

The problems behind the face recognition are all about face detection and their preprocessing approaches. This is a fact that it introduces a no error new technology. Before starting the stages including the process, first recognize their faces we should determine landmarks and also face extraction features. Segmentation problem are taken in the process and that solved by feature extraction from whole face, and eliminating background images the camera connected with raspberry pi and the steps are done and find out the student count, their uniform detection and face recognition. Based on face recognition take attendance of the students and calculated the number of students presented. In fact the actual recognition based on uniform and identity cards a features extracted from their facial landmarks is only a minor last step of the proposal and any unusual activates there must be alert messaging take place. With data input the image extraction is done by running over the image.

The implemented system will be using Raspberry Pi board for image capturing, Passenger detection, identification of students by Uniform, face detection and incident recording.

The camera in the board will be installed inside the vehicle at a convenient location from where the entire inside view can be captured. Image processing is used for the following activities:

- Capture inside image of the unoccupied vehicle and process the same to get the reference back ground
- Take images inside the vehicle at regular intervals; extract the specific features of the image after subtracting the back ground image.
- Detect number of students and recognize their faces.
- Detect the students seated as well as those who are standing.
- Identify the uniform of the students.
- Incident detection and recording of incidents.

The information collected will be conveyed outside the vehicle using Wi-Fi communication module available with the Raspberry Pi board. Image capturing and all digitals signal processing will be carried out with the processor available on board. Feature based extraction and detection scheme is planned along with image based solution for the problem of detection and identification of incidents to be reported. Neural network based intelligence that employs statistical methods will also be used in this proposed system.

IV. IMPLEMENTATION

In this project, Raspberry Pi 2 which is powered by quad core Broadcom BCM2837 64 bit ARMv8 processor. This microcomputer runs at 1.25 GHZ and has 1GB SDRAM.

A. Face detection

Face detection has very important and attractive one from many researchers and some applications such as video surveillance, face recognition, object tracking, template matching and expression analysis. It consists three stages with each stage carries some important role. There are including preprocessing, feature extraction and classification of data. Firstly, preprocessing is the process of extracting regions from images or real-time web camera, which then acts as a face or non-face candidate images. Secondly, involves segmenting the desired features from preprocessed images that is a feature extraction. Classification is a process of clustering extracted features based on certain criteria behind the recognition process. Real time face detection based on Haar features and Viola Jones algorithm is used. Fig 3 shows example of face detection in an image.
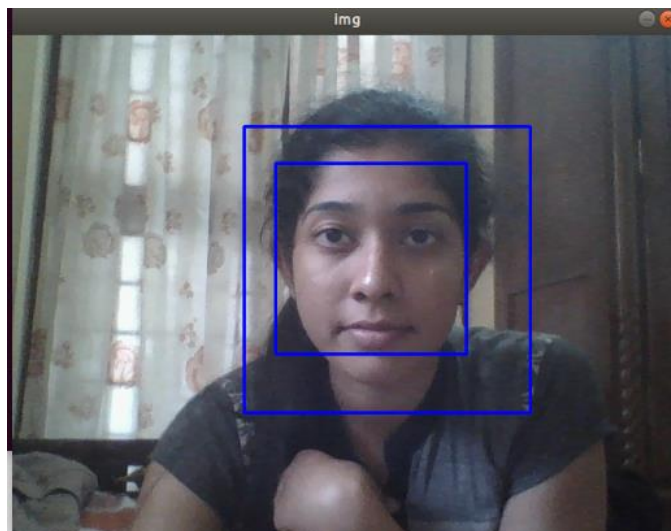

Fig.3: face detection process

Face detection systems are used to extract the fraction of whole face and here by, eliminating the background. Face recognition task is mainly used over static images, either by running across an image or capturing an image from video.

B. Face recognition

Fig.4 explains about face recognition of a student. More training data is required for neural network face detection; more over it would use a huge amount of computing. The implementation is a deformable template based technique which include component analysis method or algorithms.
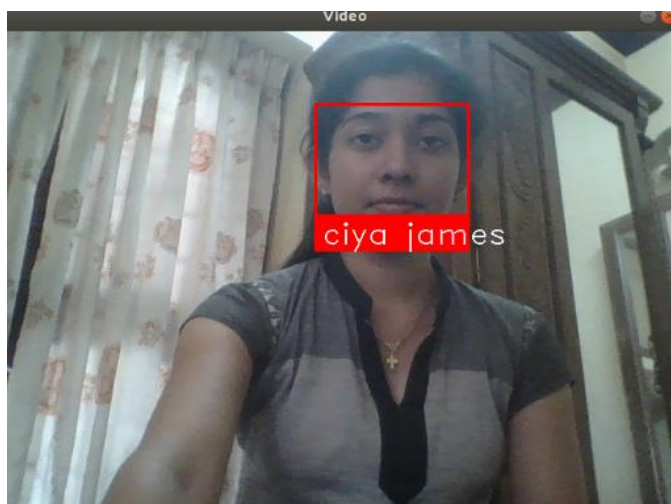

Fig.4: Face Recognition of a Human Face

This technique is based on some computations. We consider some of a set of features that are nose width length height etc.. From the picture of the respected face images .some of the features in the face image matched with the features of known individuals. The bounding boxes are used to

find the closest vector and the closest match, Raspberry pi is used for automated frontal view face detection.

Face recognition is a newly method developed in this embedding area. That is fast, robust, simple and very accurate with easy to understand algorithms and techniques.

V. RESULTS AND DISCUSSIONS

The face data was monitored and detected and recognized the faces of students. Using number of data set and training sets we are studied about recognition and detection. Varying the lightening and some of the other conditions and variables we are checking detection process.. The computational models, that uses some algorithms in this project and take for processing and that are implemented. Python codes were developed for face detection from a given data set image. This proposed technique improves security and protection of students in their school bus and organizational benefits.

VI. CONCLUSION

The automated student monitoring face detection and recognition was not very quick and hence less accuracy. The applications for the system in the real world mainly for matching and detection. Retina recognition and face recognition using the thermal spectrum requires high level of accuracy and hence the system implemented in this paper would be ideal for crowd surveillance and detection. the implementation of such systems would increase the potential for locating and tracking suspects for low enforcement.

This paper gives an insight into what future may hold in computer vision .Face detection ,recognition and template matching was completed successfully..

REFERENCES

[1] Sunehra, D., & Goud, V. S. (2016, October). Attendance recording and consolidation system using Arduino and Raspberry Pi. In *2016 International Conference on Signal Processing, Communication, Power and Embedded System (SCOPES)* (pp. 1240-1245). IEEE..

[2] Osuna, E., Freund, R., & Girosi, F. (1997, June). Training support vector machines: an application to face detection. In *cvpr* (p. 130). IEEE.

[3] Arsenovic, M., Sladojevic, S., Anderla, A., & Stefanovic, D. (2017, September). FaceTime—Deep learning based face recognition attendance system. In *2017 IEEE 15th International Symposium on Intelligent Systems and Informatics (SISY)* (pp. 000053-000058). IEEE.

[4] Lukas, S., Mitra, A. R., Desanti, R. I., & Krisnadi, D. (2016, October). Student attendance system in classroom using face recognition technique. In *2016 International Conference on Information and Communication Technology Convergence (ICTC)* (pp. 1032-1035). IEEE.

[5] Yang, S., Luo, P., Loy, C. C., & Tang, X. (2015). From facial parts responses to face detection: A deep learning approach. In *Proceedings of the IEEE International Conference on Computer Vision* (pp. 3676-3684).

[6] Chauhan, V., Kumar, S., & Singh, S. K. (2016, December). Human count estimation in high density crowd images and videos. In *2016 Fourth International Conference on Parallel, Distributed and Grid Computing (PDGC)* (pp. 343-347). IEEE.

[7] Chen, T. Y., Chen, C. H., Wang, D. J., & Kuo, Y. L. (2010, December). A people counting system based on face-detection. In *2010 Fourth International Conference on Genetic and Evolutionary Computing* (pp. 699-702). IEEE.

[8] Rodriguez, M., Laptev, I., Sivic, J., & Audibert, J. Y. (2011, November). Density-aware person detection and tracking in crowds. In *2011 International Conference on Computer Vision* (pp. 2423-2430). IEEE.

[9] Zhan, B., Monekosso, D. N., Remagnino, P., Velastin, S. A., & Xu, L. Q. (2008). Crowd analysis: a survey. *Machine Vision and Applications*, *19*(5-6), 345-357.

[10] Redmon, J., Divvala, S., Girshick, R., & Farhadi, A. (2016). You only look once: Unified, real-time object detection. In *Proceedings of the IEEE conference on computer vision and pattern recognition* (pp. 779-788).

[11] Dang, K., & Sharma, S. (2017, January). Review and comparison of face detection algorithms. In *2017 7th International Conference on Cloud Computing, Data Science & Engineering-Confluence* (pp. 629-633). IEEE.

[12] Masalha, F., & Hirzallah, N. (2014). A students attendance system using QR code. *International Journal of Advanced Computer Science and Applications*, *5*(3), 75-79.

[13] Patil, A., & Shukla, M. (2014). Implementation of classroom attendance system based on face recognition in class. *International Journal of Advances in Engineering & Technology*, *7*(3), 974..