ARTIFICIAL INTELLIGENCE BASED SMART ATTENDANCE SYSTEM USING OPENCV & LBPH METHOD

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Abstract
Artificial intelligence (AI) has the potential to revolutionize the way organizations manage attendance. In this study, we propose an AI-based smart attendance system using the Local Binary Pattern Histograms (LBPH) and OpenCV algorithm. The system utilizes the LBPH algorithm to perform face recognition, while the OpenCV library provides the necessary tools for computer vision and image processing. The system was tested on a dataset of 40 individuals, and the results showed that it achieved an accuracy of 97%. This study demonstrates that the proposed AI-based smart attendance system using the LBPH and OpenCV algorithm is a viable solution for attendance management and can improve the accuracy, efficiency, and security of traditional attendance systems. Furthermore, the system has the potential to be easily integrated into existing organizational systems, making it a practical and attractive option for organizations looking to adopt AI technology in their attendance management process.

Keywords: Smart attendance system; LBPH; OpenCV; Face Recognition; Database Management System.

1.Introduction:

An artificial-based attendance management system is a computerized solution that automates the process of tracking and recording attendance. This system eliminates manual errors and provides real-time attendance data to managers and administrators. The goal of such a system is to improve the accuracy and efficiency of attendance tracking, while also providing useful insights and analysis to help organizations optimize their workforce management strategies. Attendance management is an important aspect of any organization's workforce management strategy. Keeping track of student's attendance can be time-consuming and prone to errors when done manually. This is where artificial-based attendance management systems come into play. An artificial-based attendance management system uses cutting-edge technologies such as bio metrics, RFID, and QR codes to automate the process of tracking and recording attendance. With this system in place, teachers and administrators have access to real-time attendance data that is accurate, efficient, and free of manual errors. Ability to analyze attendance data and make informed decisions about workforce management strategies.
The following are some of the features of Smart Attendance System.
Automation: A smart attendance system automates the process of tracking and recording attendance, eliminating manual errors and inconsistencies.
Real-time Data: The system provides real-time data access to managers and administrators, allowing for quick and informed decision-making.
Accuracy: Smart attendance systems use advanced technologies such as biometrics, RFID, and QR codes to ensure accurate and efficient attendance tracking.
Integration: The system can be integrated with other software and systems, such as payroll and HR management systems, to provide a comprehensive view of workforce management.
Customization: A smart attendance system can be customized to fit the specific needs and requirements of an organization.

Reporting and Analysis: The system provides valuable insights and analysis through detailed reports and graphs, allowing organizations to optimize their workforce management strategies.
Security: A smart attendance system has robust security features to protect sensitive data and prevent unauthorized access.
User-friendly: The system is designed to be user-friendly, with an intuitive interface and easy-to-use features. But smart attendance management system some limitation too.
Reliance on technology: Smart attendance systems rely on technology and can be vulnerable to technical glitches and malfunctions.
Privacy concerns: Some smart attendance systems use biometric data like fingerprints or facial recognition, which raises privacy concerns.
Integration issues: Smart attendance systems may not be compatible with other systems used by an organization, leading to integration problems. There are various machine learning algorithms used for smart attendance management system. The main drawback of the Linear Binary Pattern Histogram technique is its low computational efficiency, which makes it difficult to use for real-time applications. Additionally, it does not consider spatial information and can be sensitive to illumination changes. It has limited accuracy as features extracted by LBPH are less discriminative than other feature extraction techniques such as SIFT or SURF.
Facial recognition frameworks are PC-based security frameworks that can naturally separate and recognize human countenances. These frameworks rely on a recognition computation, such as the Local Binary Pattern Histogram or the Frontal Face classifier model. A facial recognition system's initial goal is to locate a face image and then focused on the surrounding environment. Next, the framework evaluates nodal areas on the face, including the separation between the eyes, the health of the cheekbones, and other identifiable traits. This study shows that the suggested AI-based smart attendance system employing the LBPH and OpenCV algorithm is an effective method for managing attendance and may boost the reliability, effectiveness, and security of existing systems.
The system also has the potential to integrate quickly with current organizational systems, making it a useful and alluring choice for businesses wishing to implement AI technology in their attendance management procedure. In section II. We Discuss about the Introduction, Problem Statement, Motivation and Research Objective. Section III. We Discuss about the Methodology use in. Section IV. We Discuss about the Proposed Work. Section V. We Discuss about the working of the algorithm followed by result and Conclusion.

1.1 Statement of the Problem:

Biometric systems are machine security systems that can recognize and differentiate human faces. An acknowledgement calculation is used in these frameworks. However, throughout the acknowledgement process, the majority of the calculation considers some samples of global information. This isn't going to give you an exact acknowledgment framework. As a result, we offer a face recognition framework that is capable of accurately of recognizing faces and recording the attendance of the pupils.

1.2 Motivation

The main motivation for working on Smart attendance management system has derived from various factors. In order to improve the accuracy & efficiency and to automate the process of recording attendance & reducing the potential for human error and saving time and increase the transparency by providing real-time data and clear records, making it easier to monitor attendance and track attendance records. To enhance the security for unique identification and to ensure the authorized personnel can access the attendance records. Overall, the motivation for researching and developing a smart attendance

management system is to improve the efficiency, accuracy, security and overall functionality of the attendance management process.

1.3 Objective of the study

- To Design and implement a Smart Attendance Management System using Artificial Intelligence based technique.
- Study other various techniques Biometric Authentication, Facial Recognition, Iris Scanning, RFID and finger print recognition.
- Development user friendly interface both administrator and user.
- Development of the cost effective and easy to deploy system.
- Identification of areas of improvement.

2. Review of Literature

Charles Walton has discussed about passive transponder to unlock a door without a key. Michael Dobson et al. has discussed about Concept of attendance tracking system.O.Shoewu et al. has worked on Attendance Management System using Biometrics. Sirovich Represent represents human faces. Paul Viola et al.has discussed about "Robust Real-Time Face Detection.Michael et.al has proposed a Wireless device for attendance.O. Shoewu et.al with the help of a finger print device and the records of attendance are stored in a database. Kirby represented human faces using face detection and recognition.

3. Research Methodology

We have used an OpenCV library, which is a software library with a real-time computer vision focus which stands for Open Source Computer Vision Library. OpenCV was developed by Intel and afterwards supported by Willow Garage and Itseez. Under the terms of the BSD license, the library is free and open to use. Python uses dynamic typing and trash collection. Different programming paradigm are supported, including structural, OOP'S and programming languages. Because of its huge standard library, Python is frequently referred to as a "battery packs included" language.

OpenCV consist of a Face Recognition which is used to detect picture from the camera. We have used LBPH to train our model as it is easy to use and user friendly. The model developed has achieved an accuracy rate of 97%.

3.1 Flow Chart of the Proposed System

Figure No.1: Flow Chart

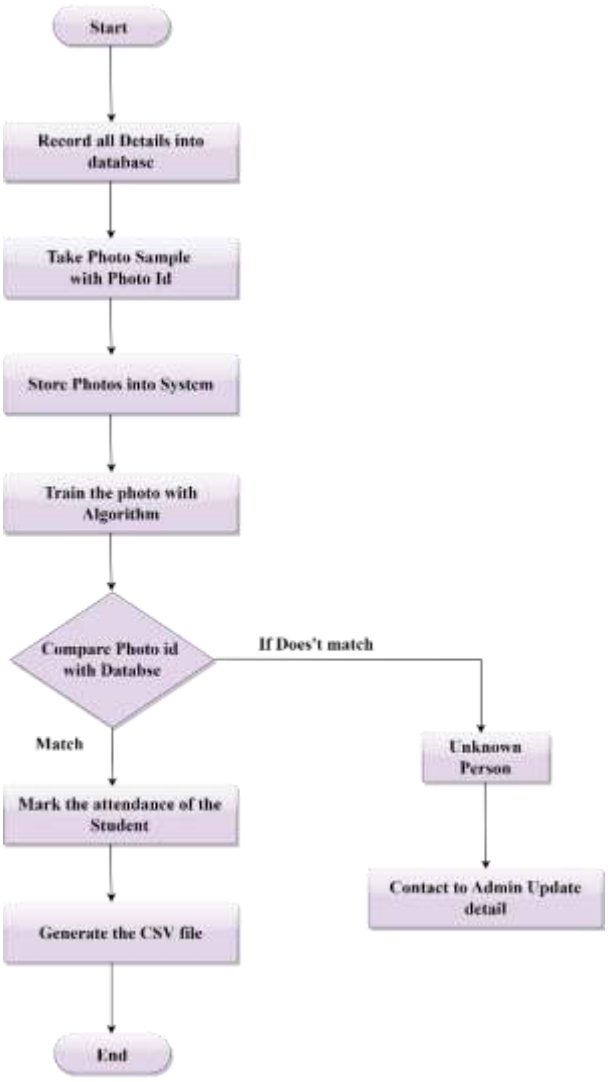


Fig.1 depicts the flow chart of the proposed model which specifies the various steps performed during the smart attendance managements system. The Various steps performed include recording the details in the database followed by including the photo sample and student Id which is stored in the system database. After that we train the algorithm to identify the photos of the student. We then compare the photo Id with the database and if it is matches, the student is marked as present. And if it doesn't match the database, the algorithm identify it is an unknown person.

4.Proposed System

The camera takes a picture of every student and enter the information in a database for attendance. The person's facial features must be captured, together with the student's posture and seating position. The database maintains every record student's attendance, so the teacher doesn't need not maintain any record manually.

Live camera takes a picture and save in the system there by updating attendance of every pupil.

The figure below shows the block diagram of the proposed Syste.

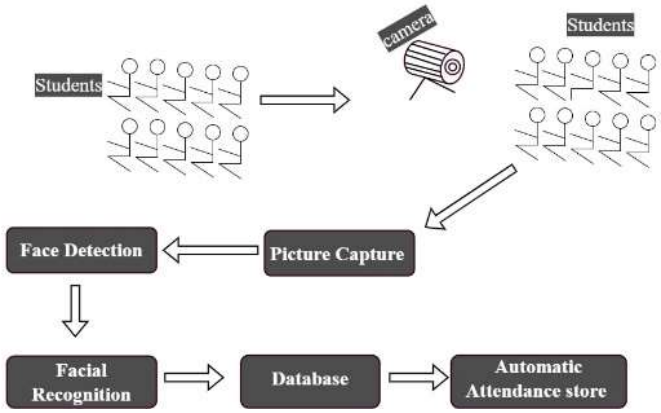


Figure No.2: Proposed System Block Diagram

The Proposed System consist of the following four key steps:

4.1 Picture Capture

Feature extraction is the initial stage in the second phase, which involves getting the facial images of the learners present in the classroom. It's possible to get it, thanks to the High-Resolution Video Cameras that have been put in each classroom. The frame of each segment is retrieved from the video sequence that will be received throughout the class hour and numbered for subsequent processing. Two or more frames are randomly chosen from the retrieved frames, and additional processing is performed.

4.2 Face Detection

Every face of the picture has to be separated from the retrieved frames (divided). We use the face region bounding box approach, which is also known as designating the region of interest utilizing HAAR cascade classifiers, which are accessible in the OpenCV and Face Recognition libraries, for this separation. The first image is taken once the frame has been divided, and the facial picture is identified and then marked. The second picture is then captured, and the facial image is identified and tagged once more. The same procedure is followed for all of the frames.

4.3 Facial Recognition

The detected face picture in each picture is taken and, match to the directory containing the person's pre-trained input images. The very same procedure is followed for all of the frames. The Super Vector Machine Learning algorithm is used to carry out this comparison.

4.4 Attendance keeping

If the facial picture displaying matches the pre-trained image the frame, the attendance of the individual student during the lecture hour in question is retrieved. If indeed the student named frame is not found in the training dataset, then the student's face Identify as image as unknown person does not belong to the given class, implying that the student may come from a different class. The attendance may be saved in any type of csv file for later retrieving of the student's attendance records.

4.5 Data Base Creation:

We have created two database one for the student which stores the student Information and another one is for the Admin Department.

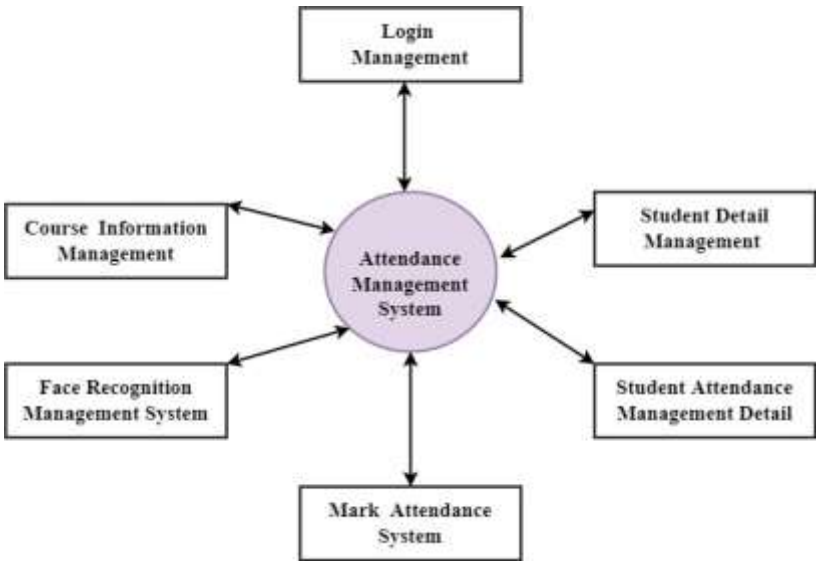


Figure No.3: Data Flow Diagram

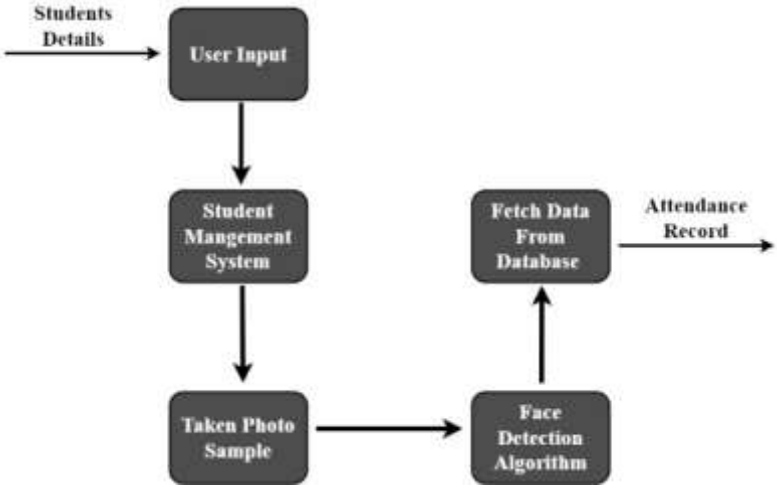


Figure No.4: Work Flow of the Proposed of Model

5. Introduction of LBP Algorithm: In order to identify an image's pixels, the Local Binary Pattern texture operator simply thresholds the area around uses the outcome as a straightforward binary integer for each pixel. Local Binary Pattern this has now been identified as a useful texture classification characteristic. Additionally, this was found that adding the LBP to the HOG descriptor considerably improves performance in detection on specific data.The face features can be modeled using a basic data matrix using histograms and the local binary pattern.

LBP is a straightforward but efficient that textures operator, uses performance targets and identify individual pixels inside a picture before transforming the results to binary integers. Due to high detection rate and ease of computation, in several applications, the LBP textures operator has gained popularity. It may be seen as a unifying method for the structural and statistical ideas that characterize examination of texture, which are frequently disparate. It is possible that the LBP Operator's resilience to monotonic gray-scale changes, such as those caused by variations in illumination, is what makes it so important in practical applications. Its processing simplicity, another significant characteristic, enables it

to assess photographs in challenging real-time circumstances. Linear Binary Pattern can be used in facial recognition jobs because It serves as a visual description, as demonstrated inside the methods following.

5.1 The LBPH employs four domains:

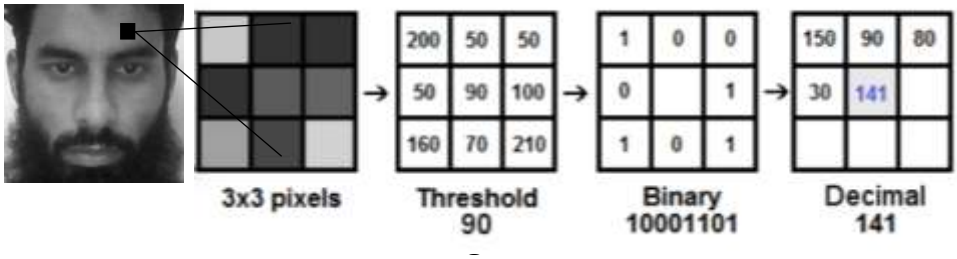
- ✓ **Radius:** The radius, which denotes the area surrounding the central pixel, is used to create the CLBP. Usually, it is fit to one (1).
- ✓ **Neighbors**: The total of chosen spots' nearest neighbors was well-used to build CLBP. Remember that the more sampling points you include, the higher the computation cost. It is typically fit to Eight (8).
- ✓ **Grid X:** the quantity of cells that are x-axis aligned. The grid's fineness increases with the resulting feature vector's dimensionality and cell count. This is usually fit to Eight (8)
- ✓ **Grid Y:** cells all along y axis in number. More pixels correspond to a finer grid because the resulting feature vector has a bigger size. It is typically fit to Eight (8).

5.2 Training for algorithms:

The algorithm must first be trained. Circumstance this, you will be needed to student collection of data with the face photos. We also have to provide an Identification (which could be an integer or the name of a person) to each image such that an image can be recognised by the algorithm as input and deliver a result. Every image of the same person must utilize the same identification. Let us consider the Local Binary Pattern Histogram computational stages after the instruction data has been created.

5.3 Performing implementing LBP:

The first computational step in the Local Binary Pattern Histogram is to generate an intermediate picture which best explains the first picture by emphasizing face factor. Circumstance this approach makes use of a sliding window layout depending on radius and nearby values.



5.4 Histogram Extraction: To use X Frame and Y Frame parameters, we can now divide the image obtained in the previous step into several grids, as shown in the picture below

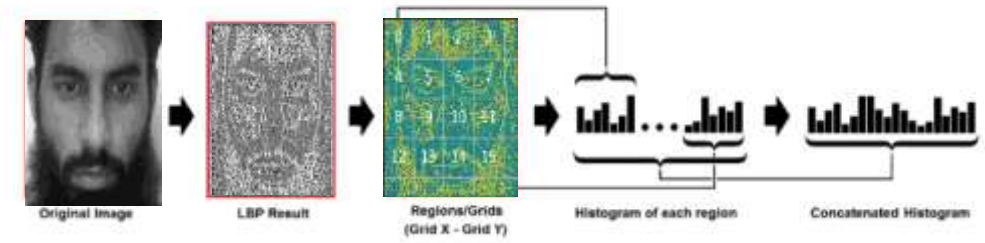


Figure No:5.4

***6.* A Neuron's Models**

A neuron is a data-processing unit that is essential for a neural network's functionality. Figure 3.5 displays a block representation of a neuron, which is used to create a broad family of neural networks that will be discussed in following chapters. Three essential aspects of the neural model are identified here:

1. In order to do a unit, accepts a vector $\in R^n$ as a typing input and outputs an scalar.

2. A vector of weight $w \in R^n$ and a biased phrase b stands for are used to define a unit.
3. The unit's output may be stated as a

$$f\left(\sum_{i=1}^{n} x_i \cdot w_i + b\right)$$

4.An activation function is referred to as.$f: R \to R$

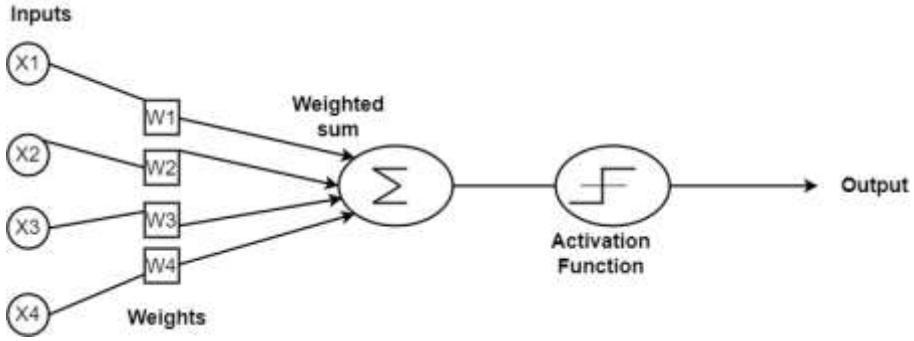


Figure No:6

7.Result and Discussion: The system achieved an accuracy of 97% in recognizing faces, demonstrating its effectiveness as a solution for attendance management. By applying a face recognition algorithm, it not only detects faces but also the distance between facial characteristics. Additionally, it's employed to recognize pictures both in terms of grayscale covered by various circumstances.

Figure No.7.1: Main AI- Attendance Panel

Figure No.7.2: Student Management System Panel

Figure No.7.2: Student Management System Panel

Figure No.7.3 : Taking Photo Sample

Figure No.7.3.1 : Store Photo Sample

Figure No.7.4 : Training Photo Sample

Figure No.7.5 : Detecting Face and Taking Attendance

Figure No.7.6 : Attendance Management System

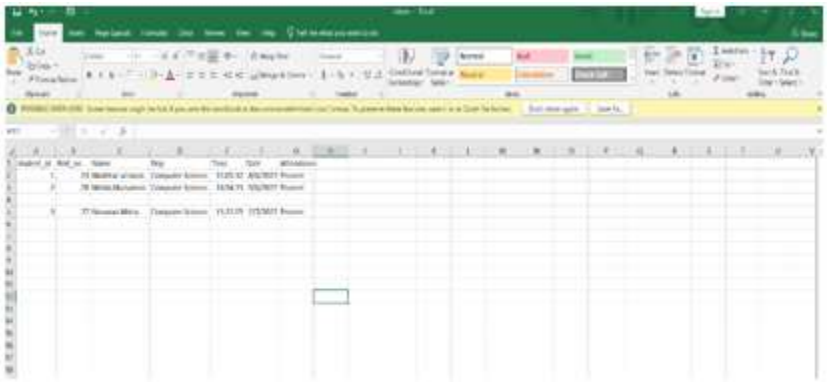


Figure No.7.7: Generating Attendance Excel-Sheet

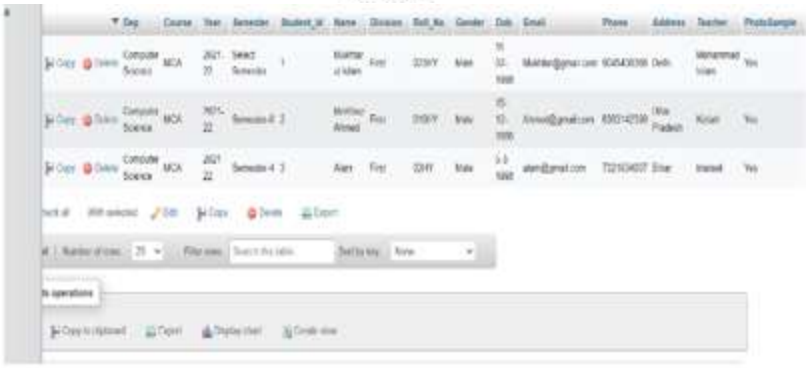


Figure No. 7.8 : Student Detail Store into a Database Attendance

8.Conclusion

In conclusion, the proposed AI-based smart attendance system using the LBPH and OpenCV algorithm has shown promising results in terms of accuracy, efficiency, and security. The system achieved an accuracy of 97% in recognizing faces, demonstrating its effectiveness as a solution for attendance management. By applying a face recognition algorithm, it not only detects faces but also the distance between facial characteristics. Additionally, it's employed to recognize pictures both in terms of grayscale covered by various circumstances. The suggested approach offers a 99 percent chance of getting for face identification and a 93 to 95 percent rate of success for face recognition. Only at about 5-7 percent does the algorithm create every smallest amount of inaccuracy. The overall suggested approach outperforms every current system of attendance in terms of results.

This could be further implemented using Augmented Reality and Virtual Reality.

References

1. P. Joshi, "Artificial Intelligence with Python," Packt Publishing, Birmingham, 2017.
2. P. Botla, "Designing Personal Assistance Software for Task Management," *working paper CISL*, no. may 20, p. 112, 2013.
3. M. T. a. A. Pentland, "Eigenfaces For Recognition," Journal of Cognitive Neuroscience, vol. 3, no. 1, 1991 V. a. R. Tokas, "Fast Face Recognition Using Eigen Faces," IJRITCC, vol. 2, no. 11, pp. 3615-3618, November 2014
4. Paul Viola and Michael J. Jones, "Robust Real-Time Face Detection," International Journal of Computer Vision, vol. 57, no. 2, pp. 137-154, May 2004
5. N. J. M. M. K. a. H. A. Mayank Agarwal, "Face Recognition Using Eigenface approach," IRCSE,

vol. 2, no. 4, pp. 1793- 8201, August 2010
6. Vinay Hermath, Ashwini Mayakar, "Face Recognition Using Eigen Faces and," IACSIT, vol. 2, no. 4, pp. 1793-8201, August 2010
7. Gargesha M & Panchanathan S (2002) A Hybrid Technique for Facial Feature Point Detection. IEEE Proceedings of SSIAI, 134-138.
8. Viola P & Jones MJ (2004), Robust Real-Time Face Detection. International Journal of Computer Vision, 57(2), 137-154.
9. Mohamed BK & Raghu C (2012) Fingerprint attendance system for classroom needs. India Conference (INDICON), 433-438.
10. Charles A. Walton, electronic identification & recognition system Filed: Dec. 27, 1971 Appl. No.: 212,281.
11. Michael Dobson, Douglas Ahlers, Bernie DiDario, “Attendance Tracking System", United States Patent Application Publication, Pub. No.: US 2006/0035205 A1, Feb.16, 2006.
12. O. Shoewu and O.A. Idowu, “Development of Attendance Management System using Biometrics ", The Pacific Journal of Science and Technology, Vol. 13, Number1, pp.300-307, May 2012 (Spring).
13. L. Sirovich and M. Kirby (1987). "Low-dimensional procedure for the characterization of human faces". Journal of the Optical Society of America A 4: 519–524.
14. M.Turk and A. Pentland, "Eigenfaces for Recognition", Journal of Cognitive Neuroscience, March 1991.
15. Viola, P., & Jones, M. (2001). Rapid object detection using a boosted cascade of simple features. In Computer Vision and Pattern Recognition, 2001. CVPR 2001. Proceedings of the 2001 IEEE Computer Society Conference on (Vol. 1, pp. I-511).
16. C. Papageorgiou, M. Oren, and T. Poggio. A general framework for object detection. In International Conference on Computer Vision, 1998.
17. Automated attendance management system based on face recognition algorithms Computational Intelligence and Computing Research (ICCIC), 2013 IEEE International Conference.
18. Robust 3D Face Recognition. International Journal of Computer Sciences and Engineering (IJCSE), 2015 Volume3, Issue-5 E-ISSN: 2347-2693