International Journal of Scientific Research in Engineering and Management (IJSREM)
Volume: 07 Issue: 04 | April - 2023 Impact Factor: 8.176 ISSN: 2582-3930

STUDENT ATTENDANCE USING FACE RECOGNITON

U.Sreenivas[1], M.DhanaLakshmi[2], B.ChandraShekhar[3], J.Muhthananda[4],k.Chand Basha[5], G.AyeshaSiddika[6]

[1]Assistant Professor, Department of Electrical and Electronics Engineering
[2, 3, 4, 5, 6] Student, Final year B. Tech, Department of Electrical and Electronics Engineering
[1, 2, 3, 4, 5, 6] Srinivasa Ramanujan Institute of Technology (Autonomous), Anantapuramu, AP, India

---

Abstract - Face recognition is among the most productive image processing applications and has a pivotal role in the technical field. Recognition of the human face is an active issue for authentication purposes specifically in the context of attendance of students. Attendance system using face recognition is a procedure of recognizing students by using face biostatistics based on the high definition monitoring and other computer technologies. The development of this system is aimed to accomplish digitization of thetraditional system of taking attendance by calling names and maintaining pen-paper records. Present strategies for taking attendance are tedious and time -consuming. Attendance records can be easily manipulated by manual recording. The traditional process of making attendance and present biometric systems are vulnerable to proxies. This Face recognition method is proposed to tackle all these problems. After face recognition attendance reports will be generated and stored in excel format. The system is tested under various conditions like illumination, head movements, the variation of distance between the student and cameras. After vigorous testing the overall complexity and accuracy are calculated. The proposed system proved to be an efficient and robust device for taking attendance in a classroom without any time consumption and manual work. The system is cost-efficient and needless installation

Key words: Eigen faces, Haar features, Fisher Face, Linear Discriminant Analysis (LDA), Fisher Discriminant Analysis (FDA),

1. INTRODUCTION

Face recognition system is the most researched area nowadays. Many new methods have been discovered for efficient face recognition. Face recognition is being widely used in areas like security systems. It can also be used for taking attendance in a classroom. It is a tedious and time consuming task to take the attendance manually. The most i

important thing in classroom attendance is which is directly linked to the academic performance of the students. Recently, some of students are busy with better during lectures only when there is massive classroom control. The smart attendance system makes the class room more efficient in participation and learning. In the past we were using techniques like roll numbering calling and signing against a particular roll number. These methods carry a high chance of proxy and are time consuming.

Regardless that this was much more practical than the attendance sheets, it did not come without disadvantages. Students can give the card to their colleagues without the professor noticing it. That information from image processing will play a great role and help in various walks of life where it could be implemented. The applications of image processing are vast and can be applied in most scenarios where imaging data could be related to pre-determined algorithms. It was an advanced application of image processing and also is the core basis for our project. Our facial structure was a typical example of a multidimensional structure and need some recognition from advanced computational analysis.

So, to solve the problem this thesis will propose usage of Computer Vision techniques for face detection and face recognition.

2. OBJECTIVE

The objective of using face recognition technology for smart attendance is to automate and streamline the attendance-taking process in various settings, such as schools, universities, offices, and other organizations. This technology uses artificial intelligence and machine learning algorithms to recognize faces and match them with a pre-existing database of individuals, allowing for accurate and efficient attendance tracking.

The benefits of using smart attendance using face recognition technology include:

Improved accuracy: Face recognition technology eliminates errors associated with manual attendance-taking methods, such as human error or inaccurate data entry.

Time-saving: The automated process of face recognition attendance saves time and effort for both students/employees and the attendance-taker.

Enhanced security: The technology allows for better security by ensuring that only authorized individuals are present on the premises.

Cost-effective: With the automated attendance system, the need for manual labor in tracking attendance is eliminated, leading to cost savings for organizations.

Real-time tracking: The technology allows for real-time tracking of attendance, enabling timely interventions and decision-making in case of emergencies.

3. PROPOSED SYSTEM

The proposed model of the smart attendance monitoring system consists of a data set with images of people faces had to be created. This data set can be created directly from the application that is developed in Python, using Open CV and its libraries. The images of students are captured and then the algorithm is trained. Before proceeding to training algorithm, images are scaled and converted to grayscale. For the face detection part, OpenCV provides pre-trained Haar cascade models trained by Intel Corporation to detect faces and eyes in an image. Local Binary Patterns Histograms is the algorithm that is used for face recognition because of results during testing and illumination invariance. Google Cloud Platform with Google Sheets API is used to create attendance sheet and add students when identified.

Haar cascade:

There were many attempts to respond to real-time constraints for object detection. The object detection application can be deployed in different platforms; it can be deployed on a high-performance platform as well as in mobile platform. It can also be used in surveillance systems with distributed cameras and a back-end server in which the detection takes place. It can also be used in mobile devices equipped with camera and processor. A highly short response time in terms of detection is essential for such systems. There are three main contributions of this face detection framework:

i) Haar-like feature: Haar feature-based cascade classifiers, classifies images based on the value of simple features. There are many motivations for using features rather than the pixels directly. More specifically, we use three kinds of features. The value of a two-rectangle feature is the difference between the sum of the pixels within two rectangular regions. The regions have the same size and shape and are horizontally or vertically adjacent shown in Fig. 3.1: (a). A three-rectangle feature computes the sum within two outside rectangles subtracted from the sum in a center rectangle shown in see Fig. 3.2: (b). Finally, a four- rectangle feature computes the difference between diagonal pairs of rectangles shown in Fig. 3.3: (c).

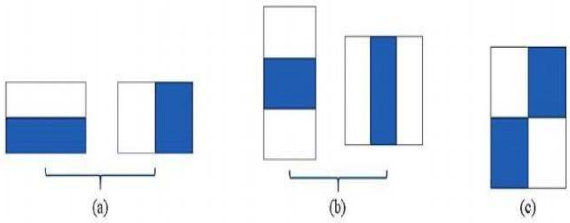
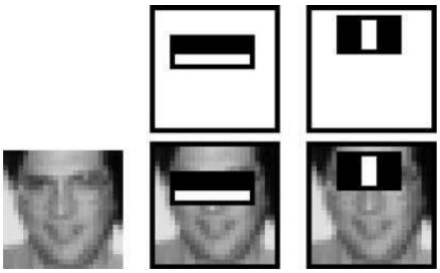


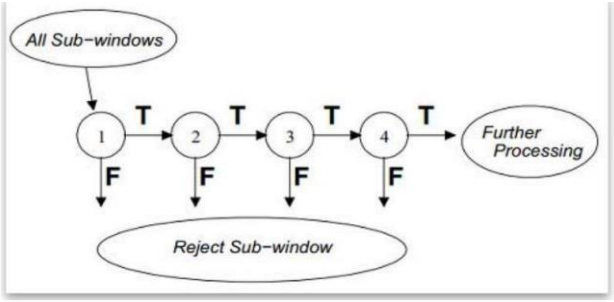
Fig: 3.1: (a). A three-rectangle feature 3.2: (b). Finally, a four-rectangle feature computes Fig. 3.3: (c). a four- rectangle feature computes the difference between diagonal pairs of rectangles

The primary reason for using an integral image is the improved execution speed for computing box filters. Employment of the integral image eliminates computationally expensive multiplications for box filter calculation, reducing it to three addition operations. This allows all box filters to be computed at a constant speed, irrespective of their size; this is a major advantage for computer vision algorithms, especially feature detection techniques which utilize multi-scale analysis.



Haar features

ii) Training classifier: For the task of face detection, the initial rectangle features select are meaningful and easily interpreted. The first feature selected seems to focus on the property that the region of the eyes is often darker than the region of the nose and cheeks . This feature is relatively large in comparison with the detection sub-window, and should be somewhat insensitive to size and location of the face. The second feature selected relies on the property that the eyes are darker than the bridge of the nose.



The structure of the cascade classifier

iii) Constructing a cascade: The cascade classifier consists of a list of stages, where each stage consists of a list of weak learners. The system detects objects in question by moving a window over the image. Each stage of the classifier labels the specific region defined by the current location of the window as either positive or negative-positive meaning that an object was found or negative means that the specified object was not found in the image.

4. BLOCK DIAGRAM

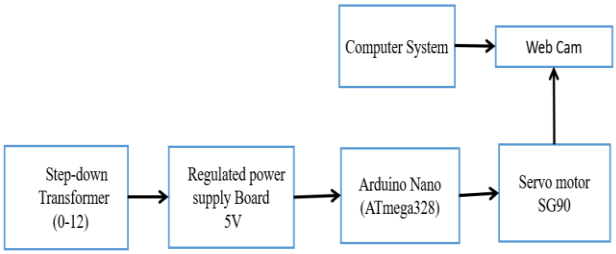


Fig -4: Block diagram

The first step in face recognition is to capture an image of the face using a camera or any other imaging device. The image can be captured in various environments, such as outdoor or indoor, under different lighting conditions. The acquired image needs to be preprocessed to remove noise, distortions, and other artifacts that may interfere with the recognition process. This step may include operations such as resizing, cropping, filtering, and normalization. The preprocessed image is then processed to extract features that are relevant for face recognition. These features may include the position and shape of facial landmarks such as the eyes, nose, and mouth, as well as texture and color information.

Once the features have been extracted, a classification algorithm is used to match the features to a known set of faces in a database. This may involve techniques such as template matching, neural networks, or statistical methods.

Finally, a decision is made based on the classification results to determine whether the input image matches any of the known faces in the database. If a match is found, the person's identity is determined.

5. COMPONENTS

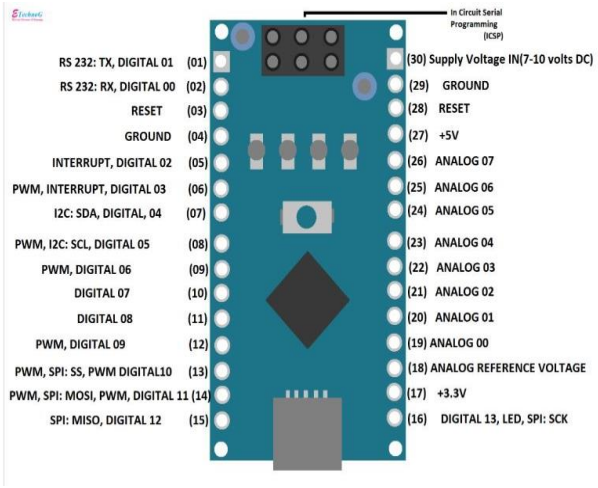
Personal Computer: It is main part of the project the observation, calculation of student data and storing of the data. Program dumping in to Arduino nano controller. Results of the student's attendance in the form of excel sheet periodically.

Webcam: A webcam is a video camera which is designed to record or stream to a workstation (computer). The main function of webcam is to transmit pictures over the internet.

Arduino Nano controller:

The Arduino Nano has a number of facilities for communicating with a computer, another Arduino, or other microcontrollers. The Arduino software includesa serial monitor which allows simple textual data to be sent to and from the Arduino board. Rather than requiring a physical press of the reset button before an upload, the Arduino Nanois designed in a way that allows it to be reset by software running on a connected computer.

One of the hardware flow control lines (DTR) of the FT232RL is connected to the reset line of the ATmega328 via a 100 nano farad capacitor. When this line is asserted (taken low), the reset line drops long enough to reset the chip. This setup has other implications. When the Nano is connected to a computer running MacOSX or Linux, it resets each time connection is made to it from software. The ATmega328 also support I2C and SPI communication.



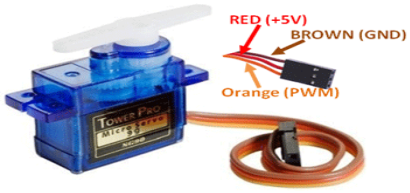
Pin diagram of Arduino Nano

Servo motor sg90:

SG90 is a micro servo motor that is widely used in hobbyist projects and small-scale robotics. It is a low-cost motor that provides precise control and is easy to use. The SG90 is designed to work with 5V DC power and can provide up to 1.8 kg-cm of torque.

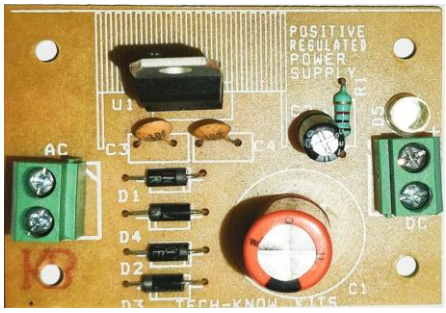
The SG90 is a small motor, with dimensions of 23mm x 12.2mm x 29mm, making it ideal for use in small robots or other projects where space is limited. It has a weight of only 9 grams and can rotate up to 180 degrees.

The SG90 is a 3-wire motor, with a red wire for power, a black wire for ground, and a white or yellow wire for the signal. It can be controlled using pulse width modulation (PWM) signals, with a typical operating frequency of 50Hz. The pulse width determines the position of the motor, with a pulse width of 1.5ms corresponding to the center position.



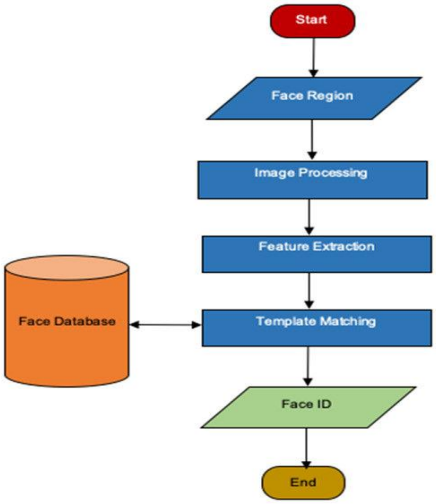
Regulated Power Supply Board: A regulated power supply is an electronic circuit that provides a constant output voltage or current regardless of changes in the input voltage or load conditions. It is an essential component of many electronic devices, including computers, mobile phones, and other electronic devices.

The main function of a regulated power supply is to convert an AC or DC voltage into a stable and reliable DC voltage that can be used to power electronic circuits. The output voltage of a regulated power supply is controlled by a feedback circuit that adjusts the voltage to maintain a constant value, even when there are changes in the input voltage or load conditions.



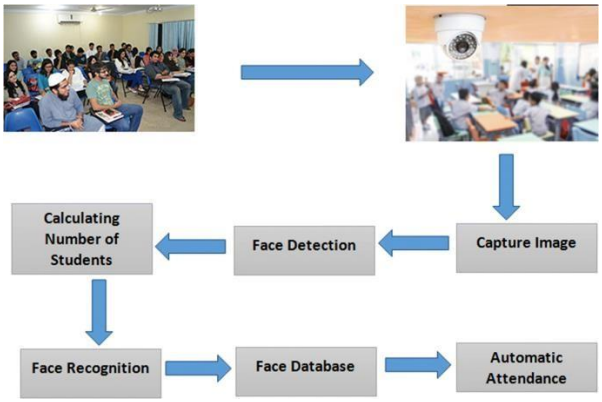
6. METHODOLOGY

The methodology of a smart attendance system using face recognition involves creating a database of individuals, acquiring images, preprocessing the images, extracting features, matching the features with the database, and tracking attendance. The system can provide a more efficient and accurate way to track attendance and can help to reduce errors and save time.



Database creation: The first step is to create a database of all the students or employees whose attendance needs to be tracked. This database should include their names and a set of images of their faces captured under different lighting conditions and angles.

Image acquisition: The second step is to acquire an image of the student or employee using a camera or any other imaging device. This image is then sent to the face recognition system for processing.



Preprocessing: The acquired image is preprocessed to remove noise, distortions, and other artifacts that may interfere with the recognition process. This step may include operations such as resizing, cropping, filtering, and normalization.

Feature extraction: Once the image has been preprocessed, the face recognition system extracts features that are relevant for face recognition. These features may include the position and shape of facial landmarks such as the eyes, nose, and mouth, as well as texture and color information.

Face matching: The extracted features are then compared with the images in the database to find a match. If a match is found, the attendance is marked for that student or employee.

Attendance tracking: The attendance of all the students or employees can be tracked automatically by integrating the face recognition system with a database management system. This system can generate attendance reports and notify the relevant authorities in case of any absences or late arrivals.

7. WORKING MODEL

A smart attendance system using facial recognition in a classroom involves the following steps:

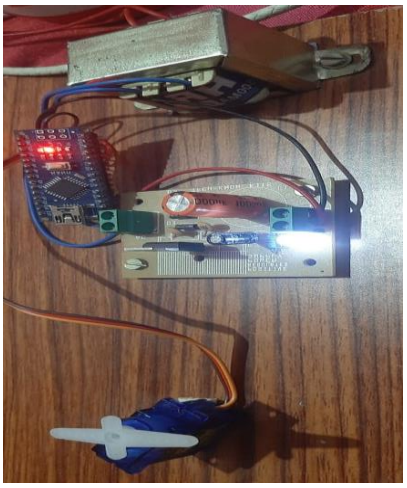
Enrollment: At the beginning of the semester, the system enrolls each student by capturing their facial features using a camera. The system may take multiple pictures of the student's face from different angles to create a more comprehensive digital representation of their facial features.

Database Creation: The system stores the digital representation of each student's facial features in a database, along with their name and other relevant information, such as their student ID number.

Attendance Taking: When it is time for attendance, the system activates the camera and begins capturing images of the students in the classroom. The system detects the faces in the images and matches them against the database of enrolled students to identify each student. This step involves feature extraction and face matching, as described in the previous answer.

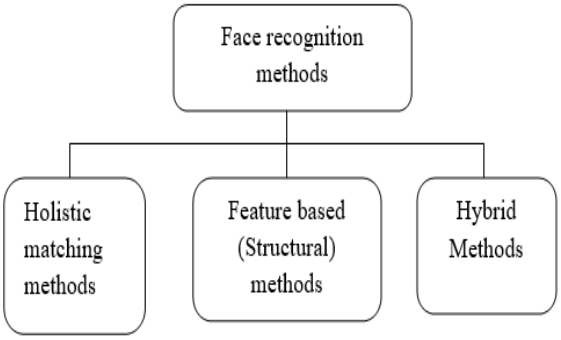
Attendance Recording: Once the system has identified each student, it records their attendance for the class session. The system may display a list of names of the students who are present or absent for the teacher to verify.

Data Management: The system stores the attendance data in a database, which can be accessed by the teacher or school administration. The system may also generate reports on attendance, including the number of students present or absent for each class session, and the overall attendance rate for each student.



8. METHODS

Face recognition is the process of identifying or verifying the identity of an individual by analyzing and comparing their facial features. Face recognition or face identification compares an input image (probe) against a database (gallery) and reports a match, if any. The purpose of face authentication is to verify the claimof the identity of an individual in an input image. These methods take into account the entirety of the object being compared, rather than focusing on specific features or parts. They analyze the overall structure, shape, and context of the objects to make a comparison. The following methods are used to face recognition:



Holistic Matching Methods:

Holistic matching methods in face recognition are a powerful tool for improving the accuracy and reliability of facial recognition results. By analyzing the entire structure and appearance of a face, these methods enable facial recognition software to provide more accurate and reliable results under different lighting conditions, angles, and poses. Holistic matching methods in face recognition have applications in various domains, including security, law enforcement, and entertainment. As the demand for more accurate and reliable facial recognition technology continues to grow, holistic matching methods in face recognition will become increasingly important in improving the accuracy and reliability of facial recognition results.

Feature based (Structural) methods:

Feature-based methods in face recognition involve identifying unique features of an individual's face, such as the distance between the eyes, the shape of the nose, and the curvature of the lips, and using these features to create a mathematical model that can be used to match an individual's face with a reference image. These methods rely on computer vision techniques such as edge detection, feature extraction, and template matching.

One of the popular feature-based methods in face recognition is the Eigenface algorithm, which uses principal component analysis to extract the most significant facial features and represent them as a low-dimensional vector. This vector can then be used to match an individual's face with a reference image by comparing the distance between the vectors. The Featured based method consists of High accuracy, Low computational complexity.

Feature-based methods can provide high accuracy in face recognition, especially when the facial features are well-defined and prominent. It can be computationally efficient, making them suitable for real-time applications.

Hybrid Methods:

Hybrid methods in facial recognition refer to the combination of different approaches or techniques to improve the accuracy and robustness of the system. Hybrid methods can combine feature-based and appearance-based methods, or use multiple feature-based methods together. Hybrid methods in facial recognition are becoming increasingly popular due to their ability to combine the strengths of different techniques and overcome their weaknesses.

Hybrid methods have several advantages over single methods, including improved accuracy, robustness to variations in appearance, and the ability to handle occlusions. However, they can also be more complex and computationally intensive than single methods, which can result in slower processing times. Hybrid methods have various applications in facial recognition, including security, law enforcement, and entertainment. They are used to improve the accuracy and efficiency of facial recognition systems and to provide more reliable results.

There are two most commonly used algorithms for face recognition, which are also easy toimplement using OpenC:

Eigenface:

Eigenfaces is a technique used in facial recognition and computer vision to reduce the dimensionality of image data and extract key features from faces. It is a form of principal component analysis (PCA) that finds the underlying patterns in a set of images and represents them as a set of eigenfaces.

Eigenfaces are a set of eigenvectors that represent the principal components of a set of face images. To generate these eigenvectors, first, a large set of face images is collected and normalized for size and orientation. These images are then flattened into a single vector and used to create a covariance matrix. The eigenvectors of this matrix are then computed, and the eigenvectors with the highest eigen values are retained. These retained eigenvectors form the basis of the eigenface space.

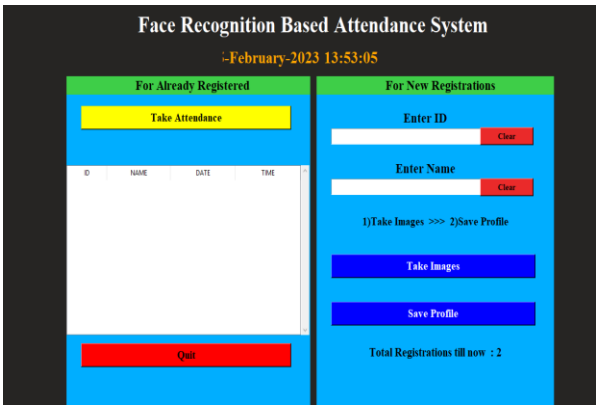
Eigenfaces are useful for facial recognition because they allow for efficient comparison of faces. To recognize a face, a new face image is projected onto the eigenface space. This projection results in a set of coefficients that represent how much the new face image matches each eigenface. By comparing these coefficients to those of known faces in a database, a match can be found, and the identity of the new face can be determined.

Eigenface

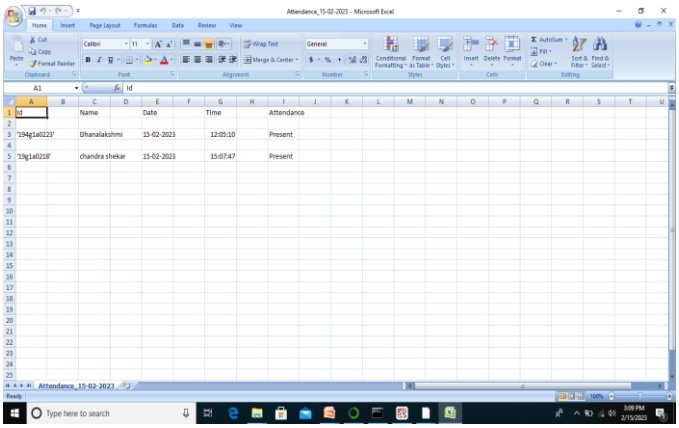
Fisherface: The Fisherface algorithm, also known as Linear Discriminant Analysis (LDA) or Fisher Discriminant Analysis (FDA), is a popular method used for dimensionality reduction and classification in image recognition tasks. The algorithm is named after its inventor, the statistician and biologist Sir Ronald Fisher. The Fisher face algorithm is particularly useful

when working with high-dimensional data such as images. It aims to find a lower-dimensional representation of the data that maximizes the separation between different classes.

9. RESULTS



Front End of FRBAS



Student Attendance is stored in the form of MsExcel

10. CONCLUSION

Smart attendance management system is designed to solve the issues of existing manual systems. We have used face recognition concept to mark the attendance of student and make the system better. The system performs satisfactory in different poses and variations. The User Interface of it is very friendly and can be easily used by anyone. It also decreases the amount of time taken to write details and other modules. All the details about students, teachers, and their other tasks can only be seen by the verified users. This Attendance Management System is a solution to all the problems related to the attendance, message, courses taken by the teachers and the students, etc. This system meets the objective of achieving high precision and less computational complexity. This system is cost-efficient and less manual work is needed. Using Gabor filters accuracy is highly improved. And it is a time saving device compare to the conventional methods of attendance and it is highly stable and accurate.

REFERENCES

[1] Belhumeur P. N., Hespanha J. P, & Kriegman, D. J. "Eigen faces vs. Fisher faces: Recognition Using Class Specific Linear Projection", IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE, VOL. 19, NO. 7, 1997, 711- 720.

[2] Clark A. F, Ehsan, S, Rehman N. u, & McDonald-Maier K. D, "Integral Images: Efficient Algorithms for Their Computation and Storage in Resource-Constrained Embedded Vision Systems", Sensors 2015. 16804-16830; doi:10.3390/s150716804.

[3] Gonzalez R. C, & Woods R. E, "Digital Image Processing" 2nd Edition, Upper Saddle River: Prentice Hall, 2009.

[4] Brian Hicks, Alec Arshavsky, Sam Trautwein, Christine Phan, James Ortiz, Krishna.R. "COMPUTER VISION: FOUNDATIONS AND APPLICATIONS" Stanford: Stanford University, CS 131, 2017.

[5] Muller A. C, & S. Guido, "Introduction to Machine Learning with Python". Sebastopol: O'Reilly Media, September 2016, ISBN: 9781449369897.

[6] Smola A, & Vishwanathan S, "Introduction to Machine Learning", Santa Clara: Cambridge University Press, 2008.

[7] Solomon C, & Breckon T, "Fundamentals of Digital Image Processing: A Practical Approach with Examples in Mat-lab". Chichester: Wiley-Blackwell, 2011, ISBN 10: 0470844728 ISBN 13: 9780470844724.

[8] Soo S, Sutton R. S, & Barto A. G, "Object detection using Haar-cascade Classifier", Institute of Computer Science, University of Tartu (pp. 1-12),. (2015).

[9] Szeliski R, "Computer Vision: Algorithms and Applications Springer", September 3, 2010 draft, Springer.

[10] Viola P, & Jones M. J, "Robust Real-Time Face Detection", International Journal of Computer Vision 57(2), 2004, 137–154.

[11] Yang M.-H, Kriegman D. J, & Ahuja N, "Detecting Faces in Images: A Survey. IEEE TRANSACTIONS ON PATTERN ANALYSIS AND MACHINE INTELLIGENCE", 2002, VOL. 24, NO. 1, 34-58.

[12] A Nagoor Kani, Microprocessors and Microcontrollers (Author) Publisher : McGraw Hill Education; 2nd edition.

[13] Ghalib Al-Muhaidhri, Javeed Hussain, "Smart attendance system using face recognition" International Journal of Engineering Research & Technology (IJERT), December-2019, Vol. 8 Issue 12