IOT
Internet of Things

BASED

ATTENDANCE SYSTEM

USING

FACE DETECTION

DURING PANDEMIC

A Capstone Project

'Submitted to'

Government Polytechnic, Gondia
ESTD. TECHNOLOGY FOR HUMANITY 2009

GOVERNMENT POLYTECHNIC GONDIA

FULCHUR PETH, GOREGAON ROAD, GONDIA

Session 2020-2021

CAPSTONE PROJECT-EXECUTION REPORT

On

"IoT Based Attendance System using Face Detection during Pandemic"

Submitted for the partial fulfilment of Sixth Semester subject "**Capstone Project –Execution & Report writing**" code: **22060**

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Department of Computer Engineering
Government Polytechnic, Gondia
Summer-2021

Certificate

This is to certify that ***Capstone Project-Execution Report*** *titled*

"IoT Based Attendance System using Face Detection during Pandemic"

Carried out under the guidance of ***Mr P S Thakre****, Lecturer, Computer department and submitted to the Department of Computer Engineering*

By

As the partial fulfilment of the Sixth Semester Course of ***Capstone Project-Execution & Report Writing****, Code:* ***22060*** *during Summer-2021*

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Acknowledgement

This is completed Capstone project Planning work comes as gift to us after all the efforts that has gone in to it has been a beautiful end over only because of the valuable guidance of our guide and well Wishers.

We wish extend our heart full gratitude of our guide **Mr P. S. Thakre** for his constant guidance, encouragement, motivation for every stage of this work made Capstone project Execution a success.
Finally we are proud to express our gratitude and respect to each member of this group.

Place: Government Polytechnic, Gondia
Date:

ABSTRACT

- To maintain the attendance record with day to day activities is a challenging task. The conventional method of calling name of each student is time consuming and there is always a chance of proxy attendance. The following system is based on face recognition to maintain the attendance record of students. The daily attendance of students is recorded subject wise which is stored already by the administrator. As the time for corresponding subject arrives the system automatically starts taking snaps and then apply face detection and recognition technique to the given image and the recognize students are marked as present and their attendance update with corresponding time and subject id. We have used deep learning techniques to develop this system, histogram of oriented gradient method is used to detect faces in images and deep learning method is used to compute and compare feature facial of students to recognize them. Our system is capable to identify multiple faces in real time.
- The attendance maintenance system is the major performance evaluation of the student. In recent periods, the student attendance is maintained in the system manually and updated in the particular college server. In proposed system, we implements a IOT based web camera technique. In this the student image is captured while registration process and saved in the database with all the relevant and personal information. To calculate the attendance the student image is captured in which the details are fetched from the database. The daily attendance is updated in the database by the administrator. When the particular student image is captured, then the details is fetched from the database. The student attendance can be updated to database and database send the attendance details to parent by mobile sms system.
- The student attendance is marked by face recognition. For face detection and face recognition the raspberry pi. If the camera is connected to Raspberry pi USB port then only images will capture of the students who are available in the class for face detection. The captured images recognises with stored images then in that images we will recognize the faces of every student and according to that attendance will be given to that subject class. This process is carried out for every class and students are given attendance accordingly. Faculty attendance is monitored with this project. We can mark the attendance at any time without any human Intervention.

- Keywords— Student Attendance, Raspberry Pi, Camera, Face Detection, Face Recognition, Image Processing, Open CV, Python, Faculty Attendance, ESP32, OLED.

Contents

CHAPTER 1
Introduction

1.1. INTRODUCTION

IoT Based Attendance System using Face Detection during Pandemic refers to an IOT based project to mark attendance automatically using Face Identification and Detection. This project is built under abnormal conditions faced by the entire world named "COVID-19" during 2020-2021, while we are remotely thinking about to solve a big problem that can be faced by Industries, Educational Sectors etc. to mark attendance of corresponding workers, students. Automatic attendance saves time and efficiently manages data but some existing devices i.e Biometric fingerprint based systems would not work in this pandemic conditions as fingerprint can also have viruses that can infect others, so to overcome this problem we have identified a project to mark attendance using Face Detection functionality.

Next thing is What does it mean by "IOT"? **IoT**(internet of things) is the process refers to scenarios where network connectivity and computing capability extends to objects, sensors and everyday items not normally considered computing device with unique identifiers object, animal and people. There is no single, universal definition.

IoT implementations use different technical communications models, each with its own characteristics are device to cloud, device to gateway, back end data sharing. These models highlight the flexibility in the ways that iot devices can connect and provide value to the user. Every Academic Session Student information systems provide capabilities for registering students in courses, documenting grading, transcripts, results of student tests and other assessment scores, building student schedules, tracking student attendance, and managing many other student-related data needs in a college. Students have unique registration number, Name ,Father Name, Location all details are stored in data base.

To maintenance and reporting the students detail. Staff management may involve moving a workforce around and utilizing Human Resource. HR planning is needed for staffing, to consider the skills, knowledge, and attributes needed when hiring new staff.

HR will also look at the number of staff needed and who they believe are the most qualified. Staff qualification, Department, handling Subject are update in the database and also Staff having a separate Login to update the students details.

View the students detail and update attendance detail. the attendance detail send sms to parents. Face recognition is a computer application capable of identifying or verifying a person from digital image or a video frame from video source by comparing selected facial features from the image and a face database and biometric method of identifying an individual by comparing live capture or digital image data with stored record for that person.

Face recognition systems based on face prints can quickly accurately identify target individuals when the conditions are favourable. Sensors detection are used in everyday objects such as view sensor and capture the image to detecting the base, besides innumerable applications. Moreover sensors such as potentiometers and force-sensing resistors are still widely used

1.2. PROBLEM STATEMENT

Traditional student attendance marking technique is often facing a lot of trouble. The face recognition student attendance system emphasizes its simplicity by eliminating classical student attendance marking technique such as calling student names or checking respective identification cards. There are not only disturbing the teaching process but also causes distraction for students during exam sessions.

Apart from calling names, attendance sheet is passed around the classroom during the lecture sessions. The lecture class especially the class with a large number of students might find it difficult to have the attendance sheet being passed around the class. Thus, face recognition student attendance system is proposed in order to replace the manual signing of the presence of students which are burdensome and causes students get distracted in order to sign for their attendance. Furthermore, the face recognition based automated student attendance system able to overcome the problem of fraudulent approach and lecturers does not have to count the number of students several times to ensure the presence of the students.

Every organization requires a robust and stable system to record the attendance of their students. and every organization have their own method to do so, some are taking attendance manually with a sheet of paper by calling their names during lecture hours and some have adopted biometrics system such as fingerprint, RFID card reader, Iris system to mark the attendance.

The conventional method of calling the names of students manually is time consuming event. The RFID card system, each student assigns a card with their corresponding identity but there is chance of card loss or unauthorized person may misuse the card for fake attendance. While in other biometrics such as finger print, iris or voice recognition, they all have their own flaws and also they are not 100% accurate

Use of face recognition for the purpose of attendance marking is the smart way of attendance management system. Face recognition is more accurate and faster technique among other techniques and reduces chance of proxy attendance. Face recognition provide passive identification that is a person which is to be identified does not to need to take any action for its identity.

Face recognition involves two steps, first step involves the detection of faces and second step consist of identification of those detected face images with the existing database. There are number of face detection and recognition methods introduced. Face recognition works either in form of appearance based which covers the features of whole face or feature based which covers the geometric feature like eyes, nose, eye brows, and cheeks to recognize the face

CHAPTER 2
Literature Survey

2.1. LITERATURE SURVEY

This section gives an overview on the major human face recognition techniques that apply mostly to frontal faces, advantages and disadvantages of each method are also given. The methods considered are eigenfaces (eigenfeatures), neural networks, dynamic link architecture, hidden Markov model, geometrical feature matching, and template matching. The approaches are analyzed in terms of the facial representations they used.

A. Eigenfaces

Eigenface is one of the most thoroughly investigated approaches to face recognition. It is also known as KarhunenLoève expansion, eigenpicture, eigenvector, and principal component. References [26, 27] used principal component analysis to efficiently represent pictures of faces. They argued that any face images could be approximately reconstructed by a small collection of weights for each face and a standard face picture (eigenpicture). The weights describing each face are obtained by projecting the face image onto the eigenpicture. Reference [28] used eigenfaces, which was motivated by the technique of Kirby and Sirovich, for face detection and identification. In mathematical terms, eigenfaces are the principal components of the distribution of faces, or the eigenvectors of the covariance matrix of the set of face images. The eigenvectors are ordered to represent different amounts of the variation, respectively, among the faces. Each face can be represented exactly by a linear combination of the eigenfaces.

It can also be approximated using only the “best” eigenvectors with the largest eigenvalues. The best M eigenfaces construct an M dimensional space, i.e., the “face space”. The authors reported 96 percent, 85 percent, and 64 percent correct classifications averaged over lighting, orientation, and size variations, respectively. Their database contained 2,500 images of 16 individuals. As the images include a large quantity of background area, the above results are influenced by background. The authors explained the robust performance of the system under different lighting conditions by significant correlation between images with changes in illumination.

However, [29] showed that the correlation between images of the whole faces is not efficient for satisfactory recognition performance. Illumination normalization [27] is usually necessary for the eigenfaces approach. Reference [30] proposed a new method to compute the covariance matrix using three images each was taken in different lighting conditions to account for arbitrary illumination effects, if the object is Lambertian. Reference [31] extended their early work on eigenface to eigenfeatures corresponding to face components, such as eyes, nose, and mouth. They used a modular eigenspace which was composed of the above eigenfeatures (i.e., eigeneyes, eigennose, and eigenmouth). This method would be less sensitive to appearance changes than the standard eigenface method. The system achieved a recognition rate of 95 percent on the FERET database of 7,562 images of approximately 3,000 individuals. In summary, eigenface appears as a fast, simple, and practical method. However, in general, it does not provide invariance over changes in scale and lighting conditions. Recently, in [32] experiments with ear and face recognition, using the standard principal component

analysis approach , showed that the recognition performance is essentially identical using ear images or face images and combining the two for multimodal recognition results in a statistically significant performance improvement. For example, the difference in the rank-one recognition rate for the day variation experiment using the 197-image training sets is International Journal of Signal Processing Volume 2 Number 2 90 90.9% for the multimodal biometric versus 71.6% for the ear and 70.5% for the face. There is substantial related work in multimodal biometrics. For example [33] used face and fingerprint in multimodal biometric identification, and [34] used face and voice. However, use of the face and ear in combination seems more relevant to surveillance applications.

B. Neural Networks

The attractiveness of using neural networks could be due to its non linearity in the network. Hence, the feature extraction step may be more efficient than the linear Karhunen-Loève methods. One of the first artificial neural networks (ANN) techniques used for face recognition is a single layer adaptive network called WISARD which contains a separate network for each stored individual [35]. The way in constructing a neural network structure is crucial for successful recognition. It is very much dependent on the intended application. For face detection, multilayer perceptron [36] and convolutional neural network [37] have been applied. For face verification, [38] is a multi-resolution pyramid structure. Reference [37] proposed a hybrid neural network which combines local image sampling, a self-organizing map (SOM) neural network, and a convolutional neural network. The SOM provides a quantization of the image samples into a topological space where inputs that are nearby in the original space are also nearby in the output space, thereby providing dimension reduction and invariance to minor changes in the image sample. The convolutional network extracts successively larger features in a hierarchical set of layers and provides partial invariance to translation, rotation, scale, and deformation.

The authors reported 96.2% correct recognition on ORL database of 400 images of 40 individuals. The classification time is less than 0.5 second, but the training time is as long as 4 hours. Reference [39] used probabilistic decision-based neural network (PDBNN) which inherited the modular structure from its predecessor, a decision based neural network (DBNN) [40]. The PDBNN can be applied effectively to 1) face detector: which finds the location of a human face in a cluttered image, 2) eye localizer: which determines the positions of both eyes in order to generate meaningful feature vectors, and 3) face recognizer. PDNN does not have a fully connected network topology. Instead, it divides the network into K subnets. Each subset is dedicated to recognize one person in the database. PDNN uses the Guassian activation function for its neurons, and the output of each “face subnet” is the weighted summation of the neuron outputs. In other words, the face subnet estimates the likelihood density using the popular mixture-of-Guassian model. Compared to the AWGN scheme, mixture of Guassian provides a much more flexible and complex model for approximating the time likelihood densities in the face space. The learning scheme of the PDNN consists of two phases, in the first phase; each subnet is trained by its own face images.

In the second phase, called the decision-based learning, the subnet parameters may be trained by some particular samples from other face classes. The decision-based learning scheme does not use all the training samples for the training. Only misclassified patterns are used. If the sample is misclassified to the wrong subnet, the rightful subnet will tune its parameters so that its decision-region can be moved closer to the misclassified sample. PDBNN-based biometric identification system has the merits of both neural networks and statistical approaches, and its distributed computing principle is relatively easy to implement on parallel computer. In [39], it was reported that PDBNN face recognizer had the capability of recognizing up to 200 people and could achieve up to 96% correct recognition rate in approximately 1 second. However, when the number of persons increases, the computing expense will become more demanding. In general, neural network approaches encounter problems when the number of classes (i.e., individuals) increases. Moreover, they are not suitable for a single model image recognition test because multiple model images per person are necessary in order for training the systems to "optimal" parameter setting.

C. Graph Matching

Graph matching is another approach to face recognition. Reference [41] presented a dynamic link structure for distortion invariant object recognition which employed elastic graph matching to find the closest stored graph. Dynamic link architecture is an extension to classical artificial neural networks. Memorized objects are represented by sparse graphs, whose vertices are labeled with a multiresolution description in terms of a local power spectrum and whose edges are labeled with geometrical distance vectors. Object recognition can be formulated as elastic graph matching which is performed by stochastic optimization of a matching cost function. They reported good results on a database of 87 people and a small set of office items comprising different expressions with a rotation of 15 degrees. The matching process is computationally expensive, taking about 25 seconds to compare with 87 stored objects on a parallel machine with 23 transputers. Reference [42] extended the technique and matched human faces against a gallery of 112 neutral frontal view faces. Probe images were distorted due to rotation in depth and changing facial expression. Encouraging results on faces with large rotation angles were obtained. They reported recognition rates of 86.5% and 66.4% for the matching tests of 111 faces of 15 degree rotation and 110 faces of 30 degree rotation to a gallery of 112 neutral frontal views. In general, dynamic link architecture is superior to other face recognition techniques in terms of rotation invariance; however, the matching process is computationally expensive.

D. Hidden Markov Models (HMMs)

Stochastic modeling of nonstationary vector time series based on (HMM) has been very successful for speech applications. Reference [43] applied this method to human face recognition. Faces were intuitively divided into regions such as the eyes, nose, mouth, etc., which can be associated with the states of a hidden Markov model. Since HMMs require a one-dimensional observation sequence and images are two-dimensional, the images should be converted into either 1D temporal sequences or 1D spatial sequences.

International Journal of Signal Processing Volume 2 Number 2 91 In [44], a spatial observation sequence was extracted from a face image by using a band sampling technique. Each face image was represented by a 1D vector series of pixel observation. Each observation vector is a block of L lines and there is an M lines overlap between successive observations. An unknown test image is first sampled to an observation sequence. Then, it is matched against every HMMs in the model face database (each HMM represents a different subject). The match with the highest likelihood is considered the best match and the relevant model reveals the identity of the test face. The recognition rate of HMM approach is 87% using ORL database consisting of 400 images of 40 individuals. A pseudo 2D HMM [44] was reported to achieve a 95% recognition rate in their preliminary experiments. Its classification time and training time were not given (believed to be very expensive). The choice of parameters had been based on subjective intuition.

E. Geometrical Feature Matching

Geometrical feature matching techniques are based on the computation of a set of geometrical features from the picture of a face. The fact that face recognition is possible even at coarse resolution as low as 8x6 pixels [45] when the single facial features are hardly revealed in detail, implies that the overall geometrical configuration of the face features is sufficient for recognition. The overall configuration can be described by a vector representing the position and size of the main facial features, such as eyes and eyebrows, nose, mouth, and the shape of face outline. One of the pioneering works on automated face recognition by using geometrical features was done by [46] in 1973. Their system achieved a peak performance of 75% recognition rate on a database of 20 people using two images per person, one as the model and the other as the test image. References [47,48] showed that a face recognition program provided with features extracted manually could perform recognition apparently with satisfactory results. Reference [49] automatically extracted a set of geometrical features from the picture of a face, such as nose width and length, mouth position, and chin shape. There were 35 features extracted form a 35 dimensional vector. The recognition was then performed with a Bayes classifier.

They reported a recognition rate of 90% on a database of 47 people. Reference [50] introduced a mixture-distance technique which achieved 95% recognition rate on a query database of 685 individuals. Each face was represented by 30 manually extracted distances. Reference [51] used Gabor wavelet decomposition to detect feature points for each face image which greatly reduced the storage requirement for the database. Typically, 35-45 feature points per face were generated. The matching process utilized the information presented in a topological graphic representation of the feature points. After compensating for different centroid location, two cost values, the topological cost, and similarity cost, were evaluated. The recognition accuracy in terms of the best match to the right person was 86% and 94% of the correct person's faces was in the top three candidate matches.

F. Template Matching

A simple version of template matching is that a test image represented as a two-dimensional array of intensity values is compared using a suitable metric, such as the Euclidean distance, with a single template representing the whole face. There are several other more sophisticated versions of template matching on face recognition. One can use more than one face template from different viewpoints to represent an individual's face. A face from a single viewpoint can also be represented by a set of multiple distinctive smaller templates [49,52]. The face image of gray levels may also be properly processed before matching [53]. In [49], Bruneli and Poggio automatically selected a set of four features templates, i.e., the eyes, nose, mouth, and the whole face, for all of the available faces. They compared the performance of their geometrical matching algorithm and template matching algorithm on the same database of faces which contains 188 images of 47 individuals. The template matching was superior in recognition (100 percent recognition rate) to geometrical matching (90 percent recognition rate) and was also simpler. Since the principal components (also known as eigenfaces or eigenfeatures) are linear combinations of the templates in the data basis, the technique cannot achieve better results than correlation [49], but it may be less computationally expensive. One drawback of template matching is its computational complexity. Another problem lies in the description of these templates. Since the recognition system has to be tolerant to certain discrepancies between the template and the test image, this tolerance might average out the differences that make individual faces unique. In general, template-based approaches compared to feature matching are a more logical approach. In summary, no existing technique is free from limitations. Further efforts are required to improve the performances of face recognition techniques, especially in the wide range of environments encountered in real world

G. 3D Morphable Model

The morphable face model is based on a vector space representation of faces [54] that is constructed such that any convex combination of shape and texture vectors of a set of examples describes a realistic human face. Fitting the 3D morphable model to images can be used in two ways for recognition across different viewing conditions: Paradigm 1. After fitting the model, recognition can be based on model coefficients, which represent intrinsic shape and texture of faces, and are independent of the imaging conditions: Paradigm 2. Three-dimension face reconstruction can also be employed to generate synthetic views from gallery probe images [55-58]. The synthetic views are then International Journal of Signal Processing Volume 2 Number 2 92 transferred to a second, viewpoint-dependent recognition system. More recently, [59] combines deformable 3 D models with a computer graphics simulation of projection and illumination. Given a single image of a person, the algorithm automatically estimates 3D shape, texture, and all relevant 3D scene parameters. In this framework, rotations in depth or changes of illumination are very simple operations, and all poses and illuminations are covered by a single model. Illumination is not restricted to Lambertian reflection, but takes into account specular reflections and cast shadows, which have considerable influence on the appearance of human skin.

This approach is based on a morphable model of 3D faces that captures the class-specific properties of faces. These properties are learned automatically from a data set of 3D scans. The morphable model represents shapes and textures of faces as vectors in a high-dimensional face space, and involves a probability density function of natural faces within face space. The algorithm presented in [59] estimates all 3D scene parameters automatically, including head position and orientation, focal length of the camera, and illumination direction. This is achieved by a new initialization procedure that also increases robustness and reliability of the system considerably. The new initialization uses image coordinates of between six and eight feature points. The percentage of correct identification on CMU-PIE database, based on side-view gallery, was 95% and the corresponding percentage on the FERET set, based on frontal view gallery images, along with the estimated head poses obtained from fitting, was 95.9%.

TABLE I
FACE RECOGNITION RESULTS OF EDGE MAP. EIGINFACE (20- EIGINVECTORS), AND LEM [61]

	Bern database			AR database		
Method	EM	Eigenface	LEM	EM	Eigenface	LEM
Recognition rate	97.7%	100%	100%	88.4%	55.4%	96.4%

TABLE II
RECOGNITION RESULTS WITH SIZE VARIATIONS [61]

	Top 1	Top 5	Top 10
Edge map	43.3%	56.0%	64.7%
Eigenface (112-eigenvectors)	44.9%	68.8%	75.9%
LEM (pLHD)	53.8%	67.6%	71.9%
LEM (LHD)	66.5%	75.9%	79.7%

TABLE VI
EXPERIMENT RESULTS USING POLYNOMIAL KERNELS

Classifiers type	Number Of Support vectors	Training Accuracy On 150 examples	Testing Accuracy On 450 examples	Testing Accuracy Using max. output from three classifiers
Frontal vs others	33	100%	99.33%	100%
Left 33.75^0 vs others	25	100%	99.56%	
Right 33.75^0 vs others	37	100%	99.78%	

We have seen that there are many projects are available in the market related to mark attendance which has submitted to Educational industries also, their Flexibility, integrity, Stability as shown below:

System type	Advantages	Disadvantages
RFID card system	Simple	Fraudulent usage
Fingerprint system	Accurate	Time-consuming
Voice recognition system	-	Less accurate compared to others
Iris recognition system	Accurate	Privacy Invasion

The aim of all the researches was to make face recognition as automated and accurate as possible through various types of inputs such as static images, video clips, etc. so as to increase its applications in real world. Computational methods of face recognition need to address numerous challenges. These type of difficulties appear because faces are need to be represented in such a way that best utilizes the available face information to define a specific face from all the other faces in the database. Also, extracting such detailed facial features can be used in slandering the search and enhancing recognition.

The problem of automatic face recognition involves three key steps:

(1) Face Detection

(2) Feature extraction

(3) Recognition

- **Internet Survey Analysis on Face Detection Technology**
    - Face recognition is an important application of Image processing owing to its use in many fields. ... The proposed system aims to overcome the pitfalls of the existing systems and provides features such as detection of faces, extraction of the features, detection of extracted features, and analysis of students' attendance.
    - Face recognition is also useful in human computer interaction, virtual reality, database recovery, multimedia, computer entertainment, information security e.g. operating system, medical records, online banking., Biometric e.g. Personal Identification - Passports, driver licenses , Automated identity verification -
    - We can use face recognition to record attendance from everyone present in an organization. In this face recognition, many algorithms are performed to dissect and capture images of someone's face, such as Machine Learning and Deep Learning. With this algorithm, the system can recognize a person's face and record attendance from that person so that attendance activities are more efficient and faster.
    - Use of face recognition for the purpose of attendance marking is the smart way of attendance management system. Face recognition is more accurate and faster technique among other techniques and reduces chance of proxy attendance.
    - This system can be used in Companies, Industries, Educational and governmental sectors to detect the presence of workers, students, employees in corresponding departments. This can also be useful in household purposes just like to secure home lock.
    - Facial recognition in future can be used in order to reduce time consumption and touch less operations.

- Face recognition algorithm can be improved with respect to the utilization of resources so that the project can recognize more number of faces at a time which can make the system far better. Many variants of the project can be developed and utilized for home security and personal or organizational benefits. We can also trace a particular student in an organization quickly with the help of this system

- The future of facial recognition technology is bright. Forecasters opine that this technology is expected to grow at a formidable rate and will generate huge revenues in the coming years. Security and surveillances are the major segments which will be deeply influenced. Other areas that are now welcoming it with open arms are private industries, public buildings, and schools. It is estimated that it will also be adopted by retailers and banking systems in coming years to keep fraud in debit/credit card purchases and payment especially the ones that are online. This technology would fill in the loopholes of largely prevalent inadequate password system. In the long run, robots using facial recognition technology may also come to foray. They can be helpful in completing the tasks that are impractical or difficult for human beings to complete.
- Governments across the world are increasingly investing their resources in facial recognition technology, especially the US and China are the leaders in the facial recognition market.
- The government of the USA has decided to enhance airport security with a facial recognition system for identification and registration of visitors. The US has several states that have allowed law enforcement to run searches within the database – these searches include details of a driver's license and ID photos. The facial recognition and resulting search techniques can be also used in police checks.
- China is already running several projects of facial intelligence when the other countries are still in its planning phase.
- The whole world is using this technology and reaping many benefits. In India, banks are using this facial recognition technology to prevent fraud at ATM's. It is also used for reporting duplicate voters, verification of passport and visa, driving license, etc.

The future of facial recognition is promising.

- The technology is expected to grow and will create massive revenues in the coming years. Surveillance and security are the major industries that will be intensely influenced by technology. Schools and universities and even healthcare are also planning to implement the facial recognition technology on their premises for better management. Complicated technology used in facial technology is also making its way to the robotics industry.

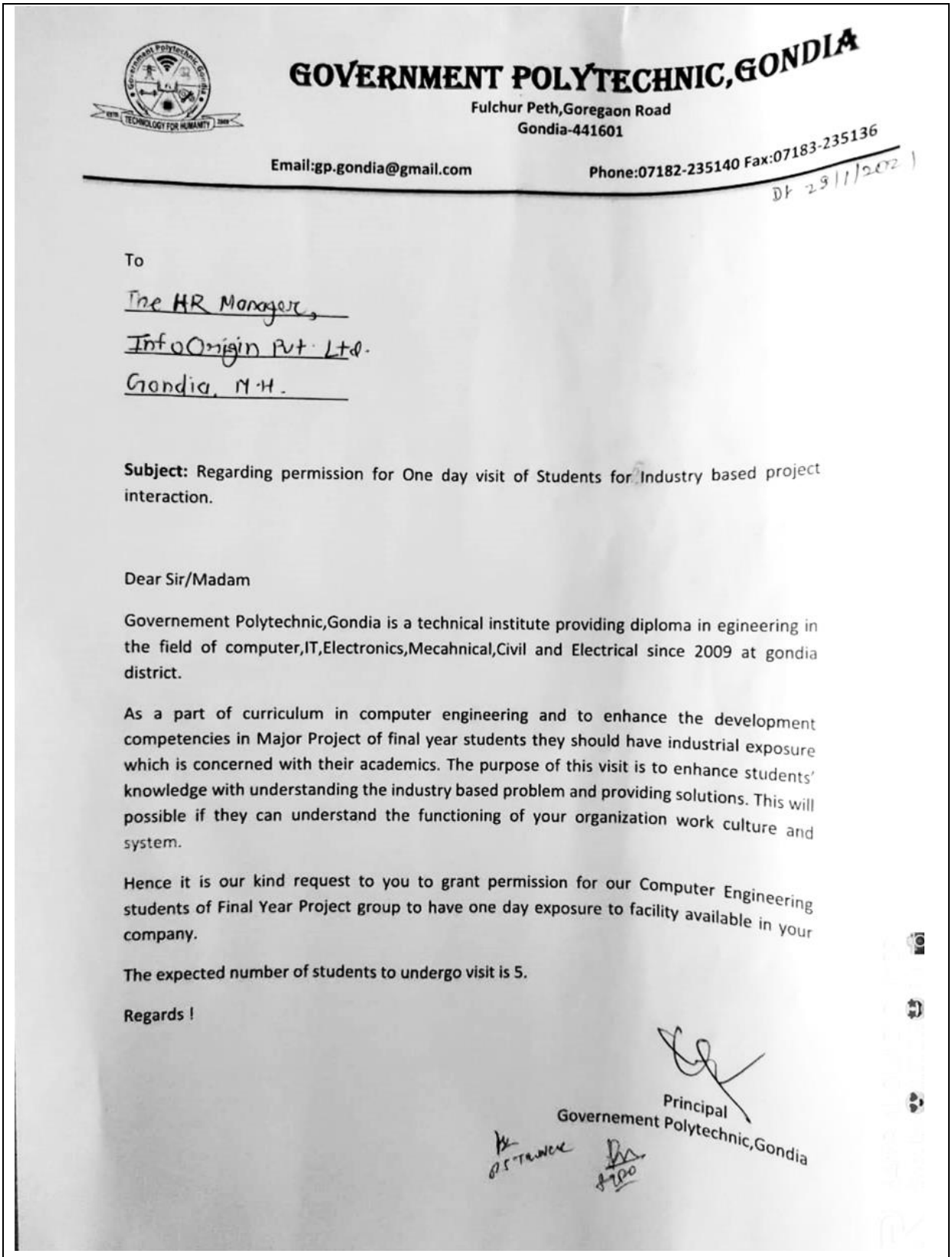
- **Industrial Visit Literature Survey(Info Origin Private Limited, Gondia)**

We have visited an Software Development Industry of our locality area company named as ***Info-Origin PVT. LTD.*** For industrial survey for out Major Project Topic to take out difficulties they are facing while registering presence/ attendance of their employees during this pandemic year.

We have noticed that company issues with registering attendance with their already having biometric fingerprint Attendance monitoring system
Which generally records presence of employee whenever employee puts his/ her fingerprint on machine, but during this pandemic year we have to stay out with regular surfaces when someone touches it and their virus can affect us, so we have notified this problem given a suggestion to that industry to take touch-less attendance via ***IoT Based Attendance System using Face Detection***.

We have presented our Idea in front of them i.e H.R Manager **Mr. Pankaj Bhojwani** Sir for that we are preparing or working on this system in current situation, so as they want to fulfil or resolve their problems difficulties they have faced this system is best for achieving.

We got an appreciation letter also from this Software Industry for presenting this beautiful idea to them and to ready/ prepare this model to resolve this problem.



GOVERNMENT POLYTECHNIC,GONDIA

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Dt 29/1/2021

To

The HR Manager,
InfoOrigin Pvt. Ltd.
Gondia, M.H.

Subject: Regarding permission for One day visit of Students for Industry based project interaction.

Dear Sir/Madam

Governement Polytechnic,Gondia is a technical institute providing diploma in egineering in the field of computer,IT,Electronics,Mecahnical,Civil and Electrical since 2009 at gondia district.

As a part of curriculum in computer engineering and to enhance the development competencies in Major Project of final year students they should have industrial exposure which is concerned with their academics. The purpose of this visit is to enhance students' knowledge with understanding the industry based problem and providing solutions. This will possible if they can understand the functioning of your organization work culture and system.

Hence it is our kind request to you to grant permission for our Computer Engineering students of Final Year Project group to have one day exposure to facility available in your company.

The expected number of students to undergo visit is 5.

Regards !

Principal
Governement Polytechnic,Gondia

THE LETTER THAT IS GIVEN BY OUR GUIDE SIGNED WITH PRINCIPAL SIGNATURE FOR PRE KNOWLEDGE OUR GROUP's VISIT TO THEIR INDUSTRY FOR 1 DAY.

Group photo with Mr. Pankaj Bhojwani sir about our one day visit and industrial based project interaction to their info origin technologies pvt. Ltd.

INFO ORIGIN

04/02/2021

TO WHOM SO EVER IT MAY CONCERN

I received your letter yesterday, which concerns about of One Day visit to our Industry for your Industry based team project interaction and to have one day exposure to facility available in our company.

- Vishal Kesharwani
- Shardaprasad Kawle
- Kunal Harinkhede
- Pankaj Maudekar
- Oditya Katre

In response to your Letter, this letter serves to confirm that above mentioned students from Government Polytechnic, Gondia was as an Industrial Visitor with **Info Origin Technologies Pvt. Ltd.** from 03rd Feb 2021 to 4th Feb 2021.

During above tenure, we found them disciplined, sincere and diligent in their duties and responsibilities.

We wish all the best for thier future endeavors.

Sincerely

Pankaj Bhojwani
Hiring Manager
Info Origin Technologies Pvt Ltd.

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Letter Received From Info Origin Technologies Pvt. Ltd.
After Successfully Completion Of One Day Visit To Their Company

CHAPTER 3
Scope of the Project

3.0. SCOPE OF THE PROJECT

- Provides an automated attendance system that is practical, reliable and eliminate disturbance and time loss of traditional attendance systems.
- Present a system that can accurately evaluate student's performance depending on their recorded attendance rate.

- This is developed to mark the attendance for students and faculty without any person interference that makes very useful for institutions and schools to mark the attendance easily. This system helps for the people by saving time they can know the attendance academic performance anywhere by registering in student/faculty registration in web page which has been developed in this paper.

- The same project can be utilized for several security applications where authentication is needed to access the privileges of the respective system. It can be used in recognizing guilty parties involving in unauthorized business.

- Face recognition algorithm can be improved with respect to the utilization of resources so that the project can recognize more number of faces at a time which can make the system far better. Many variants of the project can be developed and utilized for home security and personal or organizational benefits. We can also trace a particular student in an organization quickly with the help of this system.

Currently, industries, organizations are using personal identification strategies such as RFID, Iris recognition, Fingerprint identification is used for taking attendance. Among of all these personal identification strategies including face recognition is most natural, less time is taken and high efficient one despite being difficult to implement, a continuous observation for overcoming it.

- It has several applications in attendance management systems and security systems. In this work, a system is implemented that takes attendance for students during lecture, employees in industries and etc. using face detection and recognition technology. A time period is set for taking attendance and the database is automatically uploaded into the web server through the internet connectivity. This process is done without any human intervention. In the system a Raspberry Pi installed with OpenCV library and a Raspberry Pi Camera module is connected for facial detection and Recognition. The data is stored in the memory card connected to Raspberry Pi and it can be accessed through the internet. The results show that a continuous observation increases accuracy and maximizes the output.

CHAPTER 4
Methodology

4.1. METHODOLOGY

SYSTEM ARCHITECTURE:

Referring to System Architecture figure from above chapter the USB Camera is connected to the raspberry pi camera slot. Live video stream of students is captured in the class with USB1 camera, Raspberry pi takes those images as input images and uploaded to the AWS cloud platform and we make use of face recognition service to compare the input images with the existing image. Matched images are detected and attendance is marked with date and time for students present in class in the local data base using MYSQL. This process is carried out for every period and students are given attendance accordingly. This happens due to importing the open CV packages at the initial stage of the development of the system.

Admin tracks the attendance of the students periodically or whenever required by the administration and finds the result. The result is displayed on the monitor screen. Student/Faculty attendance will be monitored and if the student/faculty is absent for that class then the notification will send to the HOD and parents.

- **Execution Solution**

To overcome the problems in the existing attendance system we shall develop a Biometric based attendance system over simple attendance system. There are many solutions to automate the attendance management system like thumb based system, simple computerized attendance system, Iris scanner, but all these systems have limitations overwork and security point of view. Our proposed system shall be a "Face Recognition Attendance System" which uses the basic idea of image processing which is used in many security applications like banks, airports, Intelligence agencies etc.

- **SOFTWARE DESCRIPTION:**

A. Python IDLE:

IDLE is integrated development environment for editing and running python2.x or python 3 programs. Where we can see or check the output.

B. Raspbian O.S:

Raspbian is a free operating system which is used run the applications. To run our applications install the Raspbian OS. Raspbian OSis bestfor Ras-pi 3 controller for developing our system.

C. NOOBS:

NOOBS -New Out Of Box Software is aninstallation manager for the Raspberry Pi. We install this manager in SD card of Raspberry pi.

D. Python:

Python is a programming language. Which has easy syntaxes to read that allows fewer lines of code to the programmers. This language is also suitable for other customized applications.

2. Algorithms Followed in order to prepare model:

The Algorithm of proposed system is as follows.

1. Write Raspbian OS in to the SD card and fix the card into the SD slot
2. Install all the open CV libraries into the raspberry pi.
3. Fix the entire hardware setup.
4. Take the video data in that images of individual student from classroom camera
5. With the viola Jones Algorithm Face Detection is done.
6. Take the detected faces of students.
7. Crop the faces of the students.
8. In Exit folder the detected images of students will be stored.
9. The features of stored images and detected images will be compared
10. Marks the Student's Attendance based on recognized faces.

- **Face Detection Algorithm:**

In this viola jones algorithm is used in this 160,000 features are there.
For face detection in System we have 4 steps for implementing they are:

a) Selection of Haar features
b) Integral images
c) Adaboost
d) Cascade Classifier

a) Selection of Haar features:

Haar features are similar to these convolution kernels which are used to detect the presence of that feature in the given image. Each feature results in a single value which is calculated by subtracting the sum of pixels under white rectangle from the sum of pixels under black rectangle.

Val= Σ (pixels in black region) –Σ (pixels in white region)

- **Integral images:**

For generating the sum of values in a rectangular subset of a grid in the image processing domain it is known as integral image. In an integral image the value at pixel (x,y) is the sum of pixels above and to the left (x, y) inclusive.

$ii(x, y)= \Sigma i (x', y')$ (2)

$x' \leq x, y' \leq y$

Eqn.2 combines neighbour pixel values for easy of calculation.

Fig.5: Integral image.

c) Adaboost:

As declared in viola jones algorithm have 160,000 features in that only few set of features will be useful among all these features to identify a face. In adaboost we have two classifiers they are strong and weak classifiers. The adaboost constructs a strong classifier has a linear combination of the Weak classifier.

$F(x) = \alpha 1 f1(x) + \alpha 2 f2(x) + \alpha 3 f3(x) +$

F(x) = Strong classifier

αf(x) = Weak classifier

d) Cascade Classifier:

The cascade classifier is used for composed of stages each stage contains a strong classifier when all the features are combined into different stages where each stage as number of features. That each stage is used to determine whether it's a face or not a face.

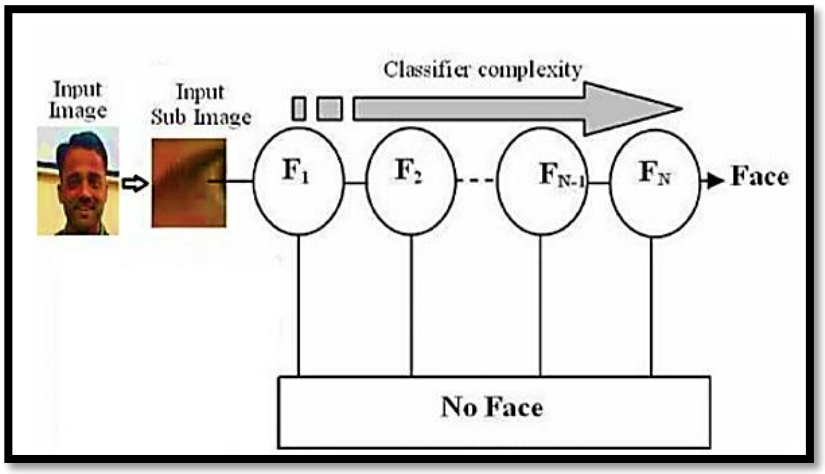


Fig.4: Cascading Classifier

6. RESULTS AND DISCUSSION: Student Registration

- **Executed System Components**

Following are the main components of the proposed system

1. Student Registration
2. Face Detection
3. Face Recognition
   - Feature Extraction
   - Feature Classification
4. Attendance management system.

   Attendance management will handle:
   - Automated Attendance marking
   - Manual Attendance marking
   - Attendance details of users.
   - Email notification for absentees.

- **Executed System Outcomes**

- ¬ It will mark attendance of the students via face Id.
- ¬ It will detect the faces via wireless camera (IP camera)/webcam and then recognize the faces.
- ¬ After recognition, it will mark the attendance of the recognized student and update the attendance record.
- ¬ The admin will be able to print these record details afterward.
- ¬ The students will also receive an email on low attendance rate.

- **Executed System Hardware/ Software Tools Used Description**

  - OpenCV Algorithm Implementation by using Any of Programming Language.
  - RASPBERRY PI 3 MODEL B (optional ESP32 board) or Arduino UNO.
  - ESP32 or Raspberry Pi Cam (upto 8MP).
  - Database (WordPress, PhP, Access or others)

OpenCV

OpenCV was started at Intel in 1999 by **Gary Bradsky** and the first release came out in 2000. **Vadim Pisarevsky** joined Gary Bradsky to manage Intel's Russian software OpenCV team. In 2005, OpenCV was used on Stanley, the vehicle who won 2005 DARPA Grand Challenge. Later its active development continued under the support of Willow Garage, with Gary Bradsky and Vadim Pisarevsky leading the project. Right now, OpenCV supports a lot of algorithms related to Computer Vision and Machine Learning and it is expanding day-by-day.

Currently OpenCV supports a wide variety of programming languages like C++, Python, Java etc and is available on different platforms including Windows, Linux, OS X, Android, iOS etc. Also, interfaces based on CUDA and OpenCL are also under active development for high-speed GPU operations.
OpenCV-Python is the Python API of OpenCV. It combines the best qualities of OpenCV C++ API and Python language.

OpenCV-Python

Python is a general purpose programming language started by **Guido van Rossum**, which became very popular in short time mainly because of its simplicity and code readability. It enables the programmer to express his ideas in fewer lines of code without reducing any readability.

Compared to other languages like C/C++, Python is slower. But another important feature of Python is that it can be easily extended with C/C++. This feature helps us to write computationally intensive codes in C/C++ and create a Python wrapper for it so that we can use these wrappers as Python modules. This gives us two advantages: first, our code is as fast as original C/C++ code (since it is the actual C++ code working in background) and second, it is very easy to code in Python. This is how OpenCV-Python works, it is a Python wrapper around original C++ implementation.

OpenCV-Python Tutorials

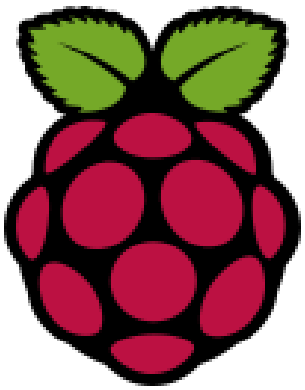
OpenCV introduces a new set of tutorials which will guide you through various functions available in OpenCV-Python. **This guide is mainly focused on OpenCV 3.x version** (although most of the tutorials will work with OpenCV 2.x also).
A prior knowledge on Python and Numpy is required before starting because they won't be covered in this guide. **Especially, a good knowledge on Numpy is must to write optimized codes in OpenCV-Python.**

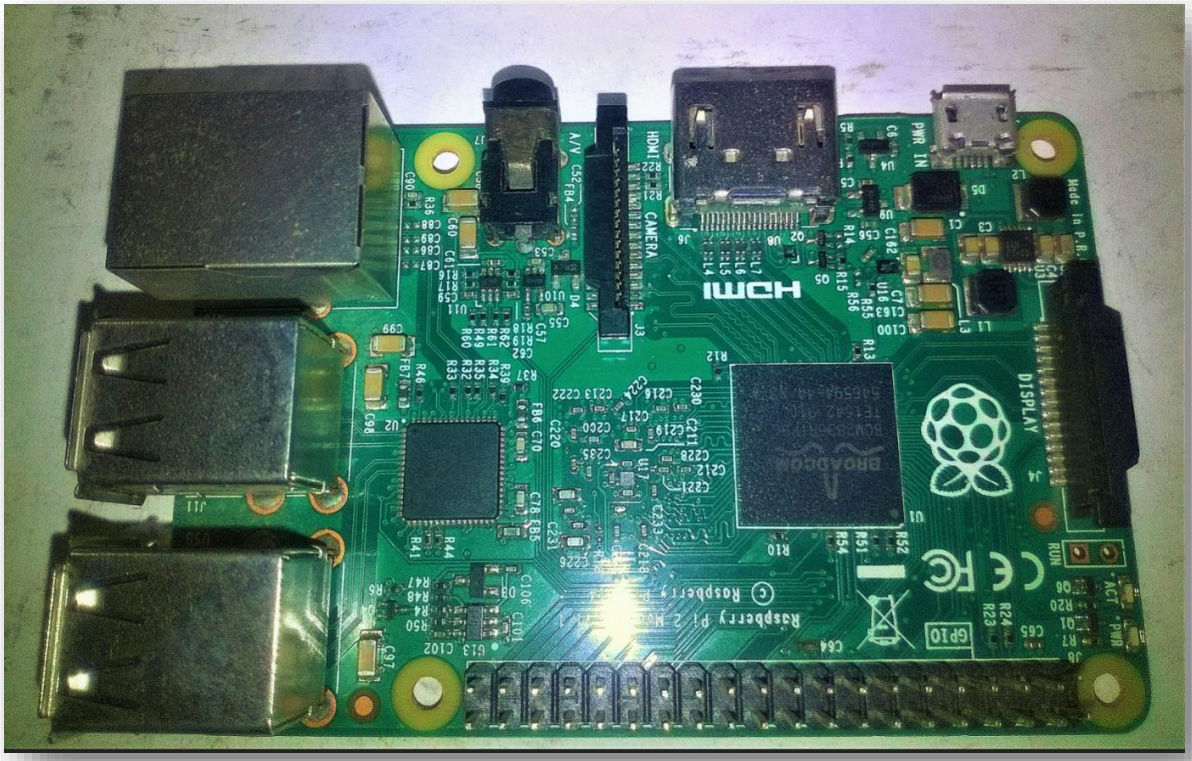
RASPBERRY PI 3 MODEL B+

Raspberry Pi is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation in association with Broadcom.[14] Early on, the Raspberry Pi project leaned towards the promotion of teaching basic computer science in schools and in developing countries.[15][16][17] Later, the original model became far more popular than anticipated,[18] selling outside its target market for uses such as robotics. It is now widely used in many areas, such as for weather monitoring,[19] because of its low cost, modularity, and open design.

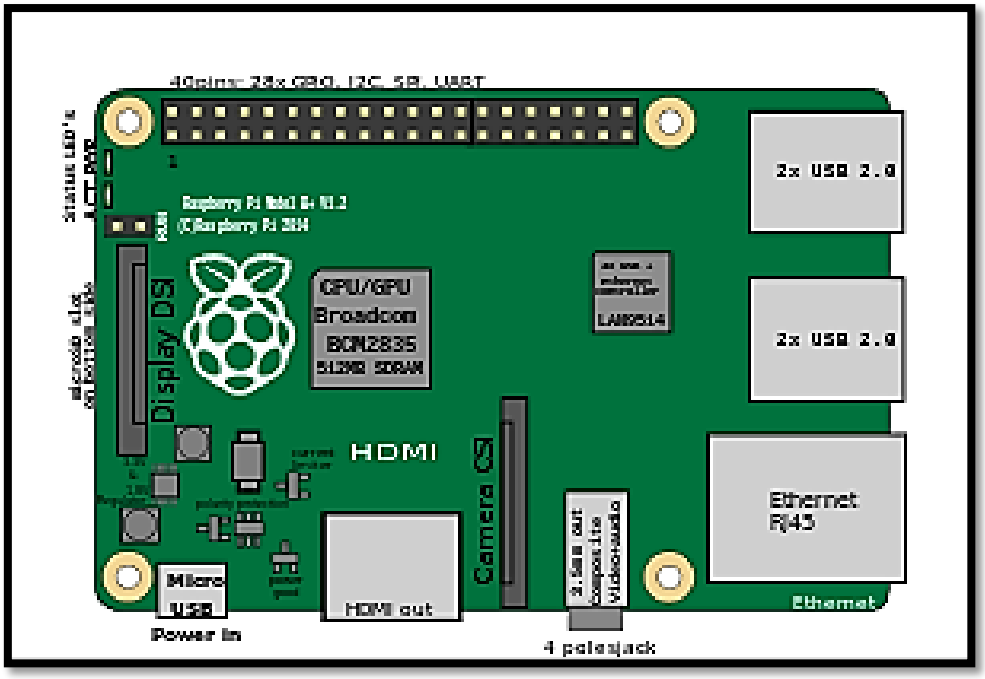
After the release of the second board type, the Raspberry Pi Foundation set up a new entity, named Raspberry Pi Trading, and installed Eben Upton as CEO, with the responsibility of developing technology.[20] The Foundation was rededicated as an educational charity for promoting the teaching of basic computer science in schools and developing countries.

The Raspberry Pi is one of the best-selling British computers.[21] As of December 2019, more than thirty million boards have been sold.[22] Most Pis are made in a Sony factory in Pencoed, Wales,[23] while others are made in China and Japan.





PI BOARD 3 INTERFACE



PI BOARD 3 ARCHITECTURE

- **Prepared Execution System**

  In our proposed system the student attendance is marked by face recognition. For face detection and face recognition the raspberry pi is used. If the camera is connected to ESP32 USB port then only images will capture of the students who are available in the class for face detection. The captured images recognises with stored images then in that images we will recognize the faces of every student and according to that attendance will be given to that subject class. This process is carried out for every class and students are given attendance accordingly. Faculty attendance is monitored with this project. A unique faceid is given to the faculty, when faculty enters the classroom, stand in front of cam, attendance will be marked with date and time. ESP32 is used along with OLED to display the faculty attendance. The student database includes the stored images which will be compared by captured images to mark the attendance and faculty database includes their registered numbers which will be compared by ESP Cam Recognized Face then attendance for the faculty is marked.

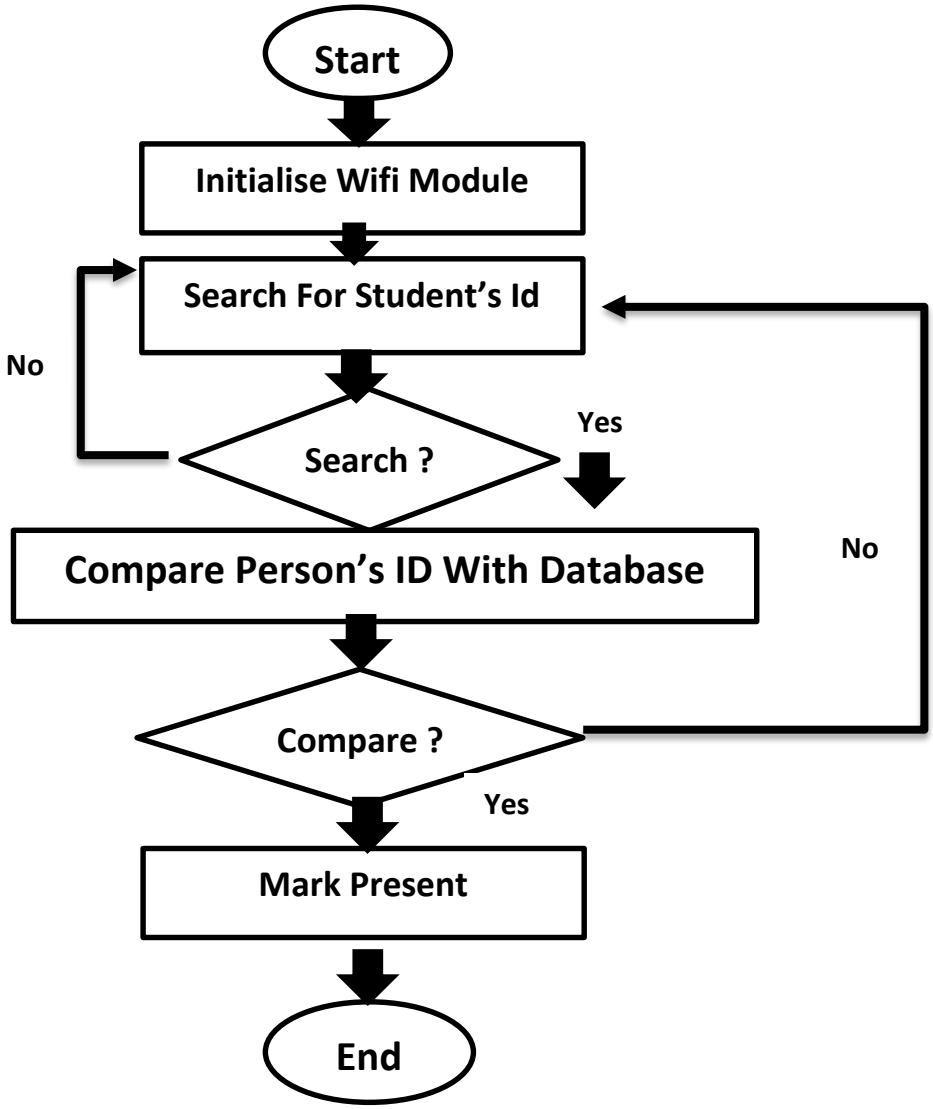


Fig. Flow-Diagram of working of our IoT Based Attendance System using Face Detection during pandemic

- **Background of the Study**

  In this process, required information of Student name, Student unique IP address, Student Register number are recorded in the local host of the main server. The same information is feed into the ESP8266 module for smart attendance system. These information will be used to identify student and delivered to local host server for validating the attendance. The host computer, Raspberry pi is connected to the computer via WiFi. Then the next step is Raspberry pi will transmit data consisting of student IP address and that indicates the attendance time to server. The attendance data will be stored in the database of local host server. After the attendance data is validated, web server response back the validation status to the Raspberry Pi. This response status will be displayed on the PC screen. By displaying this response status, staff knows whether their attendance is submitted successfully to the server or not Finally the entire students data or for an individual student data can be displayed and also staff can be take copy by taking printout. The additional application is that multiple files like documents, images, videos and zip files etc.

- **Actual Resources Used (Major Resources like raw materials, hardware, tools, software, etc.)**

Sr no.	***Resource name***	***Specifications***	***Quantity***
1.	Computer System	Desktop or Laptop with 4Gb RAM, Windows 7 or greater OS installed, 500GB SSD or 1TB HDD	1
2.	HARDWARE	RASPBERRY PI 3 MODEL B+ With inbuilt used port and cam import section.	1
3.	Camera	PI CAM 2MP/ 4MP	1
4.	USB Cable	Type C or Normal	1
5.	Software	Arduino IDE v1.8.9, Netbeans IDE v7.8 RC	---

➢ Methods Actually Followed to Accomplish this Major-Project

System installation

Raspberry Pi OS (ex Raspbian) is the recommended operating system to install and use a camera on Raspberry Pi. Everything is included and especially if you choose the official model, you'll have absolutely no issue with it. I don't know exactly which systems are compatible, you may want to try them later, but start with Raspberry Pi OS for now.

You can use the Desktop or Lite version, both are working fine with any compatible camera, so choose the one you prefer for your project.
The only advantage of the Desktop version is that you can check the picture directly on Raspberry Pi OS if you have a screen in your setup.
For remote access only, keep the Lite version.
After the installation, make sure you made these steps:

- **Raspberry Pi OS installed** with anything you need (applications, network, …)
- **Raspberry Pi OS configured** with all your favorites settings (keyboard layout and language for example)
- **System updated** with the latest version of all packages
  `sudo apt update`
  `sudo apt upgrade`
- **SSH enabled** to allow remote access for the first tests
  `sudo service ssh start`
- If you choose the Desktop version, you can also **install a remote desktop app to do everything from your computer.**

Once everything is OK, you can shut down the Raspberry Pi to install the camera
`sudo shutdown -h now`

The USB Camera We Have Used For Setting Up Hardware

Connect the camera

The camera installation on the Raspberry Pi is straightforward once you find the port location:

- Take the Raspberry Pi out of its box
- **Find the camera port on the Raspberry Pi** (between the HDMI and jack port) You'll find it easily because it's the only one that fit the cable width, and it may be written "CAMERA" on the main board.
- Before plugging the cable, you may need to remove the plastic film and lightly pull the black plastic
- **Plug the cable and push the black plastic to hold the cable inside**
    - Make sure to align both connectors on the same side (cable connectors on the HDMI port side)

Personal Hardware Setup

- Then I recommend starting with a rapid test before holding everything in the case and/or in the holder, just to be sure that it's working

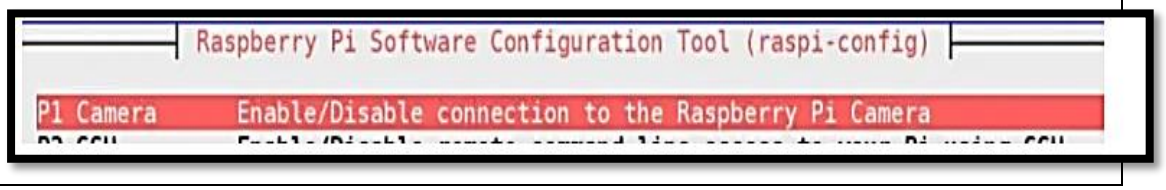
Plug all cables back (power, HDMI, network, USB …) and start the Raspberry Pi.

Enable the camera on Raspberry Pi OS

Before using the camera on your Raspberry Pi, you need to enable it in your system. The camera port is disabled by default.

- Connect using SSH (you can find useful tips here to connect via SSH from your computer).
  If you prefer, you can use a terminal on the Raspberry Pi OS desktop, or even use the Lite version.

- **Start the raspi-config tool**
  sudo raspi-config
- **Go to "Interfacing options" > "Camera"**



- "Would you like the camera interface to be enabled?"
  Yes!
- Exit raspi-config and accept the reboot

That's all you need to do.
After the reboot, the camera is ready to use.

Personal Live Streaming Camera Configured on Hands On

Commands you can use on Raspberry Pi OS to manage the camera

I will now introduce two useful commands to record and see what happen on your camera.

Take a photo

The first thing you can try is to simply take a picture of the image seen by the camera. **"raspistill" is the corresponding command on Raspberry Pi OS.** It's already installed on your system.

To use it, the basic command line is:
`raspistill -o image.jpg`

With -o you define the target file name (where the pictures will be saved) It's possible to use a file name including the path, for example: `raspistill -o ~/Pictures/mypicture.jpg`

By using raspistill without a parameter, you'll get the command help with all possible options. You can also check this page on the Raspberry Pi website for other basic options.

Control the camera with Python

The last interesting thing I want to show you is to use an advanced programming language (Python), to go further with your camera and include it in bigger projects.

Introduction

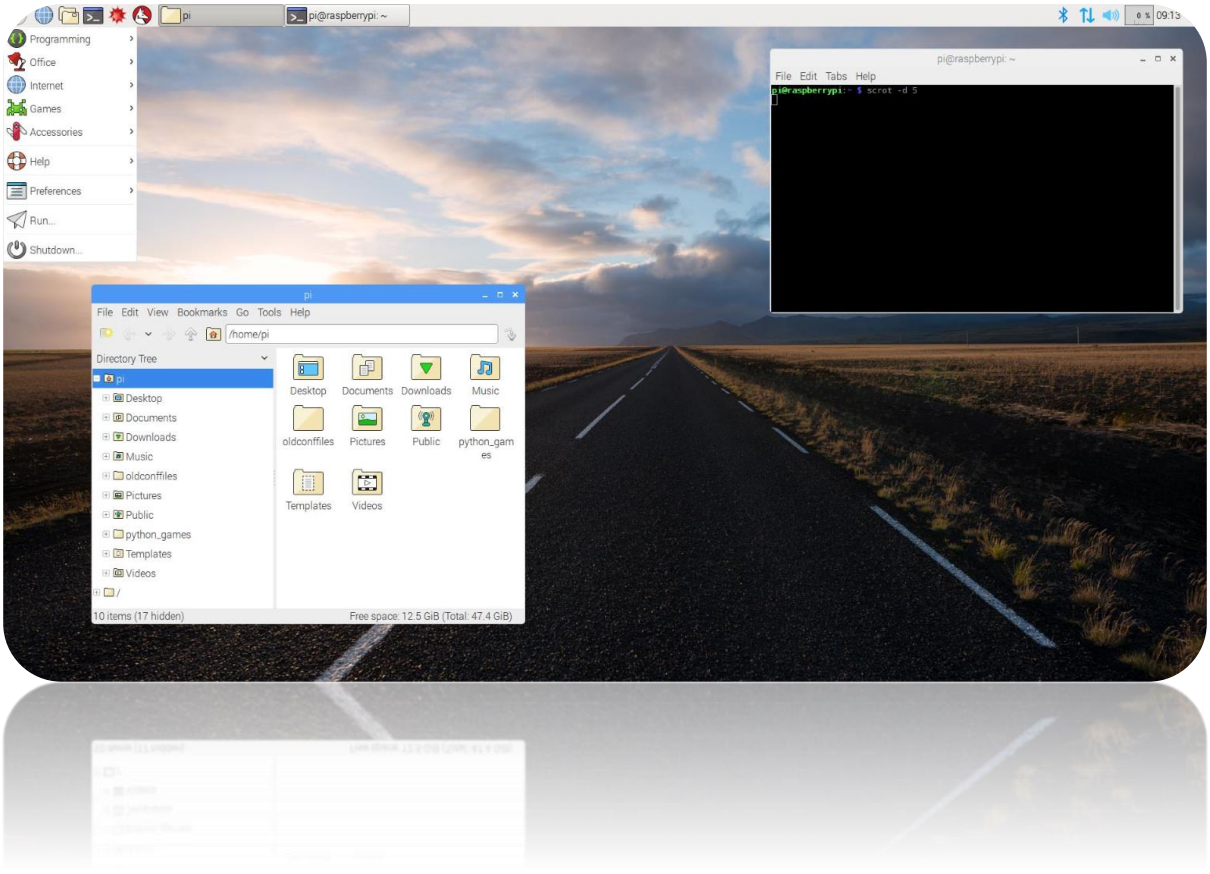
If you are new to Python and want to do more things on Raspberry, I think you may need to learn it. Python is a central language on Raspberry Pi (if I remember well, the Pi from Raspberry Pi comes from Python). And the good news is that everything is available on a default Raspberry Pi OS to use Python directly (editors, compilers, basic libraries, …).

In this part, I will not teach you everything about Python, that's not the goal, but just how to use your camera with it. If you want to learn more, I have a detailed guide on how to start with Python here.

CHAPTER 5
Design Details

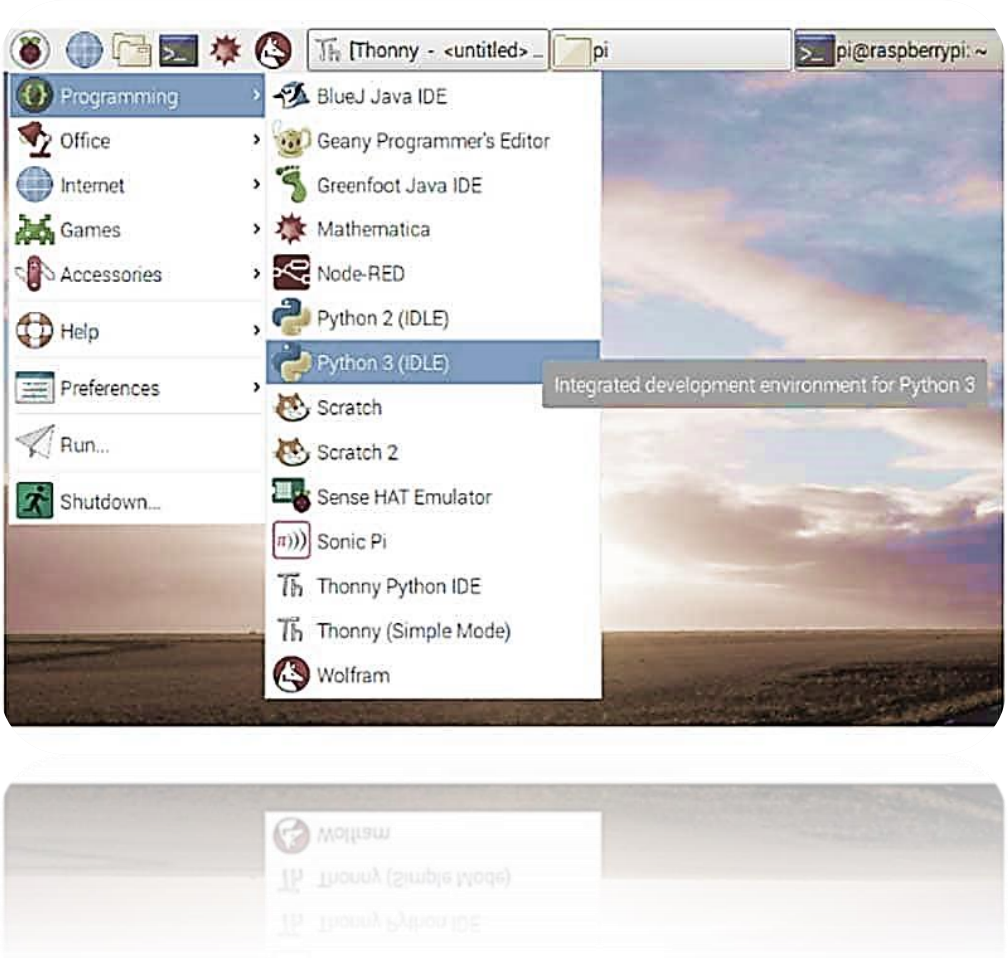
5.1. DETAILS OF DESIGN

Assembled IoT Based Attendance System using Face Detection

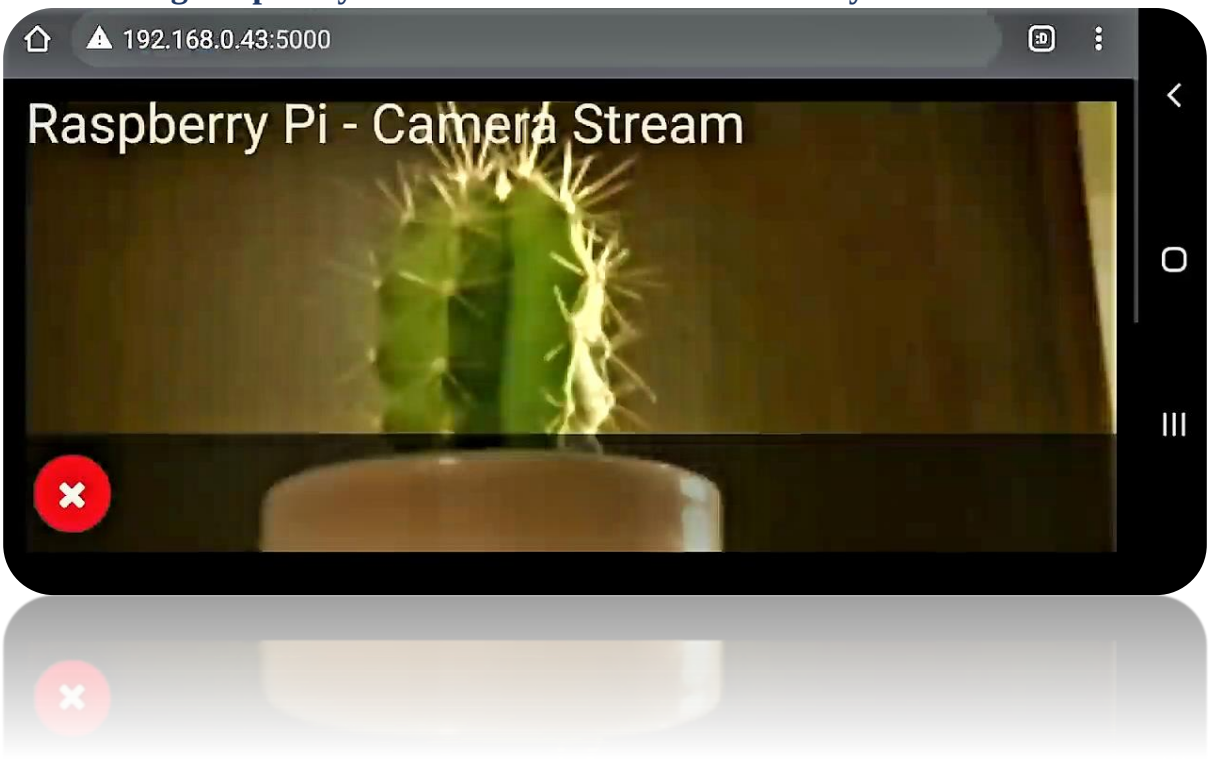


Raspberry Pi OS GUI after booting Raspberry

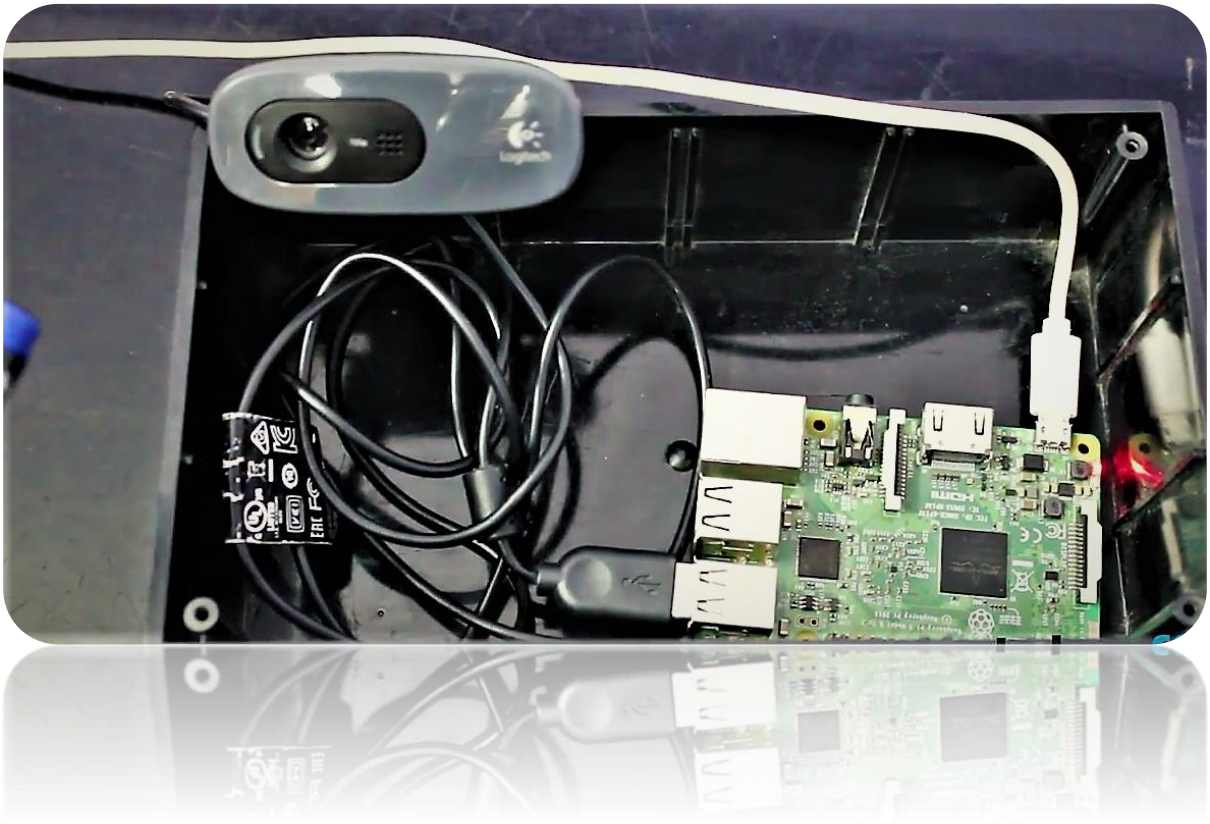
Raspberry pi Pre-Installed Python IDLE



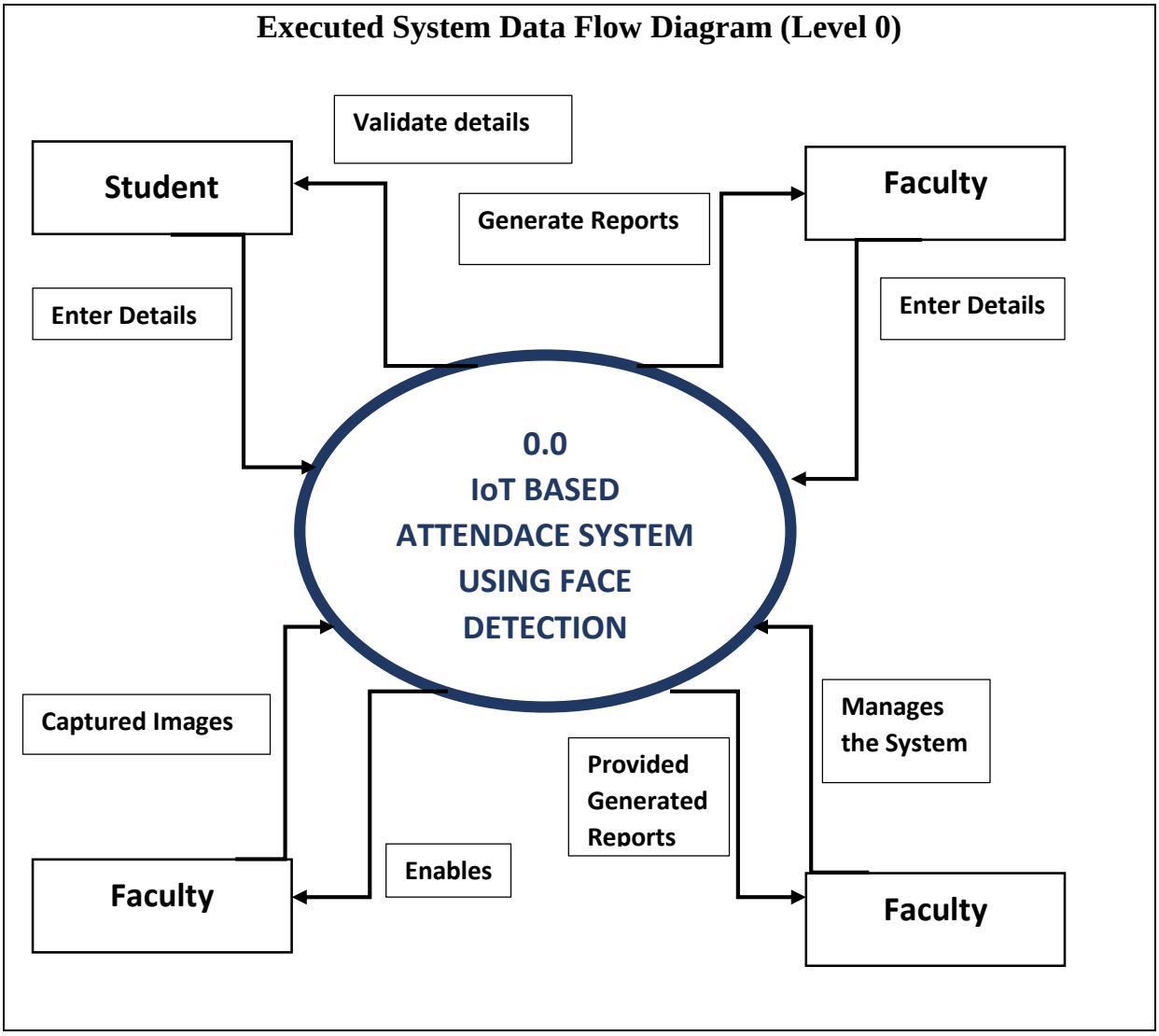
Accessing Raspberry Pi Camera Live Stream wirelessly from mobile device



Assembled Components of Face Detection Attendance System



Executed System Data Flow Diagram (Level 0)



- ## Detailed Architecture of IoT Based Attendance System Using Face Detection

Admin Logins to System

Student Registration Interface Provided

The IoT Based Attendance System Using Face Detection Module Get Started with camera enabled for capturing the face of student.

On Clicking Submit, entered data of student with detected face is then stored in database

In Real-time the Student's Face is detected and highlighted on the window.

Next Time when marking the attendance if again same student tries to recognize or record attendance, his/ her facial features is extracted and Get Matches with registered face

Student Face is Extracted from Database

If Face Matches

YES

NO

The System will show error message "Access Denied"

Attendance get marked in the database

5.2. WORKING

MAIN Methodology

The total system is divided into 3 modules- Database creation, Training the dataset, Testing, sending alert messages as an extension.

1. Database creation

a) Initialize the camera and set an alert message to grab the attention of the students.

b) Get user id as input

c) Convert the image into gray scale, detect the face and

d) Store it in database by using given input as label up to 20 frames.

2. Training

a) Initialize LBPH face recognizer.

b) Get faces and Id's from database folder to train the LBPH face recognizer.

c) Save the trained data as xml or yml file.

3. Testing

Load Haar classifier, LBPH face recognizer and trained data from xml or yml file.

a) Capture the image from camera,

b) Convert it into gray scale,

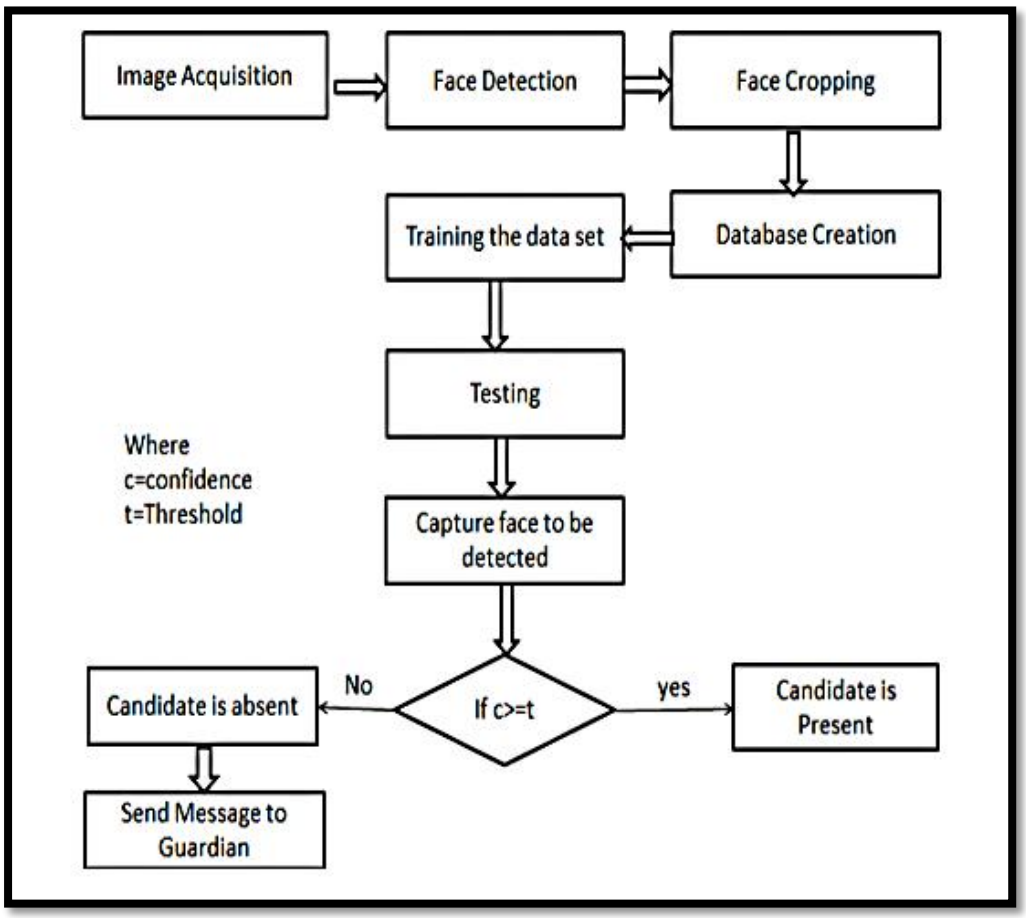
c) Detect the face in it and

d) Predict the face using the above recognizer.

This proposed system uses Viola Jones algorithm [1] for face detection which uses modified Haar Cascades for detection.

Raspberry Pi is the main component in the project. We will be using USB webcam to capture photos. We can access Raspberry Pi's console either by using SSH in laptop or by using Keyboard and mouse with the display device like TV connected to Pi. Firstly, the algorithm needs a lot of positive images and negative images to train the Haar cascades classifier. Positive images are images with clear faces where negative images are those without any faces.

To solve the complexity of the number of classifiers applied for calculation we use Adaboost machine learning algorithm, which is inbuilt in OpenCV library that is cascade classifier, to eliminate the redundancy of the classifiers. Any classifier which has a probability of 50% of more in detection is treated as weak classifier. The Sum of all weak classifier gives a strong classifier which makes the decision about detection. Although it is very vague to classify with one strong classifier we use the cascade of classifiers. Classification takes place in stages, if the selected region fails in the first stage, we discard it.



We don't use the classifiers on that region which is discarded. The region which passes all the stages i.e. all strong classifiers is treated as the detected face. Detected Faces are passed to the Face recognition phase. In this phase we use Local Binary Patterns algorithm for face recognition

5.3. PROCESSES

In this proposed system, the system is instantiated by the Power Supply .After it triggers then the system starts processing the image for which we want to mark the attendance. Image Capturing phase is one in which we capture the image. This is basic phase from which we start initializing our system. We capture an image from a camera which is predominantly checked for certain constraints like lightning, spacing, density, facial expressions. The captured image is resolute for our requirements. Once it is resolute we make sure it is either in png or jpeg format else it is converted. We take individuals different frontal postures so that the accuracy can be attained to the maximum extent. This is the training database in which every individual has been classified based on labels. For the captured image, from an every object we detect only frontal faces from viola-jones algorithm which detects only the frontal face posture of an every individual from the captured image. This detects only faces and removes every other parts since we are exploring the features of only faces. These detected faces are stored in the test database for further enquiry. Features are extracted in this extraction phase. The detected bounding boxes are further queried to look for features extraction and the extracted features are stored in matrix. For every detected phase this feature extraction is done. Features we look here are Shape, Edge, Color, Wavelet, Auto-Correlation and LBP. Face is recognized once we completed extracting features. The feature which is already trained with every individual is compared with the detected faces feature and if both features match then it is recognised. Once, it recognizes it is going to update in the student attendance database. Once, the process is completed the testing images gets deleted since, we are trying to design it for both the accuracy as well as efficiency co-efficient.

In this process, required information of Student name, Student unique IP address, Student Register number are recorded in the local host of the main server. The same information is feed into the ESP8266 module for smart attendance system. These information will be used to identify student and delivered to local host server for validating the attendance. The host computer, Raspberry pi is connected to the computer via WiFi. Then the next step is Raspberry pi will transmit data consisting of student IP address and that indicates the attendance time to server. The attendance data will be stored in the database of local host server. After the attendance data is validated, web server response back the validation status to the Raspberry Pi. This response status will be displayed on the PC screen. By displaying this response status, staff knows whether their attendance is submitted successfully to the server or not Finally the entire students data or for an individual student data can be displayed and also staff can be take copy by taking printout. The additional application is that multiple files like documents, images, videos and zip files etc.

CHAPTER 6
Results

6.1. RESULTS

Experimental Results

Test case	Image/person	Number of people	Total Images	Total Testing Images	Accuracy
Case 1	10	3	30	10	100%
Case 2	5	2	10	8	100%
Case 3	2	7	14	5	83%
Case 4	1	3	3	5	100%
Case 5	3	20	60	5	100%
Case 6	2	2	4	6	100%
Case 7	3	4	12	15	76%
Case 8	2	10	20	5	72%
Case 9	1	10	10	5	64%
Case 10	1	2	2	2	43%

Statistics

1. **Sensitivity**: measures the proportion of actual positives which are correctly identified as such. Here the condition is we have 100 non-defective tomato images and 85 images satisfy this condition.

   Sensitivity = TP / (TP + FN) = 20/(20+0) = 1

2. **Specificity**: measures the proportion of negatives which are correctly identified as such.

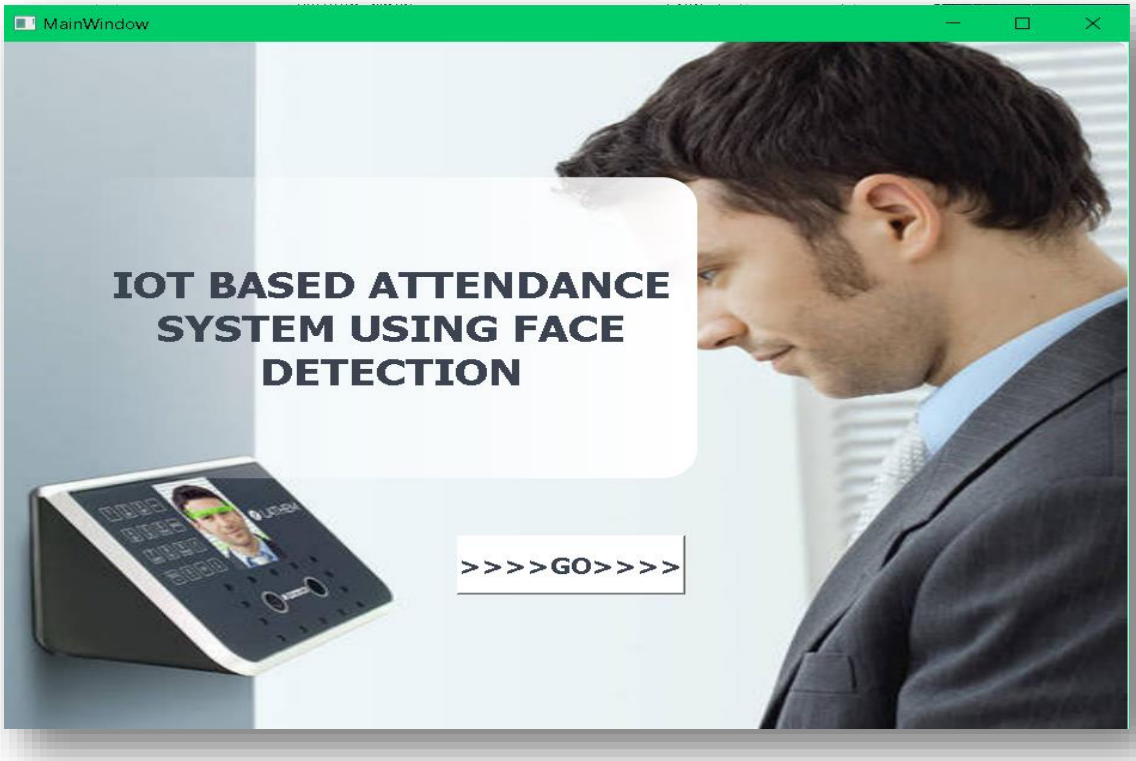
   Specificity = TN / (TN + FP)= 20/(20+0) = 1

3. **Accuracy**: measurement system is the degree of closeness of measurements of a quantity to that quantity's actual (true) value.

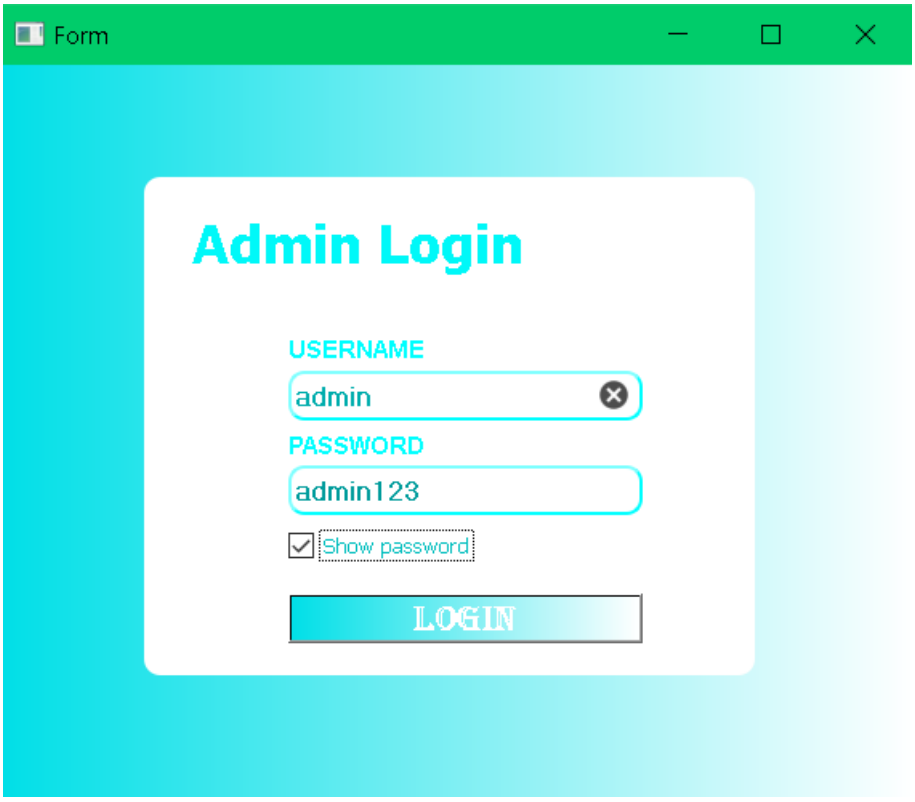
   Accuracy = (sensitivity + specificity)/2 = (1+1)/2 =1*100=100%

Initial Loading Animations

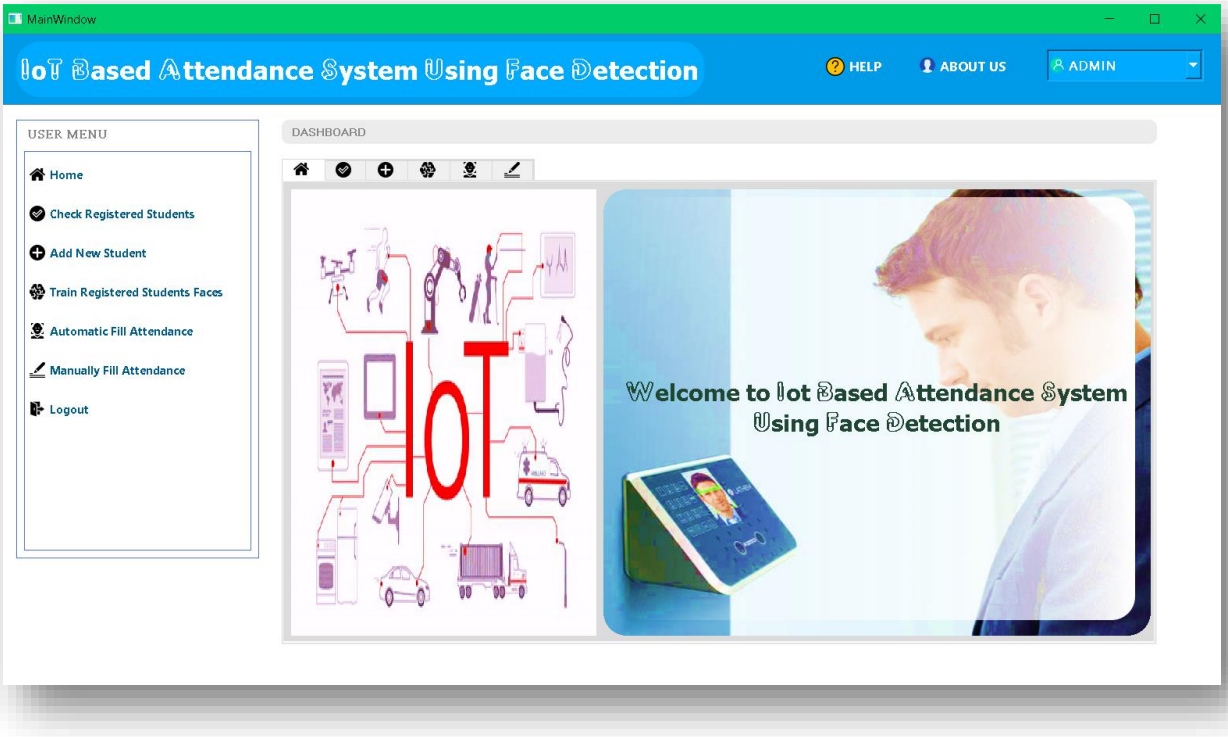
Main Landing Page of Our Attendance System



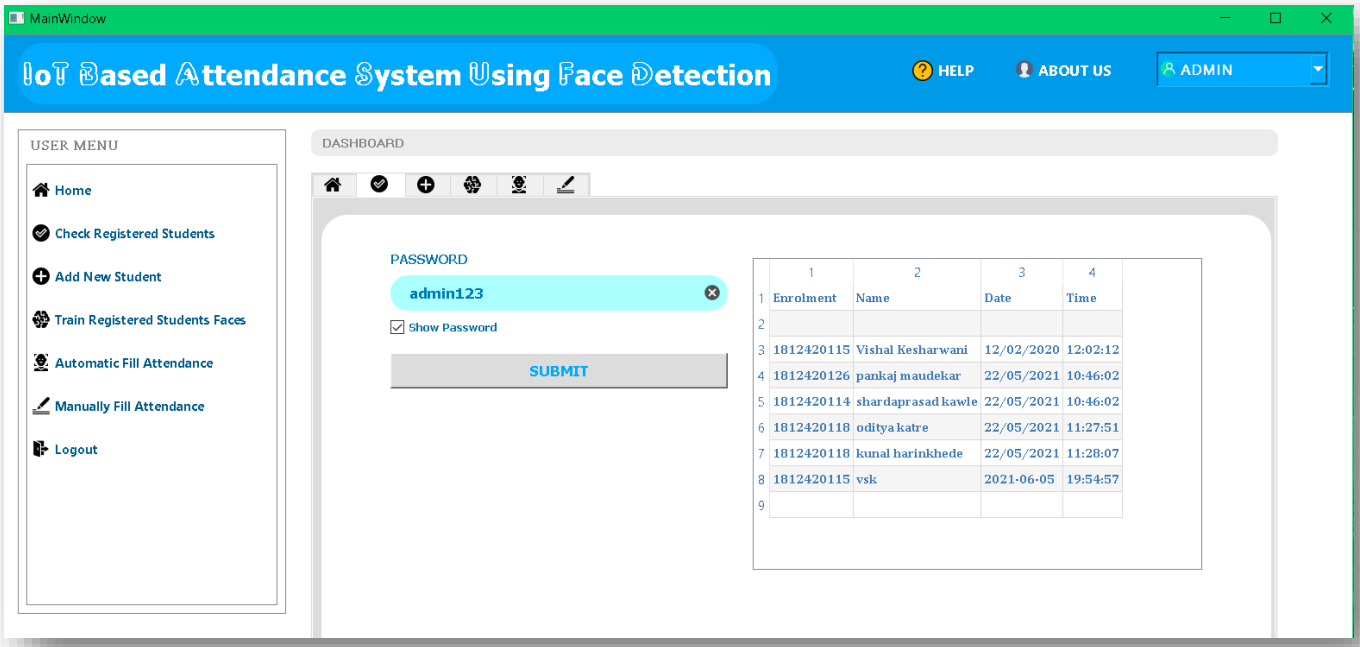
Login Page Of Our System



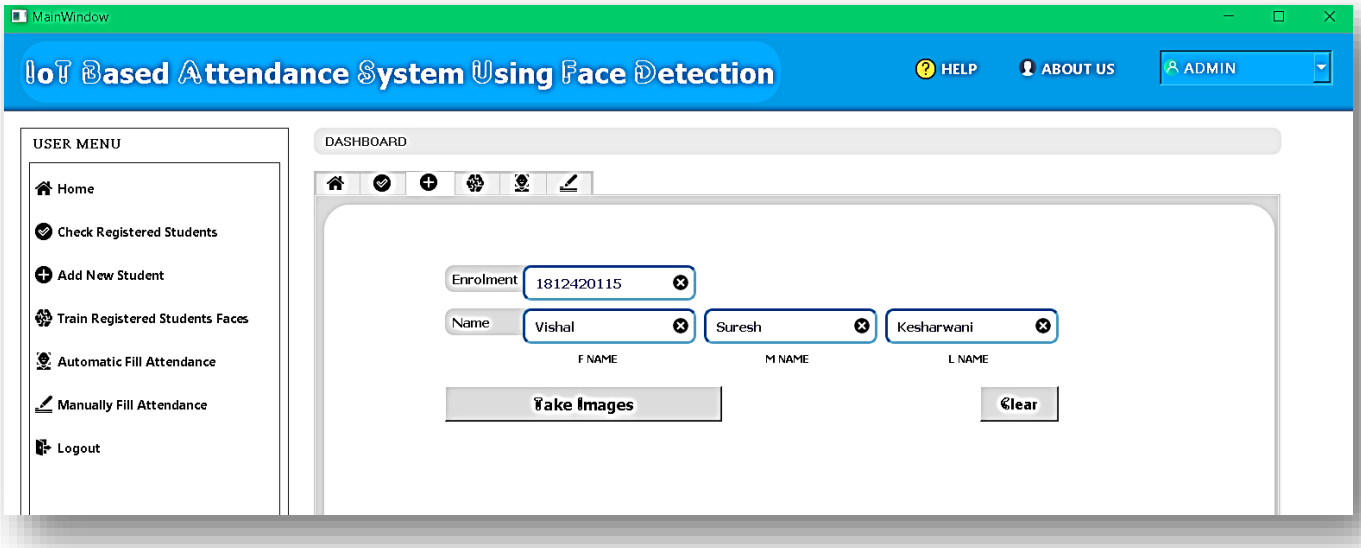
Home Page Window After Successful Loggin into system



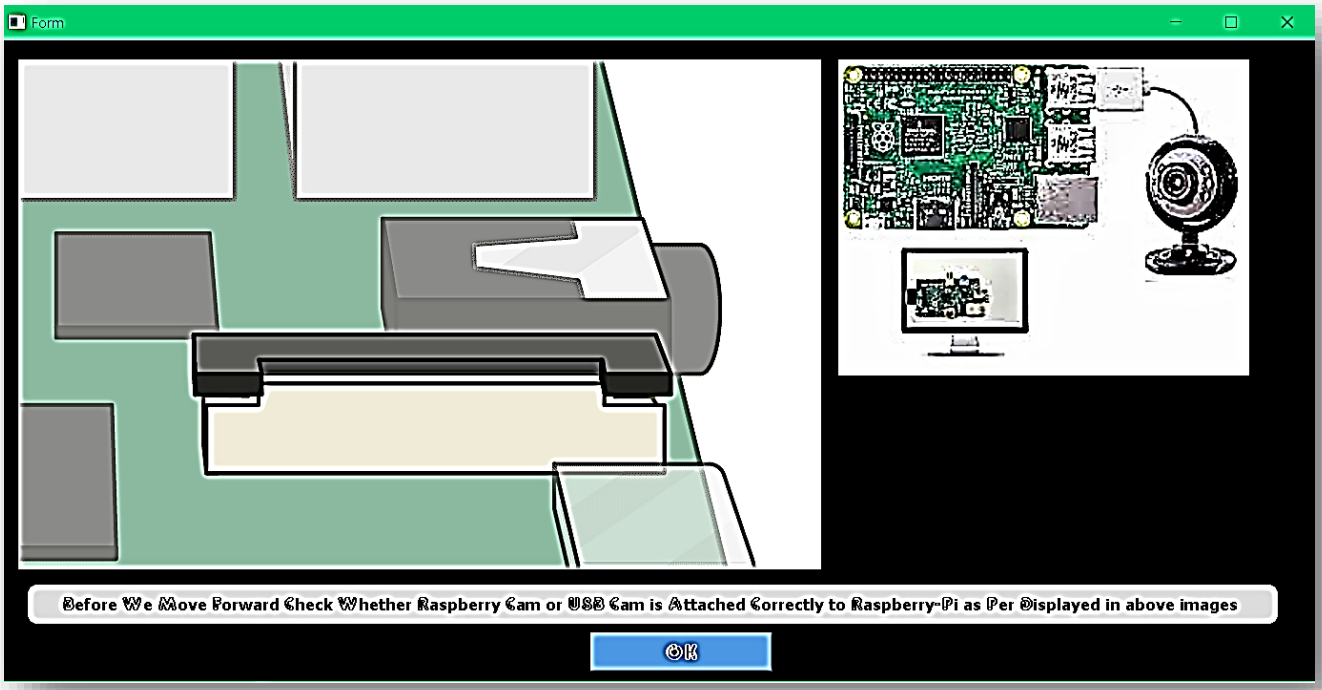
Checking Registered Students from Dashboard after Admin Verification



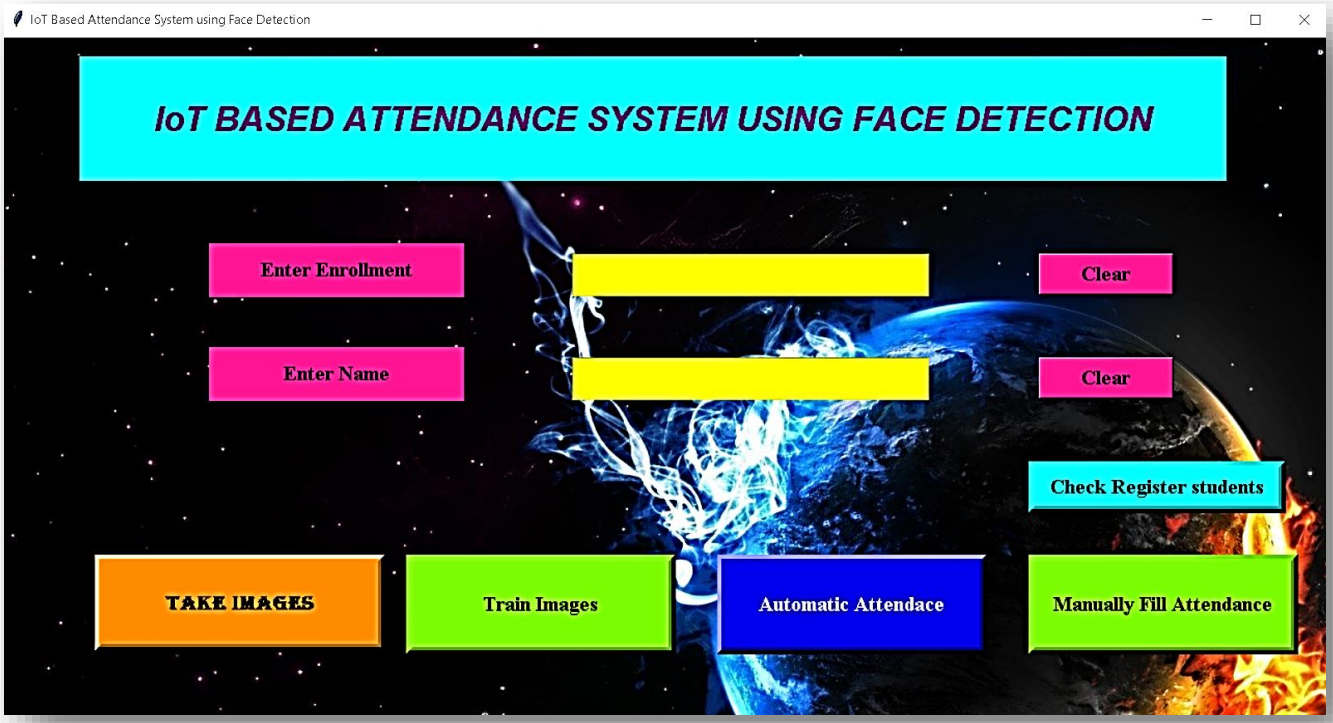
Add New Student Dashboard Window



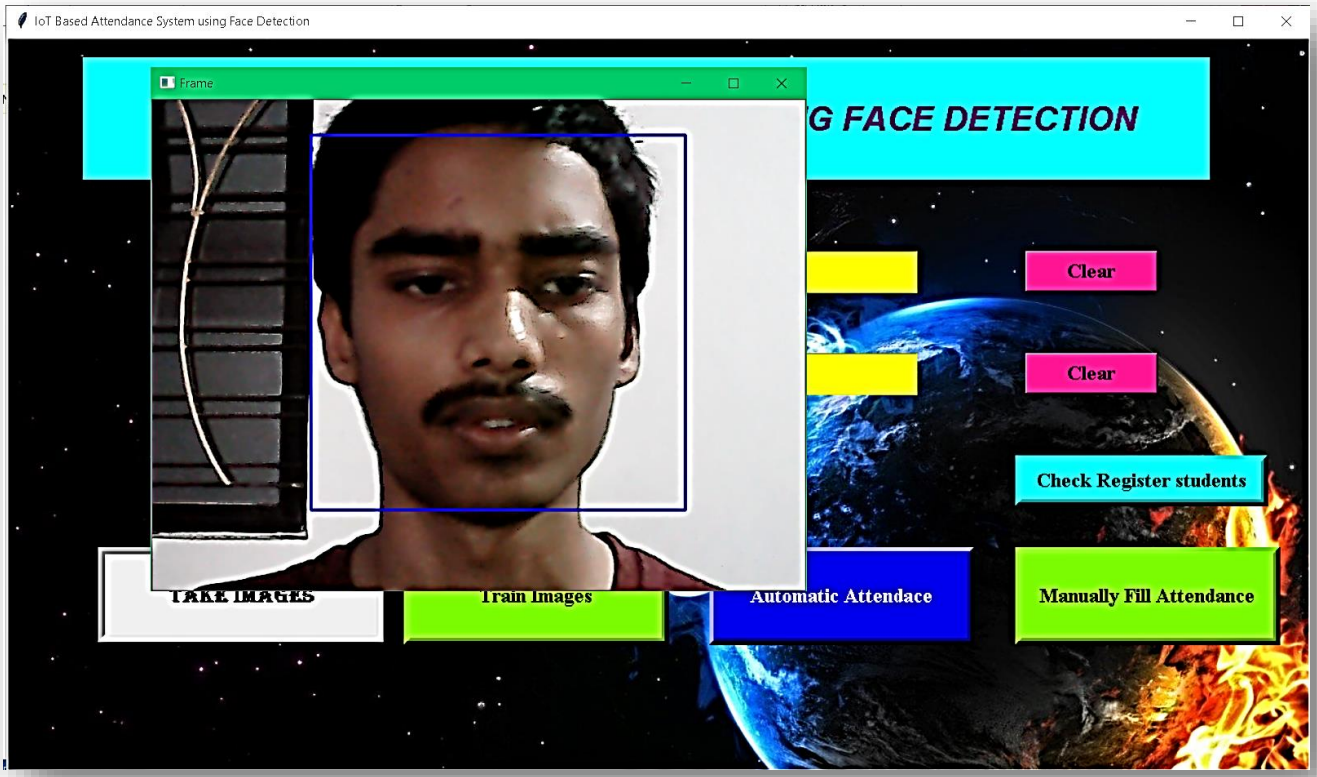
Guideline Window after clicking on Take Image Button



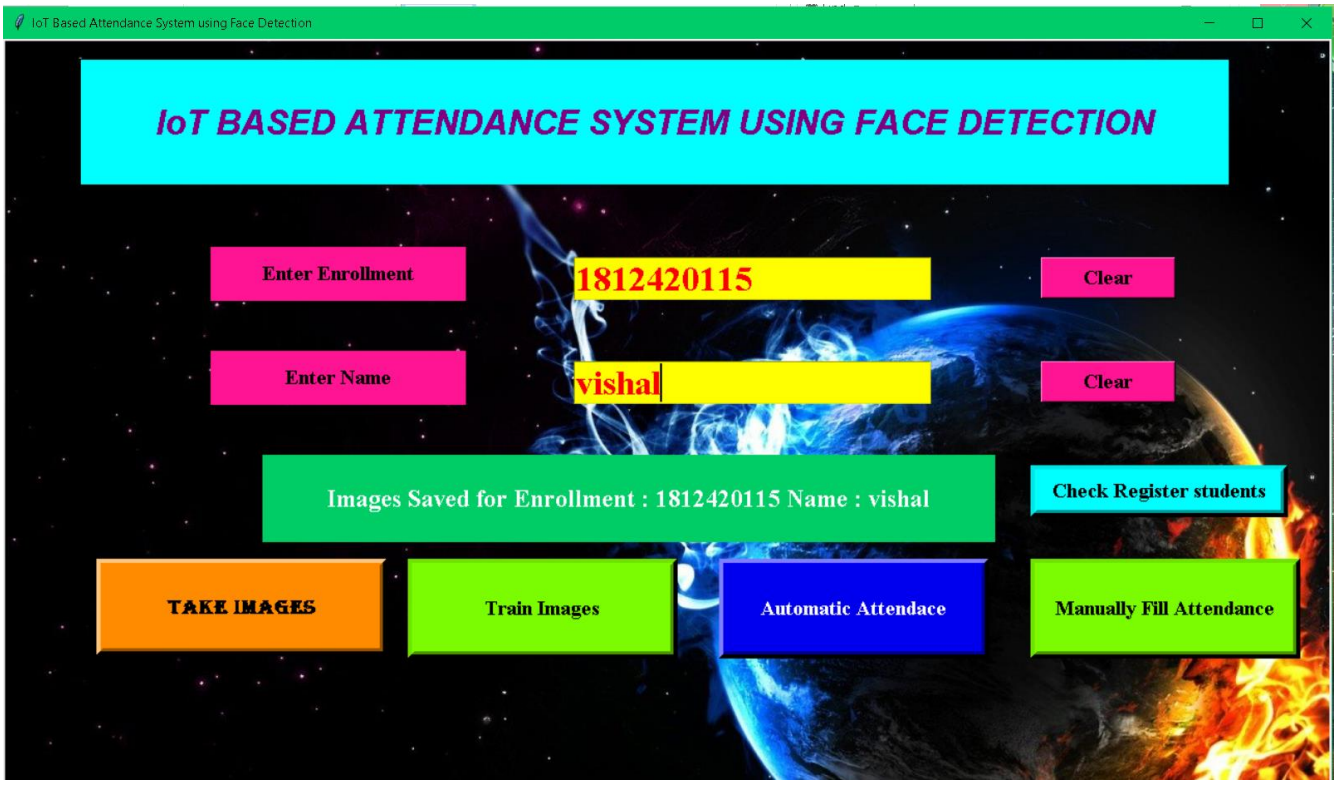
Main Landing Page of Take Image Button



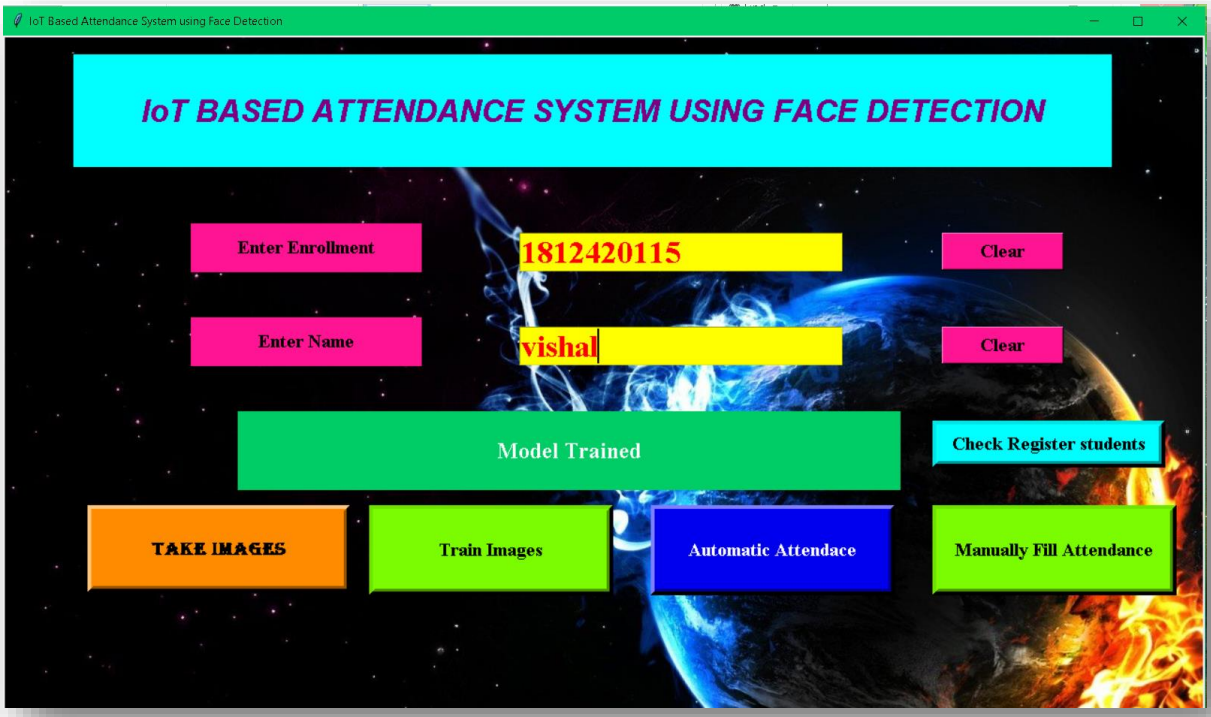
HERE, We are Taking Images of a Student and Storing into Database



After Capturing Images, Message Displayed for saving

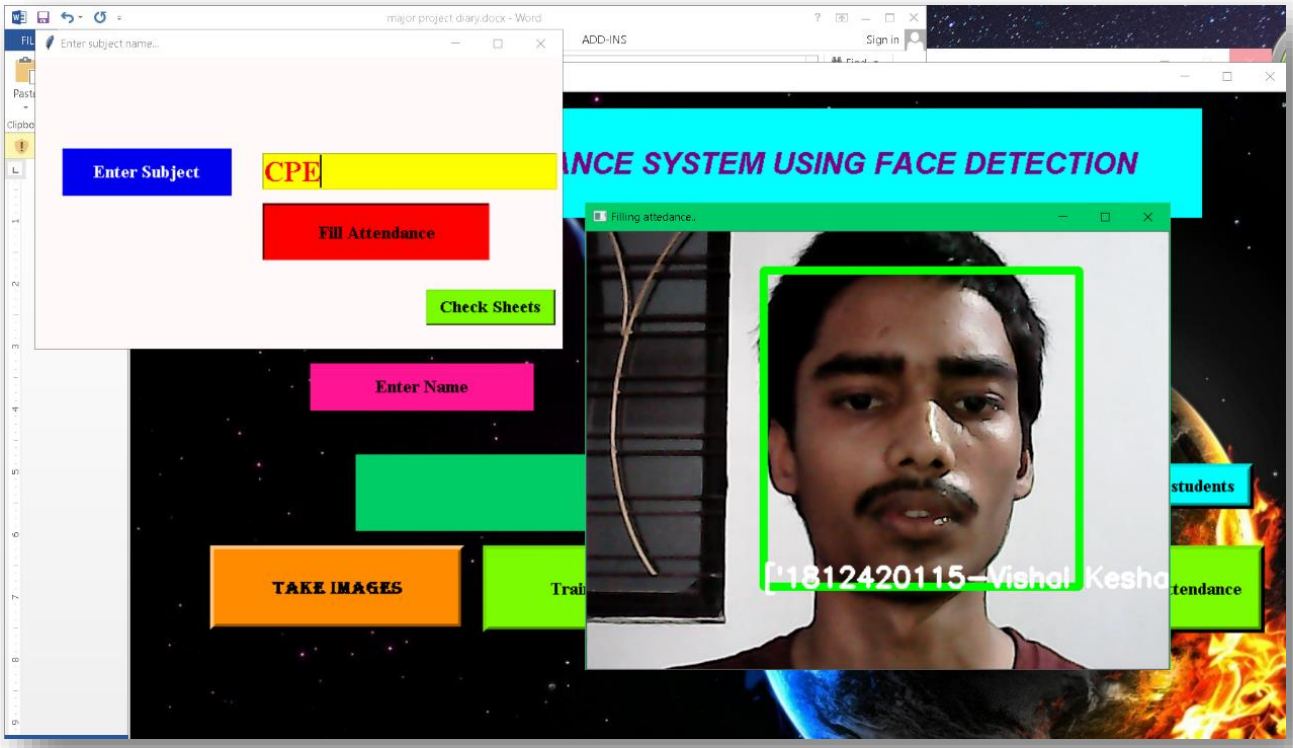


Here, We Have Trained Model System on clicking Train Model Button



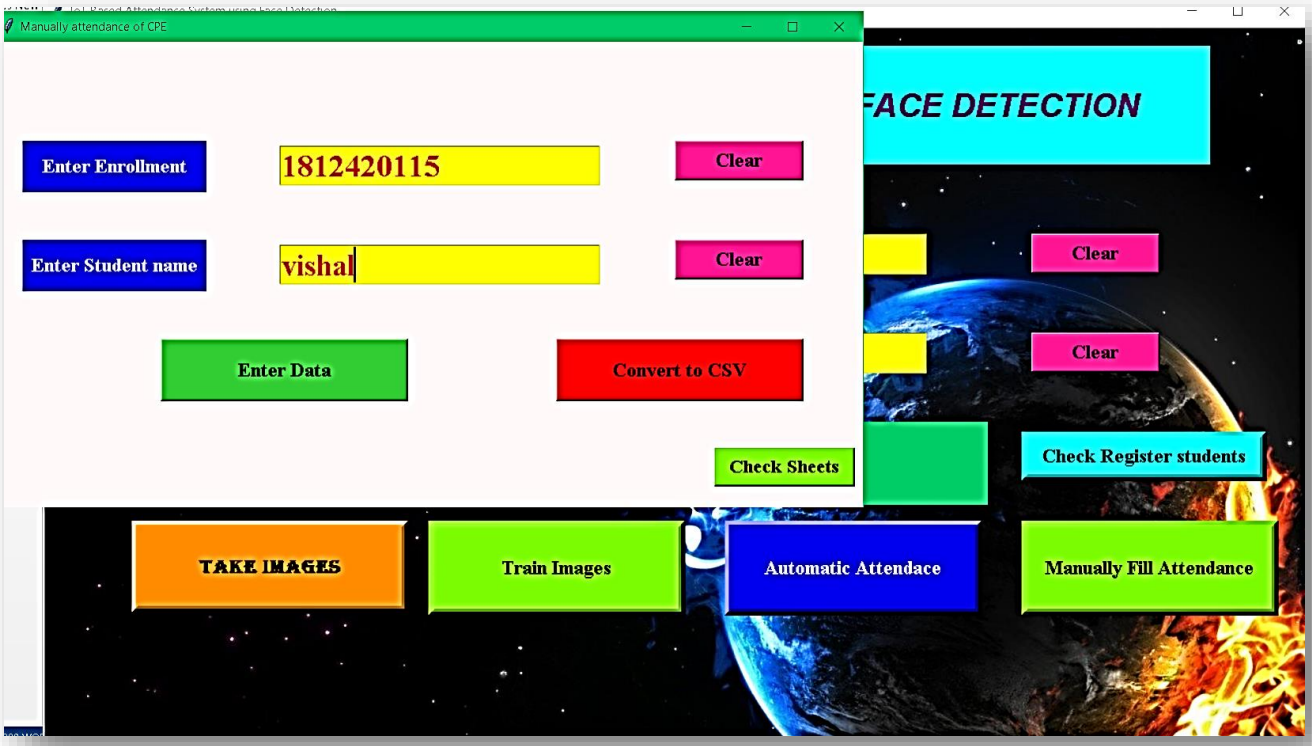
Here, We are Checking that Student Successfully Registered Or Not

Here, We Are Using Feature for Automatic Attendance Using Face Detection

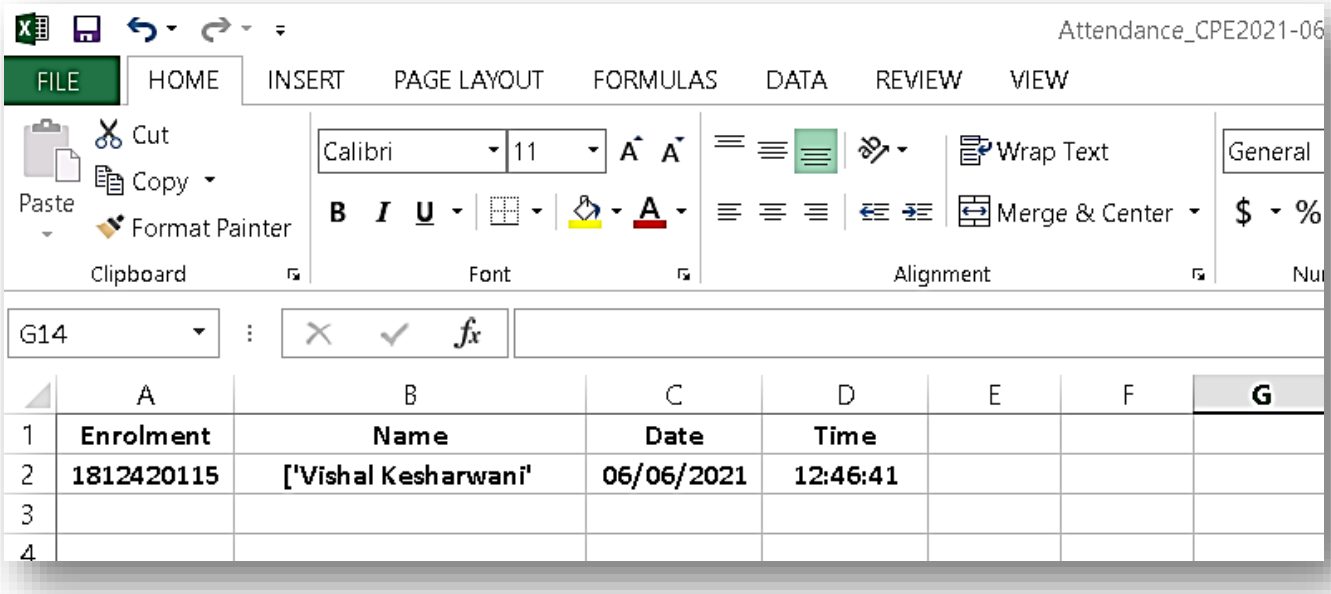


Here, Successfully Face Detecion Attendance Registered on Database

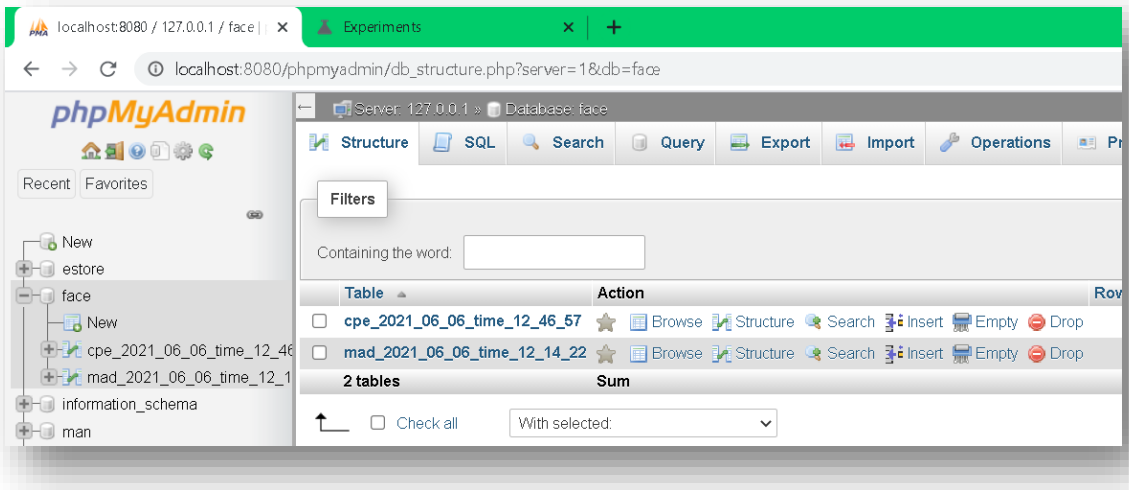
Here, We are Using Manual Attendance Feature of our Attendance System



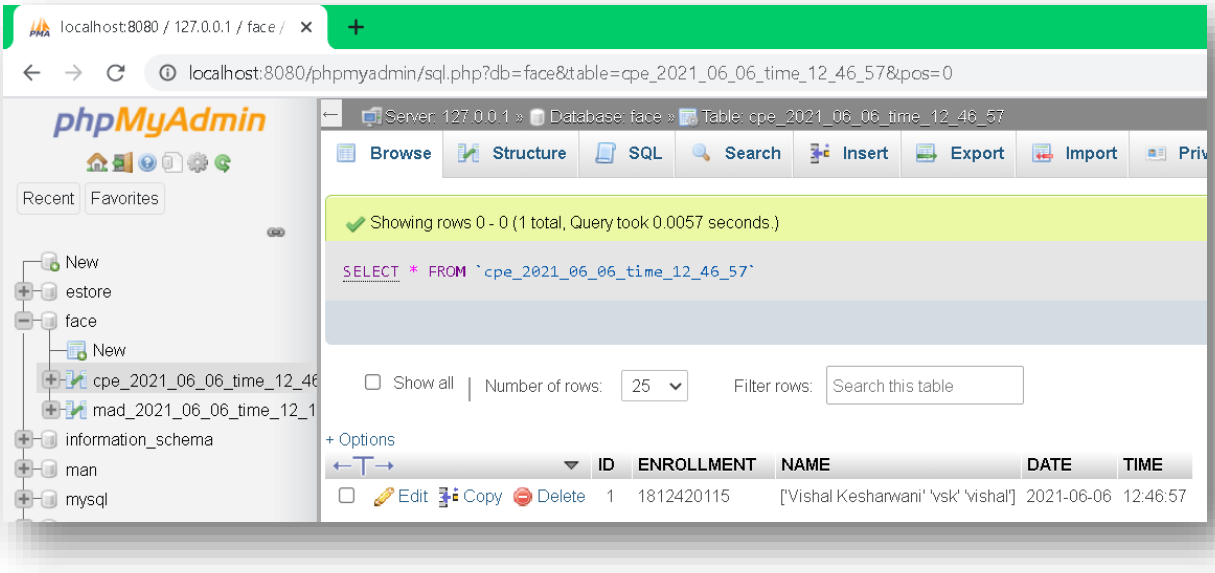
Data /Attendance Saved in Excel File Database Successfully

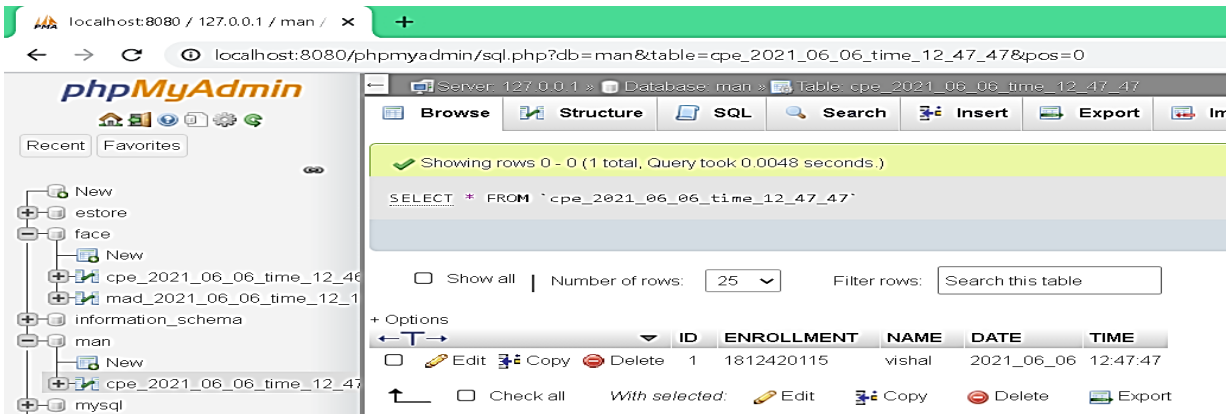


Attendance Data Automatically Saved in MySQL Database Also for Facial Attendance



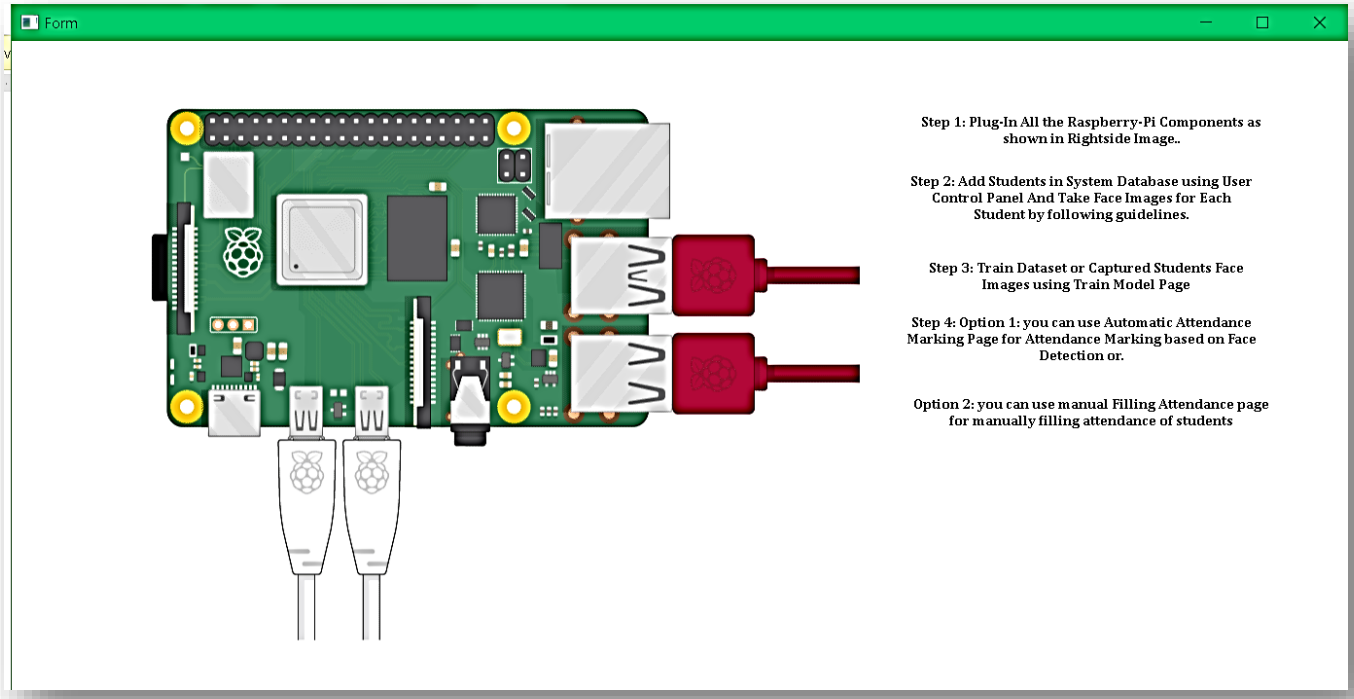
Attendance Data Automatically Saved in MySQL Database Also for Manual Attendance





About US Page Displayed After Clicking about us Button

Help Page Of System UI



6.2. APPLICATIONS

- Face recognition is an important application of Image processing owing to its use in many fields. ... The proposed system aims to overcome the pitfalls of the existing systems and provides features such as detection of faces, extraction of the features, detection of extracted features, and analysis of students' attendance.
- Face recognition is also useful in human computer interaction, virtual reality, database recovery, multimedia, computer entertainment, information security e.g. operating system, medical records, online banking., Biometric e.g. Personal Identification - Passports, driver licenses , Automated identity verification -
- We can use face recognition to record attendance from everyone present in an organization. In this face recognition, many algorithms are performed to dissect and capture images of someone’s face, such as Machine Learning and Deep Learning. With this algorithm, the system can recognize a person’s face and record attendance from that person so that attendance activities are more efficient and faster.
- Use of face recognition for the purpose of attendance marking is the smart way of attendance management system. Face recognition is more accurate and faster technique among other techniques and reduces chance of proxy attendance.
- This system can be used in Companies, Industries, Educational and governmental sectors to detect the presence of workers , students, employees in corresponding departments. This can also be useful in household purposes just like to secure home lock .
- Facial recognition in future can be used in order to reduce time consumption and touch less operations.

CHAPTER 7
Conclusion

7.1. CONCLUSION

An automatic attendance management system aims at solving the issues of manual methods of existing systems. A prototype of Smart attendance system based on ESP8266 smart card and Raspberry Pi 3 has been proposed. The concept of Smart attendance is to implement a system that marks the attendance of a particular person within a limited time period. We have made the device portable for easy use even when the sessions are on, without disturbing the class. There are future scopes to make a more compact ergonomics to make it a more user-friendly product and to make an impact in building a healthier academic environment.

7.2. FUTURE SCOPES

Face recognition algorithm can be improved with respect to the utilization of resources so that the project can recognize more number of faces at a time which can make the system far better. Many variants of the project can be developed and utilized for home security and personal or organizational benefits. We can also trace a particular student in an organization quickly with the help of this system

The future of facial recognition technology is bright. Forecasters opine that this technology is expected to grow at a formidable rate and will generate huge revenues in the coming years. Security and surveillances are the major segments which will be deeply influenced. Other areas that are now welcoming it with open arms are private industries, public buildings, and schools. It is estimated that it will also be adopted by retailers and banking systems in coming years to keep fraud in debit/credit card purchases and payment especially the ones that are online. This technology would fill in the loopholes of largely prevalent inadequate password system. In the long run, robots using facial recognition technology may also come to foray. They can be helpful in completing the tasks that are impractical or difficult for human beings to complete.

Governments across the world are increasingly investing their resources in facial recognition technology, especially the US and China are the leaders in the facial recognition market.

The government of the USA has decided to enhance airport security with a facial recognition system for identification and registration of visitors. The US has several states that have allowed law enforcement to run searches within the database – these searches include details of a driver's license and ID photos. The facial recognition and resulting search techniques can be also used in police checks.

China is already running several projects of facial intelligence when the other countries are still in its planning phase.

The whole world is using this technology and reaping many benefits. In India, banks are using this facial recognition technology to prevent fraud at ATM's. It is also used for reporting duplicate voters, verification of passport and visa, driving license, etc.

The future of facial recognition is promising.

The technology is expected to grow and will create massive revenues in the coming years. Surveillance and security are the major industries that will be intensely influenced by technology. Schools and universities and even healthcare are also planning to implement the facial recognition technology on their premises for better management. Complicated technology used in facial technology is also making its way to the robotics industry.

CHAPTER 8
Appendix

8.1. Appendix

ACTION PLAN

Sr NO.	Task achieved w.r.t	Time taken	Name of responsible team member
1.	**Problem Task Identification**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**
2.	**Literature Survey/ Industrial Survey**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**
3.	**Project Proposal**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre**
4.	**Execution Of Plan**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar**
5.	**Preparation of Project Model/ SRS**	**1 Week**	✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**
6.	**Collecting Required Resources**	**1 Week**	✓ **Oditya A Katre** ✓ **Pankaj K Maudekar**
7.	**Preparing Project**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**
8.	**Testing Of Project/ Test Plan/ Test Cases Preparation**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar**

9.	**Comparing Throughput Taken with planned**	**1 Week**	✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**
10.	**Portfolio Preparation**	**1 Week**	✓ **Oditya A Katre** ✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle**
11.	**Final Report Preparation**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar**
12.	**Checking of Report**	**1 Week**	✓ **Oditya A Katre** ✓ **Pankaj K Maudekar**
13.	**Verifying report from guide**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** **Kunal T Harinkhede**
14.	**Preparation of Presentation**	**1 Week**	✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**
15.	**Submission of the Project**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**
16.	**Taking Letter from Industry.**	**1 Week**	✓ **Vishal Kesharwani** ✓ **Oditya A Katre** ✓ **Pankaj K Maudekar** ✓ **Shardaprsad S Kawle** ✓ **Kunal T Harinkhede**

- **Work Division (w.r.t)**

Team Member	Task
Vishal S Kesharwani	• Integration of Web camera/IP Camera • Training .csy and pkl files • Automated attendance entry in Excel sheet • Email-notification • Live prediction
Oditya A Katre	• Graphical User Interface • Face Detection using CNN • Training .esv and .pkl files • Automated date increment • Testing
Pankaj K Maudekar	• Face detection using CNN • Encoding registered images • Live prediction • Unknown face identification • Testing
Shardaprsad S Kawle	• Graphical user interface • Face detection CNN • Live prediction • Creation of automatic Excel sheet and registration of student • information • Integration
Kunal Harinkhede	• Face detection using OpenCV • Capturing 100 images automatically and storage in database • Face detection using CNN • Encoding registered images • Reports generated

CHAPTER 9
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9.2. BIBLIOGRAPHY

Attendance System using Face Recognition (Computational Models)

Bibliography compiled by Laurenz Wiskott in context of the research project Face recognition by elastic bunch graph matching

Scope: This bibliography contains references to algorithms for face recognition. It is a subset of the Bibliography Face Processing.

Support level: Medium - 2000. This bibliography is medium well supported till the year 2000, i.e. I have collected quite a few references but the collection is not complete.

Publication types: Journal articles only. To keep effort low and quality high, I have confined this bibliography to journal articles only. Red titles indicate survey articles.

Online papers: An 'A' or 'P' (or 'T' for text only) after a reference link indicates that it leads to an abstract or full paper, respectively. Upper case letters refer to online documents provided by a journal, which might be accessible only to subscribers (indicated by a '?'). Lower case letters refer to online documents provided by an author. Also the links at the end of the references are differentiated in this way by upper and lower case letters at the beginning of the words 'abstract.html' etc. and by a '?', if the corresponding document is only accessible to subscribers. The site location is indicated by a preceding .uk, .com, etc.

BibTeX: A bibtex file for the journal article references is also available (compressed and uncompressed).

Feedback: Please feel free to send me any kind of feedback about this bibliography.

Related Resources
Bibliography Face Processing (a superset of this bibliography)
Bibliography Facial Feature Finding
Bibliography Face Coding and Animation
Bibliography Face Analysis
Face Recognition Homepage
Gesture Recognition Homepage
References
100 references, 9 (9%) abstracts online, 16 (16%) papers online.
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Additional Content

➢ *Achievements collected throughout this IoT Project*

Along with completion of this IoT Based Attendance System using Face Detection Project we also have participated in Some National & Institute level Technical Project Competitions organized by some other Engineering Colleges and In Our Institute Also.

In Participating of these project competitions we mentioned this project title as our Project presentation title. We presented our Idea and Project with complete demonstration while Presentation Session organized by respective Institute for project competition.

And, Surprisingly We got an Appreciation along with Individual Certificate for our project Idea Executed in this current pandemic situation. Some of the snapshots of Certificates were given below:

Akhil Bharatiya Maratha Shikshan Parishad's

Anantrao Pawar College of Engineering & Research,Pune

Accredited By NAAC , ISO 9001:2015 Certified
Under Mentorship Of College Of Engineering, Pune(COEP)
Sr. No.103,Shahu College Campus Parvati ,Pune
College Code:6794

In Association with

Maharashtra State Board of Technical Education (MSBTE)

'APCOER TECHNOTHON -2021'

NATIONAL LEVEL ONLINE PROJECT, PAPER & POSTER COMPETITION FOR DIPLOMA STUDENTS

Certificate of Participation

This is to Certify that

Mr./Ms Vishal Suresh Kesharwani from GPG Computer Engineering Department, have Participated in Online APCOER TECHNOTHON-2021 Project/Paper/Poster Competition held on 21st & 22nd May, 2021 on Title "IoT Based Attendance System using Face Detection During Pandemic"

Prof. A. T. Lohar	Prof. R.B. Gaikwad	Prof. Abhay Shelar	Dr. Sunil Thakare
Coordinator Computer Dept.	HOD Computer Dept.	Event Coordinator APCOER, PUNE	Principal APCOER, PUNE