© 2021 JETIR June 2021, Volume 8, Issue 6 www.jetir.org (ISSN-2349-5162)

FACE RECOGNITION BASED ATTENDANCE SYSTEM USING OPENCV (CNN)

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Abstract:

Attendance for the students is a key task in class. When done by calling roll numbers, it generally wastes the productive time of class. This proposed solution for the current problem is through automation of the attendance system using face recognition. The face is the primary identification for any human. This project describes the method of detecting and recognizing the face in real-time using Raspberry Pi. This project uses an efficient algorithm by using an open-source image processing framework known as Open CV. Our approach has five modules – Face Detection, Face Pre-processing, Face Training, Face Recognition and Attendance Database. The face database is collected to recognize the faces of the students. The system is initially trained with the student's faces which are collectively known as the student database. The system uses a user-friendly User Interface to maximize the user experience. This project can be used for many other applications. Raspberry Pi usage helps to minimize the cost of the product and the usability as it can be connected to any device to take attendance. This project uses a modified algorithm of Haar Cascades proposed by Viola-Jones for face detection, LBP histograms for face recognition and uses SQLite (a lite version of SQL in raspberry pi) along with MYSQL to update the database. The system will automatically update the student's presence in the class to the database. Then sends a message to guardians of absentees and also to the Head of the department. We have used an intelligent attendance system based on face recognition in this project. We have proposed to implement an attendance system for face recognization through these large applications are incorporated. The basic requirements for this system are Haar Cascades and LBP histogram for face recognization, which will first recognize the face of faculty followed by the students to identify the faces in real-time. Eigenvalues and Eigenvectors are affected both by light and exposer to the environment. We cannot ensure perfect light conditions in real-time. However, to overcome this problem, we have already used an LPF histogram. The system then compares the test image and the training image. Which are in the LiteSQL database then determines who is present and absent. If a student is absent a message will be automatically sent to the parent's phone number using the GSM module. We are installing the same intelligent face recognition system in the canteen area to monitor activities like the student is spending time in the canteen during class hours. The system will recognize the faces and will send an SMS to the respective HOD.

Key words : OpenCV is the result of these three components: the Haar cascade, LBPH recognizer, and Viola-Jones framework.

1 INTRODUCTION OF DOMAIN

Machine learning (**ML**):

To develop an effective model capable of accomplishing a variety of tasks by employing patterns and inference, an algorithm and a statistical model are both used. Machine learning is often referred to as artificial intelligence's subset of machine learning. When machine learning algorithms are applied to data, a mathematical model is built from the results. Machine learning algorithms are then used to generate predictions or judgments based on the model. A simple algorithm is impractical or even infeasible for many applications, such as email filtering and computer vision.

Computational statistics use computers to calculate. Through the study of mathematical optimization, machine learning may obtain methodology, theory, and application domains. The technique of unsupervised learning is accomplished by using algorithms to look for hidden patterns in large datasets. If you're interested in predictive analytics, you may hear machine learning referred to as predictive analytics.

Art Samuel was the first to invent the phrase "name machine learning," which was first published in 1959. Informal, as proposed by Tom Mitchell, algorithms are called algorithms "You can believe it when you see it. They claim that a computer programmed may learn from prior experiences by looking at a certain category of activities (such as a job) and measuring their performance (such as overall productivity). Rather than debating whether or not machine learning has cognitive features, this paper categorizes the field's essential building blocks. Are robots capable of thinking like humans?" What is possible for robots is it possible for humans as thinking beings? Turing proposed that, like humans, machines should be left open and unrestricted in terms of how they express themselves and how their characteristics impact their evolution.

FACE RECOGNITION

Today's technologies are built to bring about dramatic technological advancements based on knowledge. For training AI systems, deep learning uses enormous data sets and a wide range of learning methods. This has been widely accepted to be an important matter when it comes to schools having students and faculty in attendance. The technology records attendance information and keeps a track of that data. When it comes to student attendance, two methods of checking in may be used, depending on their present attendance.

- Cups and plates and counters (MAS)
- Extensive (constant) monitoring (AAS).

Student attendance management software is manual. There are two possibilities: 1) manual attendance, in which students would shout for their friends if they are missing, or 2) Attendance is done manually, in which students will continually cry out for their friends whenever they are missing.

There is a difficulty with the process for recording attendance in the classroom. we recommend the use of an Automatic Attendance System for all of these concerns (AAS).

Students using the AAS facial recognition technology look for those who are not in the classroom. If you must say that the student was asleep or napping in class, you are allowed to do so. This student data may also be used to aid students on upcoming assessments to make sure they were there. The technology is able to recognize the presence of all the pupils

in the classroom thanks to the school's high-definition monitor video streaming service.

One may easily distinguish certain facial characteristics like eyes, ears, nose, mouth, and edges thanks to the utilization of face characteristics like these. Because of this approach, it is known as the face recognition method, since it recognizes faces all over the world. Computer vision research started off using face recognition as a tool, but now it's something that is often utilized. The very core or heart of something

A computer vision-based solution will be used to fix this problem. This is explored in neurology and psychology, too. In broad terms, face recognition problems may be said to be as follows: Previously, we had just still photographs at our disposal for identification or authentication, but now that we have video footage, we can make use of a database of faces. Two separate techniques are generally necessary in order to detect facial traits. After images are scanned for faces, processing takes place to get a face's shape and size. Face recognition was discussed and dealt with. By making the private library, OpenCV, available to the public, Intel has made the technology more accessible. In the approximately 90 to 95% of clear pictures, a person's face is detected in this framework. When seen from an angle, facial recognition is usually tough to assess. When the face has to be located in three dimensions, however, it becomes problematic. Brightness has been linked to how difficult it is to discern facial features.

Although considerably less successful, face recognition is a more trustworthy approach. For the better part of two decades, face recognition research has been in a continual state of flux, but no satisfactory authentication solution has been established. Increasingly

Every year new methods are created. On the other hand, just slightly more accurate are eigenfaces, which include many research methods. In 1999, Intel co-founder Gary Bradski developed OpenCV, a free and open source computer vision library, in order to further computer vision research while simultaneously enhancing the economic viability of applications. Intel, which employed Vadim Pisarevsky before, hired him to lead the Russian OpenCV team. Life is full of constant change.

Having remained employed in academia and the business sector, the OpenCV team is now beginning from scratch. While working on other projects, the co-founders gradually phased out and began working on robots. These other initiatives brought them into contact with Willow Garage. This challenge, according to Willow Garage, was to give robots the ability to sense and respond to their surroundings as quickly as possible. When Gary and Vadim started directing the project from the ground up, they then administered and promoted OpenCV. Intel developed a proprietary computer vision library, which greatly simplifies computer vision programming. Face detection, face tracking, face recognition, and Kalman filtering are a few AI methods that may be used. Modern computer vision encompasses a broad variety of approaches, therefore it is one of the fundamental components of the field.

All-purpose APIs. It supports software that runs on several platforms; it is completely functional on Windows, Linux, and Mac OS X. When using OpenCV, it is not unusual for it to seem daunting because of the many features it provides. Utilizing OpenCV may be tough, since without knowing how these tactics function, it's impossible to implement. It is better that just a chosen few need to get acquainted beforehand. The face recognition process is stored in numerous modules, each of which is known as a "facial recognition module." This list contains important namespaces: Computer vision research started off using face recognition as a tool, but now it's something that is often utilised. This is because the issue is very important, which demands research in neuroscience and psychology together with computer science. Face recognition may be broadly defined as: For most applications, photos were sufficient for identification or authentication, but now that we have video footage, we can employ a database of faces to complete the task. Once you have a facial photo, the next step is to identify it. Face recognition uses photos of faces to search for other faces, after which those faces are then stripped of identifiable features and the rest of the picture is kept. The technology for face recognition was accepted and executed. Face recognition, the ability to identify human faces, was previously infeasible. In 2002, Intel released an open source framework they termed OpenCV, which made it possible for the first time. In the approximately 90 to 95% of clear pictures, a person's face is detected in this framework. When viewing pictures of faces from an angle, facial identification may be more challenging, while in other scenarios, head posture estimation is required. In these situations, it's easier to discern facial features. sports eyeglasses, watches, and other personal belongings

Facial recognition is far more reliable, although it is less dependable than a password. But face recognition is not yet a true form of user authentication, although it has evolved greatly in the 1990s. Innovative: Each year, new and creative ways are introduced. While it is more accurate than the Eigenface approach, there are numerous more ways and approaches built from many approaches that are more accurate. The OpenCV foundation was established in 1999, and it was formed by Gary Bradski, the Intel Corporation co-founder, to aid computer vision research and to improve commercial applications. Intel, which employed Vadim Pisarevsky before, hired him to lead the Russian OpenCV team. Within a short time, the OpenCV team began working for other organisations and for diverse research. While working on other projects, the co-founders gradually phased out and began working on robots. These other initiatives brought them into contact with Willow Garage. Willow Garage realised in 2008 that it was time to support OpenCV as an open and open-source project, since the robotics industry wanted to be able to perceive the world quickly while also making their research and products available to everyone. It may be expected that computer vision programming will be simplified substantially due to Intel's position in the area of open-source computer-vision software. Face recognition, face tracking, face recognition, Kalman filtering, and machine learning tools are included (ML). Additional computer vision building blocks are made accessible due to it being a lower-level API. This open-source machine learning library supports a number of programming languages and toolkits, and is compatible with both Linux, Windows, and Mac OS X.

The platform is multiuser. Windows, Linux, and now, Mac OS X are all supported as well. When using OpenCV, it is not unusual for it to seem daunting because of the many features it provides. Utilizing OpenCV may be tough, since without knowing how these tactics function, it's impossible to implement. It is better that just a chosen few need to get acquainted beforehand. The face recognition process is stored in numerous modules, each of which is known as a "facial recognition module." Some useful namespaces include:

Face recognition and identification is a powerful and efficient way to use picture analysis and algorithm-based understanding. In regard to the core issue, computer vision belongs to both computer science and the field of psychology and neurology. The word "computer vision" almost probably encompasses both recognizing and verifying, which may be articulated in the sentence, "Use facial recognition software to identify or verify one or with video pictures of faces."

Face recognition works in two steps:

In face detection, the location of a face is ascertained in a picture, after which the image is cropped and the face is removed, which makes recognition of the face easier. The method is called face recognition if a database of previously-recognized faces is used to find out whether someone has been positively identified. Thanks to Intel's open source library OpenCV, face recognition has become simpler and more trustworthy since roughly 10 years ago. The accuracy rate for face detection is 95 percent when using clear photographs of a person looking directly into the camera. Determining someone's face in 3D from a 3D head pose estimate is doable from the proper perspective. Inadequate brightness in an image also makes it more difficult to identify face features, and increasing the darkness makes the feature distinction much more difficult. Alternatively, the subject might be wearing glasses, or the image may be blurred.

Circuit Diagram & Block Diagram

The technology is intended to take the face of a pupil and put it in the database for attendance reasons. The dead person must be videotaped so that the viewers understand their physical look and location. On this occasion, attendance is inconsequential since the system not only records all of the class recordings but also tracks faces of students who have their faces scanned to add the data to the attendance database.

CIRCUIT DIAGRAM

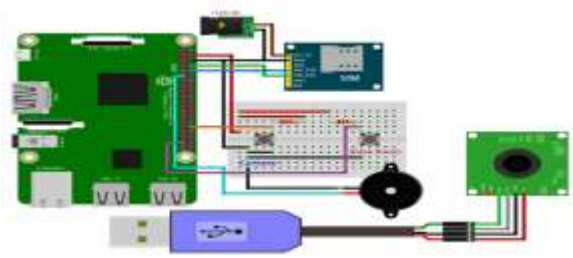
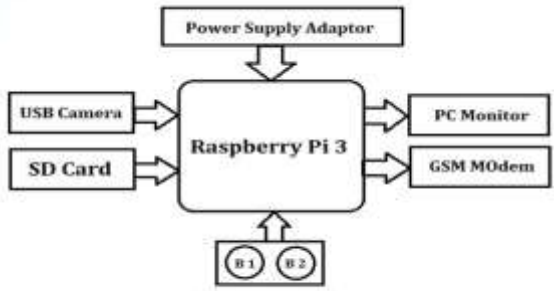


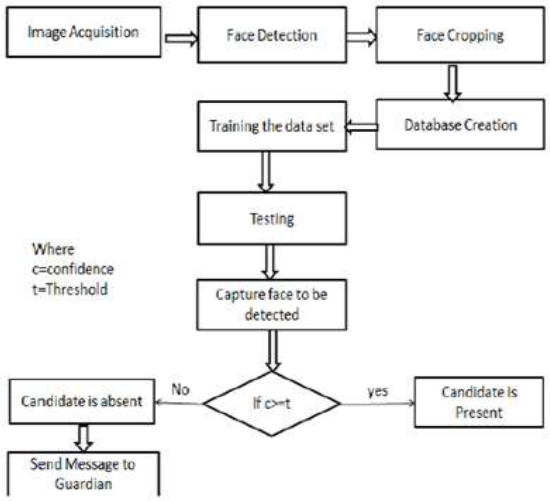
Fig 1 Circuit Diagram

BLOCK DIAGRAM



A face has to preserve features at their optimal condition to provide clear images. Facial improvement is being done via histogram equalization in this project. It is in order to retain the greatest possible efficiency that we do this. Histogram equalization is used for the left and right face, if that makes it easier to understand. Histogram equalization, another pleasant benefit, is performed on the whole face, as well as on the individual side faces.

FLOW CHART



2. LITERATURE SURVEY

Student tracking and feedback algorithms, including student attendance and feedback, were used to build the student attendance and feedback system. This system is implemented in order to gather data on students, such their attendance and their course subjects, such as science, English, etc. It is crucial to be able to recognise a student's face in order to be sure of their attendance. You will see the name and rating of each kid as well, so you can find out who is being honoured.

An automated face recognition system

A new technology is shown that can detect and record the faces of youngsters as they enter the school. Using an SVM and PCA feature selection, it is feasible to construct a version of the Viola-Jones method that utilizes cascade classifiers and PCA. By using this strategy, it cuts down on the time it takes to care for children and oversee them at the same time.

An Iris Detection attendance monitoring system

For the programmed to recognize and record the student's iris, the student must stand in front of the camera. Six-segment rectangular filters are being used in tandem with grey-scale conversion to seek for the iris. It is conceivable to affect both attendance and proxy issues, but it is only practicable after preceding participants have finished.

A lecturers' facial recognition system

The research finds that the attendance recognition system must be closely monitored to be effective In order to guarantee that a sufficient amount of monitoring is done on a consistent basis; managers will have more-capable personnel to assist them. Posture and facial expressions are used to identify the pupils in the classroom. Students are constantly monitored and recorded when they are seated to calculate the seating posture and location of each one. This project is concerned with various chair-building processes used to manufacture chairs of different weights and positions. Photographs must be more specific in order to help in the identification procedure.

Procedures that have previously been established

Fingerprint recognition software is becoming operational. The present attendance method can only be used if a portable fingerprint reader is first installed on the student's person. Because students need to be present all the time, they must have fingerprints. Students might be distracted by the duration of the lecture technique since it takes a considerable amount of time to convey.

3. HARDWARE COMPONENTS

POWER SUPPLY ADAPTOR:

The project work must be powered by a power source in order to operate. The DC power supply is also used to power the base unit as well as the recharging unit. The center-tapped secondary of a 12V-012V transformer is used in this instance. This transformer is supplying electricity to our device at a voltage of 5V.

RASPBERRY PI 3:

Raspberry Pi is a credit card-sized computer that connects to a monitor or TV using a USB connector, and is equipped with a standard keyboard and mouse. This product is perfect for younger learners who wish to try programming in languages like Scratch and Python, as well as for those who are just starting out and learning to code. The Raspberry Pi is connected to the internet by an Ethernet connection and contains the ENC28J60 Ethernet chip.

FIG 1 Raspberry pi 3

GSM MODEM:

The GSM may be shortened to GSM (GSM). GSM was first developed at Bell Laboratories in the 1970s. This technique of mobile communication is in widespread use worldwide. The global system for mobile (GSM) employs the 850MHz, 900MHz, 1800MHz, and 1900MHz frequency bands to deliver mobile phone and data services.

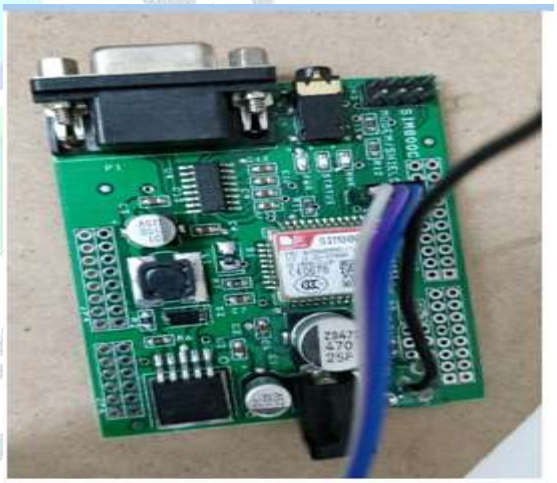


Fig 2 GSM Modem

In the GSM system, TDMA mechanisms were employed for communication. In a process called GSM, digital data is turned into an analogue format, and then de-serialized, which allows it to be sent over two channels: one that happens at a precise moment, and the other after it. 64 kilobits per second to 120 megabits per second, the digital system can handle data.

SIM card personalization

A free-ranging phone number (FDN) It is both practical and aesthetically pleasing to have a simple real-time clock with alarm scheduling.

Impressive public speech

A Smartphone software that scrambles Smartphone talks to help keep conversations safer

Text messages (SMS)

The most modern security features available on the market today are used to help assure the GSM network's security. It is a major step forward in security, from beginning to finish.

A cellular modem

Computers which have the potential to operate as data modems also have the capacity to be utilized as mobile phones. In order to be useful, a GSM modem needs a SIM card. USB, serial, or Bluetooth may be used to connect the machine. If you have a GSM mobile phone and link it to your computer with the right cable and software driver, you will be able to use a serial or USB port on your computer. For the vast majority of users, using a GSM modem is preferred over using a GSM mobile phone. A GSM modem has several commercial and industrial applications, as well as security, weather, supply chain, and GPRS remote data recording. Everything that has to do with the GSM module is included in this document

A GSM modem may successfully be connected to the MC by using the Max232 level shifter IC. GSM modem SIM card installed and data sent through serial connection to the MC are then sent by cellular SMS to the client. The programmed keeps running while the programming is active, and when this happens, the GSM modem gets a signal that tells it to "STOP." Thus, the switch contact points on the MC (mechanical controller) are utilized to deactivate the ignition switch. The command is only delivered when the user obtains the 'ALERT' prompt on his GSM modem. This approach is completely shown on the screen, which has a display resolution of 16×2.

Fig 3 A Cellular Modem

A mobile phone modem

Computers that can work as data modems are also able to be used as mobile phones. A GSM modem requires a SIM card to be functional. The machine may be connected through USB, serial, or Bluetooth. You may utilize a serial or USB port on your computer if you utilize the GSM mobile phone and connect it to your computer with the correct cable and software driver. For most people it is preferable to utilize a GSM modem over a GSM mobile phone. A GSM modem offers a variety of commercial and industrial uses, and also remote data recording for security, weather, supply chains and GPRS.

All matters related to the GSM module are contained in this document. The Max232 level shifter IC allows a GSM modem to be effectively linked to the MC. The GSM modem SIM card and data sent by serial connection to the MC are subsequently sent to the customer through cellular SMS. The programme continues while programming is ongoing, and the GSM modem receives a signal to "STOP" when this occurs. The MC (mechanical controller) switch contact points are thus used to disable the ignition switch. The command comes only when the user receives the 'ALERT' prompt on his GSM modem. This technique is fully shown on the screen with a display resolution of 16 to2.

Fig 4 : Camera Modem

USB-UART CABLE:

USB - UART Cable, which is a fairly popular debugging tool called a USB serial port a serial console may be redirected to your PC and you may utilize any command. The terminal can get loads of printed information so that your Cubieboards can be easily controlled and debugged. This paper introduces the usage of the Cubietech USB - UART cable connecting the Debugging Cubieboard. Mainly introduce how to utilise the Windows and Ubuntu UART Cable Debuggage Cubieboard.

Fig 5 USB-UART Cable

4. IMPLEMENTATION & CODING

OpenCV:

Gary Bradsky developed OpenCV at Intel in 1999, and the first version of OpenCV was published in 2000. Vadim Pisarevsky joined Gary Bradsky's Russian OpenCV team. For Stanley, the vehicle that won the DARPA Grand Challenge in 2005, OpenCV was utilised in 2005. Later, alongside Gary Bradsky and Vadim Pisarevsky, the Willow

Garage was actively created for the project. OpenCV supports and expands everyday numerous computer vision and machine learning algorithms. OpenCV today supports a number of programming languages such as C++, Python, Java, and others, and is available across numerous platforms, including as Windows, Linux, OS X, Android, and iOS. CUDA and OpenCL interfaces for high-speed GPU operations are continuously developed. OpenCV-Python is the Python API for OpenCV. The main components of the OpenCV C++ API are merged with Python.

Python The OpenCV Open Python is a generic programming language introduced by Guido Van Rossum, who was very popular in a short time because of its simplicity and legibility. It enables programmers to articulate their concepts without compromising readability in fewer lines of code. Python is slower than C/C++ languages. Another important characteristic of Python, however, is that C/C++ may be readily extended. This method allows us to use heavy C/C++ functions and to construct a Python wrapper as Python modules. This gives us two advantages: first, the code is as fast as the original C/C++ code (since it operates in the background of the true C++ code) and secondly, Python is easy to write. So does OpenCV-Python, it is a Python wrapper around the original C++. And Numpy's support simplifies the process. Numpy is a very powerful digital library. It gives MATLAB style syntax. All OpenCV array structures are translated from and to Numpy arrays. You may combine it with OpenCV, which increases the armoury of weapons to any operation in Numpy. Moreover, numerous other libraries, notably SciPy, may also be used to enable Numpy in Matplotlib. OpenCV-Python is hence a great solution for fast prototyping computer vision problems.

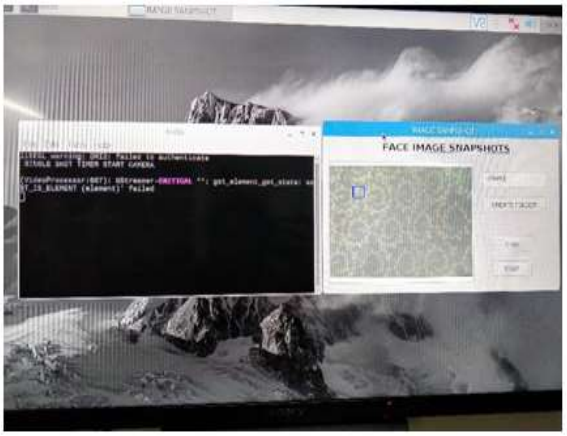


Fig 6 implementation of face image

Image processing module:

Image processing is a method to perform some operations on an image, in order to get an enhanced image (simply to highlight certain features of interest in an image) or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image.

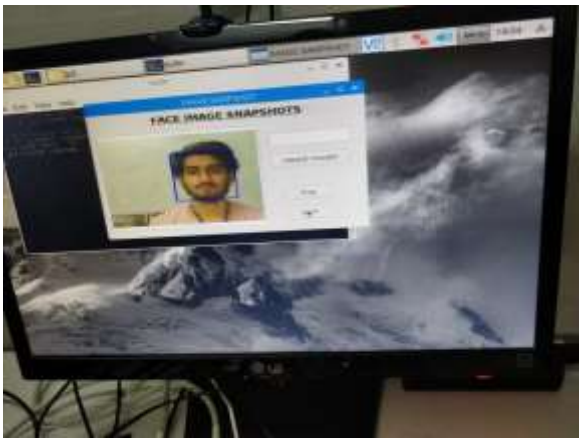


Fig 7 Image processing module

Purpose of Image processing:

An important goal of image processing is to accommodate photos from five diverse groups. little, insignificant, inconsequential

1. Visualization - view items not seen. 1.

2. Picture form and repair - Shape a better picture.

3. Picture recovery- Interest search picture.

4. Pattern of measurement - Measure multiple things in a picture.

5. Image recognition - Distinguish the components in an image.

i. Haar Classification:

This system is meant to deliver a detection level comparable or better than the face detection of the image in real time. Explicit instructions and recommendations are required for computers; humans may discover solutions to problems on their own if they have the appropriate resources. In order to reduce the intensity of the treatment, Viola-Jones suggests making the patients' faces as clear and fresh as possible. Make yourself tougher to see by showing your complete face to the camera. Functional limitations may lower the efficacy of the algorithm during the detection phase, but this is accepted, since in the majority of cases, the recognition phase follow.

The Viola–Jones parameters determine how effectively a detection technique works.

a) Rugged – extremely high (true-positive) detection rate, always extremely low false-positive rate.

b) Two frames per second are essential for practical applications.identification of facial features (detection is the first step in the recognition process).

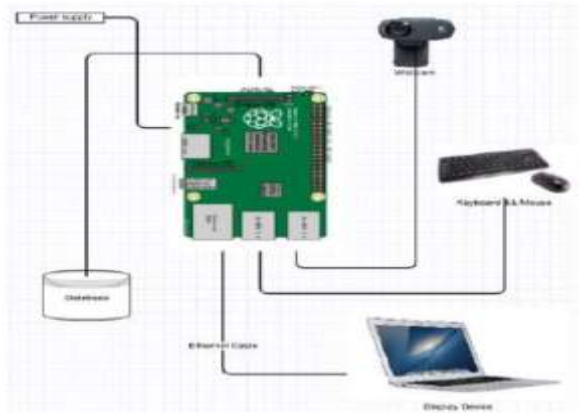
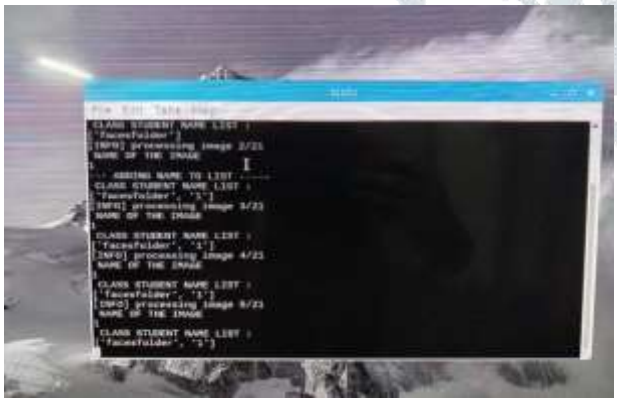


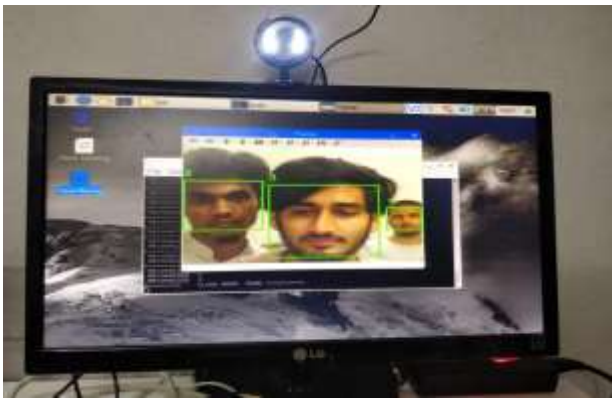
Fig 8 Hair Classification

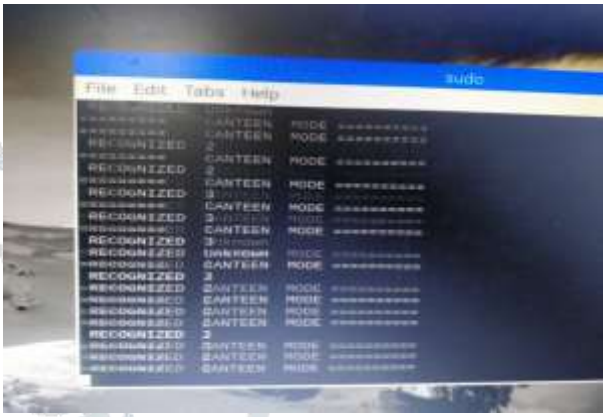
5 RESULTS AND ANALYSIS

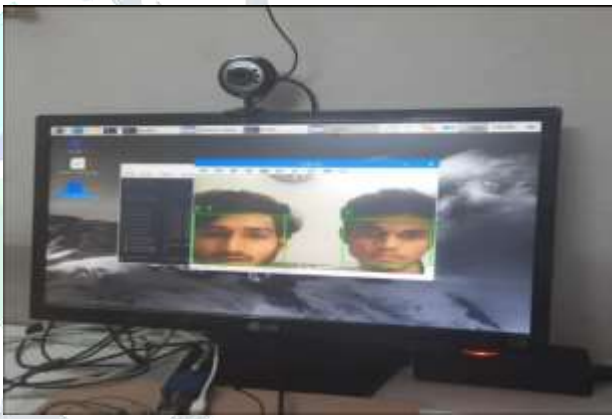
RESULT:

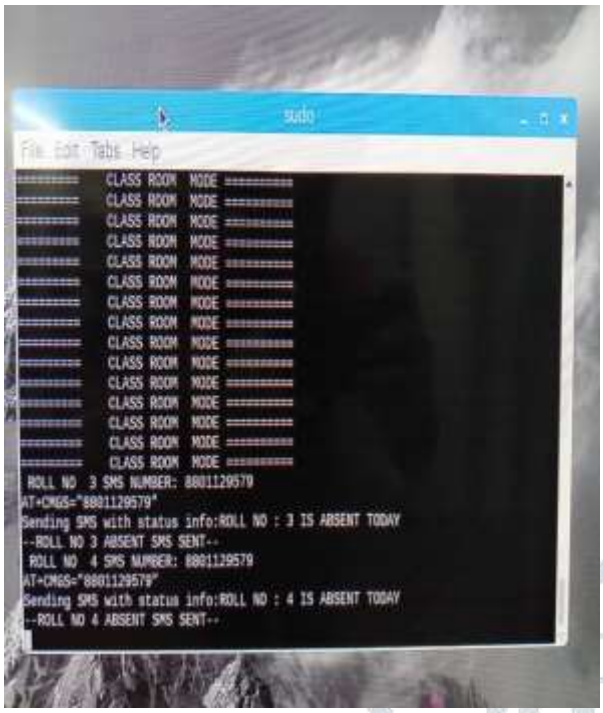
Therefore, each picture file name has its unique user identification. The picture is stored in the file extension.jpg in the folder's dataset. For phase 2: The system trains the recognizer in this way to offer the recognizer with facet data within the data set. The result was saved to the.yml file extension. The recognition is already a face recognizer in the OpenCV package for Local Binary Pattern Histogram (LBPH). All information the recognizer has learnt is transformed into a binary model and maintained in the folder of the trainer. There are essential aspects to emphasize in this strategy. For the new data acquired in phase 1, faze 2, the recognizer must be able to analyze and recognize the new data picture. In step 3, the camera captures a new face and checks if it has been captured and taught earlier. The code includes a new array that displays a matching name for the ID. For instance, the new array was formed by Python 3 before coding when the data set contains just three IDs, the coding is the same:











ANALYSIS:

This project stores an image in a resulting photo folder to evaluate if a student has a face like Figure 8 and Figure 9 in that class. It may therefore reveal who participates and who is missing from the class as a student with a name appears in the picture. This is an extremely harmful procedure. Sometimes it's not like a rigid and precise procedure; the name and face didn't match. This might be due to the lack of example photos captured and kept in a dataset. Furthermore, because of lack of light intensity, the face was frequently hard to recognize, even if the camera had an infrared ability.

A reliable use of student involvement in face-to-face reconnaissance necessitates the use of fast processors with expert programming to meet the continuing needs. Raspberry Pi II has reached 56% accuracy on the Linux stage with an usual handling time of 120 ms. Constant recognition of feeling is a new system which may be used with Raspberry Pi II for numerous applications, since it is almost nothing, lightweight and less energy is needed.

Since it is straightforward and independent, the redesigned framework focuses on the usage of raspberry Pi. A Raspberry Pi and Raspberry Pi night-watching camera is used to recognize the face of a schoolgirl that went to school and then detect the face of the student. As the graph indicates, the camera can record and recognize this face with a great deal of distance and angle.

6 CONCLUSION AND FUTURE SCOPE

CONCLUSION:

This study aims at collecting the student's video, converting it into frames, connecting it to the database to ensure that it is there and not present and marking the student's attendance in order to record it. Finally, the Automated Classroom Assistance System increases the accuracy and efficiency necessary for automated classroom assessment.

FUTURE: SCOPE:

When authentication is required to access the privileges of the relevant system, the same project may be utilized for numerous security applications. It may be used to identify those guilty of unlawful transactions. As far as the use of resources is concerned, the face recognition algorithm may be changed so that the project recognizes more faces at a time that may improve the system. Many project variants for home safety and personal or commercial purposes may be produced and used. We may also swiftly monitor a specific student in an organization using this method.

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