

## Smart Classroom Monitoring System

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### Abstract

For over every college has its own facilities and unique techniques of management. So, besides the teaching stuff that every college has, taking attendance of students is a lot of time-consuming process. Even faculty is assessed with a particular amount of time for their teaching. Besides their teaching operation, they are given with a task to take students presence in the class. This is a confusing and a lot of time taking part for a faculty. Moreover, faculty has another major job during examinations. That is observing the student's activity and to take care that no miss-conduct of examination takes place. So, A particular faculty besides their main role doing additional roles which will affect their physical and mental efficiency. So, in order to Avoid that interruptions in their life and make life easy and uninterrupted. So, there must be taken an advantage of our technology in order to get benefited. So, Time is only thing that doesn't wait for us. So, we must save the time and spend the saved time in an effective manner.

**Keywords:** Deep learning, Raspberry pi, Conventional neural network, Camera, Attendance

### 1. Introduction

For a particular Job there will be a particular role to do. So, if we are into a particular role then if we assigned with some other content that does not relate to our Job, why should we do it? We can use artificial intelligence instead of humans. So, a person will work

with maximum efficiency. We observed that there is lot of issues happening while taking attendance of students during lecture hours. This literally reduces a faculty's teaching efficiency. We as modern humans

select modern technology. Modern problems need modern solutions. So modern solutions can be achieved by analysing the problem correctly and responding it with a solution with a proper research. These days most of the schools and colleges have cameras in classrooms for monitoring. Using these cameras, an effective system can be developed for recording student attendance, checking malpractice during exams and for various functions for monitoring

students. So deep learning-based system will be an effective system in monitoring the students.

The concept of face recognition is to give a computer system the ability of finding and recognizing human faces fast and precisely in images or videos. Numerous algorithms and techniques have been developed for improving the performance of face recognition. Recently, Deep learning has been highly explored for computer vision applications. Human brain can automatically and instantly detect and recognize multiple faces. But when it comes to computer, it is very difficult to do all the challenging tasks on the level of human brain. The face recognition is an integral part of biometrics [2].

## Smart Classroom Monitoring System

Multi view face recognition has become an active research area in the last few years. In this paper, we present an approach for video-based face recognition in camera networks [5]. Deep learning models are being used actively to solve wide variety of legal tasks and are giving state-of-the-art performance [3]. Artificial intelligence is playing a major role in current scenario. In fact, manual intelligence is being overtaken by artificial intelligence for its efficiency, accuracy and more. Now a days, artificial learning and deep learning models can be trained in a manner such as that the accuracy and precision will be in a unimaginable way so nowadays scientists prefer artificial learning and deep learning technologies to solve a modern problem. Using deep learning model, the data is transferred through various layers to help the algorithm in learning. Deep learning models are something that is able to learn almost each and everything according to the input data. Deep learning consists of different types of fields based on artificial intelligence.

The image which is captured can be identified and detected by using the face hallucination method. As the image from camera is very small and the face recognition model requires high quality images, so high image resolution technique was developed to enhance the image and to detect the face of the user. Before submitting the image to face recognition system by using the face hallucination algorithm the age and the face demographic characteristics are received. The technique used increases the facial recognition technique performance. Facial detection technique is been used in different type of applications starting from automobiles to multi-national companies for this purpose. Face detecting algorithms help to mark a layout of face and recognizes the face and the other parts of the image will be converted into low resolution images that can be neglected.

### 2. Related Work

The biometric system for attendance is a common and widely used these days but the main problem with the biometric system is that it is time taking system where people have to stand in a queue to scan their fingerprints and to register their attendance. Thus, we came up to remove this delay by using image processing method. In recent years, image processing has been used to use the image to process important information from the image which involves interpretation of the image for extracting useful information.

RFID based system is widely used these days for marking attendance. Radio Frequency ID system works based on the barcode given to employee.

It mainly uses RFID reader and RFID tag. A unique tag will be given to employee which will be consisting of separate barcode. The user has to show the tag to the RFID reader. System will be scanning the barcode and process the attendance based on it. The main problem with this system is that anyone with the tag will be able to mark the attendance to that employee. So, it is not a reliable method for attendance management.

With the increasing amount of popularity of cameras among the people these days, there is a demand to exploit the mobility of these devices and create easily accessible systems. So, why we have decided to create our attendance system which would make use of cameras rather than any dedicated setup for attendance system. As we know that the face of student or employee is unique and also it consists of a set of features that matches with another student or employee. Our system will make use of this unique group of features of each student or employee to recognize their faces and mark attendance easily.

### 3. Methodology

The automatic deep learning-based attendance marking system which is mainly based on face recognition algorithm. The steps of our proposed system works as follows :

The image of the student or employee face will be recorded within specific range of the camera.

Then separate the detected or the captured images according to the class or the employee attendance given in database.

Next, the deep learning model will run its face detection algorithm to find the student or employee image in the database.

The students must show their face to the camera in order to detect properly. This device can easily identify the faces.

### 4. Proposed System

In our project ,we use the cameras that are present in college or office for surveillance purpose. The raspberry pi camera module will be capturing the image of the student or the employee. The image is processed by raspberry pi 4 model B. The deep learning model after the image is captured will process the image captured with image in the database using face recognition algorithm. Our proposed system (see the Fig.1) will make use of "deep matric learning". In deep matric learning, the working pipeline can be divided into two phases:

- 1) Face Detection using HOG (Histogram of gradients) with linear SVM.
- 2) Face Recognition using 128-d feature vector.

HOG is a simple and powerful feature descriptor. It is used for object detection. HOG is robust method used for object detection by the characterization using the local intensity gradient distribution and edge direction.

Hence, this is method is quite fast and suitable for our system. And after detecting faces, we will provide the ROI (Region of interest) to deep learning-based facial embedding model. The model using here is ResNet-34 from the Deep Residual Learning for Image Recognition paper by He et al., but with fewer layers and half, the number of filters used. This network is already trained on a dataset of ~3 million images. On the Labelled Faces in the Wild (LFW) dataset, with staggering 99.38% accuracy. The important catch in our method is we are not training the images on ResNet-34, instead we will get 128-d facial embedding vectors which then we can use a simple k-NN model to make the final face classification.

The working pipeline of our system :

- 1) Capturing images from Pi camera mounted on Raspberry pi-4
- 2) The captured image is processed by the above model.
- 3) Once, student face detected it will record the attendance for the respective student.

From the block diagram (see Fig.3), the image processed is obtained as output from raspberry pi 4 and finally the attendance for the student will be given accordingly present or absent. The report of each and every class will be sent directly to head of department of the respective department immediately after the report time. A detailed report will be given without any delay. Hence she/he can note the absented students with ease. The teacher need not waste their time for marking the attendance of their students. So, the teachers will be able concentrate on teaching.

### Block Diagram

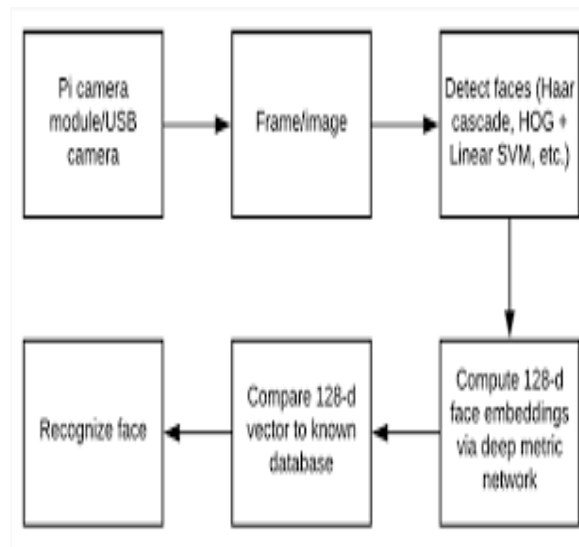


Fig: 1

### System Description

For the aim of easy development, we've divided our entire attendance system into multiple modules. The primary module is that the development of a face detection part for the system. Next step is to make a coaching module which might train itself supported the input pictures for a user. This may be followed by the face recognition module. The entire system are going to be hosted on a Django based mostly net application with a MySQL info. As mentioned earlier within the introduction that the face detection and recognition are going to be finished the assistance of YOLO algorithmic rule and Siamese network severally, it's necessary to notice that these are a locality of Convolutional Neural Networks (CNN) and a deep understanding of CNN can facilitate in straightforward implementation of those above-named modules.

## Convolutional neural networks :

A Convolutional Neural Network comes under deep learning that takes image as a input from the camera, assigns importance to numerous aspects/features within the image and differentiates the various objects within the image from each other. CNN's are inspired by the property pattern of the human nervous network. They're created of neurons with learnable weights and biases. Many inputs are received by every nerve cell associate degreed a weighted add of those inputs is passed to an activation function and this results to the output. Convolution is basically sliding a filter over a picture and take a real number on the manner whereas sliding. Thus the result's a scalar amount.

In CNN, we tend to take the input as tensor that may be a multi-dimensional matrix of variety. The most building blocks of CNN are the convolution layers over the tensor input. Every layer depends on associate degree independent filter and is obtained by convolving the filter with the image. These filters are every which way initialized and that we will create them be our parameters by learning the network over multiple epochs. The filters within the initial layers depict some low-level options like edges, colours, gradients, etc. As we tend to run within the convolutional layers, we are able to decide high-level options giving America a network having associate degree overall understanding of the image.

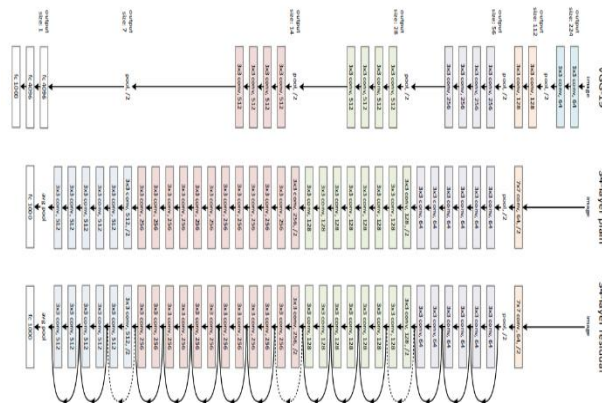
## ResNet :

In the year 2015, researchers introduced ResNet architecture which was known as residual network.

It was introduced for solving the exploding gradient problem the architecture innovated a concept called Residual Network. A technique known as skip connection was introduced by this architecture. This tend to skip the training from a few numbers of layers which is connected directly to output at the end.

## Network Architecture :

The architecture is a 34 layers network architecture (see Fig.2) with a new shortcut connection. The number of shortcut connections is used for converting the architecture into a network called residual network.



**Fig: 2**

## Circuit Diagram :

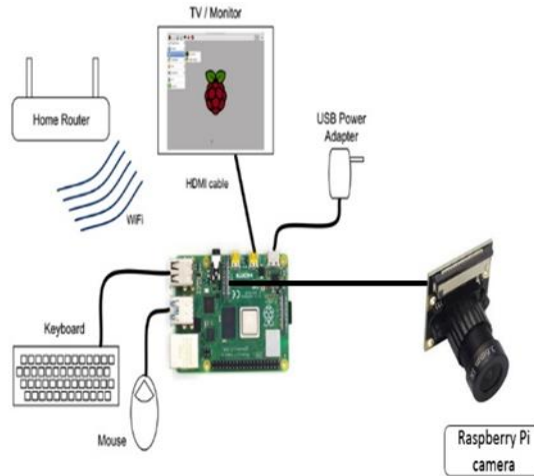
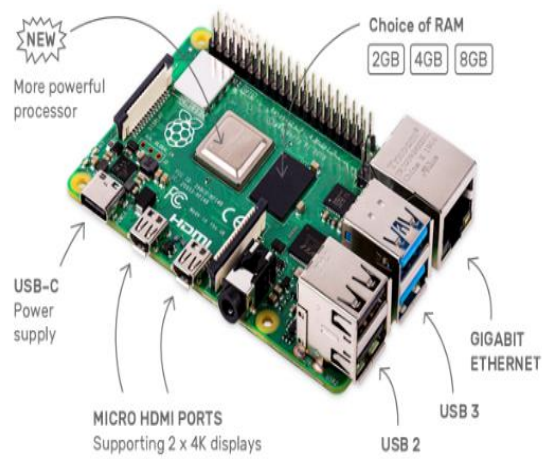


Fig: 3

**Hardware description:**

**Raspberry pi 4 model b :**



## Smart Classroom Monitoring System

Raspberry Pi 4 Model B is the recent product in the Raspberry Pi wide range of computers.

It is used to increase processor speed, memory, multimedia performance and connectivity when compared to the previous generation of Raspberry Pi ,while retaining its compatibility and lesser power consumption.

Raspberry Pi 4 Model B use to give desktop performance compared to the entry level computers.

The Raspberry Pi is improved through a lot of versions which consists of different variations in the type of central processing unit, amount of memory capacity and peripheral device support.

The Raspberry Pi 4 with quad-core processor is said to be have three times the performance of a previous versions of the Raspberry Pi .

Raspberry pi camera module :



It is a portable very light weight camera that supports Raspberry Pi.

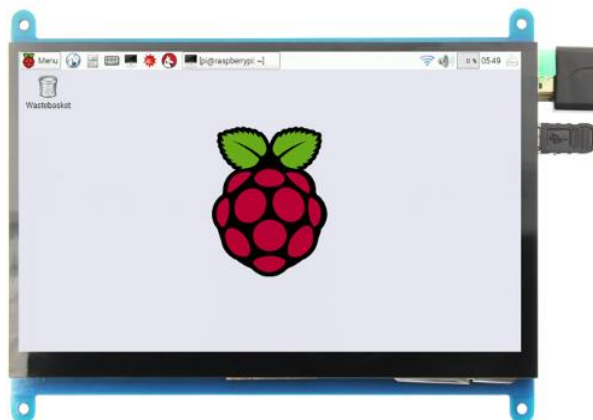
It is normally used in image processing or in surveillance projects. It is commonly used in image processing since the load of camera is very less.

Apart from these modules it can also use normal USB webcams that are used along with computer.

It can also be used to take high-definition video, as well as still photographs. It is easy to use for beginners, but has plenty to offer to advanced users if you're looking to expand your knowledge.

The high definition 5 Mega pixels camera delivers outstanding photos but can also shoot video, ideal for a surveillance project. The lightweight camera board allows for its use in more practical roles, such as a hidden camera.

7-inch HDMI display-b :



7-inch Touch Screen LCD, HDMI interface, with a capacitive touch panel, which can be used as a computer monitor, Supports all versions of Raspberry Pi.

While the LCD working with the Raspberry Pi, the resolution must be done by the user manually, else, it will cause some abnormal display.

It Can also be used as general-purpose HDMI monitor, for example: connect with a computer HDMI as the sub-display.

It also Support backlight control alone; the backlight can be turned off to save power. It Supports Raspbian, 5-points touch, driver free.

## 5. Results

From the below Fig. 4, we can see that it can detect student from the database and the attendance for that student is recorded automatically. One of the unique feature is that it can detect face of the student at greater accuracy with only single frame. This process will take of max 5 sec for each students. Hence faster compared to traditional method (taking attendance by teacher manually). The attendance is recorded at the backend and HOD can get attendance information anytime from his/het desktop.

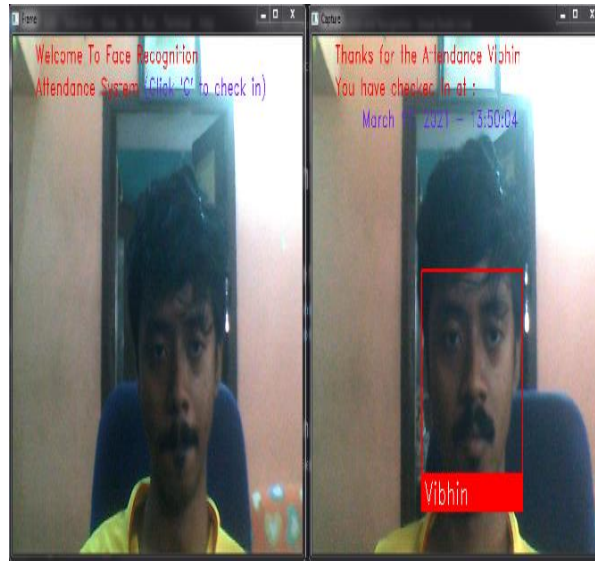


Fig. 4

## 6. Conclusion

Since the world is going automation so all the things that are appearing small are now upgrading to smart. Same here, our project deals with the efforts of faculty. Educational staff not only do their role of teaching they also included in the major part of the institution. Which is so called the attendance. The system for attendance management is a necessary tool for taking attendance in any environment where attendance recording is crucial. The existing approaches for marking attendance are time consuming, intrusive and requires manual work from user. In our project, we have tried to eliminate the challenges that are mentioned above by successfully demonstrating the use of face recognition in student's attendance management system which will be marking attendance by capturing the pictures with the help of a camera after which the faces in the image will be detected and processed with the already existing pictures in the database. Finally, based on the results of the captured image, a student will be marked as present. The proposed system is designed to be cost effective with no specific vendor hardware as we have cameras and software required for deployment

The method for marking the attendance is an important and a play a necessary part in any environment where attendance recording plays a major role like in offices, colleges and schools. The existing methods for marking attendance are consuming more time and also requires manual work from user like professors taking attendance in colleges. In our project, we have tried to eliminate the challenges that are mentioned above by the use of face recognition successfully in student's attendance management system which will be marking attendance by capturing the pictures regularly with the help of a camera after which the faces in the image will be detected and processed with the already existing pictures which are given by the student or employee present in the database. At last, based on the results of the captured image from the deep learning model which uses face detection algorithm, a student will be recorded as present or absent accordingly.

The attendance system we came up with is designed in such a way that no specific hardware is required as we have cameras and software required for deploying our model which make it cost effective.

### 7. Future Work

To extend the scope of this proposed system, we are trying to create a system that can not only just mark the attendance but also analyse it and create reports at the end of each month and report it to the consent authority. We can also add a mailing system which will notify the students and their parents about the students' attendance report or to head of department of the company. The accuracy of this model can be improved by improving the system to learn with the models wearing accessories.

An additional advantage of this model is to track the students' performance during examinations, like Mal practicing, talking etc. The other way in order to extend this above system is by using faculties to know how they teach more interesting by tracking down the student gestures, thus enhancing the quality of education. We can also track students who are bunking classes and wasting time roaming outside the classes and can also track their check in/out timings. We can also develop a system in such a way that once student of that respective class is recognized, the class door will only open. Hence we can also track students who try to go into other classes without any permission.

We can include two camera system for each class one at outside and other in inside to track class room activities. We can also intimate the classes where staffs are not there, so that HOD can provide respective staffs for that class

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