AI based contactless attendance monitoring and management system

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Abstract---The traditional methods of attendance marking need to be replaced with an Artificial Intelligence based attendance monitoring system. The process of checking attendance using the existing methods is time consuming and open to easy fraud. The usage of Biometrics poses the threat of viruses. A contact-less Attendance Management System (CAMS) is proposed to overcome the above challenges. AI based attendance monitoring system will record the students attendance automatically while they enter the class, by recognizing their faces. The in-time and out-time of the students are also recorded on a regular basis. The Holistic Face Matching algorithm is used to compare the facial images. The total time duration, the students were present inside the class can be easily calculated. There is no chance of fake attendance as each student has to record his or her facial identity. The main objective is to achieve reliability, accessibility and security in a very efficient way. The results showed that by interfacing a face recognition system with a server, a real-time attendance system can be built and be monitored automatically. Finally, the student's attendance details can be updated in the academic management system.

Keywords---face recognition, RFID, IoT.

Introduction

The (IoT) Internet of Things refers to the system of interrelated, internet-connected objects that are able to collect and also transfer data over a wireless network without any human intervention. Artificial intelligence (AI), is a branch of computer science that focuses on building and managing technology that can learn to autonomously make decisions and carry out actions on behalf of a human being. In any organization, the management of attendance will involve an important role. The duration in which an employee is inside an organization, is to be noted to calculate pay rolls. The difficulties in the traditional system are time-consuming, higher cost, and insecurity almost a teacher spending more quality hours for getting and storing student's attendance.

This issue must be approached in a new and sophisticated technological manner than a traditional way. There are various softwares and advanced technologies that they even allow blurred images to be rendered enough and investigated to know the personality of the individual. Facial recognition technology is capable enough to verify the identity of an individual by analyzing a picture or video footage. The objective of this paper is to make a face recognition based automated attendance system. For obtaining a better performance, the test and training images of this project are limited to frontal and upright facial images which consist of single face only. Both the test and the training images need to be captured using the same device to ensure there is no quality difference. If possible, the owner or the person having the rights to access the database can add high quality images captured from a high quality camera and later that image to the database, but as mentioned only the administrator or the person having the rights to access the database can enroll or remove the students or faculty data from it. In educational institutions, managing attendance of students/candidates is a tedious task, as there happen to be a large number of students and keeping track of all of them is hard. There are certain situations where students can act as proxies for their friends even though they are not present.

Face Recognition

A Facial Recognition System is capable of comparing and matching a digital image or a video frame against a database that consists of facial images. It is usually used to authenticate users by ID verification services. It functions by pinpointing and measuring the facial features from the given image. When the RFID card is recognized by the RFID reader, the Pi camera module scans the face of the user. The scanned image is compared with the pre existing image in the database using Holistic Face Matching Algorithm. Face authentication allows users to unlock their device just by staring at the front of their device. In the initial stage, user is authenticated by capturing his/her image and compares with those already stored. If there's a match then attendance process starts, else the system terminates. The primary priority is to test the lighting condition and noise within the background before capturing the image. Then, the image detection of faces are done using haar cascade algorithm. Finally, the face is compared or recognized with face of student already stored. If match is found, attendance is written or updated.

A methodology is used to avoid fake attendance and proxies, there by reducing the light intensity problem and head pose problem. A portable device has been developed to monitor the attendance of the students using face recognition technology. This is aimed to avoid human errors and to reduce time. A RFID based attendance system is designed to operate as a standalone system by sending E-mail notification to the users. Face recognition system is established for marking the attendance of the students. The clustering of the facial images is done with the help of PCA. RFID tag and RFID reader is used by another system to track the attendance. It focuses on privacy and security related issues.

Literature Review

Facial recognition technology could be a framework or software which is capable enough to verify the identity of the person by analyzing an image or video footage. RFID uses radio waves to identify and track objects and track tags within the following Literature review , various methods of existing attendance marking systems are clearly analysed. Attendance is an important part of daily classroom ascertainment for the teacher for his or her smooth running of class. At the beginning and ending of the class, usually teacher check the attendance, but the manual attendance system may lead to appear that a teacher may miss someone or some students may answer multiple times. Now a days, Machine Learning has been highly explored for computer vision applications.[1] So, we use the concept of machine learning in Face – recognition for automatic attendance systems. In this paper, we perform the face recognition and face detection algorithms, to provide the computer systems the ability of finding and recognizing human faces fast and precisely in images or videos so that the systems can be used in giving attendance.

The conventional methods of attendance management such as calling by name is time consuming with a chance of proxy attendance. The following face recognition system is used to maintain attendance record of students.[2] The daily attendance of students is recorded individually by subject which happens to be already stored by the administrator. When the corresponding subject time arrives the system automatically starts taking snaps and also applies face detection and recognition technique to the given image and the students that are recognised are marked as present and their attendance is updated with corresponding time and subject id. Various machine learning techniques have been used to develop this system, histogram of oriented gradient method is used to detect faces in images and the Deep learning method is used for computing and comparing the facial features of the students to recognise them. The system is capable of identifying multiple faces in real time.

The Face can be defined as the representation of one's identity. An automated student attendance system is created based on face recognition technique. This system happens to be very useful in day to day life applications such as in the security and surveillance systems. Security systems in airports use face recognition to identify suspects. CBI (Central Bureau of Investigation) and FBI (Federal Bureau of Investigation) use face recognition for the purpose of criminal investigations.[3] In this paper, video framing is also performed by accessing the camera through an user friendly interface. The face gets detected and is

segmented from the video frame by means of using HOG (Histogram of Oriented Gradient) algorithm.

Attendance by means of calling names or passing around sign-in sheets is time-consuming and receptive easy fraud. This paper presents the detailed implementation of a real-time roll call system supported face recognition and its results. The system must first take and save an image of the scholar as a reference in a very database. During the attendance checking process, the online camera takes pictures of the scholars face to be recognise then the face is automatically detected by a computer and therefore the student name who presumably matches the image is identified. An excel file is updated for attendance record supported the face recognition results. [5]In this method, a pretrained Haar Cascade model is employed to detect faces from web camera video. A Face-Net, trained by minimizing the triplet loss generates a 128-dimensional encoding for a face image. The similarity between the encoding of two facial images determines whether the two facial images are coming from the identical students or not. this method has been used for a category, and therefore the results are very satisfactory. A survey has been conducted to research the pros and cons of the attendance system on college education management.

In the modern meeting room, smart systems to make attendance quickly are mandatory. The existing systems perform manual method of attendance such as registration and fingerprint. Despite the fact that fingerprint method can reject the unknown person and give the grant access to the known person, it takes time to register a person one-by-one. It is possible to create long queues for fingerprint checking before the meeting room entrance. Machine learning, with the Internet of Things (IoT) technology is the best solution as it offers various advantages when getting applied in the meeting rooms. This method used is to create a presence by means of detecting the faces. In the paper, a facial recognition authentication based on machine learning technology for connection to the meeting rooms is provided. Also a specific website for displaying the detection result and data storage design testing is developed. The method uses the Dlib library for deep learning purposes, OpenCV for video camera processing, and Face Recognition for Dlib processing. The proposed system allows placing as much cameras as needed in a meeting room. The various tests conducted are one known person, identification of one unknown person, identification of two people, and three people. The parameter that needs to be focused on is the required time for detecting the number of faces recorded by the camera. These results reveal that the face can be recognised or not recognised, after which it is displayed on the website.

In most of the organizations, attendance is taken manually by calling their register numbers and names. This in turn is noted in attendance registers issued by the heads of departments as proof and in certain organisations the students are supposed to sign in these sheets which are in turn stored for future references. [8] This method additionally makes it more complex to track all the students attendance and also makes it difficult to monitor individual student attendance in big classroom atmospheres. In this article, face detection and recognition framework are used to continuously recognize students going to class and by comparing their faces with database to match and mark attendance. The

facial biometric framework takes a picture of the person using a camera and contrasts that image and compares it with the image that is stored at the time of enrolment and if it matches attendance is marked and student performance is monitored continuously. The concept of artificial intelligence concept is used to find out how much time the student presents in class.

Automated attendance system records the status of the particular student; whether he or she is present in the class. This system, detects the student using web cam when entering the class room and marks the attendance by recognition. The system architecture and algorithms used at each stage are described in this paper. Various real time scenarios are considered to evaluate the performance of various face recognition systems. The paper proposes the techniques to be used in order to handle the spoofing threats. When compared with the traditional attendance marking, this system saves time and monitor the students effectively. Therefore from the above conducted literature review a common thing we notice in almost all the works is that 'Face Recognition' plays a major role in creating an attendance based management system and that any kind of attendance management system created would have to rely on a Face recognising algorithm. It is understandable that there is a lot of scope in the topic Face recognition for a future research.

Methodology

The implementation of the AI based contact less attendance monitoring system is explained below. An RFID reader and a Raspberry Pi camera are placed at the entrance of the building. When the person passes through the RFID reader, their ID (RFID) card is detected and the unique number is sent via WIFI to the server. The facial image of the person is also captured simultaneously by the Raspberry Pi camera. The server stores the entry time and the captured facial image. The captured image is compared with the image of the particular ID card holder (RFID) in the MySQL Database using the Holistic Face Matching Algorithm. The entire process for attendance monitoring system is depicted in the figure 1.

Then there are 4 conditions to be analyzed,

Condition 1
If the image and the RFID matches, the attendance is marked.

Condition 2
If the person doesn't carry an ID card when going inside the building, an alert is raised and attendance is not marked.

Condition 3
If the person carries an ID card (RFID) and the picture taken doesn't match the image in the MySQL database, an alert is raised and an intimation is sent via mail to the ID card holder along with a picture captured at the entry.

Condition 4
If someone enter with unauthorized card or other card it gives an alert and it is noted in the cloud.

At the beginning when entering the building Unique ID is read by the RFID reader. If ID is valid, Face is captured and stored in the database. The time at which ID is detected and facial image is captured is noted.If ID isn't valid, Face is captured and stored in a seperate part of the database. The time at which ID is detected and facial image is captured is noted. The captured image is compared with the image in the existing database. If both images match, Photo and ID are valid. Attendance is marked and the process comes to an end.If Both Images Don't Match, Photo and ID card are invalid. An alert notification mail is sent with captured photo. Then the process comes to an end. The system architecture is represented in figure 2, and the components involved in implementation is explained below.

- **RFID Reader**
  The RFID Reader could be a device that has one or more antennas that emit radio waves and receive signals back from the RFID tag.
- **PI Camera Module**
  The Pi camera module could be a portable light weight camera that supports Raspberry Pi. Communication with Pi is done using the MIPI camera serial interface protocol. it's normally utilized in image processing, machine learning or in surveillance projects.
- **Micro SD Card**
  A type of very small memory card typically utilized in mobile phones and other portable devices.
- **NodeMCU ESP8266**
  NodeMCU may be a low-cost open source IoT platform. It initially included firmware which runs on the ESP8266 Wi-Fi SoC from Espressif Systems, and hardware which was supported the ESP-12 module.
- **MySQL Database**
  MySQL is an open-source computer database management system. like other relational databases, MySQL stores data in tables made of rows and columns. Users can define, manipulate, control, and query data using Structured command language, more commonly called SQL.
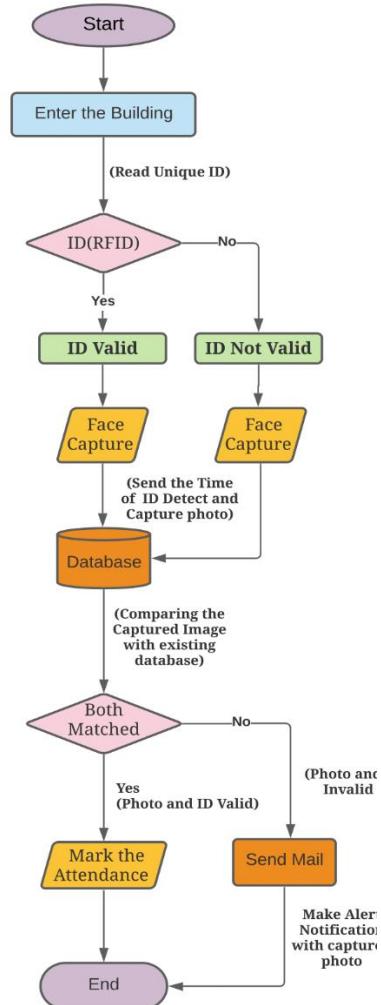
Figure 1. Flowchart for the Attendance Monitoring System
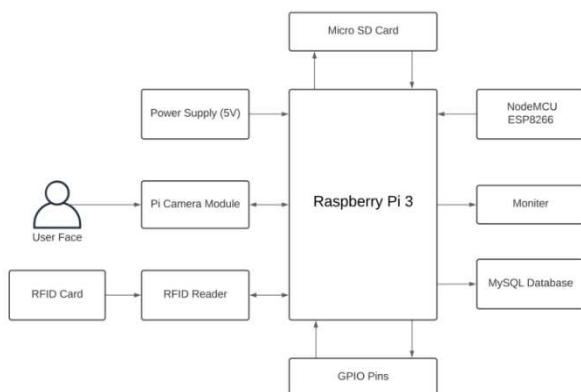
Figure 2. System Architecture

GPIO Pins

A General-purpose input/output is an uncommitted digital signal pin on an microcircuit or electronic card which can be used as an input or output, or both, and is controllable by the user at runtime. The Raspberry Pi 3 module is connected to the Power supply (5v). The Micro SD card is it's memory. The NODEMCU ESP8266 is working as it's WIFI server. The Monitor is used to display what's happening inside the Raspberry Pi Module. It uses a MySQL Database. They all are connected using GPIO (General Purpose Input Output Pins). When the RFID card is recognized by the RFID reader, the Pi camera module scans the user-face. The scanned image is compared with the pre-existing image in the database using Holistic Face Matching Algorithm.

Result and Discussion
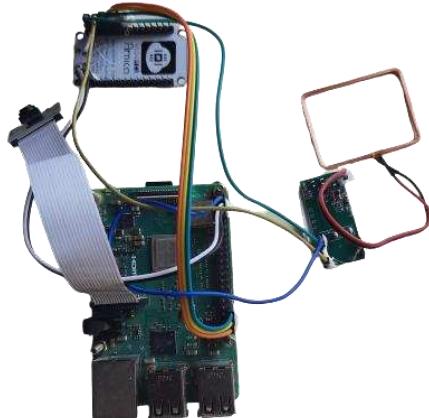
Figure 3. Attendance Monitoring System

It is seen that improvement in the process of taking attendance using AI happens. An improvement in the accuracy of taking attendance is noted. After applying the Holistic Face Matching Algorithm the time utilised on taking attendance is drastically reduced and this results in us focusing on other important activities. The usage of this form of attendance management helps us in avoiding the use of bio-metrics which have a higher percentage of resulting in spread of diseases such as COVID. The usage of this form of Attendance Management eliminates the chances of malpractice which are a major flaw of Manual Attendance Marking.

Report Generation

Attendance report status of the persons is given by total time noted in records according to the conditions mentioned below: If a person is present for a time equal to or more than 7 hours, Their attendance is marked as Present. If a person is present for equal to or above 3 hours 30 minutes and below 7 hours, their attendance is marked as Half-Day Present. If a person is present below 3 hours 30 minutes, their attendance is marked as absent. We can calculate the total time by using the record of clock in and out. If we need details of a particular person

we can find them by using the search bar by typing any information from the column. The report generation is performed for a day, week or even a month.

Student Registration

A new student can register for any course from any department. The chances of success registration depends on the availability of seats in the department. The student can enter their fundamental data in the registration form. Once the fundamental data are filled and the form is submitted a pop-up message indicating that the registration is successful is displayed along with a Reference Number. Inside the staff login, the concerned authorized staff can view the list of people who have applied using the registration form. The student is authorized once the registration form is viewed and the register number is allotted to the particular student. The allotment of register number and admission of student can be performed by The Principal, Head of Department, Coordinator and Admin. Those who are mentioned above can also preview the fundamental data of the students filled in the registration form before assigning the register number. Since some students join by lateral entry/transfer, the option for viewing the semester of joining is also included. Once authorized a pop up message is received on the staff side declaring the message that the student has been activated successfully. It is possible for the respective staff to download the namelist of a particular class or department in the form of a "PDF".

Student OD/Leave Application

A student can apply for OD/Leave using the student login. The following three step process is involved in the procedure,

Step 1: Application of OD/Leave Form by Student

In this form the student must specify whether it is OD or leave , specify the time duration using From/To option, Specify the reason for applying under the reason tab and attach documents/reference (if necessary) and submit the form. A pop-up message is displayed saying "Successfully applied for OD".The student can view if the OD/Leave is approved or cancelled.

Application of OD/Leave Form by Student

Step 2: Approval of OD/Leave by Class Advisor

Once the student fills and submits the OD/Leave form the next step in this process is approval of Class Advisor. The form will move into Step 3 only if approved by the Class Advisor. Inside the staff login the Class advisor can see the details of the student who applied for OD/Leave. In case the Class Advisor approves the request, a message is displayed asking for confirmation to approve OD. Once OK, is selected a pop-up message is displayed saying OD/Leave is granted successfully.

Step 3: Approval of OD/Leave by HOD

The next step in this process is approval by HOD. Once the HOD approves the request OD/Leave will be generated successfully.

Once all these three steps are completed student can view the status of OD/Leave.

10610

Screenshots

Figure 1
Attendance: (Today attendance)

Generate Report :(Current Month Report)

4	1821109	Devadarsan A	IV - VIII	2022-04-01	2022-04-30	50	23	22.5 Days	0.5 Days
5	1821117	Kailash M S	IV - VIII	2022-04-01	2022-04-30	48	23	22.5 Days	0.5 Days
6	1821118	Kamalesh S	IV - VIII	2022-04-01	2022-04-30	48	23	20 Days	3 Days
7	1821119	Karthick R	IV - VIII	2022-04-01	2022-04-30	48	23	23 Days	0 Days
8	1821121	Kowshick A	IV - VIII	2022-04-01	2022-04-30	48	23	22.5 Days	0.5 Days
9	1821124	Mohamed Shameer S	IV - VIII	2022-04-01	2022-04-30	48	23	21.5 Days	1.5 Days
10	1821125	Muthukumar V	IV - VIII	2022-04-01	2022-04-30	48	23	23 Days	0 Days

Showing 1 to 10 of 18 entries   First Previous 1 2 Next Last

Show 10 ✔ entries   Search:

S.NO	REG NO	NAME	YEAR/SEM	REPORT FROM	REPORT TO	TOTAL ENTRY	TOTAL DAYS	TOTAL DAYS ATTEND	TOTAL DAYS ABSENT
11	1821126	Navaneetha Krishnan G	IV - VIII	2022-04-01	2022-04-30	48	23	22.5 Days	0.5 Days
12	1821133	Saiyogesh S	IV - VIII	2022-04-01	2022-04-30	48	23	23 Days	0 Days
13	1821134	Sanjeev R	IV - VIII	2022-04-01	2022-04-30	48	23	22.5 Days	0.5 Days
14	1821135	Saran G	IV - VIII	2022-04-01	2022-04-30	48	23	23 Days	0 Days
15	1821141	Thangalakshmi J	IV - VIII	2022-04-01	2022-04-30	48	23	23 Days	0 Days
16	1821143	Venkatesh S	IV - VIII	2022-04-01	2022-04-30	50	23	20.5 Days	2.5 Days
17	1821144	Vighnesh A R	IV - VIII	2022-04-01	2022-04-30	48	23	23 Days	0 Days
18	1821145	Vignesh S R	IV - VIII	2022-04-01	2022-04-30	50	23	22.5 Days	0.5 Days

Showing 11 to 18 of 18 entries   First Previous 1 2 Next Last

Entry Time : (Current Month Entry Time)

Search For : **IT - This Month Entry...**

🗎 Export to PDF

Show 10 ✔ entries   Search:

S.NO	STUDENT REG.NO	STUDENT NAME	DEPARTMENT	COLLEGE	TIME
1	1821109	Devadarsan A	IT	KSRCT	01-04-2022 08:40:32 AM
2	1821143	Venkatesh S	IT	KSRCT	01-04-2022 08:42:26 AM
3	1821101	Achuthan S	IT	KSRCT	01-04-2022 08:43:03 AM
4	1821144	Vighnesh A R	IT	KSRCT	01-04-2022 08:44:30 AM
5	1821141	Thangalakshmi J	IT	KSRCT	01-04-2022 08:45:01 AM
6	1821134	Sanjeev R	IT	KSRCT	01-04-2022 08:46:14 AM
7	1821105	Arun Prakash K	IT	KSRCT	01-04-2022 08:47:46 AM
8	1821145	Vignesh S R	IT	KSRCT	01-04-2022 08:49:05 AM
9	1821117	Kailash M S	IT	KSRCT	01-04-2022 08:50:21 AM
10	1821133	Saiyogesh S	IT	KSRCT	01-04-2022 08:52:19 AM

Showing 1 to 10 of 870 entries   First Previous 1 2 3 4 5 ... 87 Next Last

Benefits

- **Payroll Integration :** Assuming that the payroll process has been automated, time and attendance module should also be able to integrate seamlessly into payroll functionality. It can provide accurate attendance data for the payroll cycle that can be used to rapidly and accurately calculate salary and other benefits.
- **Clocking In & Out:** It can be considered as the most important feature. Needless to say, the main purpose of a time and attendance module is to allow employees to clock in and out easily and keep a record of their working hours.
- **Reliability & Accuracy:** In the traditional method, employees report their work hours manually. This process has many loopholes. Employees forget to log in correct timings and there is also a chance of employees misusing the system by giving incorrect inputs. However, having an automated attendance

management removes all these problems and helps us to keep the data safe and accurate.

- **Cost Effectiveness :** Getting automated attendance management system helps in cost cutting and it is one time investment and you don't have to pay a human for doing this task.
- **Increased productivity :**Automated time & attendance management systems save time & human effort in keeping track of employees. Now work schedules are easily created based on job requirements, employee availability and eligibility, and they are easily duplicated. This will free managers from routine, manual scheduling activities so they can focus strategically on their business.
- **Regular Alerts :** This function of the attendance management system allows the parents of school children to get alerts if they're children haven't reached school and gotten their attendance marked. It is easier than ever before for parents to be updated about their children's daily school attendance.
- **Advanced Analytics :** Attendance management systems powered with advanced analytics offer granular visibility into attendance patterns, highlighting those who frequently put in overtime or diverge from scheduled hours.
- **Leave Management :** Attendance management system plays an important role in leave management. A missed day shouldn't simply be marked as absent instead an alert should be sent to the concerned employee with options to apply for leave or make a special request (such as half day).
- **Online OD form :** We can apply the OD through online in facilitated space , view the status of the OD applied of particular student by themselves.
- **No long queues :** It is not necessary to stand in long queue to punch the smart card or thumb for fingerprint reader.
- **No biometric issues :** No biometric issues such as finger printings can't be determined. Biometric/punch system can pose a threat to the spread of various flu and virus.
- **Identifying multiple faces :** It can recognize multiple faces simultaneously in the photo captured and give attendance.

Conclusions and Future Work

This study in particular focuses on the double confirmation of the automatic attendance system. A two step verification RFID attendance system along with AI will result in an efficient system. Any IoT application must be done with higher security, reliability, faster performance and cost-effectiveness. In that respect, all the characteristics are obeyed by the developed prototype and it works without any glitches. Practically all academic institutions require attendance record of students and maintaining attendance physically can be hectic as well as time consuming task. Hence automatic maintaining of attendance with the help of face recognition will be exceptionally useful and less prone to mistakes or errors as compared to manual procedure. This will also reduce the manipulation of attendance record done by students and reduces time consumption too. The future extent of the proposed work can be, catching numerous definite pictures of the students and utilizing any cloud innovation to store these pictures. This framework can be designed and utilized in ATM machines to identify frauds. Also,

the framework can be utilized at the time of elections where the voters can be distinguished by perceiving the face.

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10614

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