# Three Stage Robust Attendance Recording and Monitoring Using Social Media Platform, Image Processing and Cloud Computing

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*Abstract* – **Within the ambit of this paper, we propose a system that takes attendance of students for classroom lecture with a three stage robust mechanism for precise attendance recording with high accuracy and weeding out proxies completely. These days it is easily possible to estimate automatically the number of students present or absent and using image processing, each student can be identified. The solutions available are however, heavily hardware dependent like RFID or Bluetooth technology and are not tamper proof. We propose a method that takes attendance by tracking the cell phones of students, counts the number of students in order to check duplicity of devices and in the third stage identifies the registered users individually to detect impersonation. The robust algorithm will be very effective in controlling the cases of cheating by impersonation in entrance examinations. In the proposed system, firstly, an Arduino based hardware system scans for registered Wi-Fi devices. Secondly, a face detection system counts the number of students in the class. Finally, a face recognition system that employs Facebook's API can tag students in real time on dedicated Facebook pages for a particular class. This way the attendance taking process is streamlined & proxies completely removed.**

*Keywords – Automated attendance; Arduino; Voila-Jones & KLT algorithm; Camera; Face detection; Face-recognition; Facebook tagging.*

## I. INTRODUCTION

Attendance recording, management and analysis, is fundamentally important to any education system [1, 2,3,4].Research shows that it is critical to academic achievement and enhancement of students' understandings, knowledge and skills to move into employment and higher education. Research studies also suggest that this correlation between attendance and academic achievements becomes more significant when the students move to secondary and higher education levels. In most of the countries attendance management is a legal obligation on educational institutes. These institutes thus require a very robust and reliable way of recording attendance. Academically, there is a significant positive relationship between learner achievement and learner attendance. Traditional paper based attendance system, for educational institutes,

manufacturing plants etc is cumbersome as teachers, managers not only maintain a complete log of attendance but, are also expected to update it regularly. It is then transmitted to the administration often by hand. The entire process is tedious, time consuming and subject to human error. Further, there's always a chance of proxy attendance. Also, most of the students never get regular updates related to their attendance and the paper based record keeping mechanism is always vulnerable to theft of physical damages.

The attendance record in educational institutes, if not properly maintained or analysed, may have serious consequences for school administrators directly and government policies indirectly. In this paper we propose a robust system that records and analyses the attendance of students using face recognition, APIs of social media platforms and cloud computing techniques. Currently available attendance tracking systems using face recognition only are neither very accurate nor precise. Other alternatives like the bio-metric system and certain bluetooth based attendance devices are either too costly to be installed in educational institutions or simply can't address proxy-attendance issue. These systems are designed to record attendance as the data of a single event. If the learners are asked to record attendance on bio-metric at a regular interval then the lecture and the learner concentration will be disturbed. These limitations are easily overcome if image processing techniques are used for the purpose.

In addition to educational institutes, for most organisations today, attendance recording and analysis is very important. More and more emphasis is being given to attendance data collection, analysis and benchmarking for preventive measures or disciplinary actions. This also helps in framing new or tweaking policy decisions for better, positive and efficient attendance management strategy. The analysis of the big data reveals the summary of factors that result in absence provides better insight into the problem.

So what kind of attendance recording and monitoring system should educational institutes or employers choose to make good decisions or to avoid making mistakes? A biometric system [5,6, 7] is the best

bet that comes to mind, but it has its own inherent limitations. In that system the person has to go to the machine and swipe the card or touch with finger. But to monitor whether the student was present for the entire duration of the lecture or an employee was present in the factory for the designated time is very difficult in this technology. The safety of learners is of paramount importance in primary schools, may be more then their academic performance. Biometrics are not particularly suitable in such cases. In primary schools the learners grow at fast pace hence the system will require frequent re-registrations of fingerprints.

An improvement to this can be a RFID based attendance monitoring. But in that method the problems of proxies or impersonations are difficult to check. For maintaining security standards hourly or continuous recording may be necessary. The task can be accomplished using network of CCTV cameras but CCTV cameras are normally not programmed to verify the persons' identity in the video and raise alarm in case of an emergency.

Hence to maintain strict standards of safety and security of the young learners, to record and maintain attendance it is imperative to deploy a system, which not only records the number of persons present in the range, verifies their authenticity, take pictures at regular intervals and processes the image for checking impersonation and intruders. For monitoring these parameters at a regular interval would be very tedious, costly and time consuming using existing techniques. Big business organisations or manufacturing plants for wage determination etc, maintain these records on hourly basis. These records may have discrepancies for a number of reasons, if we use biometric or RFID techniques. If these discrepancies are not sorted out, situations may arise in which institutes or employers may have to deal with legal actions, penalties or insurance claims. The techniques proposed in this paper sort out all these issues with very high precision. A system that records attendance with persons' identity through facial recognition, with very high accuracy, but also integrates easily with the data processing software so the information stored can be quickly accessed and processed.

*A. Related work*

Today, biometric recognition based attendance recording and person identification is most common and reliable technique available. Biometric verification of identity may be based on various characteristics such as fingerprints, electrocardiogram [8], faces [9], irises [10], retinal patterns, palm prints [11], voice and hand-written signatures. RFID is also a very reliable identification and data collection technology that ensures highly accurate and precise data recording [12].

## II. PROPOSED ATTENDANCE SYSTEM:

This proposed system records and analyses the attendance of the students in a classroom with very high

precision and accuracy, involves three stages of operations:

*Stage I:* The system scans the Wi-Fi devices present in the range i.e. classroom. The system scans pre-registered devices only and very effectively weeds out the other active WI-Fi devices in the range. The data is then matched with the data received from the counter installed at the gate. In case of any mismatch the Wi-Fi devices are scanned again. In case of no mismatch the data is stored on a server for further processing. One of the good points about this method is that it is non-intrusive and almost everyone these days posses one or more Wi-Fi devices. MAC addresses of pre-registered devices are fed into the system. The system then scans only for these pre-registered devices and weeds out other active Wi-Fi devices in the range. This data is stored on a server.

*Stage II:* The mechanism described in stage I has few inherent limitations like one person may be carrying more than one WI-Fi devices and both devices may be pre-registered. Counters installed at the gate have their own set of limitations. There is a very high probability of getting the number wrong if pupils enter in the classroom in groups. An unauthorized person may also carry pre-registered device and attend the lecture. In this case the data from Wi-Fi devices as well from the counter will be correct but it will be a proxy attendance. To overcome these limitations and weed out proxies, this method recommends using image processing and face recognition techniques to establish, beyond doubt, the identity of an authorized user. The number of persons present in a range is calculated using image processing techniques [6,7,8]. A high resolution camera installed in a class then, takes regular snaps and gives a count of the number of students in the class. This data is then, matched with the one obtained through the Arduino-based system. If both the systems give identical result then, attendance is registered else there's a high probability of proxy error.

The methods discussed above may have limitations but will be effective in cases where schools, class-rooms do not have internet connectivity. Not every class room in schools in many countries has net connectivity. If there is connectivity, using social media platform for attendance management is the best bet.

*State III:* Creating a face database of the students is a time consuming task. The accuracy of the algorithm developed is not as accurate as the one used by the popular social media sites like Facebook. Hence it is advisable to use this platform for identification and verification. This stage of the system uses Application Program Interface (API) of Facebook, the social media platform to tag persons present in the picture captured. A list of persons tagged in the picture, the number of

students are then matched to the earlier results. The name list is stored and customized as per the requirement for processing. It has been observed over the number of data set that the final list of students prepared using all non-intrusive techniques is full proof with very high precision and accuracy.

The system comprises of minimal hardware, doesn't require any kind of card swiping, biometric machines or any other method in which attendance is marked individually. All that is required is a Wi-Fi scanner, a high resolution camera and connectivity on the hardware side and cloud computing platform and data analytics tools on the software side.
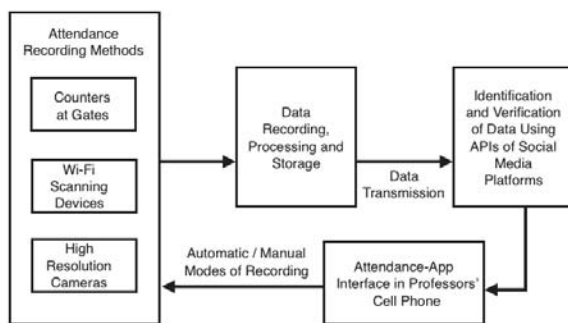
### III. SYSTEM IMPLEMENTATION SCHEME



Figure 1: Basic block diagram of the proposed attendance system

#### B. Architecture and Working

The key part of the system is ATmega328 microcontroller, Wi-Fi module, that receives names of every student by using peripheral interfaces. It uses 2.4GHz to 2.48GHz frequency of the ISM (Industrial Scientific Medical) band.

The steps involved in the attendance taking are:

i. The system scans the active Wi-Fi devices in the range.
ii. The MAC addresses of all the registered users are fed into the system. The list MAC addresses of scanned devices is then matched with the list of registered users. The Arduino based hardware was to filter these devices out of the many in the vicinity, figure 2.
iii. The filtered and sorted attendance list is then, stored on a server.

The student only requires an android powered smart phone to connect with the system. The process of attendance taking is initiated by the professor through his android application. Unlike traditional attendance methods, the system automatically takes attendance, stores it on to a server and sends it to the recipient with complete analysis of his regularity for different classes.



Figure 2: Result of attendance recording using a pre-registered device and storing the data on a local server.

#### C. MATLAB based face detection

To be able to remove the problem of proxies we require an automated counting method. In this project, we use image processing to count the number of students entering the class. The Wi-Fi based system independently takes the attendance and then, matches it with the result of image processing employing a camera placed near the entrance of the class. If the match is successful this means there isn't any discrepancy in the attendance. However, if there isn't a match then, the system intimates the professor about potential proxy attendances that would need a manual counting/correction.

The image being captured is sent securely to an analysis platform wherein the feature extraction algorithms help to decipher the number of people present in a room. This is done on the MATLAB platform using Voila-Jones and KLT algorithm for face recognition and object classification and tracking [13,14,15].
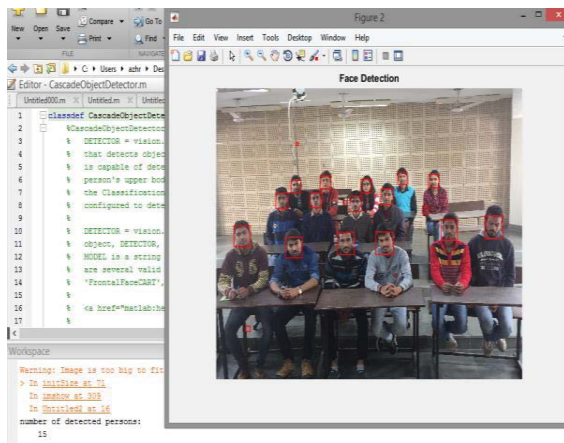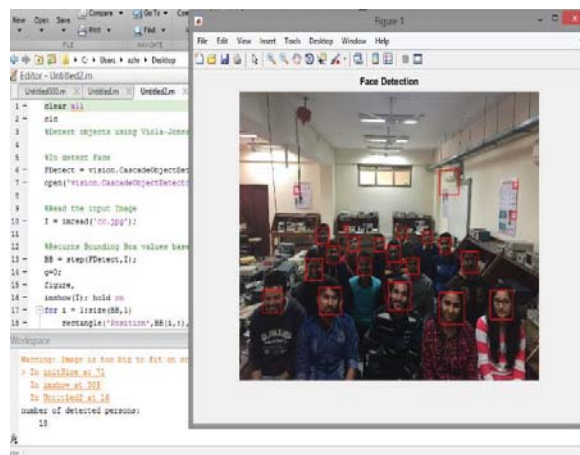
Figure 3: Source image and the result of face detection technique.

As is evident, figure 3, the system under ambient conditions is quite successful in counting the number of faces. However, under adverse conditions it may fail to generate expected results, for instance; there are cases where the system ends up counting objects such as window panes and paintings as faces.

In order to overcome this issue, cascade object trainer is employed to teach the software not to consider false data. Here, the system calculates the mean area of a presumed face by considering all the purported faces. Then, it compares this mean area with every other supposed face. If an alleged face happens to have a n area that vastly varies from this mean quantity then, it's simply cast-off as a false result.

Having tweaked the algorithm as mentioned above the system turned out to be fairly robust. This is underscored by the following result, figure 4.

The system despite recognizing false results as faces now only considers actual faces while showing the count.



(b)

Figure 4 (a) & (b): Source image and the result after incorporating the changes in ambient conditions.

## D. Facebook based face recognition:

The Facebook API, are available to its members for developing interactive applications. Members may create applications for their own purposes using Facebook's API platform and database. The proposed system uses Facebook's face recognition API to tag the students through their Facebook profiles. The mechanism actually requires that students be connected to a dedicated Facebook page for their class. Each time the system takes a snap of the class, it uses Facebook's API to identify all the faces in a photograph, figure 5. The data obtained from Facebooks' APIs are recorded in the excel sheet as the attendance.



(a)



(a)
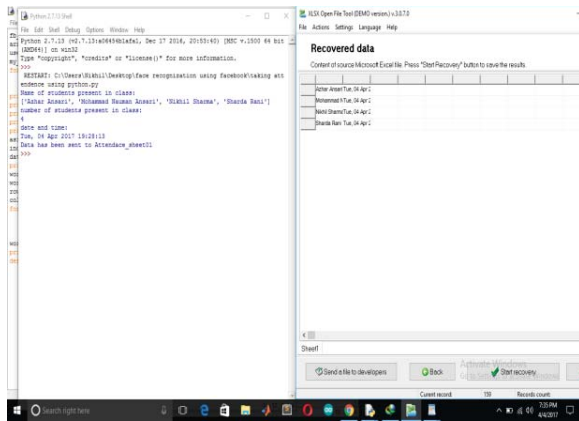
(b)

Figure 5 (a) & (b): Source image for face recognition and result of Facebook tagging and the recovered data in excel sheet.

This scheme of face recognition using Facebook makes the system fairly robust, simple yet accurate, as shown in figure 5. Identifying individual students this way makes the chances of proxy attendances very slim, virtually impossible. The system can be used as a check against impersonations at competitive examinations by installing the face recognition system through Facebook as a primary check for admitting students in the exam hall. Another important application of this system can be in tackling sexual offences at schools where the victims are disproportionately from primary section. This system can be deployed as a security scheme that monitors people entering and exiting various sections of the school. The Facebook based system can tag the people in real-time and produce alerts if an unauthorized entry is detected. Employing the Facebook based face recognition method makes the CCTV monitoring system fairly automatic by tagging people to their Facebook profiles and generating real-time results on excel sheets. Hence, there's little need for someone to regularly monitor the CCTV recordings.

## IV. CONCLUSION AND FUTURE SCOPE

The attendance management systems, these days, come with highly interactive interface for the best results. Almost all RFID based systems to the biometrics-powered systems, are very flexible and scalable, but can be further improved with passwords and multimodal recognition systems. This proposed system is one of the best ways to tackle cases of proxies, impersonation and to handle security concerns in educational institutions. It is also one of the best methods to record the attendance of the employees in the work place. A system that is ideally designed for educational institutes may save a lot of lecture time which is lost because of traditional attendance taking systems. It can be further strengthened by adding a cloud-based solution with comprehensive data analysis to generate a complete breakdown of student attendance and regularly keep them updated through e-mails and mobile alerts. A time-table module may also be attached with this system so that it automatically fetches the subject, class and batch details.

The proposed system can be highly suitable for business enterprises, which have mobile workforce, and need a suitable time and attendance system. The system can provide options in which employees can clock in and out with their smartphones and social networking sites. The system can be designed to record the starting and ending time of shifts of employees.

The three stage mechanism of attendance with a face detection and recognition system using social media is a robust and reliable system for attendance management. The hardware required is minimal hence implementation is easy. The proposed system is a very simple, cost effective, non-intrusive technique performs different tasks without compromising on accuracy.

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