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Smart Attendance Management System for Students Engagement and Academic Growth using Machine Learning

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ABSTRACT
The attendance is one of the important tasks for every organization or university to monitor the regularity of each student. The manual procedure is quite complex and sometime data may get lost. In this paper, we try to develop a smart attendance system using machine leaning (ML) that provides an effective solution to track the students in any organizations and schools. The system relies on the functionality of Raspberry Pi as crucial unit with camera enabled and Open CV for processing of image with facial identification algorithms that will process and store data. ML programming will help to manage all the stored attendance for analysis. Using this method the attendance can be increase up to 30-40% and this will increase the involvement of participants for academic growth and its development. It also improves the authenticity of each candidate and largely minimizes the fake attendance. This system will help to tackle the real-time challenges of identification of candidates and provide effective way to improve the student's involvement and academic growth.

KEYWORDS
Smart Attendance, Machine Learning, Accuracy, False Rate, SVM

1. INTRODUCTION

Tracking of attendance is one of the important tasks of any organizations and institute to collect the daily in and out status of participations. The existing manual process is quite difficult to manage the attendance and sometime it may get lost due to some mishap [1]. Manual process may sometime very time consuming and causes may error and counted as one the ineffective way to measure attendance [2-3]. To overcome such issues smart management system may proves to be one the possible way through which such situations can be primarily minimized [4]. This smart system integrates various features to measure the attendance and delivers the authentic data to the organizations or institutes [5]. The main aim of this smart attendance management system to track the student's presence inside the campus for greater involvement using the image and that image is further processed to get the clear picture of data for student in term of true identification, false identification, authentication etc. Such a system can help to manage the huge data in a systematic way and this will also support in growth of student's attendance and provide smooth growth in academic work. Our aim through this management system is to improve the level of participants in institute or organization and track the candidates having less attendance as per university/institute norms and make them aware about his/her attendance. The complete structure of a system revolves around the image analysis from enrolment to recognition and such identification method improves the quality and higher involvement of students using the Raspberry Pi technology and machine learning involvements.

2. RELATED WORK

In recent years the development in efficient solution is increased for various institutes, organization and, schools and brought greater attention on the utilization and creation of smart attendance system. This complete literature review gives clear picture of various solution and methods involved with this system and it has been observed that this it is one of the favourite areas of research and its development, focused on different domain like technology integration, user to user, design etc. To deal with various smart enrolment devices, researcher is digging to integrate various technologies which includes biometric, RFID, machine vision etc. The main advantages of biometric technology, as it deals with iris and finger identification, in tracking the participants as mentioned by Jani et. al., Xiange et. al., [6-7]. Zhang et. al., mentioned the application to monitor and recognize participants with a non-interfering approach [8]. Jha et. al., and Chen et.al., discussed a technology relies on facial identification which is feasible with respect to the educational point of view [9-10]. Such studies primarily focus on the strong algorithms and optimal efficiency and infrastructure of hardware. A. Upadhyay et. al., discussed an image identification approach using embedded model under different scenario [11]. Goyal et. al., discussed the development of smart attendance mechanism using Raspberry Pi with different platform. [12]. S. Upadhyay mentioned the identification of image using IoT technology improving the security level of image [13]. Various studies utilize the camera and Raspberry Pi tool to increase the capability and adaptability of various attendance monitoring system [13-14]. Lei et. al. and Lim et. al., discussed the successful application of smart involvement management in

examining the perceptions and behaviors of shareholder which includes teachers, administrators, students etc. [15-16].

3. HARDWARE FUNCTIONING PROCEDURE

The main component of smart attendance system is Raspberry Pi which is interfaced with all the external components for its proper functioning for entire process that involves image identification as shown in Fig. 1. The complete hardware will be interfaced with the machine learning algorithm to collect the data received from the web camera. The collected may be in large and it can create huge problem of data management and such issue will nicely be handled using ML algorithm to classify the images received for further processing.

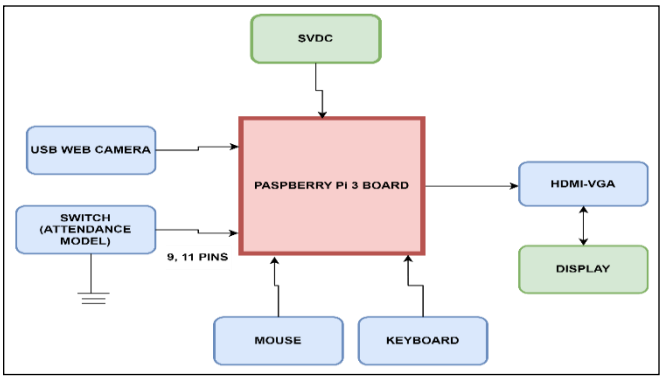
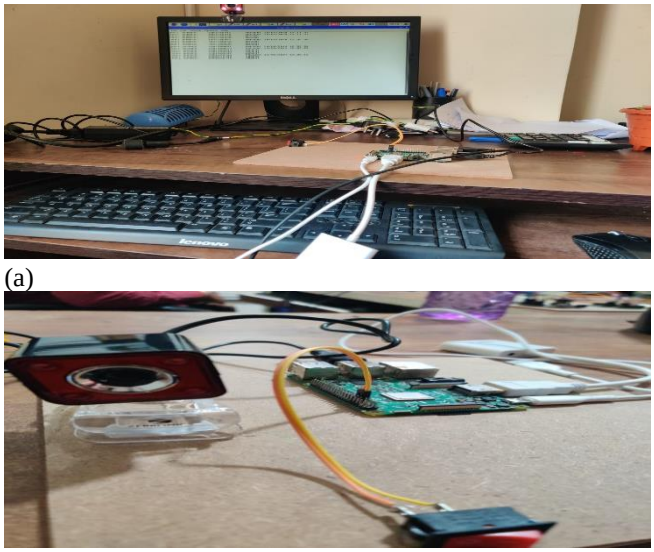


Fig. 1. Procedure for hardware functioning

The main aim of the hardware-based system is to gather, process and keep the attendance recorded data using Open CV [17]. Raspberry has various ports to connect the external peripherals which includes keyboard, camera, mouse etc., as shown in Fig. 2. HDMA-VGA is used to carry the video signal with HDMI output to display on monitor with VGA output. The switch attendance model allows the upgraded power supply to Raspberry Pi using pin 9 and 11 and will be made ON and OFF for identifying the image [18-19]. The system uses the camera to capture the image of the candidates coming in front of camera and saved in some folder for processing. After completion of the complete process each image is analyze using Open CV tool that follow the PIXEL environment Linux based to run the Python programming for the analysis of complete dataset recorded [20-21]. Further each image is marked as true image and if any image not found in the database treated as incorrect or false image. This complete process takes the advantage of Raspberry Pi to gather the whole cycle. The complete procedure of hardware functioning depends upon the Raspberry Pi as it provides the complete access to the components connected with it.



(a)

(b)

Fig. 2. Hardware setup (a & b)

The hardware as depicted in Fig. 2 required one system to perform the complete task from tracking to analysing.

4. PROPOSED ARCHITECTURE

The complete management for implementing the proposed smart attendance relies on cameras and Raspberry Pi that provides an efficient and convenient way to track the original person. Raspberry Pi act as a central unit to execute the entire system [22-23]. The proposed system initially gathers the video image using and camera and treated as enrollment stage as shown in Fig. 3. Now, each frame is stored in folder and create a database of the images. In the recognition stage, each frame is analyze using machine learning algorithms. Further, in next step the removal of feature is done and it is classified as recognized person with some unique id number. The removal of feature is done to identify the exact face structure of each enrolled candidates and they will be treated as present or absent.

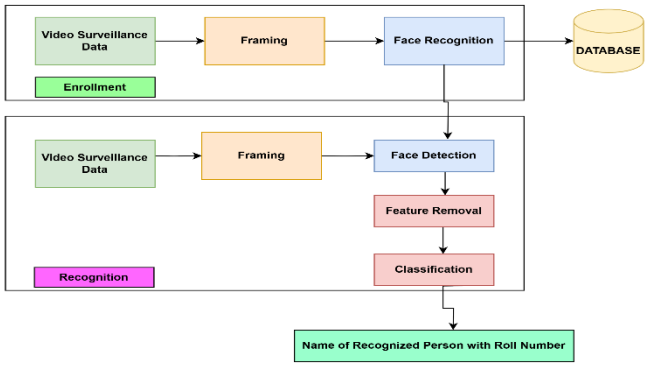


Fig. 3. Proposed mechanism for decision making

The complete mechanism for decision making will help to detect the desired image for the proper authentication of image and this will minimize the changes of false detection.

5. IMPLEMENTATION PROCESS

For the process data and facts must be pre-processed and gathered from different sources using camera. It basically collects the applicable facts which includes real-time images, database images etc., and gathers the gender and ages of the users. The information now transformed and filtered out into its proper format for ML (machine learning) computation which covers categorical or numerical values [24-25]. When the information is ready for processing ML model must be picked. Normally, it is a model in form of neural network, and it has the capability to handle the typical relationship among the different data points. The data can be re-sampled to achieved the proper result which combines the precision of such four algorithms which is shown Fig. 4.

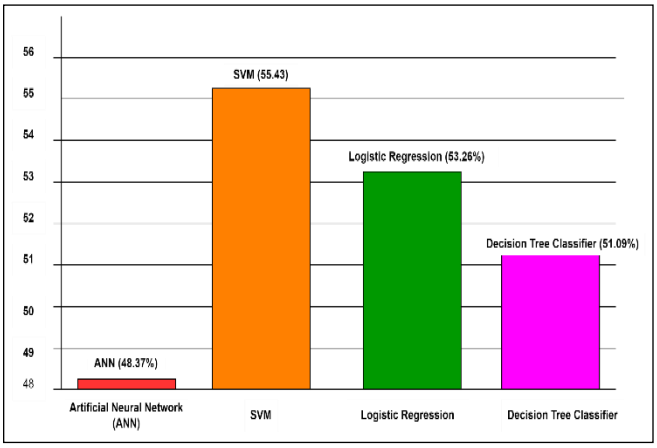


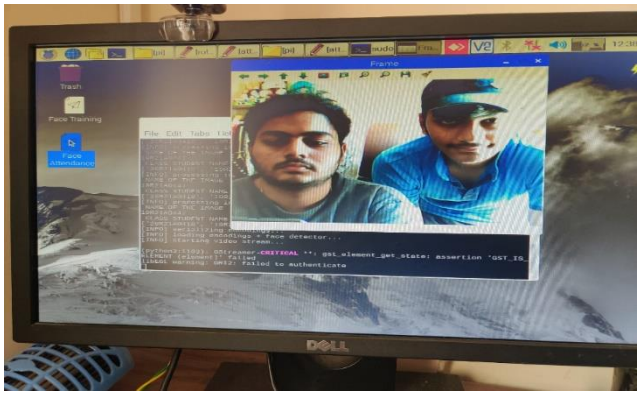
Fig. 4. Precision rate of four algorithm

SVM showing a higher rate of precision compared to all the three algorithms and the implantation [26]. The importance of this algorithms is to choose the best suited algorithm for image processing.

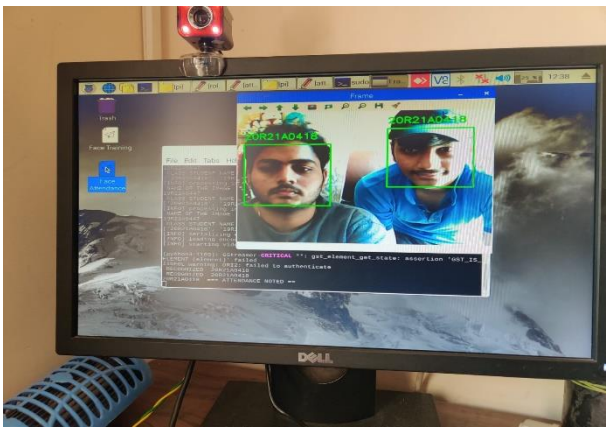
6. EXPERIMENTAL RESULTS

The complete process of identification from enrollment to prediction is shown in Fig. 5 and this platform is GUI based interface for complete analysis of input data. The quantitative facts involve name, roll number, gender etc. has been considered for analyzing the gathered data which may act as a crucial data for testing the gathered data from end users also it is depicted in Fig. 6 (a & b).

Fig. 5. Registering process



(a)



(b)

Fig. 6. Recognition of the concern candidate (a & b)

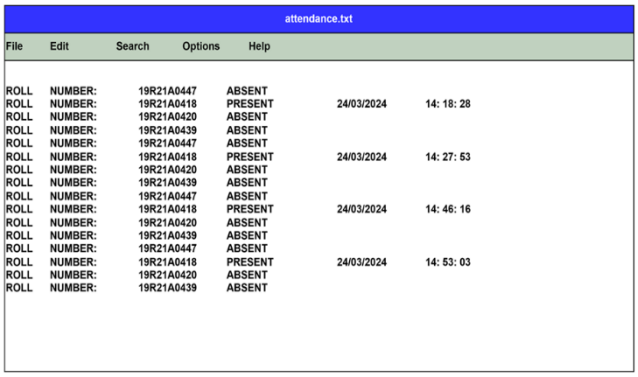


Fig. 7. Identification of student as present or absent

The evaluation of absent and present students is depicted in Fig 6 and Fig. 7 shows the graphical representation to recognize true students is 44.89% and 35.67% is for false acceptance found. The level of complete detection of false and correct image shown in Figure represents the percentage for the actual candidate found is about 44.89% and for false candidate is 35.69%. The level of image identification for correction detection is higher compared to false detection as depicted this will measure the identification level of authentic image coming from the database after feature extraction and classification shown in Fig. 8.

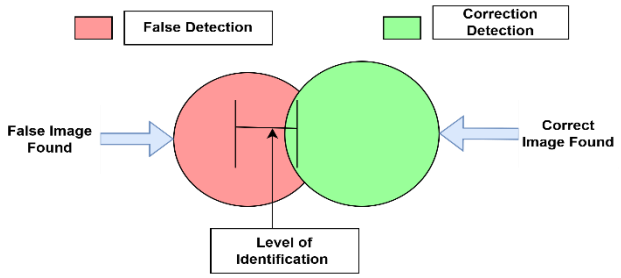


Fig. 8. Level of image identification

The accuracy is also very important to identify the facts that is achieved and mathematically evaluated as:

$$\text{Accuracy} = 44.89/35.69 + 44.89 = 47.405\% \quad (1)$$

The actual candidate identified with their complete identity is shown in Fig. 9 and the analysis of different parameters involved in image recognition has also been observed as shown in Fig. 10 where the true rate, false rate, true false observation, and authentication rate is analyzed.

Fig. 9. Actual candidate identified

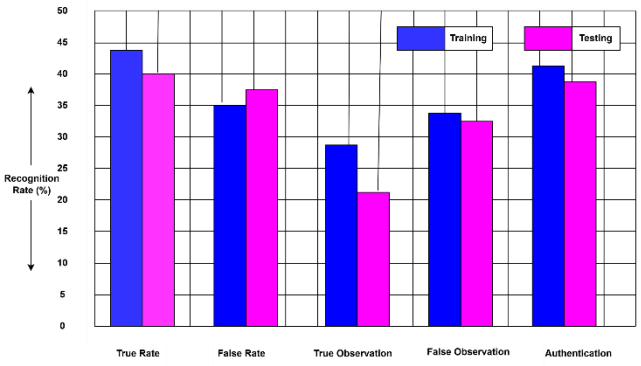


Fig. 10. Analysis of different parameters for improvements

The complete analysis has been done at different level of training and testing by the proposed model to achieve the improved result. The true observation for while training is 25.88% and for testing it is observed to be 22.26% also the authenticate rate will be 41.19% and testing it will be 39.89%.

7. CONCLUSION

The proposed smart attendance system delivers the best possible solutions in maintaining the attendance of each participant. The overall efficiency of authenticity will maximum reaches up to 40% and it may be improved using the advanced feature of image recognition and machine learning involvement. It also offers an accurate attendance data by analyzing the facial behaviors of students. The entry and exit process of the students will be quite easy and false attendance claimed can be tracked out easily. The academic growth relies completely on the involvement of students and this system will encourage for regular classes and daily activity. So, this system may improve the performance of students in term of results and innovative learning and, it will help the organization or schools to give up the traditional method of attendance and supply new and updated version for the proper academic development and growth in future.

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