

“Contactless smart attendance system using facial recognition and QR code”

Simran B. Wanjare *Author, Department of Electronics & Telecommunication Engineering,*
Dr. J. R. Mahajan *Guide, Department of Electronics & Telecommunication Engineering,*
Prof. S. S. Gadekar *Co-Guide, Department of Electronics & Telecommunication Engineering,*

ABSTRACT

Over the years the manual attendance management has been carried across most of educational institutions. To overcome the problems of manual attendance, I have developed Smart Attendance System Using Facial Recognition [2][7] & QR Code [1]. Attendance monitoring is one of the crucial administrative processes in all educational institutions and organizations. A well-structured system will enable the institutions to have an increasing growth. It helps the students, teachers and parents in all ways to have a good progress in the attendance and security, thereby reducing the teachers' time and effort. The traditional method of checking the student's ID's and marking their presence/absence is the routine process followed regularly. Contactless smart Attendance system [5] is proposed using facial recognition and QR code. Firstly, a database containing the facial images and QR scanner of the students in a particular class is constructed. This system is designed to improve the students' engagement time inside the university, to communicate to the parents frequently, to avoid proxy attendance and to generate detailed reports for future reference.

KEYWORDS: c# language, facial recognition, QR

Date of Submission: 07-06-2024

Date of acceptance: 21-06-2024

I. INTRODUCTION

Attendance Management System is software developed for daily evaluation of students in their continuous assessment record, and performance in accordance with the principle of the institution. It is facilitated to access the performance and information of attendance of a particular Student in a particular semester of study. The information is sorted by the teachers, instructors and advisors, as provided by the student for a particular day throughout a complete semester. This system will also enable the evaluation of student regular presence in various lectures which will determine the eligibility of the student to sit for a semester examination. Attendance Management System [23] basically has three main modules for proper functioning

- First module is admin which hold the key for editing and updating information. The admin has absolute right to all the users which are the Teachers and Student.
- Second module is handled by the user which can be a teacher or Instructor. This user has a right of making daily attendance, updating, editing and generating reports to the students.
- Third is handled by a user which is the student, he has less privilege to the access of the system; the student can only view his own record by providing his username and password. He will be able to see the percentage of his attendance as well as his results. If any comment or change of class schedule the student can see in his own profile only. This user can receive alert / message from his teachers related to his attendance performance [8]. It is obvious that Students with poor attendance will see their attendance in a red warning table that can make the student to be careful not to miss classes anymore.

Facial Recognition-Based Attendance System Facial recognition [6] technology leverages artificial intelligence and machine learning algorithms to identify and verify individuals based on their facial features. This technology has gained significant traction due to its non-intrusive nature and high accuracy. By capturing and analyzing the unique facial characteristics of each individual, the system can automatically mark attendance with minimal human intervention [22].

The process typically involves:

Image Capture: Using a camera, the system captures an image of the individual's face. **Feature Extraction:** Key facial features are extracted from the captured image. **Database Matching:** The extracted features are compared against a pre-registered database of faces. **Authentication:** If a match is found, the individual's attendance is recorded. This method ensures quick and reliable attendance marking, enhances security, and reduces the possibility of proxy attendance.

QR Code-Based Attendance System Quick Response (QR) codes [1] are two-dimensional barcodes that can store information, such as URLs, text, or other data, in a machine-readable format. QR code-based attendance systems utilize this technology to streamline the attendance process. The typical workflow involves: **QR Code Generation:** Each individual is assigned a unique QR code. **Scanning:** At the time of attendance, the individual scans their QR code using a scanner or a mobile device equipped with a QR code reader. **Data Logging:** The system reads the QR code, verifies the individual's identity, and logs the attendance. **Integration of Facial Recognition and QR Code Technologies** Combining facial recognition and QR code technologies can create a comprehensive attendance management system that maximizes the strengths of both methods. Such an integrated system can offer: enhanced security, user convenience, scalability.

II. LITERATURE REVIEW

Face recognition is crucial in daily life in order to identify family, friends or someone we are familiar with. We might not perceive that several steps have actually taken in order to identify human faces. Human intelligence allows us to receive information and interpret the information in the recognition process. In order to overcome human limitations, computers with almost limitless memory, high processing speed and power are used in face recognition systems. The human face is a unique representation [7] of individual identity. Thus, face recognition is defined as a biometric method in which identification of an individual is performed by comparing real-time capture image with stored images in the database of that person. The current attendance system is manual and time-consuming, prone to errors. Lecturers record attendance manually, leading to errors and time-wasting. Proposed QR code system aims to verify students' identity and prevent cheating and records will be instantly available to students and lecturers, reducing manual effort in attendance tracking.

Sarker D K, Hossain N I and Jamil I A et.al, (2021)[1] created a smart attendance system using QR codes. The system includes a backend and frontend, uses unique QR codes to prevent proxy attendance, and can be integrated with other software tools. It ensures accuracy, real-time monitoring, high security, and cost-effectiveness. Attendance system with facial recognition is more efficient than traditional methods, focusing on accuracy and limitations. Image processing aids in automated attendance monitoring in classrooms and surveillance systems.[2] Machine Learning improves attendance systems by addressing pose, facial expression, illumination, and occlusion issues. The paper reviews advancements and discusses ML's role in reinforcement for accuracy evaluation. Smart Attendance Monitoring System uses Face Recognition for classroom attendance, emphasizing the importance of regular attendance.

The proposed CNN shows better accuracy and robustness in complex environment. Sarker D K, Hossain N et.al introduced a smart attendance system in Bangladesh using RFID, biometric fingerprint sensor, and password technologies to improve efficiency. Hung, Shih-Hsuan; Yao et.al [9] presented a method to create high-quality micrography QR codes by warping letters and adjusting font weights. Chen, Rongjun et.al [10] proposed an adaptive binarization approach for QR codes in warehouse systems to handle uneven illumination effectively. A new method for face recognition from connected devices is suggested, involving HOG features, SVM, Face Net neural network, and QR code-based smart attendance system. Kadry, Seifedine et.al [15] proposed a wireless iris recognition attendance system based on Daugman's algorithm to improve attendance accuracy and effectiveness.

Thus, combining all this literature, we have made a proposed system consists of two modules: mobile face detector captures and stores student faces, while desktop application recognizes faces, marks attendance, and stores results in a database.

III. SYSTEM DEVELOPMENT

Facial recognition technology has become increasingly ubiquitous in a variety of contexts, including security, surveillance, user authentication, and personalized marketing. The process of facial recognition comprises multiple essential stages, each playing a role in the precise identification of individuals based on their facial characteristics. Let us delve into these stages via a visual representation:

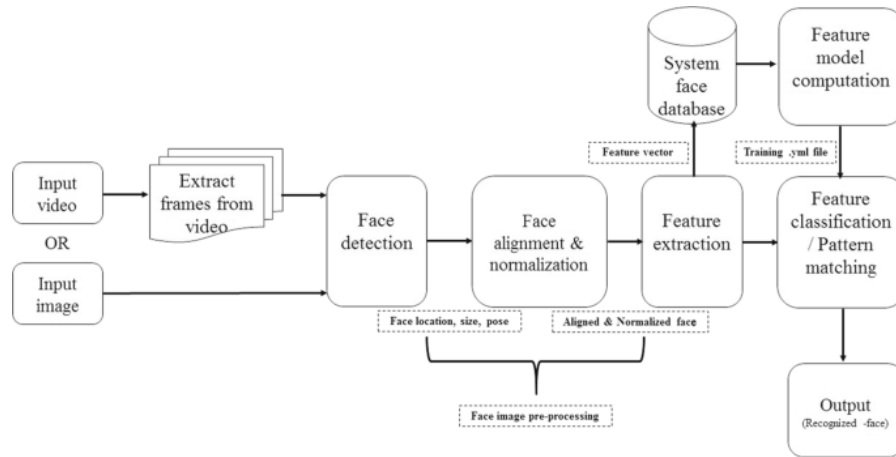


Figure: 3.1

Step 1: Facial Detection occurs by employing computer vision algorithms to identify faces in an image or video frame. If no faces are detected, the process halts.

Step 2: Preprocessing involves enhancing the quality of facial images and standardizing their appearance by normalizing lighting conditions, aligning facial features, and eliminating noise or background distractions.

Step 3: Feature Extraction includes extracting crucial features from pre-processed facial images such as distances between facial landmarks and the overall shape and texture of the face.

Step 4: Feature Matching compares extracted features with a database of recognized faces to identify potential matches based on similarity scores or distances.

Step 5: Verification or Identification is executed based on the context, where the system either verifies if the input face corresponds to a specific individual's face in the database or scans the entire database to identify the closest match.

Step 6: Decision Making is based on the outcomes of feature matching and verification/identification. The system makes decisions concerning the identity of the input face, prompting further actions like granting access, issuing alerts, or logging attendance.

In conclusion, facial recognition [18] technology provides a potent mechanism for automating various activities linked to identity verification and authentication. By adhering to the steps delineated in this flowchart, facial recognition systems can precisely and effectively identify individuals based on their facial attributes, facilitating a broad array of applications across diverse sectors.

IV. PERFORMANCE ANALYSIS AND RESULTS

A. Facial recognition

Facial recognition technology identifies individuals by analyzing unique facial features. It works by capturing a face image and comparing features with a database for a match. Components include hardware for image capture and software for data analysis. Applications range from security to marketing, raising privacy concerns and ethical considerations. Legal regulations are being introduced to address privacy and ethical concerns. Technological advancements in facial recognition include improved accuracy and speed with the help of machine learning and AI. Challenges include bias, accuracy across demographics, and privacy concerns. Adoption of facial recognition technology requires careful consideration of ethical, legal, and privacy implications.

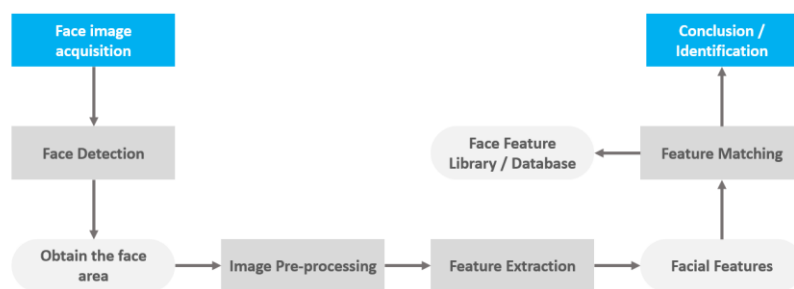


Figure: 3.2

B. QR code verification

Three different components constitute the solution: a web module, a mobile module, and a backend service module. The Quick Response code (QR code) generated by the backend service module is displayed by the web module. To prevent fraud, the QR code is updated every 10 seconds.

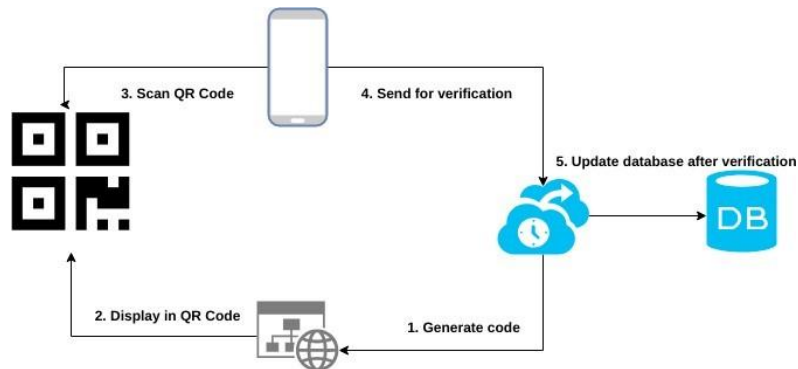


Figure: 3.3

Students can verify their attendance by scanning a QR code with the mobile module. After that, the request is forwarded to the backend service module for confirmation. The backend service module will update the database containing the attendance records after the verification of attendance. Taking attendance should take less than five minutes overall, which is far faster than the previous method.

V. RESULTS

The results for the proposed model consist of three stages first stage consist of taking data from the user for database second stage consist of recognizing the face, and finally third stage consist of marking his or her attendance.

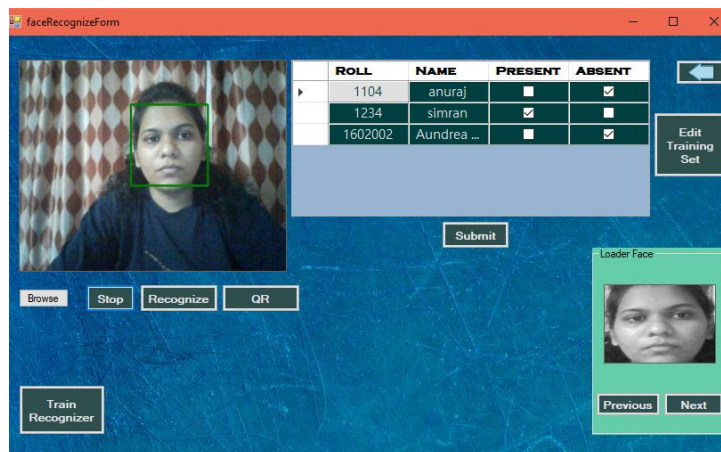


Figure: 4.1

After this the actual attendance taking by facial recognition stage which is shown in figure 4.2



Figure: 4.2

Finally, the mail is send to their parents about he presence or absence of their child with roll no. of student and presence status

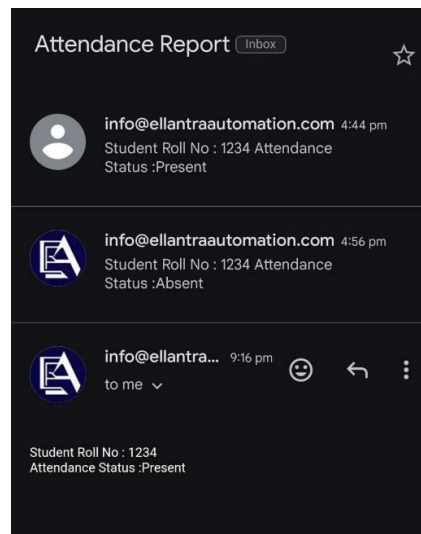


Figure: 4.3

VI. CONCLUSION AND FUTURE SCOPE

The development and analysis of our facial recognition system have provided valuable insights into the capabilities and limitations of this technology. Throughout the project, we have achieved several key milestones and made significant contributions to the field. Firstly, our system demonstrated robustness and accuracy in recognizing faces across various environmental conditions, including different lighting conditions, angles, and facial expressions. This indicates the effectiveness of the algorithms and techniques employed in our implementation. Secondly, through rigorous testing and evaluation, we have identified areas for improvement, particularly in enhancing the system's performance with diverse demographics, including different age groups, ethnicities, and genders. Addressing these challenges will be critical for ensuring the inclusivity and fairness of facial recognition technology. Moreover, our project highlighted the importance of ethical considerations in the deployment of facial recognition systems. We recognize the potential risks associated with privacy invasion and algorithmic biases, and we are committed to implementing measures to mitigate these concerns. This includes incorporating privacy-preserving techniques and conducting thorough impact assessments to ensure the responsible use of the technology.

REFERENCES

- [1]. Sarker D K, Hossain N I and Jamil I A 2016 Design and implementation of smart attendance management system using multiple step authentication 2016 International Workshop on Computational Intelligence (IWCI) pp 91-95.
- [2]. Abas M A, Tuck T B and Dahlui M 2014 Attendance Management System (AMS) with fast track analysis 2014 International Conference on Computer, Control, Informatics and Its Applications (IC3INA) pp 35-40
- [3]. Chintalapati S and Raghunadh M V 2013 Automated attendance management system based on face recognition algorithms 2013 IEEE International Conference on Computational Intelligence and Computing Research
- [4]. Wagh P, Thakare R, Chaudhari J and Patil S 2015 Attendance system based on face recognition using eigen face and PCA algorithms 2015 International Conference on Green Computing and Internet of Things
- [5]. Bhattacharya S, Nainala G S, Das P and Routray A 2018 Smart Attendance Monitoring System (SAMS): A Face Recognition Based Attendance System for Classroom Environment 2018 IEEE 18th International Conference on Advanced Learning Technologies (ICALT) pp 358-360
- [6]. Lodha R, Gupta S, Jain H and Narula H 2015 Bluetooth Smart Based Attendance Management System Procedia Computer Science 45 pp 524-527
- [7]. Mohamed, B. K. P and Raghu C V 2012 Fingerprint attendance system for classroom needs 2012 Annual IEEE India Conference (INDICON) pp 433-438
- [8]. Raghuvanshi A and Swami P D 2017 An automated classroom attendance system using video based face recognition 2017 2nd IEEE International Conference on Recent Trends in Electronics, Information & Communication Technology (RTEICT) pp 719-72
- [9]. Chen H 2014 Intelligent Classroom Attendance Checking System Based on RFID and GSM Advanced Materials Research 989-994 pp 5532-5535
- [10]. Poornima S, Sripriya N, Vijayalakshmi B and Vishnupriya P 2017 Attendance monitoring system using facial recognition with audio output and gender classification 2017 International Conference on Computer, Communication and Signal Processing (ICCCSP)
- [11]. Pireva K. R, Siqeca J and Berisha S 2013 RFID: Management System for students' attendance IFAC Proceedings Volumes 46(8) pp 137-140
- [12]. Alghamdi S 2019 Monitoring Student Attendance Using A Smart System at Taif University SSRN Electronic Journal pp 107-115
- [13]. Rajan Patel, Nimisha Patel, Mona Gajjar 2012 Online Students' Attendance Monitoring System in Classroom Using Radio Frequency Identification Technology: A Proposed System Framework International Journal of Emerging Technology and Advanced Engineering 2, Issue 2 pp 61-66.
- [14]. O.K. Oyetola, A.A. Okubanjo, O.O. Olaluwoye 2017 A Secure Students' Attendance Monitoring System Journal of Engineering Technology 2, Issue 1, pp 14-25
- [15]. M. Olagunju, A. E. Adeniyi, T. O. Oladele 2018 Staff Attendance Monitoring System using Fingerprint Biometrics International Journal of Computer Applications 179, Issue No.21
- [16]. D. Demirović, E. Skejić and A. Šerifović-Trbalić, "Performance of Some Image Processing Algorithms in Tensorflow," 2018 25th International Conference on Systems, Signals and Image Processing (IWSSIP), Maribor, 2018, pp. 1-4, doi: 10.1109/IWSSIP.2018.8439714.
- [17]. L. Yuan, Z. Qu, Y. Zhao, H. Zhang and Q. Nian, A convolutional neural network based on TensorFlow for face recognition, IEEE 2nd Advanced Information Technology, Electronic and Automation Control Conference (IAEAC), 2017, pp. 525-529. doi: 10.1109/IAEAC.2017.8054070.
- [18]. Q. Cao, L. Shen, W. Xie, O. M. Parkhi and A. Zisserman, "VGGFace2: A Dataset for Recognising Faces across Pose and Age," 2018 13th IEEE International Conference on Automatic Face & Gesture Recognition (FG 2018), Xi'an, 2018, pp. 67-74, doi: 10.1109/FG.2018.00020.