International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 05 May 2026
Page No: 2960-2966
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0373

MarkIt: An Automatic Facial Recognition-Based Attendance Management System

Archana G[1], Inba M[2], Keshni B[3], Janani R[4]
[1,2,3]UG Student, Department of CSBS, Panimalar Engineering College, Chennai, Tamil Nadu, India
[4]Assistant Professor, Department of CSBS, Panimalar Engineering College, Chennai, Tamil Nadu, India.
Emails: *archanagunalan16@gmail.com[1], inbamajaba@gmail.com[2], keshnin0529@gmail.com[3], jananideivamani@gmail.com[4]*

Abstract
Tracking classroom attendance is often tedious and error-prone, especially regarding proxy attendance. Techniques commonly used to take roll calls and use physical registration systems are disruptive to classroom processes and unfortunately not always as reliable. MarkIt provides an online system that takes roll calls by using a basic web camera and is totally web based, meaning no sophisticated hardware is needed to utilize it. MarkIt employs YOLOv8 to detect faces in real-time and generates facial embedding vectors via face-api.js, which are matched to individual student profiles through usage of Euclidean distance and permits for reliable identification. MarkIt is developed on a React/TypeScript stack, with Supabase providing authentication/storage support, computations being done locally utilizing WebGL and WebAssembly; providing low latencies for processing while preserving the highest quality of privacy because no sensitive info ever leaves the client. MarkIt offers an expedited, accurate and secured process to track and maintain student attendance.

Keywords: *Attendance automation; Browser-based systems; Computer vision; Facial recognition; YOLOv8.*

1. Introduction
Accurate attendance tracking is essential for both educational and job-related environments. Students typically must meet certain attendance criteria at numerous colleges and universities before they will be allowed to take an exam or continue to meet their academic goals. As a result, organisations ought to have efficient and effective attendance tracking systems in place. Even though digital technologies are available for tracking attendance, many organisations still utilise old methods, such as roll-call and paper attendance lists. These manual processes are often time-consuming, difficult to manage in large classes, subject to human error, involve lost attendance records, include various methods for recording absences, and generally have proxy issues with abuse. To address these problems, a variety of automated attendance tracking solutions have been introduced over the last 10 years, such as AI-based facial recognition systems that can deliver superior efficiency and accuracy (Patel, J. et al., 2025; Sakthikumar, S. B. et al., 2025). The introduction of modern methods to record attendance has improved the accuracy of attendance records while reducing the amount of time it takes to record attendance with the use of RFID cards, fingerprint recognition devices, or mobile applications. Traditionally, attendance devices have required the use of dedicated hardware interfaces. This not only raises the ownership/operating costs of the devices, but also adds significant complexity. Advances in new artificial intelligence and computer vision technologies have led to the widespread acceptance of facial recognition as an alternative for automating attendance tracking systems; therefore, it provides a solution to many of the limitations that present-day traditional biometrics systems currently face (e.g., contactless and real-time functions). Since these functions can be performed with typical consumer devices (e.g., laptops/webcams/smartphones), they present a very strong case for using facial recognition

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 05 May 2026
Page No: 2960-2966
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0373

to automate attendance tracking systems. The way in which existing facial recognition systems have been described involves a server-based approach. This means that your image goes out to a remote server to be processed and stored. This raises several issues. One of them is privacy with respect to storing someone's image. Another issue is the latency associated with sending the image out to the server and back to the user's machine. The last one is the cost associated with the infrastructure required to handle large amounts of data. However, with the advent of latest technologies, it is now possible to run the heavy lifting of machine learning right in the user's browser with the help of WebAssembly and WebGL. This allows machine learning to run in the browser itself. This reduces the latency and scalability of the existing approach. Also, the user's image and other identifying features do not have to be sent to a remote server, thus increasing the level of privacy. We developed a web-based attendance system called MarkIt that provides a face recognition function. To accomplish both detection and recognition of faces in real-time in the client environment only, the application uses lightweight deep learning models built with modern web frameworks. Thus, users can run MKIT using standard web browsers along with a web camera without needing to install additional hardware. The face detection model leverages YOLOv8 (Real-Time Object Detection with YOLOv3), which processes images through ONNX Runtime Web, while the facial landmark model is built upon face-api.js in generating facial descriptors of recognized faces. By keeping the entire inference pipeline within the browser (i.e., processing through client-side computing), we further reduce server access necessary to run analyses performed by MKIT while delivering the same level of real-time performance [1].

2. Existing Systems

For years now, there have been many different types of technological solutions that have been created in order to provide automation in terms of recording attendance at schools and other organizations. These systems are intended to help streamline the process of tracking attendance, increase the accuracy of attendance records, and eliminate fraudulent attendance activities. Some of the most popular technologies used for automated attendance systems include RFID technology, biometric fingerprint recognition, mobile apps for checking in/out attendance, and facial recognition systems that work with a cloud server.

2.1. RFID-Based Attendance Systems

Automated attendance management has utilized RFID (Radio Frequency Identification) technology for years. An enrollment management system with RFID allows students and employees to use smart cards that contain passive RFID tags identifying each person by a unique ID number. Upon entry into a classroom or auditorium, the RFID reader scans each card as the user brings it into proximity to the reader. The ID number of the user is transmitted to the central database, which captures and records attendance information. When we use attendance systems that are based on RFID they are a lot faster than doing things by hand. This makes it easier for instructors because they have work to do. RFID-based attendance systems are really helpful for instructors. Nevertheless, RFID-based attendance management has various drawbacks. For example, students could give or trade RFID cards with other students, resulting in proxy attendance if a student carried a card belonging to someone else and marked attendance for that person. Furthermore, the installation of card readers and additional management systems necessary to use RFID for attendance are also initial start-up costs and ongoing regular maintenance costs associated with implementing RFID-based methods for attendance management. Attendance management can be hindered when a student loses or damages his/her RFID card, requiring administrative help to rectify the situation [2].

2.2. Biometric Fingerprint-Based Systems

Biometric fingerprint recognition systems can identify you by looking at your fingerprint. When you use this system, you place your finger on the scanner. The scanner takes a picture of your fingerprint and compares it to other fingerprints stored in the computer. If it is a match, it confirms that you really are who you say you are. Fingerprint recognition systems are better than RFID because your fingerprint is unique. You cannot use someone else's

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 05 May 2026
Page No: 2960-2966
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0373

fingerprint. This makes it almost impossible for someone to pretend to be you when you use fingerprint recognition. Your fingerprint is like your own code. Only you have that code. No one else does. That is why fingerprint recognition is how to make things secure. Fingerprint attendance systems have some points, but they also have some problems. When a lot of students need to use the fingerprint scanner one by one, it can take a lot of time to record attendance in big classrooms. Fingerprint attendance systems need people to touch the scanner. That is not very clean, especially in places where a lot of people are using the fingerprint attendance systems. The fingerprint attendance systems also have trouble recognizing fingerprints sometimes. This can happen when someone's fingerprints are worn out or when the fingerprint scanner is dirty or when the air is not good. The problem with the fingerprint attendance system is that it can be affected by these things [3].

2.3. Mobile App-Based Attendance Systems

With smartphones and online learning platforms becoming very popular, many schools and colleges are now using apps to track attendance. Google Classroom, Microsoft Teams, and Moodle are some examples of platforms that allow teachers to take attendance digitally and provide reports. Some systems even use QR codes or location tracking to make sure students are really present. They scan a code or their location is checked to make sure they are within an area. These methods make it easier for students and teachers. Reduce the need for paper records. They only work if students participate and can be tricked in various ways, such as sharing QR codes, faking their location, or someone else accessing their account. The use of mobile-based attendance systems is. Mobile-based attendance systems have their advantages and disadvantages. Mobile-based attendance systems are convenient. Mobile-based attendance systems also have some security concerns [4].

2.4. Server-Based Facial Recognition Systems

Facial recognition is a way to check who someone is without touching anything. It is sometimes used in schools. Cameras are placed to take a picture of students. Then, they are sent to a computer somewhere else. The computer uses a program to look at the pictures and determine who is in them by comparing them to other pictures they have. It is easier for them to keep track of who is in the school. It is causing a few problems. For example, some people do not like having their pictures sent to a computer all the time. It can also take a long time if the internet is not working very well. It costs a lot of money to have a computer that can do all of this. Facial recognition is still a thing because it is convenient. We have to think about all of these problems when we use facial recognition [5].

2.5. Limitations of Existing Systems

The way things are now, attendance systems are able to do certain tasks automatically, but they also have a lot of issues that prevent them from being used by everybody. Some attendance systems require equipment like this, and this makes it hard to set them up and also makes them expensive. Some attendance systems require people to do certain tasks, and this makes them slow. Some attendance systems that require servers to recognize people, like attendance systems that are similar to MarkIt, also require privacy because they are able to recognize people and are located in one place. They are also slow and do not work well when lots of people are using them. All these issues show us that we need an attendance system that works for lots of people without requiring lots of equipment. MarkIt is a solution because it performs attendance recognition directly in the browser, and this way, we do not require equipment. This makes it more efficient and private. MarkIt is a solution because it does facial recognition in the browser. This way, MarkIt does not require equipment or servers. MarkIt makes things more efficient and private [6].

3. Method

MarkIt is a web-based platform that uses advanced real-time recognition technology which tracks attendance through user device-based recognition. The system architecture of the system develops multiple components which merge user-friendly design elements with specialized machine learning systems to enhance operational efficiency. The design decreases server requirements which leads to better system performance and capacity growth that can handle increased user traffic. MarkIt maintains strong privacy and security protections because it operates all functions within a protected space that

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 05 May 2026
Page No: 2960-2966
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0373

users manage themselves [7].

3.1. Overall Architecture

MarkIt's website design has three parts: presentation, logic, and data. The presentation part is a one-page application, and it is developed using React 18 and TypeScript 5. The presentation part is developed using Vite. The students are able to register for this part, and the administrators are able to monitor the attendance and use the dashboards. There are a lot of things that an administrator is able to do with the MarkIt application. The administrator is able to control the sessions, watch what is happening, and even make reports. The students are even able to use the application in monitoring their progress with regard to their attendance. The logic part of the website design of the MarkIt application is the part that functions in the browser and takes care of the machine learning. The machine learning part of the website design of the MarkIt application makes use of a model named YOLOv8. It makes use of this model in finding the faces. The application makes use of a library named @vladmandic/face-api in finding the features of a face and generating a code for a face [8].

3.2. Student Registration

The student enrollment process involves taking six photographs of the student's face from different angles, including front, left, right, up, and down. The purpose of capturing images from these various angles is to improve the accuracy of face recognition. Each image is checked to see if it contains a face using YOLOv8. If the face is not clearly visible, the image is discarded. Once the images are confirmed to have a face, the face-api is used to process them. This processing generates a set of numerical values based on the student's facial features. These numerical values are then averaged to create a final set of numbers that represent the student's face. Along with these numbers, the student's personal details are stored in a database. The original images are also saved in Supabase storage and can be accessed if needed in the future [9].

3.3. Face Detection Pipeline

During the attendance session, the system captures the frames. The frames are processed immediately. The frames are processed through the detection pipeline. The frames are made 640x640. The frames are then given to the YOLOv8 model through ONNX Runtime Web. The model is used to give boxes to the face and to determine the confidence level of the model if it is indeed a face. If the model is not very sure, i.e., if the confidence level is below 0.5, then it is discarded. The faces, if they are indeed faces, are taken out and made the same through 68-point landmarks. The faces are then given to the face-api model. The model is used to make 128 embeddings to determine who it is. The system has a plan: it has the SSD MobileNet if the browser cannot handle the WebAssembly optimizations [10].

3.4. Descriptor Matching and Confidence Scoring

At the start of each attendance session, all registered facial embeddings are retrieved and cached locally in the browser to reduce latency and avoid repeated database queries. For each query descriptor $\square_q$ from the live stream, the system computes the Euclidean distance with stored descriptors $\square_i$.

$$dist(d_q, d_i) = \| d_q - d_i \|_2 \qquad (1)$$

The descriptor with distance is taken as a predicted match. It is accepted when the distance is below a certain threshold, τ=0.45. Otherwise, the face is classified as unregistered. The distance is mapped to a confidence score by applying a sigmoid function. It makes it easier [11].

$$confidence = \frac{1}{1 + e^{k(dist - \tau)}} \qquad (2)$$

where k is a steepness parameter, which we set to 20 based on experience. The transformation will give us confidence values ranging from 0 to 1. Matches will have confidence near 50%, and good matches will have confidence near 100%. The confidence score we calculate will be stored with our attendance record. This will be visible to us in our administrator dashboard, allowing us to audit and verify this information. In order to prevent attendance entries for the same session, we will cache student IDs that we have already verified at the session level. If we recognize a student correctly, we will not use this ID for matching until the session has ended.

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 05 May 2026
Page No: 2960-2966
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0373

3.5. Database Schema

The backend PostgreSQL database of the Supabase service contains a relational database table for user authentication, student enrollment, and attendance. The profiles table is an extension of the user authentication table with additional columns to provide definitions for the roles of the students and administrators in the user_roles table [12]. The registered_students table provides data on the students, where averaged 128-dimensional facial embeddings are stored as JSONB arrays. The studentimages table provides references to the images used for the enrollment process of the Supabase service. The attendance_sessions table stores session-level metadata, and the attendance_records table provides the attendance data with references to the student ID, session ID, time, and confidence. Foreign key relationships enforce referential integrity between these tables, while Row-Level Security (RLS) policies ensure that access permissions are enforced consistently across the system Shown in Figure 1.

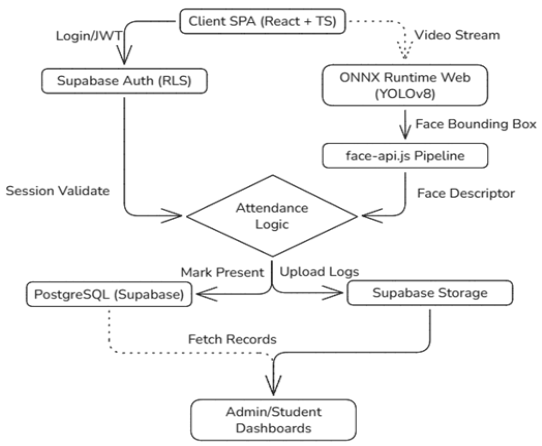

Figure 1 Architecture of the MarkIt Attendance System

4. Results and Discussion

4.1. Results

The system we proposed was tested in classrooms to see how it works in the real world. We looked at three things: how well it recognizes faces, how fast it responds, and how easy it is to use. We did experiments to test the system in lighting with faces at different angles and with many users at the same time.

4.1.1. Experimental Setup

We designed the system as a website that can be viewed in any browser. It employs libraries such as ONNX Runtime Web and face-api.js to detect and recognize faces on the user's computer. We employed a laptop with a camera to test the system. It viewed video from the camera and then recognized faces through the YOLOv8 model before comparing the faces to images to recognize the users. We employed Supabase for operations such as signing in and managing the database and files. We had a set of pictures of people's faces taken in lighting and from different angles. Each user had one or more pictures stored in the system.

4.1.2. Facial Recognition Accuracy

The system worked well when faces were easy to see. It was correct about 92–96% of the time. It could. Recognize many people in the same picture at the same time without many problems. The system worked well when we set a threshold for how similar faces should be. It did not work as well when the lighting was bad or when faces were at strange angles or when faces were partly covered.

4.1.3. System Response Time

We also looked at how long it took to find and recognize a face. On average the system took 200–400 milliseconds to do one recognition, which is almost as fast as real time. Because the system does all the work on the user's computer, it does not get slowed down by waiting for the internet. This means it can work smoothly on devices without needing special hardware, and it also helps the server by not making it work too hard.

4.1.4. Usability Evaluation

We tested the system with people acting as students and administrators. Administrators could easily start taking attendance, look at results, and view attendance records. Students could look at their attendance history in a simple way. Because the system works in a browser, people do not need to install any software. This makes it easy to use. Helps when we need to set it up.

4.2. Discussion

The results from testing our attendance tracking solution indicate that our solution is successful with regard to attendance tracking. Our attendance solution utilizes machine learning at the browser

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 05 May 2026
Page No: 2960-2966
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0373

level; therefore, any user who uses our attendance tracking solution will not disclose their private identifying information nor input their identifiable information in order to take attendance. Compared to using RFID or biometric/fingerprint technologies, our attendance tracking solution uses a more cost-efficient equipment model, where a minimal amount of equipment is required and the user does not have to physically touch any object since data processing occurs on the user's device. Nonetheless, there are still barriers in the development of our attendance tracking solution. Examples include poor lighting conditions or angles of view that could result in the user not being able to be identified correctly. To reduce this problem of misidentification, advanced machine learning algorithms can be employed to increase accuracy and reliability of the system. It is evident that, notwithstanding its current limitations, the proposed system provides a viable and efficient solution to traditional attendance management systems.

Conclusion

The attendance management system they are talking about is a system of tracking the attendance of the students. This system makes use of recognition in order for it to be accurate. It is a better system compared to tracking attendance by calling the name of each student and by using the paper method. These methods consume a lot of time and are not accurate either. This new system makes use of computer recognition of faces. This means that teachers do not have to spend a lot of time tracking the attendance of the students. It is also a very honest and accurate system for tracking attendance. This attendance management system makes use of a web browser. It does not require equipment for it to function. It is therefore very easy for schools to make use of this attendance management system. All the attendance records of the students are kept on a computer. It is therefore very easy for it to be retrieved. It is a solution for tracking attendance in schools.

References

[1]. J. Patel, S. Gandhi, V. Katheriya, P. Pataliya, and A. Majumdar, “Enhancing Classroom Attendance Systems with Face Recognition through CCTV Using Deep Learning,” Procedia Computer Science, vol. 258, pp. 3031–3041, 2025.

[2]. H. M. Yisihak and L. Li, “Advanced Face Detection with YOLOv8: Implementation and Integration into AI Modules,” Procedia Computer Science, vol. 258, pp. 3031–3041, 2025.

[3]. H. Deng, S. Zhang, X. Wang, T. Han, and Y. Ye, “USD-YOLO: An Enhanced YOLO Algorithm for Small Object Detection in Unmanned Systems Perception,” Applied Sciences, vol. 15, no. 7, p. 3795, 2025.

[4]. S. B. Sakthikumar, S. J. Idin, S. Ramalingam, S. Shakunthala, T. Saghana, and S. Shivadharshan, “Smart AI Based Attendance Monitoring System Using YOLOv8,” International Journal of Innovative Science and Research Technology, 2025.

[5]. K. P. Hasaraddi, A. P. Patil, G. Thambkar, A. P. Bidargaddi, and G. Betageri, “YOLOv8-Enhanced Facial Recognition for One-Shot Learning Attendance System,” International Journal of Advanced Computer Science and Applications, 2024.

[6]. N. S. Vemulapalli, P. Paladugula, G. S. Prabhat, S. Abhishek, and A. T., “Face Detection with Landmark Using YOLOv8,” International Journal of Computer Vision and Image Processing, 2024.

[7]. A. O. Soumaine and S. Kahraman, “Detection of Face Mask Wearing Conditions Using YOLOv8s,” in Proc. International Conference on Innovations in Intelligent Systems and Applications (ASYU), 2024.

[8]. B. K. Putra, A. G. Putrada, and I. D. Oktaviani, “YOLOv8 and FaceNet Algorithm for Real-Time Face Recognition Attendance System,” International Journal of Advanced Computer Science and Applications, vol. 14, no. 6, pp. 412–418, 2023.

[9]. Agustiyar, R. R. Isnanto, and C. E. Widodo, “Face Recognition for Attendance Systems: A Bibliometric Review of Research Trends and Opportunities,” IEEE Access, vol. 11, pp. 120345–120360, 2023.

[10]. R. Nidhya, D. J. A. Pabi, U. DivyaSree, B. Abhishek, A. Harika, and S. A. Alim, “Exploring Facial Recognition Technologies

International Research Journal on Advanced Engineering Hub (IRJAEH)
e ISSN: 2584-2137
Vol. 04 Issue: 05 May 2026
Page No: 2960-2966
https://irjaeh.com
https://doi.org/10.47392/IRJAEH.2026.0373

for Classroom Management," International Journal of Innovative Research in Computer Science and Technology, 2023.

[11]. K. G. Oladele, E. J. Iseh, J. O. Oladele, and P. R. Bhaladhare, "AI-Based Face Recognition Attendance System," International Journal of Scientific Research in Computer Science, Engineering and Information Technology, 2022.

[12]. K. Wagh, K. S. Suresh, M. Sayed, and S. Shahane, "Exploring Transfer Learning in Image Analysis Using Feature Extraction with Pre-Trained Models," International Journal of Engineering Research & Technology, 2022.