IJARCCE ISSN (O) 2278-1021, ISSN (P) 2319-5940



International Journal of Advanced Research in Computer and Communication Engineering

Impact Factor 8.471 ⁜ Peer-reviewed & Refereed journal ⁜ Vol. 15, Issue 10, October 2026

DOI: 10.17148/IJARCCE.2026.1510124

DESIGN AND PRELIMINARY FUNCTIONAL EVALUATION OF GUARDIAN ATTENDANCE: A BROWSER-BASED FACE RECOGNITION SYSTEM FOR EXAMINATION-HALL ATTENDANCE

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Abstract: Attendance recording in examination settings requires a process that is efficient, consistent, and resistant to duplicate entries. Guardian Attendance is a browser-based application developed to support student registration, face-based identity matching, examination workflows, and attendance-record management. The implementation uses a browser facial-analysis library to produce face descriptors and compares descriptors for identity matching; application data persistence is handled through Supabase. This manuscript documents the system design and reports preliminary functional observations from single-user testing. The tests reported by the developer include successful registration, recognition of a registered user, rejection of an unregistered face in one reported trial, and persistence of an attendance record after page reload. A repeated-scan test was also performed. Camera-permission-denial behavior also requires confirmation. No multi-participant dataset or formal accuracy evaluation is currently available. Therefore, the observations are treated as functional checks rather than evidence of general recognition accuracy. The paper defines a reproducible evaluation plan covering known-identity matching, unknown-identity rejection, duplicate attendance, camera-permission handling, processing latency, and privacy safeguards. The current work provides a basis for further controlled testing before any claim of deployment readiness.

I. INTRODUCTION

Attendance is an important administrative record in educational institutions, particularly during examinations where identity and presence must be recorded consistently. Manual roll calls can take time and depend on the attention of the person recording attendance. Digital systems can reduce some clerical work, but their usefulness depends on correct identity matching, reliable record handling, and clear behavior when a camera or network resource is unavailable.

Face recognition has been explored as one way to automate attendance recording. Earlier work has investigated classroom recognition, mobile attendance, and deep-transfer-learning approaches. Reported performance from one system cannot be assumed for another because camera quality, matching thresholds, enrollment images, lighting, and test populations differ. A working interface is not, by itself, evidence of recognition accuracy or suitability for high-stakes examination use.

This paper presents Guardian Attendance, a browser-based attendance application intended to support examination-related workflows. The present study focuses on describing the implemented workflow and establishing a transparent preliminary test record. The contribution at this stage is a system description and functional evaluation plan; a large-scale accuracy claim is outside the evidence currently available.

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II. RELATED WORK

Alhanaee et al. studied a smart attendance system using deep transfer learning and reported the use of convolutional neural networks for face identification . Sunaryono et al. presented an Android-based course attendance system combining face recognition with a QR-code-based workflow. Oad et al. described a facial-recognition attendance system intended to reduce the time and proxy-attendance limitations of manual processes . These studies show that attendance automation has been explored using different platforms and recognition methods.

Guardian Attendance differs in its browser-oriented implementation and its integration of registration, examination workflow, recognition decisions, and persistent attendance records. This describes the implementation scope; it is not a claim of algorithmic novelty. The literature review should be expanded after further full-text review and bibliographic verification.

III. SYSTEM DESIGN AND METHODOLOGY

A. System Overview

The application is implemented as a web interface using React and TypeScript. The browser accesses the camera with user permission and runs facial analysis through the @vladmandic/face-api library. Face descriptors are compared to support identity matching. The application includes student registration and examination-related screens, attendance logging, and record-history functionality. Supabase is used for data persistence in the inspected implementation.

B. Recognition Workflow

At a high level, the workflow consists of enrollment, camera access, face processing, descriptor comparison, decision handling, and attendance recording. A match decision is intended to associate the captured face with an enrolled identity; an unknown or uncertain result should not create an attendance record. Repeated scans should not create multiple attendance entries for the same student and session. These intended behaviors must be verified against the application and stored records.

C. Functional Requirements

The functional checks considered here are: (1) registration of an enrolled user, (2) recognition of that registered user, (3) rejection of an unregistered face, (4) prevention of duplicate attendance entries, (5) persistence after page reload, and (6) safe handling of camera-permission denial. These checks are reported separately because successful registration or page reload does not measure recognition accuracy.

The functional requirements can be divided into four categories. Identity-related requirements: The system should support registration, identify an enrolled user under suitable conditions, and reject an unregistered face when the matching criteria are not satisfied.

Attendance-related requirements: A valid recognition result should be associated with the correct attendance workflow. Repeated scans should not produce duplicate attendance entries for the same student and session.

Data-related requirements: Attendance information should remain available after a page reload. The application should distinguish between a successful interface response and a confirmed change in stored records.

Error-handling requirements: If camera permission is denied, the application should communicate the problem clearly and avoid treating the missing capture as a successful recognition event.

These requirements provide a practical basis for testing the system. They also help identify which behaviours have been observed and which still require stronger evidence.

D. Evaluation Procedure

Each test should record its identifier, purpose, preconditions, action, expected result, observed result, and evidence source. Attendance history or database records should be checked for tests involving record creation or duplication. Where latency is measured, the start and end events and timing method should be stated. Failed or ambiguous outcomes should remain in the log rather than being removed.

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IV. IMPLEMENTATION

The application was run locally in a browser during development. The reported development environment used Node.js and Vite, with the project opened in Visual Studio Code on Windows. The developer reported that the interface and webcam recognition flow worked during initial checks. Components not confirmed in the source code should not be attributed to the implementation.

The implementation should be documented with an architecture figure and screenshots only after confirming that the figures show the actual application and contain no private student information. Face images and descriptors used for evaluation should be handled with consent and appropriate access controls.

A. Browser-based implementation

The inspected project uses React and TypeScript for its web interface, the @vladmandic/face-api library for browser-based facial analysis, and Supabase for data persistence. The browser-based approach allows the application to be run through a web browser during development without requiring a dedicated attendance device. Camera use depends on browser permission and the availability of a suitable camera.

The interface connects the recognition process with student registration and attendance-related operations. This structure makes the application accessible for local testing and allows its principal functions to be checked through a sequence of user actions. The current implementation has been exercised locally during development, and the developer reports that the webcam and recognition workflow operate correctly in the tested environment.

B. Duplicate attendance prevention

Duplicate prevention is important because one student may be scanned more than once during the same examination session. Without suitable checks, repeated scans could create multiple entries and make the attendance history inconsistent. Guardian Attendance is intended to identify repeated attendance attempts and prevent duplicate entries.

The developer reports that duplicate detection is working in the current application. To document this result rigorously, repeated scans should be performed for the same registered student within one session, followed by a check of the stored attendance history or database. The number of scans, number of resulting attendance records, and session conditions should be recorded. This would provide stronger evidence than relying on the interface response alone.

C. Camera-permission handling

Camera access is a necessary part of browser-based face recognition. A user may deny permission, the camera may be unavailable, or the browser may be unable to capture a suitable image. The application should handle these conditions without treating them as successful recognition attempts.

The developer reports that camera-permission handling is working correctly. A documented test should record what message is displayed when access is denied and confirm whether the attendance history remains unchanged. Clear error handling is important because it helps the user understand what went wrong and prevents an incomplete recognition attempt from being mistaken for a successful attendance operation.

V. PRELIMINARY FUNCTIONAL EVALUATION

The current evidence comes from the developer's single-user testing and is preliminary. The developer reported that registration succeeded, a registered face was correctly identified in one reported trial, and an unregistered face was rejected without creating an attendance record in one reported trial. The developer also reported that an attendance record remained after a page reload.

A repeated-scan check involved five scans in one session. The developer initially reported one student record, but the attendance history or database count was not independently verified at that point. This outcome remains provisional until stored records are checked. Camera-permission denial also requires a re-test to determine whether a new attendance record can be created.

A. Evaluation approach

The preliminary evaluation was conducted manually while the application was running in a browser. The purpose was to check whether the main functions could be exercised and whether the application produced the expected outcomes in the available test environment. The evaluation included student registration, recognition of a registered user, rejection of an

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unregistered face, record persistence after page reload, duplicate-attendance prevention, and camera-permission handling.

The results are based on developer-reported observations from single-user testing. They should not be interpreted as a formal benchmark because the number of participants is limited and the test conditions have not been controlled across a larger sample. In particular, one successful recognition trial does not establish the system's accuracy for other users or under different lighting and camera conditions.

B. Interpretation of the results

The reported registration and recognition checks suggest that the principal user workflow can be exercised in the development environment. The reported rejection of an unregistered face is also a useful functional observation because the system should not create an attendance record for an identity that has not been confirmed.

The developer also reports that repeated scans are handled through duplicate detection and that camera-permission handling works correctly. These behaviours are important for attendance management because repeated attempts and unavailable camera access are realistic operating conditions.

VI. DISCUSSION AND LIMITATIONS

The observations from the initial tests are encouraging, but further testing is needed to check whether the system works consistently. Some functions, such as preventing duplicate attendance entries and handling camera-permission denial, still need to be checked by examining the records stored in the database.

The current evaluation was carried out on a very small scale, so it is not sufficient to determine the overall performance of the face-recognition system. Metrics such as recognition accuracy, false acceptance rate, false rejection rate, and processing time have not yet been measured. These results can only be reported after conducting a planned set of tests and collecting enough observations. For this reason, the present study focuses on the basic functions of Guardian Attendance rather than making claims about its recognition accuracy.

Before the application is considered for use in an actual examination hall, it should be tested with more participants who have given their consent. The evaluation should include separate images for registration and testing, different lighting conditions, variations in head position, and repeated recognition attempts. The collected results can then be used to calculate performance measures using a clearly defined testing procedure.

Privacy is another important aspect of the system because facial images and face descriptors contain biometric information. Only the data needed for attendance should be collected, and participants should be informed about how their data will be used. Access to stored information should be restricted, and data should not be retained longer than necessary. Until the system has been tested for reliability, fairness, and security and has met the institution’s requirements, it should not be used as the only basis for important examination-related decisions.

false acceptance rate, false rejection rate, or robustness across different people and imaging conditions. Latency has not yet been measured. Duplicate-prevention and camera-denial outcomes require record-level verification.

VII. CONCLUSION

This paper described Guardian Attendance as a browser-based face-recognition attendance application and documented the current status of its single-user functional checks. Reported tests cover registration, known-face recognition, unknown-face rejection, and persistence after reload, while duplicate-record behavior and camera-permission denial still need verification. The present evidence supports a preliminary functional description only; it does not support a general accuracy claim. Future work will complete the unresolved checks, measure processing latency, and conduct a consent-based multi-participant evaluation before drawing broader conclusions.

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