iJRASET
International Journal For Research in Applied Science and Engineering Technology

INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Volume: 13 **Issue:** IV **Month of publication:** April 2025

DOI: https://doi.org/10.22214/ijraset.2025.68710

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International Journal for Research in Applied Science & Engineering Technology (IJRASET)
ISSN: 2321-9653; IC Value: 45.98; SJ Impact Factor: 7.538
Volume 13 Issue IV Apr 2025- Available at www.ijraset.com

QR Code Based Attendance System

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Abstract: ***Manual attendance recording is a repetitive and time-consuming task that demands considerable human effort and administrative overhead. The traditional process, repeated daily across multiple classes, often reduces the time educators can spend on academic activities. This paper proposes an automated attendance system utilizing QR code technology to address these challenges. In the proposed system, students scan their unique QR codes in front of a camera, which then records the attendance and stores it in a centralized database. The system captures subject-wise attendance and automatically generates monthly attendance reports, including individual attendance percentages. By automating the process, the system improves efficiency, accuracy, and allows lecturers to focus more on teaching rather than administrative tasks.***
Keywords*: Online Attendance System, QR Code, Student Attendance System, Smart Attendance*

I. INTRODUCTION

Presently, attendance of students in most institutes is taken by the teacher on paper based attendance registers. There are various disadvantages to this approach such as data is not available for analysis because paper based registers are not uploaded to a centralized system, time taken for data collection reduces the effective lecture time and fake attendance by students. The existing conventional attendance system requires students to manually sign the attendance sheet every time they attend a class. As common as it seems, such system lacks automation, where a number of problems may arise. This includes the time unnecessarily consumed by the students to find and sign their name on the attendance sheet; some students may mistakenly or purposely sign another student's name. Also, the attendance sheet may get misplaced. As for system development and implementation, it should be able to help the lecturers to managing their student attendance systematically. By considering this issue we propose an attendance tracking system based on QR Codes and Web Camera. The system throughout the academic faculty will benefit the academic management as students attendance to classes is one of the key factor in improving the quality of teaching and monitoring their students' performance.

II. PROPOSED METHODOLOGY

The proposed methodology consists of a series of interconnected modules designed to automate the end-to-end process of attendance management:

A. QR Code Generation

Each student is uniquely identified using a generated QR code that encodes vital information such as student ID and course details. These QR codes are created using Python libraries such as qrcode and Pillow, which allow for customization and high-resolution output. All generated codes are stored in a secure database and linked to the student's profile.

B. Attendance Scanning

During attendance, students present their QR codes to a webcam or mobile camera. The system, using OpenCV and pyzbar Python libraries, captures the QR image and decodes the information in real time. The interface provides immediate feedback, allowing users to confirm that their attendance has been registered successfully.

C. Data Processing

The decoded data is validated against the registered student list. The system checks for duplication to prevent multiple entries and ensures that each QR code can be used only once per session. After validation, the attendance is recorded along with a timestamp, course code, and subject details, ensuring contextual accuracy of the data collected.

D. Database Integration

Firebase Realtime Database is used to store all attendance records in a secure and scalable environment. Firebase's cloud-based infrastructure enables seamless synchronization across devices and platforms. Real-time updates allow for immediate data availability to administrators, reducing delays in record management and enhancing transparency.

E. Admin Panel

The administrator (lecturer) can view attendance reports, generate monthly summaries, and track subject-wise attendance percentages

III. WORKING MODEL

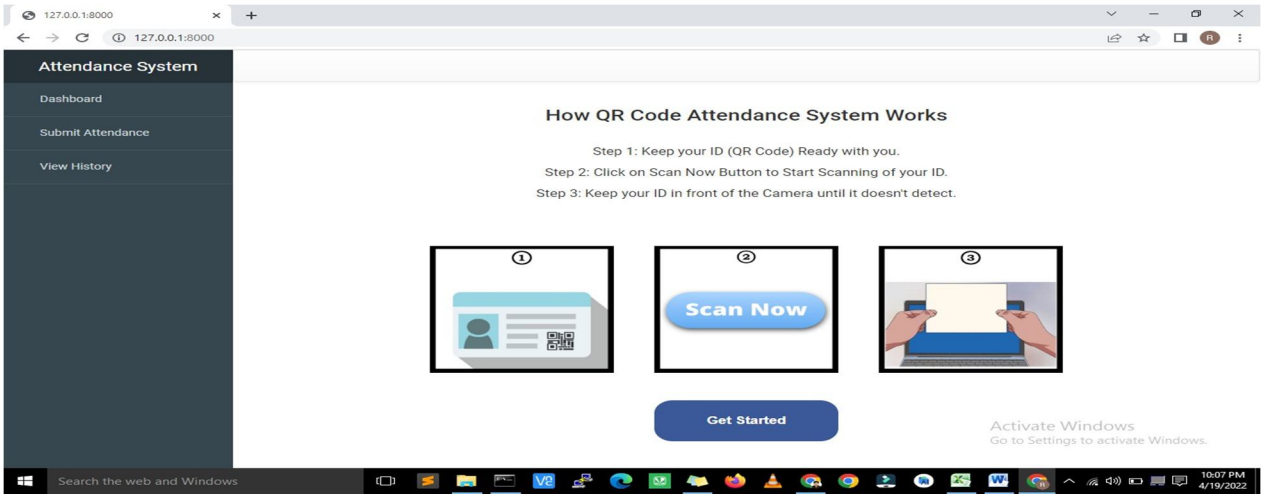
The QR Code-Based Attendance System operates through two main interfaces: Attendance System Panel and Admin Panel. Each panel has dedicated functions for educators and administrators to manage attendance data efficiently and securely.

A. Attendance System Panel

This panel is primarily designed for teachers to manage daily attendance sessions. It consists of the following components:

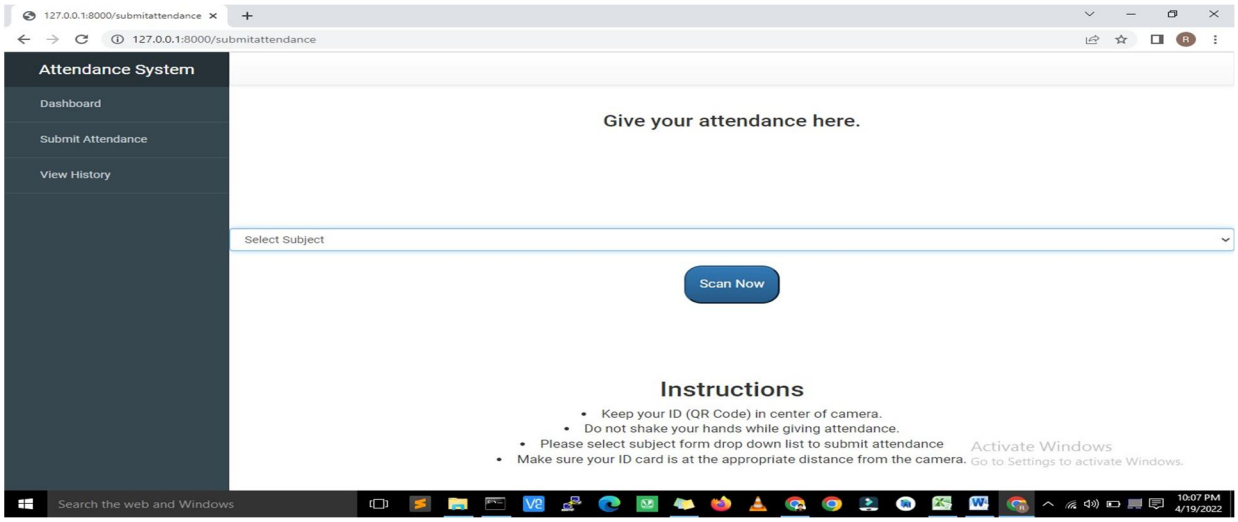
1) Dashboard

- Provides a user-friendly interface for teachers to get started with the day's session.
- Displays quick links to functionalities such as Submit Attendance and View History.
- Shows session-wise summaries like total classes conducted and overall student participation.



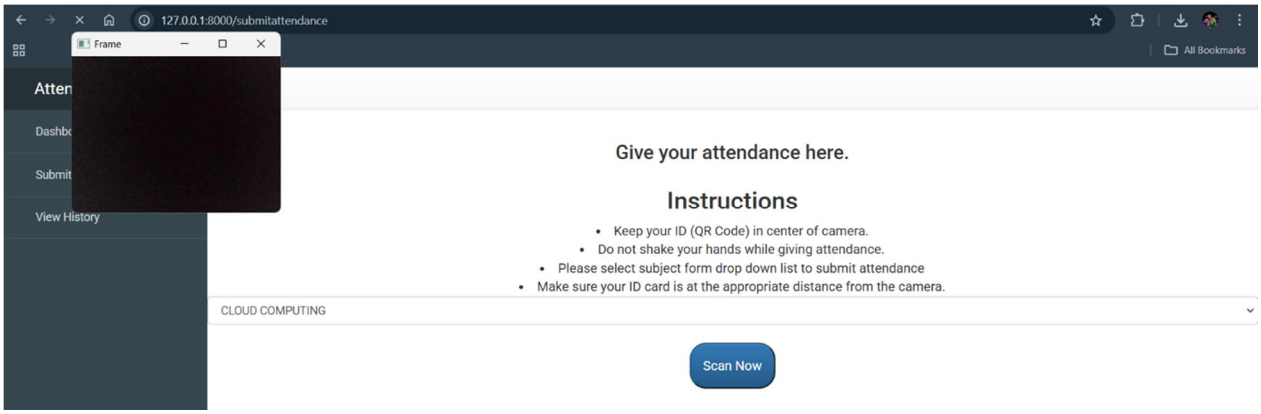
2) Submit Attendance

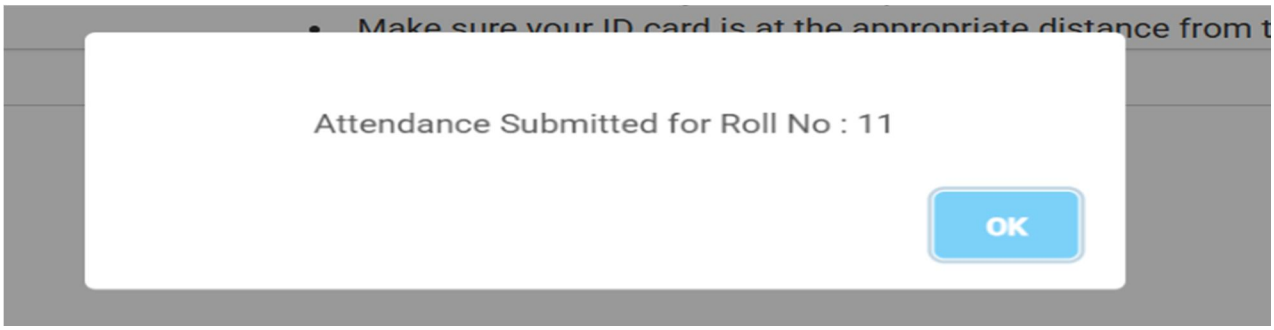
- The teacher selects the course or subject for which attendance is to be taken.
- Upon selection, the system activates the webcam or mobile camera for QR code scanning.
- Students scan their unique QR codes, which are decoded in real-time and validated.
- The attendance is automatically logged into the Firebase database along with timestamp and subject metadata.



3) QR Code Scanning Interface

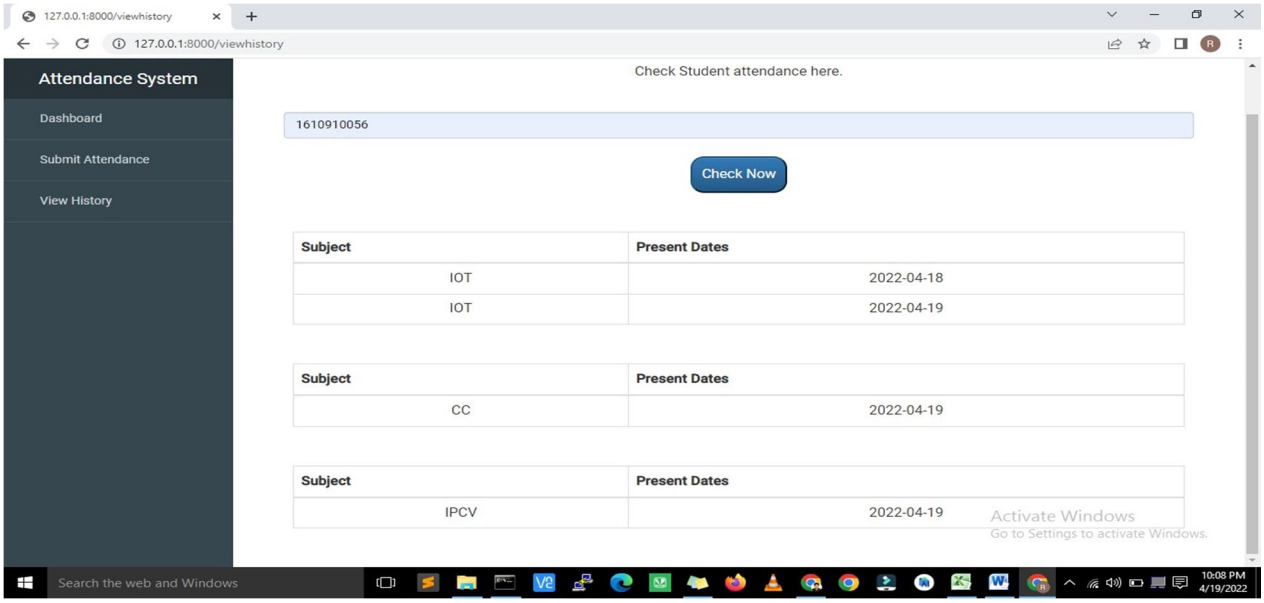
- Integrates OpenCV and pyzbar to capture and decode QR codes.
- Includes real-time feedback (success or error message) upon each scan.
- Prevents duplicate entries by validating each code per session.





4) View Attendance History

- Allows the teacher to view student-wise attendance history for a selected subject.
- Data can be filtered by date, student name, or attendance status.
- Teachers can download daily or weekly attendance logs in PDF or Excel format.

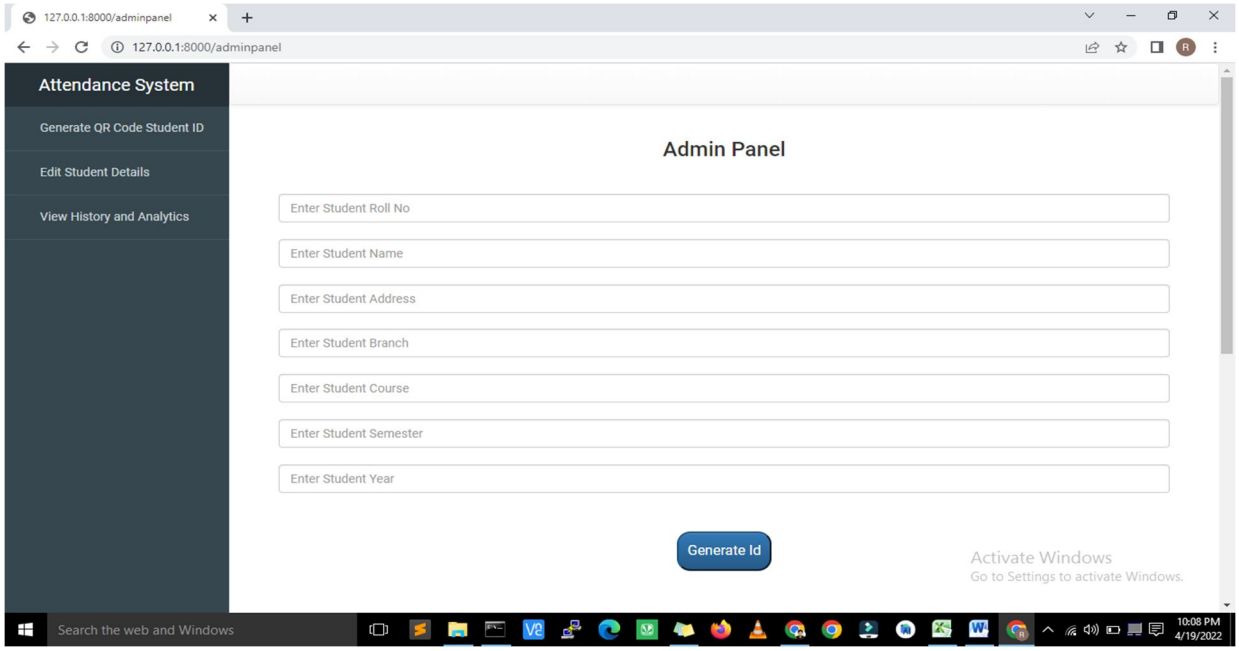


B. Admin Panel

The Admin Panel gives administrators full control over the system's backend data. It includes the following key modules:

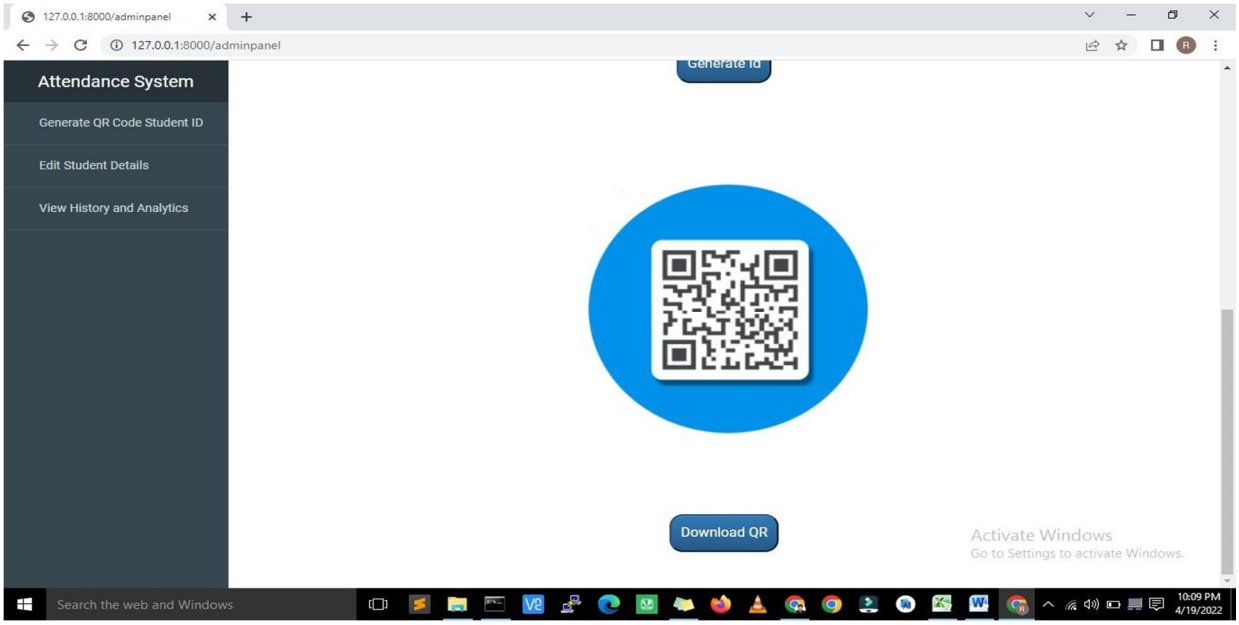
1) Generate QR Code / Student Registration

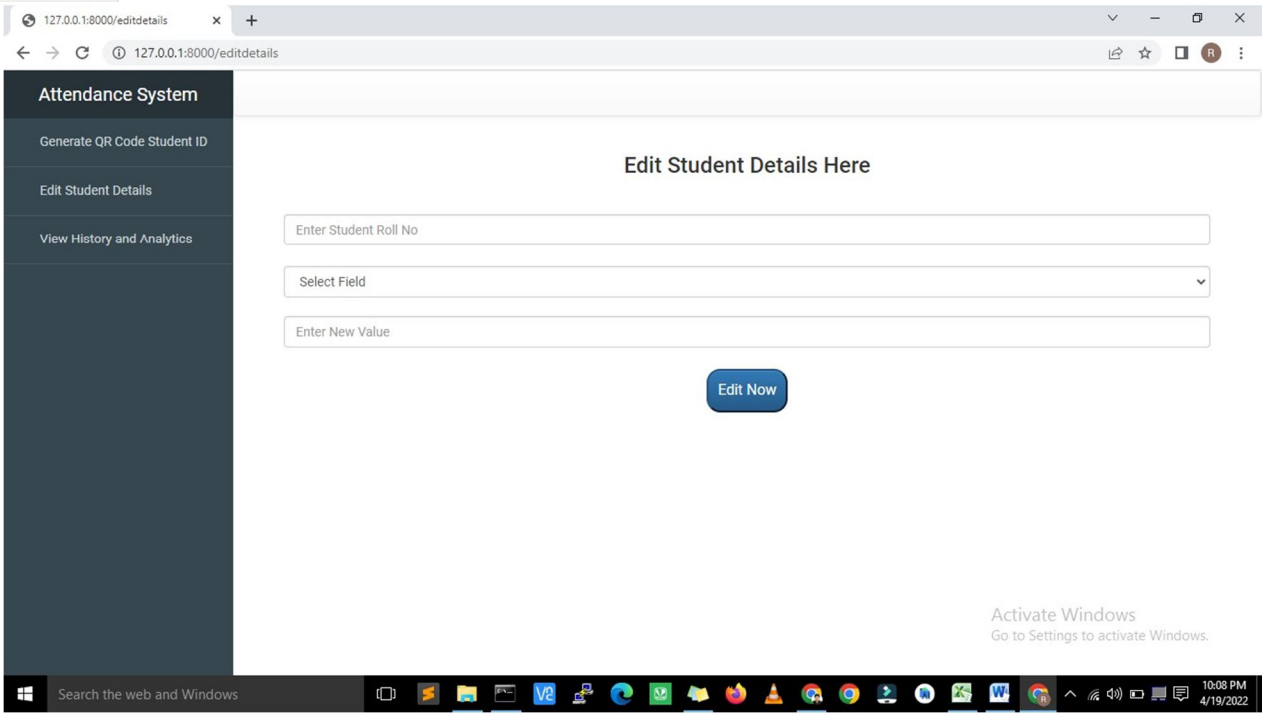
- Admin inputs the student's name, unique ID, course name, and semester.
- The system generates a personalized QR code using the qrcode Python library.
- The QR is saved to the student's profile and can be printed or shared digitally.

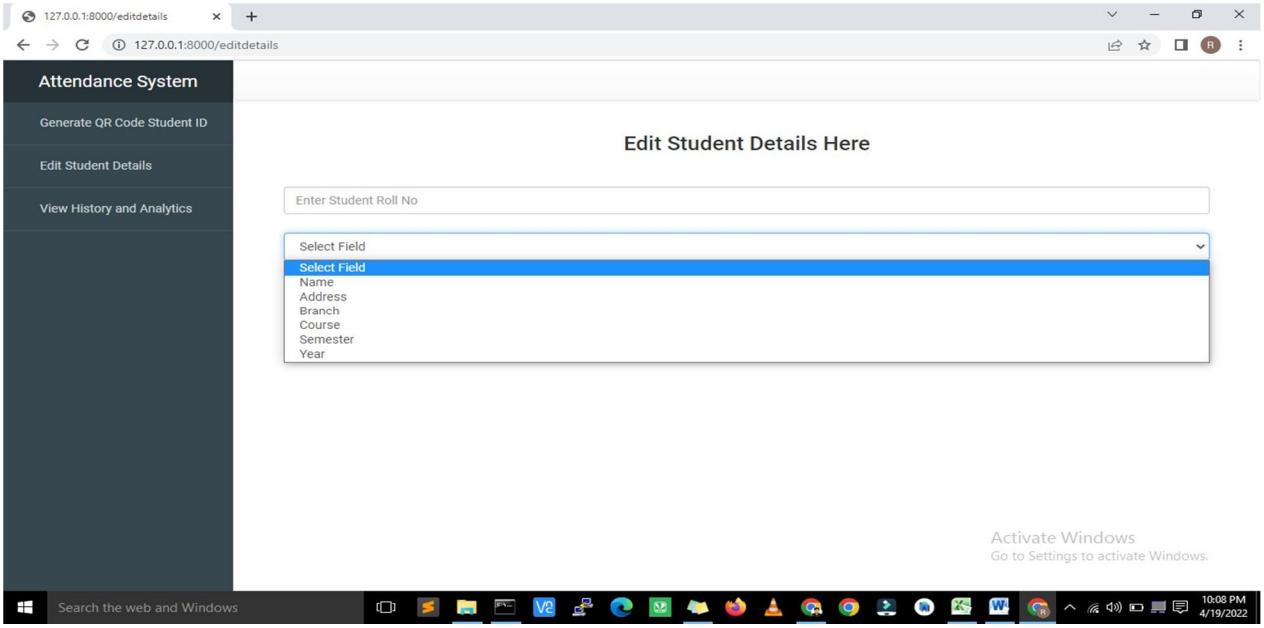


2) Edit Student Details

- Enables admins to update student information such as name, course, or ID in case of data entry errors or course changes.
- QR code can be regenerated if changes affect the embedded data.

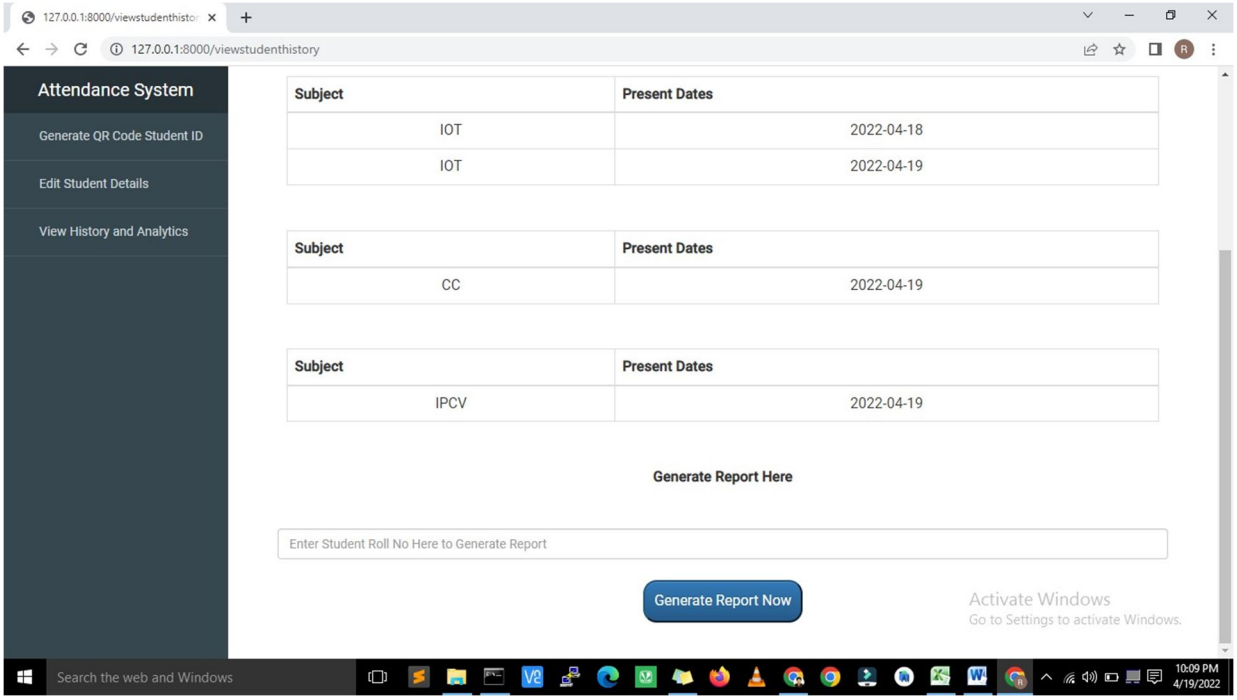






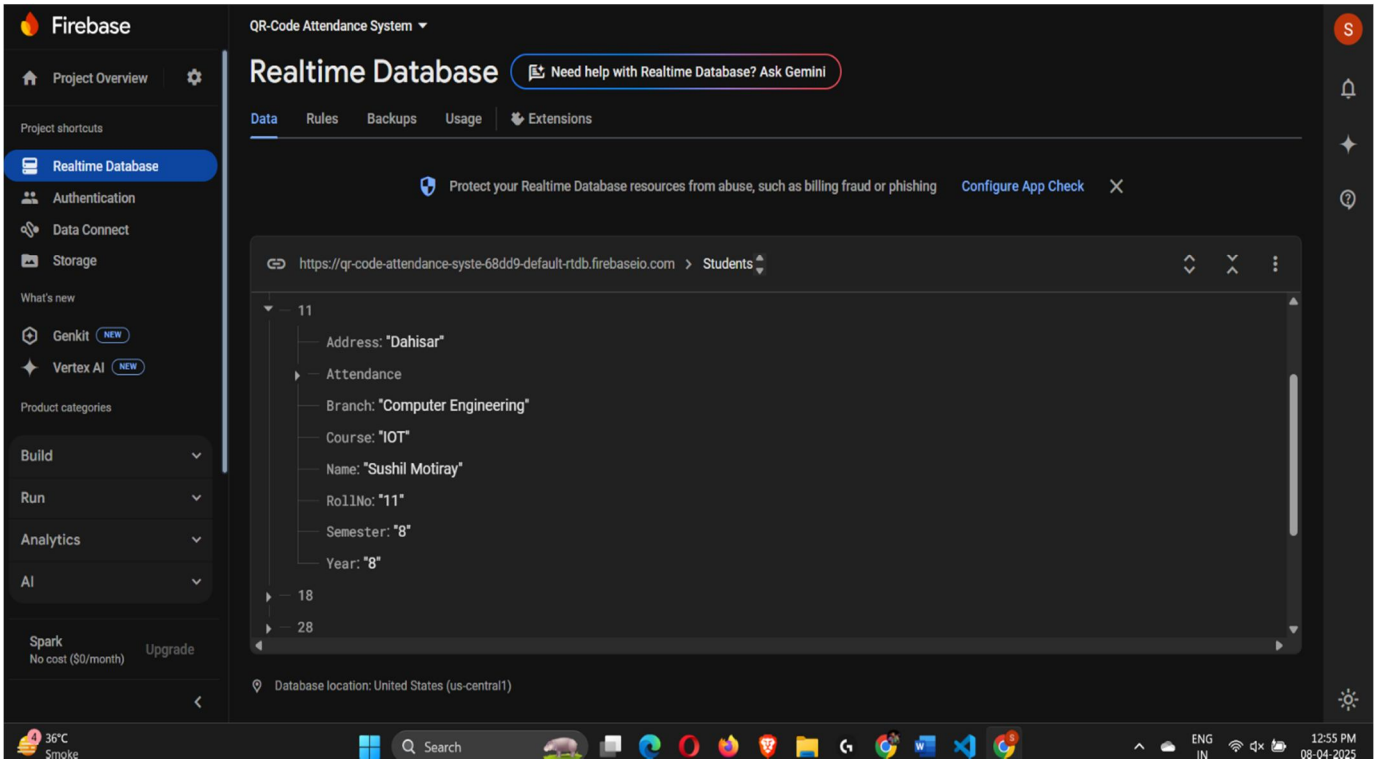
3) View History and Analytics

- Admin can access full attendance logs for all students across all subjects.
- Data is displayed with filters for date range, subjects, and attendance percentage.
- System provides graphical reports and charts showing:
  - Subject-wise attendance distribution
  - Monthly attendance trends
  - Low-attendance warnings (e.g., <75%)
- Reports can be exported or printed for administrative use.



4) Data Security and Synchronization

- The entire system is backed by Firebase Realtime Database.
- All updates (QR generation, attendance logging, editing) are synchronized in real-time.
- Multi-device access is supported, ensuring seamless experience on both PCs and mobile devices.



Technologies Implemented:

- Python (qrcode, Pillow, OpenCV, pyzbar)
- Firebase Realtime Database
- Webcam or Android-compatible scanning device

System Benefits:

- Fully automated attendance tracking
- Eliminates proxy and manual errors
- Cloud-based secure data storage
- Quick access to records and analytical reports

IV. CONCLUSION

User-friendly and scalable for institutions of all sizes. The QR Code-Based Attendance System offers an efficient, secure, and scalable alternative to traditional attendance methods. By leveraging real-time scanning, cloud-based storage, and intuitive user interfaces for both teachers and administrators, it minimizes manual workload and eliminates the chances of proxy attendance. Its modular design ensures ease of use, real-time data access, and customizable reporting. This system enhances overall academic administration and sets the foundation for smart institutional management.

V. ACKNOWLEDGMENT

We would like to express our deepest gratitude to our project mentor and faculty advisor for their invaluable guidance, continuous support, and constructive feedback throughout this project. Their expertise and encouragement played a vital role in shaping this system from concept to implementation.

We are also thankful to the Department of Computer Science for providing the technical resources and collaborative environment necessary for development and testing. Special thanks to the system testers and student volunteers who actively participated in validating the application.

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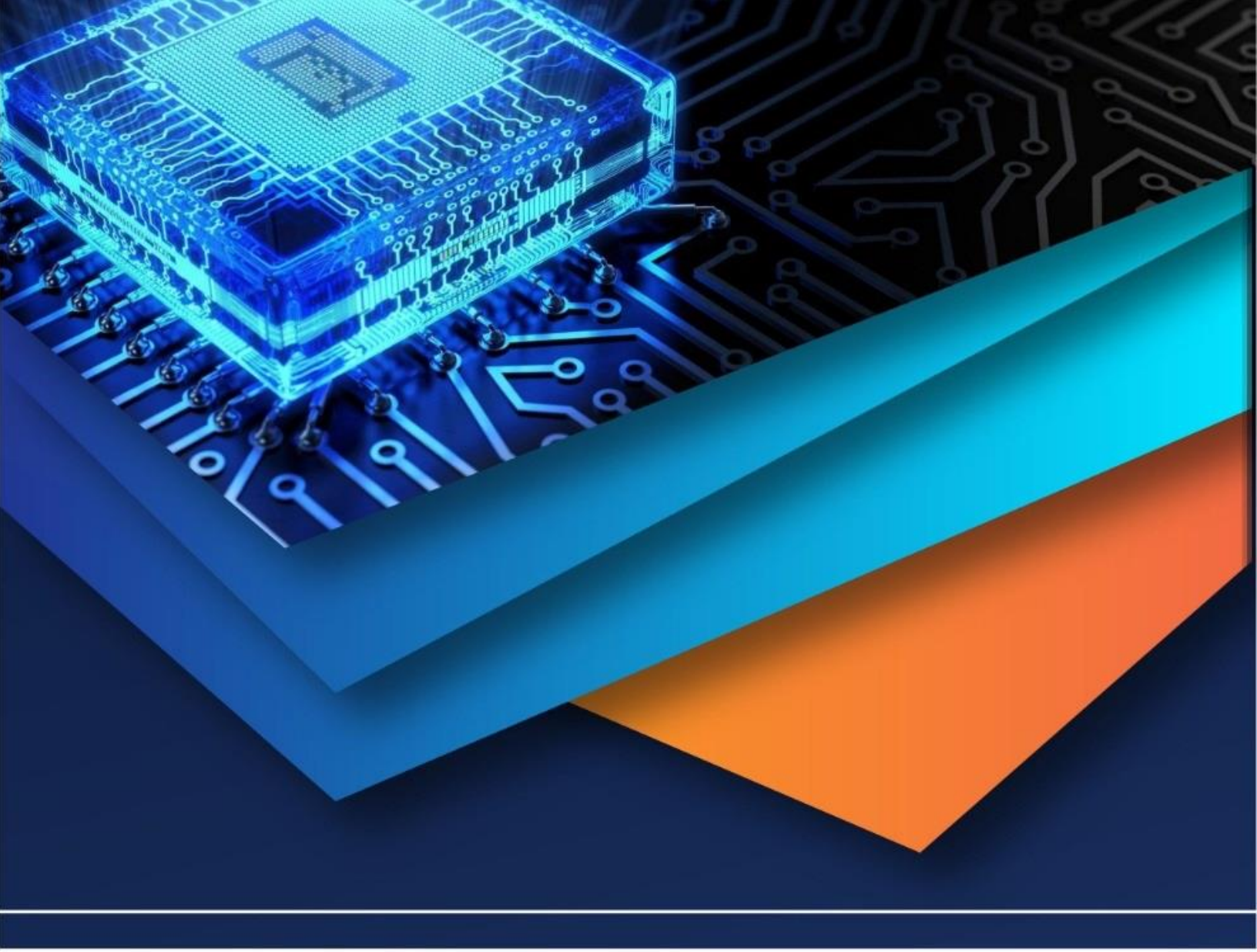

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