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Integrated Student Attendance Monitoring and Smart Scheduler System

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Abstract: *Managing student attendance and class schedules effectively is a big challenge for schools today. Old ways of taking attendance by hand take too much time, are easy to cheat with, and can mess up the class. Also, fixed schedules don't let tethers or students change things quickly when needed.*
To fix these problems, this study introduces a new system that combines attendance tracking with smart scheduling using dynamic QR codes. The system has a website where tethers can set up student profiles and create special QR codes right &fore a class starts. These QR codes only work for one minute and then disappear, stopping people from using them for fake attendance. Students check in by scanning the QR code with their phones. The system also has a smart scheduler that shows real-time class schedules and lets teachers easily look up student information. The platform is simple to use, fast, and safe.
Testing shows that using dynamic QR codes with smart scheduling cuts down on exira work, stops fake attendance. and helps tethers and students manage time better in class.s.

Keywords: Authentication, Dynamic QR Code, Real-time **Scheduling, Smart** Campus, Student Information System, University Management

I. INTRODUCTION

Student attendance tracking and managing the academic schedule are essential parts of running a good educational system. In the past, attendance was usually recorded by hand using paper forms or through verbal roll calls.However, these methods are slow, often lead to mistakes, and take up time that could be used for teaching. Also, manual systems are easy to manipulate, as students can fake attendance for others. As university campuses grow and classes become more crowded, old thinking methods are proving to be clumsy and hard to manage.

To deal with these problems, universities are now turning to digital solutions and automation. Modem campuses need smart systems where teachers can quickly view student details and where class schedules are updated in real time. Relying on printed schedules or split student data often creates a gap between tethers and students. Therefore, there is a need for a simple system that brings together scheduling, student details, and attendance tracking into one easy-to-use platfomi. New developments in QR code and mobile tech have created new possibilities for campus management. QR codes offer a fast, easy, and cheap way to send data.

Scanning a QR code with a phone can send information to a central server in a flash. But standard QR codes don't stop people from sharing them, as students can take a picture of the code and send it to others. To stop this, time-limited QR codes are needed so only students who are there can sign in. The main goal of this project is to create an Integrated Student Attendance Monitoring and Smart Scheduling System using dynamic QR codes. The system lets kachers create a special QR code at the start ofa class. To keep things fair, this code only stays visible for one minute, making it impossible to share outside the class. Alongside tracking attendance, the system functions as a centml dashboard where teachers can see student profiles and use real-time, intelligent timetables. The web interfme is built to be simple, fast, and easy to use for both teachers and students. By handling these everyday tasks automatically, the system reduces intemiptions in class and ensures accurate attendance records

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This research shows how lightweight web tools and smart QR code systems can work together to cut down on cheating and make university management more efficient.

II. METHODOLOGY

The methodology of the proposed system explains the whole process of designing, building, and putting into action a dynamic QR-code-based attendance and smart scheduling system. The system is made up of several connected parts, like the web portal, QR code generator, time-tracking module, and database. The following sections describe ah pan of the methodology.

A Data Collection and System Inputs

The first step in the system is figuring out the details needed to track attendance and manage schedules.
Instead of using health-related information. the system gets academic data déectly from the institution's database and realtime inputs from faculté members.
The data inputs used in the system include:
Student Faculty Credentials: For secure login and acccss to profilcs.
Course and Lecture Details: Such as course code, lecture hall, and time slots. o Timestamp & Geolocation Data (Optional): To check when the scan happened.
Dynamic Tokens: Automatically created number strings used to make
The faculty starts the attendance process by choosing a course, which makes the system retrieve the relevant lecture information and prepare the QR code generator.

B. System Architecture and Design

The proposed system is a secure, web-based platform.
The architecture is divided into three msin layers :
1. User Interface Layer (Front-End): This is built using standard web technologies like HTML, CSS, JavaScript, and Bootstrap. It features a split dashboard: a faulty portal, which allows teachers
2. Application Processing Layer (Back-End): This is developed using Python (Flask or Django) or Node.js. It manages the flow of data, handles user sessions, and ensures that time is synchronized between the server and the devices that connect to it.
3. Data Access Layer (Database): This uses a relational database like MySQL or PostgreSQL to safely store information such as student profiles, attendance records, and fixed timetables.

C. Smart Scheduler and Dynamic OR Code

The unique feature of this system is its rule-based scheduling and anendance process that works with timing.
1. Real-Time Smart Scheduling
The system pulls data from the database to display the daily timetable. If a teacher changes a class time, the system updates immediately, giving students an up-to-date view of theé schedule. Teachers can click on any student's name in the schedule to see their full academic information.
2. The l-Minute Dynamic QR Algorithm
to create QR codes, view schedules, and access student profiles, and a student portal, which lets students view schedules and scan QR codes using their device's camera.
To stop fake anendance (like someone scanning on behalf of another), the system uses a special temporary token system:
To stop fake attendance (like someone scanning on behalf of another), the system use:
Step 1: Generation — The teacher starts the lecture and triggers the system. The back-end creates a random cryptographic hash token and includes it in a QR code.

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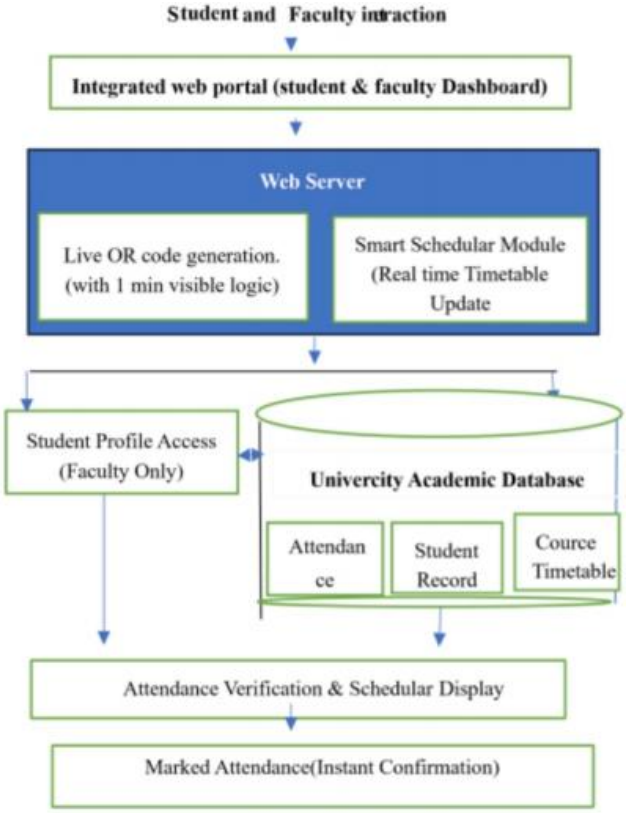
Step 2: Activation —The QR code is shown on the classroom screen. The server begins a 60-second countdown.
Step 3: Verification — When a student scans the QR code, their device sends the token along with their student ID to the server. The server checks if the token matches the current
Step 4: Expiration/invisibility —After exactly 60 seconds, the QR code disappears from the sc



D. Attendance Tracking and Scheduling Process
The system works in a clear, real-time way between tethers and students.
The process starts when a tether logs into the website to start a lecture session.
Session Initiation & QR Generation: The faculty clicks to start a lecture. The bmkend server instantly generates a unique, encrypted QR code and displays it on the classroom screen. Simultaneously. the system triggers a 60second countdown timer.
l. Scanning & Verification: Students physically present in the classroom open the web portal on their mobile devices and scan the live QR code. The frontend pushes the scanned token and the student's ID to the server.
2. QR Expiry (Invisibility): After exactly 60 seconds, the frontend hides the QR code. Any late attempts or scans of a forwarded photograph are rejected by the server as expired A Iasplcascatatio• Tools a•d Technologies The development of the proposed system utilizes a modern, lightweight tech wk to ensure fast execution and crossplatform compatibility. These include:
1. Pytkoa (Flask/Djaago) or Node.js —Used for backend routing server-side clock management, and database queries.
2. HTML5, CSG3, JavaScripi (ootstmp/jQ«ery) — Used to design mobile-responsive dashboards for both faulty and students
3. QR Code JS Librnries (e.p, qrcode.js) — To dynamically generate and render vector QR codes in the browser.

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4. Relations I Database (MySQL / PostgreSQI. / SQI.ilc) - To secure student profiles, encrypted passwords, attendance logs, and timetables

5. Result Generation and Data Output Once the lecture session ends, the system collects the data and creates realtime results for the administration.

• Real-time Attendance Logs: Faculty can view automated, student information.

• Student Profile Summaries: Faculty can view the academic history, contact details, attendance percentages of any student right from the dashboard.

• Dynamic Schedule Displays: Both students and faculty receive updated views of their daily and weekly

III. WORKING

The proposed integrated student attendance monitoring and smart scheduler system is designed to provide an automated, secure, and user-friendly platform for university classroom management. The system operaes through a sequence of processes that include user authentication, dynamic QR generation, real-time scanning, and schedule visualization. The overall working of the system is explained in the following steps

A. User Interaction with the Portal

The interface is made to be easy to use and not too complicated so that faculty members and student can use it without knowing a lot about technology. When a faculty members use the interface they go to their special page where they can see what they are temhing each day and lmk at the profile of student who are registered. The interface is developed to be lightweight and simple so that faculty members and students can navigate it with zero technical training. For students, the portal serves as a view-only viewport for timetables, alongside a native camera-trigger module for scanning in-class QR codes.

B. Input Parameter Collection and Triggering

Once a faculty member clicks on a lecture to it will start the system pulls the required input parameters to generate a unique, session-specific QR code.lt is easy-to-use

The parameters collected by the system it's include:

Faculty/Course ID: To bind the QR code to the specific class session.

Geographical/Time Context: To verify which time slot the scanner will hit.

Crypto-Hash Token: A randomly generated alphanumeric c string that acts as a secure container for the scan.

The system ensures that these values are active and loaded before proceeding to render the visual QR on the classroom's projector or smart-screen.

C. Backend Processing and Dynamic Expiry (1-Minute Invisibility)

The backend processing of the system is implemented using the Python Flask framework. When the faculty initiates the session, the backend server automatically runs a server-side countdown clock.

The process functions as follows: -

The Generation Phase: The Flask server uses a QR library to generate a visual code based on the generated token.

Render Phase: The QR code displays on the classroom scrtcn. Students can pull their smartphones to scan it

The 1 -Minute Rule: Exactly 60 seconds after creation, the backend server invalidates the hash Simultaneously, the frontend dashboard uses JavaScript to wipe the screen or display a "QR Code Expired" visual block.

By making the QR code invisible and invalid after 60 seconds. the system successfully remove the proxy attendance {where students take a photo of Qr code and mark attendance of the friends)

D. Attendance Logging and Timetable Display

After check the student information the system puts the request , into groups based on what happen right away with the student information

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1. Expired Link Handling

If a student scans a stale code after the 60-second timer drops to zero, the system returns a red error. The systrm prompts the student to speak to the faculty member physically, preventing remote cheating.

2.Real-Time Smart Scheduling and Profiles

Outside of active attendance tracking, the backend acts as a visual live audit trail Faculty can click on any student's digital row to instantly pop open their cumulative attendance analytics and academic metadata profiles Timetables arc generated in a clean matrixview, which updates instantly if the administration adjusts a venue or time block.

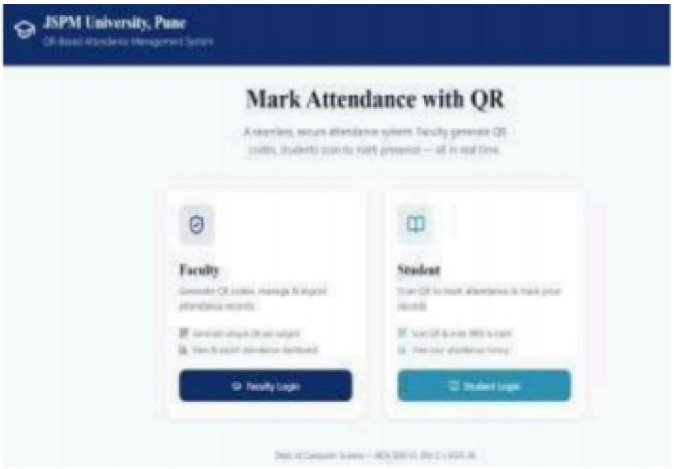

Fig 1.2 Systems Architecture

E. attendance validation and dashboard display

Once the scan validation is done the system gives a response away This response has the attendance status, profile information and timetable updates The response is sent back to the user interlace It is shown to both teachers and students in an easy-, toread format he web portal shows the results It also gives feedback like:

Instant Attendance Confirmation; It will show the green mark when attendance is marked.

• Token Expiry Warning it show red alert when siudcnt scan after 60 sec

F. system work flow

The way the new system works is pretty simple. Here are the steps:

* Accessing the Portal: Faculty and students go to the website. Log in to their accounts using a regular web browser. The first thing they see is the homepage.

” Displaying Timetable: The homepage shows the schedule for both faculty and students. The faculty can start a lecture from their dashboard.

”Dynamic Triggering: When the faculty starts a lecture it shows up on their dashboard. Then a special code is made.

”QR Code Generation: The code is made by the backend system. It shows up as a QR code on the lecture screen. The students in the class can see this code.

”Scanning: They use their phone cameras to scan the QR code. This sends some information to the server.

* Data Transmission: The server gets the students ID and a special token from the browser. The system uses the Internet to do all this.

The new system is based on the Faculty and students using the Portal and the Faculty initiating lectures and the students scanning the QR code to send their student ID and session token to the server, for the Faculty and students

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IV. LITERATURE REVIEW

Kamaraju M et al. (2013) proposed a web-based attendance system, it allow real-time tracking for the faculty and as well as students

Anil k. Jain et al. (2004) contributed to biometric-based attendance systems using fingerprint recognition, improving security and eliminating proxy attendance

• Consolidated Profile Previews: One-click accessibility for faculty so records the student data.

W Chen et al.(2019) proposed a QR code-based attendance system, which is low-cos! and easy to implement Students scan QR codes to mark attendance within a time limit

M. Turkanovk ct :tl. (2018) discussed loT-based smart campus systems, where attendance is integrated with cloud platforms for real-time monitoring and analytics

V. RESULTS AND DISCUSSION

The student attendance monitoring and smart scheduler system thai was made was tested in different classroom settings and with many different faculty interactions.

The system was able to make QR codes and keep track of who was in class based on the information that was given to it. When the system was being tested it responded quickly. Worked well with both the faculty and student parts of the system. The website was made to be easy to use so people who do not know a lot about technology can use it without any problems.The results of the system showed that it could put attendance records into categories and check if they are correct based on time. lf someone scanned the code within 60 seconds it was. Confirmed, but if they tried to scan ii late the system would not let them.

The system also showed when classes were scheduled and gave feedback away after figuring out who was in class. This helped the faculty keep track of how classes were going and how students were doing. Even though the system uses a time stamp and validation method the results showed that it can still be very helpful in running a university.

Overall the system did what it was supposed to do, which was to make it easier to track anendance and stop people from cheating by saying they were. in class when they were not. The student attendance monitoring and smart scheduler system was very successful. The developed integrated student attendance monitoring and smart scheduler system was tested using multiple input scenarios representing different classroom environments and faculty interactions. The system successfully generated dynamic QR codes and captured classroom attendance based on the provided parameters. During testing, the system demonstrated quick response times and smooth interactions between the faculty and student portals. The web interface was designed io be simple and easy to use, allowing individuals with minimal technical knowledge to interact with the system comfortably.

Reel-time Validstio•s: The system successfully categorized students into present and absent groups based on the dynamic QR token scanned within the valid time.

Consistent Classification: The platform produced consistent attendance logging across multiple classroom inputs, demonstrating high reliability in the implemented in a backend server.

Fsst Response Time: It help to provide fat respond time . it can stop students to stop from cheating.

CONCLUSION

This study is about creating a system to monitor student attendance and make schedules. The system uses codes that change quickly called Quick Response codes. The old way of taking anendance is time consuming and people can cheat by having someone else sign in for them. This new system uses a framework called Python Flask and regular web tools to automatically check if students are really in the classroom. The system was tested and it works well because it makes the codes disappear after one minute so people cannot cheat from away. Teachers can now easily see student information and class schedules all. in one place. The system is easy to use. Helps teachers stay organized. This research presents the design and implementation of an lntegrated

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Student Attendance Monitoring and Smart Scheduler System utilizing dynamic, time-sensitive Quick Response (QR) codes. Traditional, manual attendance king systems are notoriously time-consuming and vulnerable to academic fraud via proxy sign-ins. By leveraging the Python Flask framework and standard web technologies, the proposed system successfully automates the authentication of students present in a classroom. The experimental evaluation demonstrates that the one-minute QR invisibility rule effectively neutralizes remote proxy cheating. Faculty members are provided with seamless, centralized access to student profiles and live timetables , reducing administrative friction and instructional downtime.

VI. LIMITATIONS AND FUTURE SCOPE

A. Limitations of the Proposed Systems

Rule-Based Validation Model and Limited Input Parameters: The system evaluates student attendance using only a few parameters such as student ID, class ID, and a 1minute time-sensitive QR code. However, verifying physical classroom presence in a real educational environment can involve additional parameters such as physical geolocation (GPS) and network IP verification. The system is not safe when it does not have these things. This means a student in the classroom can scan the code for a friend who is sining next, to them. The attendance tracker needs the students phone and internet to work. lf the students phone camera is not good or the phone battery is dead or the internet is not working they might not be able to scan the code in time. The anendance tracker will not work if the students phone and internet are not working properly. The system will only work if the students phone and internet are working in time. The anendance tracker and the system rely on the students phone and internet. The system and the attendance tracker need the students phone and internet to be good.

Future research may focus on integrating advanced machine learning algorithms such as anomaly detection or neural networks to automatically flag suspicious classroom anendance patterns.

The smart scheduling portal could also be enhanced by incorporating natural language processing (NLP) techniques to support more advanced conversational search queries for faculty digging through student profiles. Additional improvements may include native mobile application development (iOS/Android), biometric verification (fingerprint or fmial recognition), and integration with university-wide database ERP APls for smoother semester auditing. Such enhancements would significantly improve the usability and overall instiMional effectiveness of the system.

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