Report on

Innovation & Design Thinking (IDT518) Project Titled

“A SMART ATTENDANCE SYSTEM”

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CERTIFICATE

This is to certify that the Innovation & Design Thinking project work entitled

“Smart-Attendance” is a Bonafide work carried out by Kishan Kumar V (4MC25EC046), Darshan Kumar (4MC25EC027) and Hemnath C L (4MC25EC043) in partial fulfilment for the award of degree of Bachelor of Engineering in Electronics and communication during the year 2025-2026. It is certified that all corrections/ suggestions have been incorporated in the report. The project report has been approved, as it satisfies the academic requirements in respect of the work prescribed for the Bachelor of Engineering Degree.

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1.INTRODUCTION:

In today’s academic and extracurricular environments, maintaining accurate attendance records is an essential task. Traditional attendance methods such as manual roll calls or paper-based registers are time-consuming, prone to errors, and require additional effort for later data analysis. To overcome these limitations, there is a growing need for a simple, reliable, and automated attendance management system.

This project focuses on the design and development of a Wi-Fi based Attendance Management System using ESP32. The system allows students to mark their attendance using their own mobile devices by connecting to a dedicated Wi-Fi network created by the ESP32. Once connected, students are automatically redirected to a web page where they enter their University Seat Number (USN) to record attendance.

To ensure fairness and prevent misuse, the system restricts each device to only one attendance entry per day. Attendance data is stored locally in the ESP32’s flash memory in CSV format, making it easy for the administrator to download and analyse the data later using tools such as Microsoft Excel. An admin panel protected by a password allows manual attendance entry for students who do not carry mobile devices, as well as downloading or deleting attendance records for a selected date.

The system uses a DS1302 Real Time Clock (RTC) module to accurately record the date and time of attendance. To manage limited flash memory, attendance records older than one month are automatically deleted. This project provides a low-cost, offline, and efficient solution suitable for club meetings, workshops, and small academic gatherings.

2.EMPATHISE:

Students often feel that traditional attendance methods are slow and repetitive. Manual roll calls waste valuable time that could be used for learning or activities. Organizers struggle to manage large groups efficiently. There are frequent issues such as proxy attendance and data mismatch. Maintaining paper records becomes difficult over time. Digital systems available are often costly or require internet access. Many students forget to carry ID cards or sign sheets. Organizers need a simple and reliable solution. Therefore, understanding these real-world challenges is essential to design an effective attendance system.

Observation:

During observations conducted in college classrooms and club meetings, several challenges related to attendance management were identified. It was noticed that manual attendance consumes a significant portion of class or meeting time, especially when the number of students is high. Students often lose interest while attendance is being called out, leading to distractions and noise. In some cases, students answer on behalf of their absent friends, resulting in proxy attendance.

Paper-based attendance registers were found to be difficult to maintain over long periods. Pages can tear, get misplaced, or become unreadable. Transferring this data to digital format later is time-consuming and prone to human errors. Faculty members and event coordinators also expressed difficulty in tracking attendance across multiple sessions.

Digital attendance systems used in some institutions require constant internet access, which is not always available or reliable. Biometric systems, while accurate, are expensive and require physical contact, which may not be hygienic. Observations also revealed that most students always carry smartphones, making mobile-based solutions more practical.

These observations highlighted the need for a low-cost, offline, and secure attendance system that minimizes manual effort, prevents duplicate entries, and ensures accuracy. The ESP32-based Wi-Fi attendance system addresses these issues effectively by allowing students to mark attendance using their own devices while enforcing restrictions such as one entry per device per day.

Interview:

interview 1 – Student

Question: What problem do you face with current attendance methods?
Response: Roll calls take too much time, and sometimes attendance is missed due to confusion.

Interview 2 – Faculty Member

Question: What challenges do you face while taking attendance?
Response: Managing attendance for large classes is difficult, and transferring data later is very tiring.

Interview 3 – Club Coordinator

Question: Why is a new attendance system needed?
Response: During events, tracking attendance manually is chaotic and error-prone.

Interview 4 – System Administrator

Question: What features do you expect from an ideal system?
Response: It should be secure, prevent duplicate entries, work offline, and provide easy data download.

Overview of the interview:

The interview was conducted to gain practical insight related to the project topic. The interviewee explained the importance of the problem, discussed existing solutions and their limitations, and shared real-world challenges faced during implementation. Valuable suggestions for improvement and future enhancements were provided, making the interview informative and helpful in validating the project idea.

Literature survey:

1. Smart Presence: Wi-Fi-Based Online Attendance Management

Gopal, Poojary, and Siddiqi (2019) proposed a Wi-Fi-based automatic attendance system that records student attendance when smartphones connect to a designated access point. The system eliminates manual roll calls and stores attendance digitally in real time, improving accuracy and efficiency. By leveraging existing Wi-Fi infrastructure, the approach is cost-effective and scalable for educational institutions. This work was published in the Proceedings of the IEEE International Conference on Intelligent Computing and Control Systems (ICICCS), which focuses on intelligent systems and automation in computing environments (Gopal et al., 2019).

2. Secure Wi-Fi-Based Attendance System Framework

Priya, Shylaja, and Umamaheshwari (2019) addressed security and privacy challenges in Wi-Fi-based attendance systems by proposing a secure framework based on device identification and authentication. Their system minimizes unauthorized attendance marking and mitigates MAC address spoofing threats by validating legitimate device connections. The authors emphasized the importance of data integrity and identity protection in automated attendance systems. This study was published in the International Journal of Advanced Trends in Computer Science and Engineering (IJATCSE), a peer-reviewed journal covering secure and emerging computing technologies (Priya et al., 2019).

3. Attendance Monitoring System Utilizing Wi-Fi with Other Technologies

Elbasiony, Badawy, and Farouk (2019) proposed a hybrid attendance monitoring system that combines Wi-Fi connectivity with biometric authentication methods such as fingerprint and facial recognition. In their system, Wi-Fi is used to detect the presence of a device, while biometric verification confirms the identity of the student, thereby reducing proxy attendance. This integrated approach improves both accuracy and security. The research was published in the International Journal of Communication Networks and Distributed Systems (IJCNDS), which focuses on wireless communication and network-based applications (Elbasiony et al., 2019).

4. Machine Learning and Wi-Fi Signal Strength for Attendance Detection

Wang, Chen, and Zhang (2019) explored the use of machine learning techniques to detect user presence using Wi-Fi signal features such as RSSI values and access point associations. Their research demonstrated that supervised learning models can classify indoor presence with high accuracy without requiring additional hardware. This approach highlights the potential of intelligent data analysis in Wi-Fi-based attendance systems. The study was published in IEEE Access, an open-access journal by IEEE that covers multidisciplinary research in advanced computing and communication technologies (Wang et al., 2019).

3.DEFINE /ANALYZE:

Multiway technique:

Interviewer: I will begin with the problem statement. What issues do you see in the existing attendance system?

Teacher: The current attendance process is mostly manual. It is time-consuming and allows proxy attendance.

Interviewer: These problems led me to design a smart attendance system. Do you think this problem is relevant in real situations?

Teacher: Yes, it is a real problem faced daily in colleges.

Interviewer: While reviewing my solution, did you notice any loopholes initially?

Teacher: One concern was whether a student could mark attendance multiple times using the same device.

Interviewer: To address that loophole, I implemented MAC-address locking so one device can submit attendance only once per day.

Teacher: That solution seems effective. Were there any data-management concerns?

Interviewer: Yes, storage limitation was a loophole, so I added automatic deletion of attendance data older than one month.

Teacher: How did you handle unauthorized access to attendance records?

Interviewer: I secured the admin panel with password protection so only authorized users can download or delete data.

Teacher: Overall, how would you describe the completeness of your solution now?

Interviewer: After identifying and fixing these loopholes, the system is stable, secure, and ready for real-world use.

Teacher: I appreciate how you identified problems and improved the solution. It is a well-thought-out project.
Interview overview:

The interview discussed limitations of traditional attendance systems.
Initial loopholes such as duplicate entries and storage issues were identified.
The interviewer explained how each loophole was resolved through technical solutions.
Security and reliability improvements strengthened the system.
The teacher appreciated the final solution for its practicality and completeness.

Causes and effect diagram:

The Wi-Fi based attendance device was developed to address issues such as manual attendance errors, proxy attendance, and time consumption in traditional systems. Increasing smartphone usage among students made it practical to use personal devices for attendance marking. The need for an offline system in areas with poor internet connectivity also influenced its design. Another cause was the requirement for low-cost and portable solutions suitable for classrooms or club meetings.

The device ensures accurate attendance by allowing only one entry per device per day, reducing misuse. It minimizes human effort and saves time during sessions. Attendance data is stored locally, improving privacy and security. Automatic file management prevents memory overflow. Overall, the system improves efficiency, reliability, and transparency in attendance management.

4.IDEATE:

List of solutions:

Manual roll call using attendance registers

Biometric fingerprint–based attendance system

RFID card–based attendance system

ESP-based Wi-Fi captive portal attendance system

QR code–based attendance system

Face recognition attendance system

Mobile application–based attendance system

Desktop software–based attendance system

Google Forms–based online attendance

Selected solution & Justification:

Existing attendance methods such as manual registers, QR codes, and RFID systems are either time-consuming or prone to proxy attendance. Some digital systems depend on internet connectivity or require additional hardware. These methods also increase cost and maintenance complexity. The proposed ESP32-based attendance system works offline and allows students to mark attendance using their own devices. By restricting multiple entries per device and storing data locally, the system provides a secure, low-cost, and efficient solution.

5.PROTOTYPING:

The prototype of the attendance system was built using an ESP32 microcontroller. A DS1302 RTC module was added to track date and time accurately. Little storage was used to save attendance data locally. Students mark attendance through a mobile-friendly web page over the ESP32 Wi-Fi network. The system prevents multiple entries from the same device using MAC-address locking. Admin controls were added to download, delete, or add manual attendance.

Core Components & Functionality:

1.ESP32 Development Board

Purpose: Main controller; runs the web server, handles Wi-Fi, RTC, and file storage.

2. DS1302 RTC Module

Purpose: Keeps real-time clock for date/time stamping attendance.

3.Connections:

VCC → 3V3 (or 5V if module supports)

GND → GND

CLK → D5

DAT → D4

RST → D2

4. Breadboard & Jumper Wires

Purpose: Connect ESP32 to RTC module easily.

5. Power Supply

Purpose: Power the ESP32.

ESP-32 DEVOP MODULE REAL TIME CLOCK

JUMPER WIRES AND BREAD BOARD

Design & User Experience:

The Smart-Attendance system was designed with a strong focus on simplicity, usability, and reliability. The system uses a Wi-Fi based captive portal approach, allowing students

to mark attendance using their personal mobile devices without the need for installing any additional applications. The user interface is lightweight and mobile-friendly, ensuring quick access and minimal interaction steps for students.

From the user experience perspective, the attendance page is designed to be intuitive, requiring only the entry of the USN to mark attendance. Automatic redirection to the attendance page upon Wi-Fi connection reduces confusion and improves ease of use. Feedback messages are displayed immediately after submission, informing the user whether the attendance has been successfully recorded or already marked.

The admin interface is secured with password protection and is separated from the student interface to prevent unauthorized access. It provides clear options for manual attendance entry, date-wise CSV download, and data deletion, enabling efficient management of attendance records. Overall, the design emphasizes minimal input, fast response, and clear interaction flow, ensuring a smooth and reliable user experience for both students and administrators.

Key Features:

■ Device-Level Attendance Locking

■ Daily MAC-Based Re-entry Control

■ Date-Wise Attendance File Generation

■ Automatic 30-Day Data Purging

■ Local On-Device Student Verification

■ Excel-Compatible Attendance Logging

■ Admin-Controlled Manual Override

■ Session-Locked Attendance Submission

6.TESTING:

Developing a Smart Attendance System using ESP32 necessitates rigorous and multi-faceted testing to ensure the device is reliable, secure against proxy attendance, and genuinely useful for academic environments. This comprehensive testing process moves through several stages, starting with technical verification of the network components in a controlled lab setting, progressing to real-world functional testing in a classroom environment, and culminating in crucial user evaluation and feedback from actual students and faculty. The initial phase of testing involves thorough technical and functional verification in a controlled environment. Engineers test individual components like the ESP32 Wi-Fi module, the DS1302 Real Time Clock (RTC), and the flash memory storage to ensure they work within specified parameters. This includes calibrating the RTC to accurately maintain date and time even during power cycles and verifying that the Captive Portal mechanism triggers instantly when a device connects to the network. The system's power stability is also evaluated, ensuring the microcontroller can handle the load of

hosting a web server without resetting. This phase often involves testing the durability of the data storage, ensuring that CSV files are created and appended correctly without corruption. The reliability of security features, specifically the MAC-address locking mechanism, is a critical safety test conducted during this stage to confirm that a single device cannot submit attendance more than once within a 24-hour window.

Following technical validation, the Smart Attendance System undergoes performance and usability testing in real-world scenarios. This involves testing the prototype in diverse environments, from small tutorial rooms to larger lecture halls, which present challenges regarding Wi-Fi signal range and connection stability. The performance of the web server is tested against multiple simultaneous connection requests to measure response time and stability under load. Data gathered during these trials helps refine the HTML interface and adjust the Wi-Fi signal strength for optimal coverage. The goal is to ensure the system provides a seamless "connect-and-mark" experience without becoming slow or unresponsive for the user. Developing this system involves designing a solution that goes beyond a simple digital log; it must be a robust tool that enforces academic integrity while remaining offline and easy to access.

Feedback from customers

The Smart Attendance System is appreciated by students because it saves time compared to traditional roll calls. They like that they can use their own mobile phones, so there is no need for ID cards or biometric contact. This makes the system more hygienic and modern. The automatic opening of the attendance page is also convenient because students do not need to type a link or install an app. Teachers find it helpful because they can easily download the attendance as a CSV file, which reduces manual work.

However, some problems were noticed during testing. When all students try to connect at the same time, the network becomes slow or rejects connections. In very large classrooms, the signal strength is weak, especially for students sitting at the back. Some users also suggested adding a live counter on the admin screen to show how many students are connected in future we will solve this problems using extenders or strong signal devices.

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