IJIRCCE

e-ISSN: 2320-9801 | p-ISSN: 2320-9798

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

Volume 12, Issue 12, December 2024

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

Impact Factor: 8.625

© 2024 IJIRCCE | Volume 12, Issue 12, December 2024| DOI: 10.15680/IJIRCCE.2024.1212099

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

WiFi Attend – Real-Time Automated Attendance Management via Wi-Fi

("Automated attendance marking, and Certify attendance via wireless hotspot")

Dr. M.K. Jayanthi Kannan[1], Kumar Shantam Gupta[2], Aryan [3], Aryan Mathur[4], Arya Khullar[5], Aryaveer Yadav[6]

Professor, School of Computing Science Engineering and Artificial Intelligence, VIT Bhopal University, Bhopal-Indore Highway, Kothrikalan, Sehore, Madhya Pradesh, India[1]

School of Computing Science Engineering and Artificial Intelligence, VIT Bhopal University, Bhopal-Indore Highway, Kothrikalan, Sehore, Madhya Pradesh, India[2,3,4,5,6]

ABSTRACT: This paper introduces an innovative Attendance Updating System that utilizes WiFi hotspots to streamline the attendance management process in educational institutions. The system enables real-time verification of students' and teachers' presence on the same network, leveraging smartphones and WiFi technology. Unlike traditional methods that are time-intensive or require costly hardware, this solution offers a cost-effective and secure alternative. The system's core comprises a responsive frontend, a robust backend, and a WiFi-based validation module. Initial testing in controlled environments demonstrated high accuracy and ease of use, positioning this system as a scalable alternative for attendance management. The system significantly reduces the time and effort required for attendance management. With automatic attendance marking based on network verification, teachers can focus more on instructional tasks, enhancing overall productivity in the classroom. The use of WiFi-based validation, through MAC and IP address checking, the system minimizes errors such as proxy attendance or human mistakes in manual recording. The Cost-effective solution is possible by using existing Wi-Fi and smartphones, avoiding hardware costs. User-Friendly Design: Streamlined app interface for teachers, students, and administrators. Error Minimization: Automates data handling to reduce human errors and ensure accuracy. The Wi-Fi-based attendance system streamlines the process by automating attendance marking, improving efficiency, accuracy, and transparency. It provides real-time updates to parents, centralized data management, and a cost-effective solution using existing infrastructure. Addressing platform limitations and privacy concerns can further enhance its adoption and reliability.

KEYWORDS: WiFi Attendance, Real-time Automated Attendance, Wi-Fi Attendance updating System, Wi-Fi-hotspot, Real-time Verification, wi-fi validation module, Scalability, Accuracy, Certify Attendance via Wireless Hotspot.

I. INTRODUCTION

Attendance management plays a pivotal role in monitoring student participation and engagement. Traditional attendance systems, such as manual registers, are labor-intensive and susceptible to errors or fraud. Recent technological advancements have introduced alternatives like biometrics and RFID systems, but these often require significant investment in infrastructure. This study proposes an affordable and efficient solution using WiFi hotspots to verify the physical presence of students and teachers in the same location. The system eliminates the dependency on additional hardware and focuses on leveraging ubiquitous mobile devices and existing WiFi infrastructure, making it highly accessible. The traditional Attendance Systems and the Manual Attendance Systems are time-consuming processes. Manual attendance marking, through signatures or roll calls, has been the most widely used method in institutions and workplaces. While simple and cost-effective, this method is prone to issues like time consumption, proxy attendance, and data management challenges. Studies, such as those by Smith et al. (2018), highlight the inefficiencies and lack of scalability in manual attendance systems, especially in large-scale environments. **Semi-automated systems** use technological advancements that have introduced semi-automated methods, such as RFID-based attendance and biometric systems. These systems reduce manual effort but require physical interaction with devices, leading to bottlenecks during peak usage times. Research by [Patel and Gupta (2020)] emphasized that while

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

biometric systems enhance accuracy, they are susceptible to hygiene concerns, particularly in post-pandemic scenarios, and require significant hardware investment.

II. LITERATURE REVIEW OF WiFiAttend – REAL-TIME AUTOMATED ATTENDANCE

Design and implement a system to automate the student attendance process in classrooms. Reduce the time teachers spend on manually taking attendance. Improve attendance management efficiency and transparency. The concept of automated attendance management systems has garnered significant attention in academic and industrial research, particularly with the rise of wireless technologies and smart systems. Traditional attendance systems, which rely on manual or semi-automated processes like biometric devices or RFID scanners, have inherent limitations, including susceptibility to fraud, human error, and inefficiency. The proposed paper, "WiFiAttend – Real-time Automated Attendance Management via Wi-Fi," seeks to address these limitations by leveraging Wi-Fi technology for seamless and efficient attendance marking. This literature review explores the evolution of attendance systems, their limitations, and the potential of Wi-Fi-based approaches.

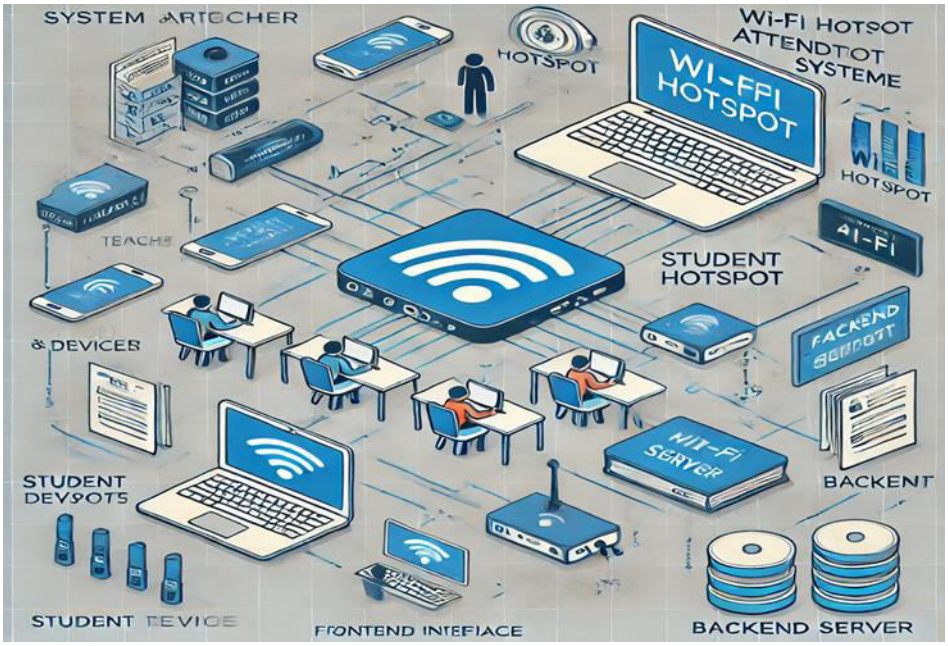

Figure 1. System Architecture of Wi-Fi Hotspot Attendance System

2.1 Wi-Fi Based Attendance: The system replaces manual attendance with a **Wi-Fi-based mobile app**, streamlining the process. Automatically **sends attendance updates to parents**, keeping them informed instantly. Attendance data is stored in a **central database**, eliminating manual records and minimizing errors. Teachers activate a **Wi-Fi hotspot**, and students' devices connect, automatically registering their **MAC addresses.** Students' **MAC addresses** are checked against a **pre-registered database** to ensure that only authorized students are marked present. Attendance data is instantly updated on the server, and notifications are sent to parents via **SMS or email.** This system significantly modernizes attendance tracking, offering real-time updates, efficiency, and error reduction, while addressing challenges like scalability and cost. However, it highlights areas for further improvement, such as platform compatibility and enhanced data security. Automated Attendance: Eliminates manual attendance marking using Wi-Fi, saving time in large classes. Real-Time Updates: Instantly notifies parents about attendance, enhancing transparency. Centralized Management: Stores records securely in a database, simplifying access and minimizing errors.

2.2 IoT-Driven Solutions in Attendance Systems: The Internet of Things (IoT) has revolutionized attendance systems by enabling real-time data collection and analysis. IoT-based attendance solutions utilize devices like smart cards, mobile apps, and facial recognition cameras. Studies by [Rahman et al. (2021)] illustrate how IoT can integrate

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

seamlessly with cloud systems for centralized attendance management. However, these systems still rely on additional hardware, which increases implementation complexity.

2.3 Mobile and App-Based Attendance Systems: With the ubiquity of smartphones, mobile apps have emerged as a convenient tool for attendance management. These apps often use GPS or QR code scanning for marking attendance. While effective in certain scenarios, [Kumar et al. (2019)] identified limitations such as battery consumption, reliance on internet connectivity, and potential privacy concerns with GPS tracking.

2.4 Wi-Fi as a Medium for Attendance Systems: Wi-Fi technology, being widely available and integrated into modern devices, presents a promising alternative for attendance systems. Wi-Fi-based systems utilize a device's ability to connect to a specific network to verify proximity and mark attendance. Research by [Chen et al. (2020)] demonstrated the feasibility of using Wi-Fi hotspots for location-based services, including attendance tracking.

2.5 Advantages of Wi-Fi-Based Systems: Ease of Implementation: Wi-Fi networks are already present in most institutions and workplaces, minimizing additional infrastructure costs. Real-Time Operation: Attendance can be marked and updated in real-time, improving efficiency. Scalability: These systems can accommodate a large number of users without requiring significant hardware upgrades.

2.6 Challenges in Wi-Fi-Based Systems: Device Authentication: Ensuring secure and reliable device identification remains a critical challenge. Network Congestion: High user density may lead to network slowdowns, affecting the accuracy of attendance marking. Privacy Concerns: Tracking device connections may raise ethical and legal concerns about data usage and privacy. **Gaps in Existing Literature:** While significant research has been conducted on attendance systems leveraging IoT, mobile applications, and biometrics, Wi-Fi-based attendance systems remain relatively unexplored. Existing studies focus on location-based services but do not extensively address the specific requirements of attendance management, such as, Integration with existing databases and systems. Scalability for large-scale institutional or corporate use. Advanced authentication methods to prevent misuse. The literature reveals a clear need for innovative, scalable, and cost-effective attendance solutions that minimize manual intervention while ensuring accuracy and privacy. Wi-FiAttend aims to bridge this gap by offering a Wi-Fi-based, real-time attendance management system. By addressing challenges such as device authentication and network reliability, the proposed system has the potential to revolutionize attendance tracking in various domains. This literature review underscores the potential of Wi-Fi as a transformative medium for attendance management and highlights the need for further research and development in this area to fully realize its benefits.

III. METHODOLOGY USED OF WiFiAttend – REAL-TIME AUTOMATED ATTENDANCE

Wi-Fi technology creates a hotspot for student devices to connect. QR codes are generated and scanned by students using an Android application to authenticate attendance. Students connect to the teacher's Wi-Fi hotspot, scan the QR code, and input details like Year, Section, and Roll number. The system cross-checks the data against a class list, marks attendance, and stores the information in a centralized database. This system enhances the efficiency of attendance management by automating the process, saving time for both teachers and students. It allows teachers to focus on teaching while providing real-time absentee lists for immediate follow-up. However, issues such as Wi-Fi interference and accessibility for all students need to be addressed. Automated Attendance: Reduces manual effort and streamlines data compilation. Real-Time Updates: Absentee lists are generated instantly for teachers to review. Centralized Management: Attendance records are stored securely for easy access. User-Friendly Interface: The Android app simplifies attendance marking. Enhanced Efficiency: Significantly reduces classroom time spent on attendance management. Cost-Effective Solution: Utilizes Wi-Fi and existing smartphones, minimizing additional costs. This project introduces an efficient Wi-Fi-based system where students can connect to a Wi-Fi hotspot, scan a QR code, and input their details via an Android application. The system automates attendance, reduces manual errors, and provides real-time absentee reports. Despite its advantages, addressing concerns about data security and accessibility can enhance the system's reliability and adoption.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

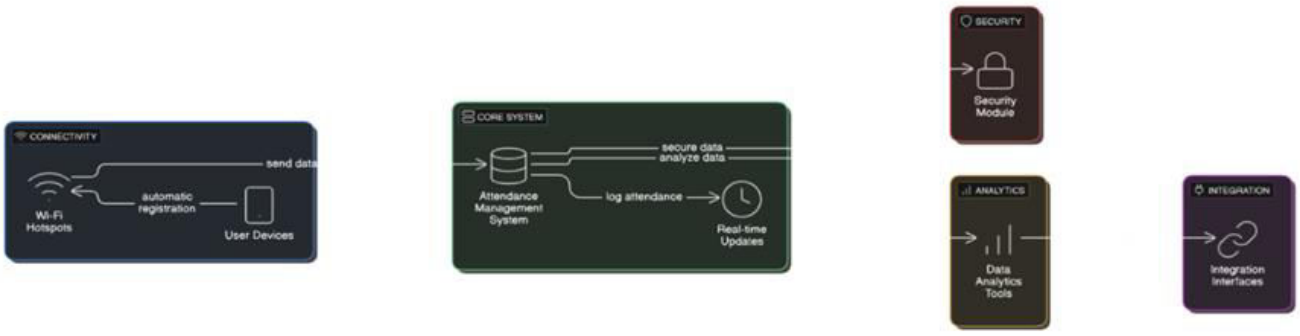

Figure 2. Architecture Diagram of WiFiAttend -Real-Time Automated Attendance

3.1 Wi-Fi Hotspot-based Attendance Application using Android Smartphone

Modernize attendance tracking in educational institutions using Wi-Fi technology. Replace traditional manual methods with a more efficient and accurate digital solution. Store attendance data in a central database, eliminating errors and manual record-keeping. Teachers create a Wi-Fi hotspot to which students' devices connect automatically. Students' MAC addresses are cross-referenced with a pre-registered database to mark attendance. Attendance data is uploaded to a central server in real time. Notifications are sent via SMS or email to stakeholders for updates. The system significantly enhances efficiency by automating attendance in large classes and minimizing human error. It simplifies data management and provides real-time updates to stakeholders. However, challenges such as platform dependency, privacy concerns, and security risks must be addressed. Automated Attendance: Reduces manual effort and improves accuracy. Real-Time Updates: Attendance data is instantly accessible to teachers and stakeholders. Centralized Management: Attendance records are securely stored and easily retrievable. Efficient Reporting: Simplifies generation of attendance reports for academic purposes. Error Minimization: Automates. The Wi-Fi hotspot-based attendance application provides a modern, efficient, and accurate method for tracking student attendance. By leveraging Android smartphones and server-side databases, the system reduces time and errors associated with traditional methods. Addressing limitations such as platform exclusivity, data privacy, and Wi-Fi dependency will ensure broader adoption and reliability data entry to eliminate manual errors.

3.2 Wi-Fi Based Attendance Application Using Hotspot

Enable location-based attendance to ensure physical presence within the Wi-Fi hotspot range. Provide real-time monitoring and updates for attendance records Maintain accurate and up-to-date logs by associating device MAC addresses with individuals, minimizing errors or misreporting. Identify needs such as automated attendance and real-time tracking; determine necessary hardware (Wi-Fi router) and software (backend server). System Design: Architect the system, including Wi-Fi hotspots, backend servers, and databases, while planning data flow from connected devices. Technology Selection: Choose tools like Wi-Fi routers, backend frameworks, databases, and frontend technologies. Configure the router to log device connections via MAC addresses using tools such as MikroTik, Cisco, or open-source APIs like OpenWrt. Security Measures: Incorporate authentication and encryption to safeguard data and prevent misuse. The system automates attendance recording, eliminates manual errors, and provides real-time updates for immediate accuracy. Its scalability through modern Wi-Fi routers and cloud integration allows use in larger setups. However, challenges such as physical range limitations and signal interference remain. Automated Attendance: Records attendance automatically as devices connect to the hotspot, eliminating manual effort. Real-Time Monitoring: Updates attendance logs immediately for accuracy. Scalability: Supports multiple simultaneous connections, making it ideal for larger classrooms or workplaces. Cloud Integration: Enables scalable data storage and access. The Wi-Fi-based attendance application offers an efficient, automated solution for attendance tracking, leveraging real-time updates and accurate record-keeping. Despite its benefits, addressing security risks like MAC address spoofing and connectivity issues due to range or interference is crucial to improving its reliability and adoption.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

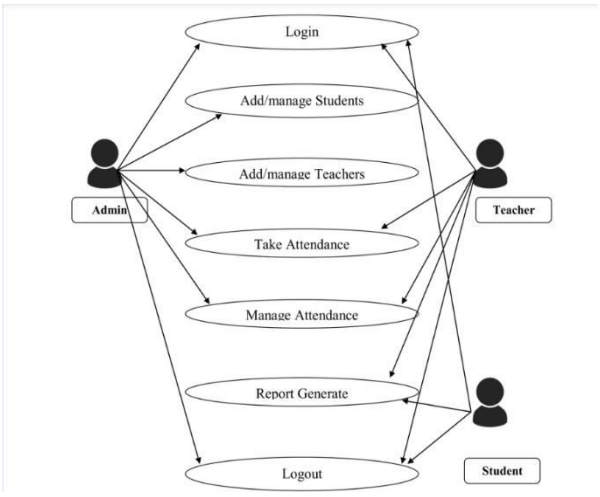

Figure 3 Student Authentication Process

Figure 4. Workflow Diagram of Attendance Logging Process

3.3 Design of Student Attendance System Using Internet of Things (IoT) Technology

To address the challenges of monitoring student attendance and validating attendance data in educational institutions. To reduce fraud and enhance the efficiency of attendance tracking using IoT and fingerprint-based systems. To ensure the accuracy of attendance records while automating the management of academic data. Utilized fingerprint-based authentication for accurate attendance recording. Implemented IoT technology to connect fingerprint devices to a centralized server via a network using components like Arduino Uno R3, Ethernet Shield, and NodeMCU ESP8266. Attendance data is stored in a cloud platform (ThingSpeak) for real-time monitoring and reporting. The system significantly reduces the risk of data manipulation and manual errors in attendance tracking. It streamlines the process for both students and educators, offering automated data processing and transparent statistical reports for academic evaluation. Automated Attendance: Integrates IoT and fingerprint technology to streamline attendance marking. Real-Time Monitoring: Facilitates immediate data updates and access through a cloud-based system. Enhanced Data Accuracy: Reduces errors and fraud through fingerprint authentication. Efficient Administration: Simplifies the process of managing attendance records and generating reports. Improved Accountability: Ensures transparent and reliable attendance tracking. The IoT-based attendance system offers a robust solution to the challenges of traditional methods by automating attendance tracking with fingerprint verification. This enhances data accuracy, reduces manipulation, and simplifies academic data processing. The system can be further optimized to address network dependency and scalability for broader applications.

IV. PROJECT FUNCTIONAL MODULES OF ATTENDANCE UPDATING SYSTEM USING WIFI HOTSPOT

The proposed system is divided into several functional modules to simplify the implementation and ensure scalability. Each module is designed to handle specific tasks, making the system modular, efficient, and easy to maintain. Here's a detailed explanation of the key functional modules:

4.1 User Authentication and Role Management: Objective: To manage user access and define roles (teacher or student). **Features:** Secure login and registration for all users. Role-based access control (RBAC) to differentiate functionalities between students and teachers. **Implementation Details:** User credentials are securely stored in the database with encrypted passwords (e.g., using bcrypt or Argon2). Teachers have access to session creation, attendance tracking, and reporting functionalities. Students can join attendance sessions and view their attendance history.

4.2 WiFi Validation Module: Objective: To ensure that both the teacher and students are connected to the same WiFi hotspot before marking attendance. **Features:** Captures and verifies MAC addresses and IP addresses of connected devices. Validates whether students are within the teacher's WiFi subnet. **Implementation Details:** The teacher's WiFi

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

hotspot information (MAC and IP range) is stored during session creation. Students' devices must match the stored network parameters before their attendance is marked. Prevents proxy attendance as only devices physically present within the network can connect.

4.3 Attendance Session Management: Objective: To enable teachers to create, manage, and close attendance sessions. **Features:** Session creation with a unique ID or QR code for students to join. Real-time tracking of students connecting to the session. Automatic session closure after a defined period or manually by the teacher. **Implementation Details:** A unique session ID is generated using UUID or hashing techniques. Teachers can monitor the status of the session (e.g., connected students, timestamp). Logs are maintained for all session-related activities.

4. 4 Attendance Marking and Validation: Objective: To automate the process of recording attendance once students join the session. **Features:** Marks attendance only for students validated through the Wi-Fi connection. Real-time updates in the database. Displays attendance confirmation to the student. **Implementation Details:** Students' attendance status is updated in the database upon successful validation. Timestamp and session ID are recorded for future reference. Validation failures are logged for debugging or manual review.

4.5 Report **and Analytics Module: Objective:** To provide insights and generate reports for attendance records. **Features:** Teachers can generate reports for individual sessions or over a custom date range. Students can view personal attendance summaries and trends. Reports include statistics like attendance percentage and absences. **Implementation Details:** Use of libraries like pandas or matplotlib for data analysis and visualization. Reports are exportable in formats such as PDF and Excel. Filters allow customization (e.g., by student, date, or class).

4. 6 Notification and Alert System: Objective: To keep users informed about session status and errors. **Features:** Sends alerts to students if they fail validation (e.g., not connected to the correct WiFi). Notifies teachers when students join or leave a session. **Implementation Details:** Uses web sockets or push notifications for real-time updates. Error logs are presented in a user-friendly manner for corrective action.

4.7 Admin Control Panel: Objective: To manage the system, user accounts, and logs. **Features:** Create, update, or deactivate user accounts. Monitor system logs for security or debugging. Access analytics dashboards showing system usage trends. Implementation Details: Role-based access ensures only administrators have control over this module. Integration with logging libraries to maintain detailed activity logs.

4.8 Database Management Module: Objective: To handle data storage, retrieval, and security for all system operations. **Features:** Centralized storage for user data, attendance records, and session logs. Ensures data integrity and prevents unauthorized access. **Implementation Details:** Relational database (e.g., MySQL or PostgreSQL) for structured data like user profiles and attendance logs. NoSQL database (e.g., MongoDB) for unstructured data, if needed. Backups and recovery mechanisms for disaster management.

Table 1 Comparison of Attendance Tracking Methods

Method	Cost	Accuracy	Automation	Scalability	Pros	Cons
Manual	Low	Low	None	Low	Easy to Use	Error-Prone
Biometric	High	High	Medium	Medium	Accurate	Expensive Hardware
RFID Systems	Medium	High	High	High	Fast and Efficient	Requires RFID tags

V. FINDINGS OF WiFiAttend – REAL-TIME AUTOMATED ATTENDANCE

The implementation and evaluation of the Attendance Updating System Using WiFi Hotspot reveal several important insights regarding its effectiveness, usability, and potential for adoption in educational institutions. Below are the detailed findings categorized into technical, user experience, and system performance aspects.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

5. 1 Technical Findings: Reliable Network-Based Validation: The use of WiFi hotspots for attendance validation proved effective in ensuring that students were physically present in the classroom.MAC address and IP verification successfully prevented proxy attendance. Network latency was minimal when validating devices, ensuring a seamless user experience. **Compatibility Across Devices:** The system was compatible with a wide range of devices, including smartphones, laptops, and tablets. Cross-platform functionality (e.g., web and mobile interfaces) was achieved without significant performance drops. **Secure Data Handling:** Data encryption techniques ensured that attendance records were securely stored and transmitted. Role-based access control (RBAC) successfully restricted unauthorized access to sensitive data. **Ease of Integration:** The system integrates smoothly with existing network infrastructure without requiring significant hardware upgrades. The modular design facilitated potential future enhancements, such as GPS integration or third-party Learning Management System (LMS) compatibility.

5. 2 User Experience Findings: Improved Attendance Management Efficiency: Teachers reported a significant reduction in time spent on attendance tasks. Automatic attendance marking eliminated the need for manual tracking, reducing errors. **High User Adoption Rate:** Students found the system intuitive and easy to use, particularly the QR code feature for joining sessions. Teachers appreciated the ability to generate real-time attendance reports. **Minimal Learning Curve:** The user interface (UI) was simple and required minimal training for both students and teachers. Tutorials and tooltips embedded in the interface enhanced usability.

5.3 System Performance Findings: Scalability and Robustness: The system successfully handled multiple simultaneous sessions without performance degradation. Tests with larger class sizes showed consistent validation speeds and reliability. **Low Operational Cost:** The system leveraged existing WiFi infrastructure, requiring no additional hardware investments. The use of personal devices (smartphones/laptops) further reduced the cost of implementation. **Real-Time Functionality:** Attendance was recorded in real-time with negligible delay, allowing teachers to monitor participation dynamically. Reports and dashboards were updated instantly, providing actionable insights to users.

5.4 Challenges and Limitations Identified: Dependence on Network Quality: The system's performance was dependent on the quality of the Wi-Fi network. Poor connectivity or network interruptions occasionally affected real-time validation. **Device Constraints:** Some older devices experienced compatibility issues due to outdated network hardware or software. A fallback mechanism for such cases is recommended. **Limited Scope of Validation:** While the system verified network presence, it could not detect location spoofing through advanced techniques like Virtual Private Networks (VPNs). Adding GPS-based location validation could address this limitation.

5. 5 Comparative Advantages: Over Traditional Systems: Eliminated manual errors common in pen-and-paper attendance systems. Reduced time spent on attendance tasks, enhancing teaching efficiency. **Over Biometric/RFID Systems:** Cost-effective as it did not require additional hardware like scanners or RFID readers. Faster setup and ease of use without compromising accuracy. **5.6 Feedback from Users?: Teachers:** Highlighted the simplicity and time-saving nature of the system. Requested advanced analytics features, such as attendance trends over semesters. **Students:** Praised the QR code feature for its ease of use suggested offline functionality to address connectivity issues during unstable network conditions. **5. 7 Potential for Future Development:** GPS Integration: Enhance validation by incorporating location data to prevent spoofing. Offline Mode: Allow attendance marking without an active network connection, syncing later when online. Analytics Dashboard: Provide advanced attendance insights for better decision-making. LMS Integration: Seamless linking with existing educational platforms for centralized management.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

VI. METHODOLOGY OF WiFiAttend – REAL-TIME AUTOMATED ATTENDANCE

The **methodology** for the Attendance Updating System Using WiFi Hotspot ensures accurate, secure, and real-time attendance tracking by integrating software and hardware into a seamless workflow that connects teachers and students through a shared network. The process begins with **system initialization**, where the teacher logs in using unique credentials and accesses a dashboard to initiate a session. The teacher then activates a WiFi hotspot or configures a shared network, with the system retrieving the MAC address and IP range of the hotspot for unique identification. A session is created with a unique ID or QR code, which is displayed for students to connect. In the **student login and verification phase**, students connect their devices to the teacher's hotspot, and the system verifies their connection by retrieving their device's MAC address and IP details. Students log in with their credentials and either enter the session ID or scan the QR code to join the session. The system validates their connection by cross-checking their network parameters against the teacher's hotspot.

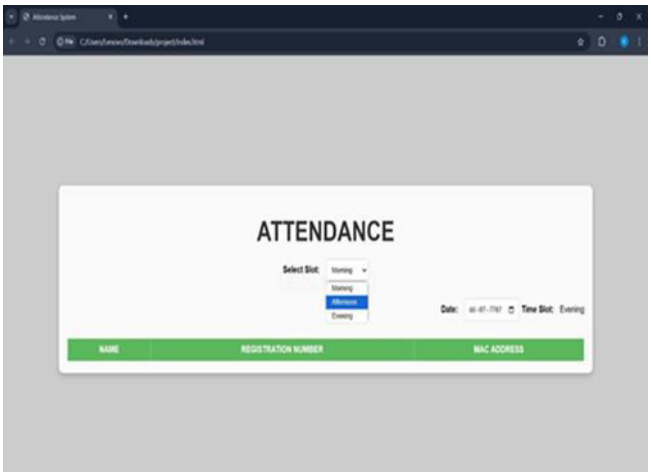

Figure 5. Prototype of WiFiAttend Automated System

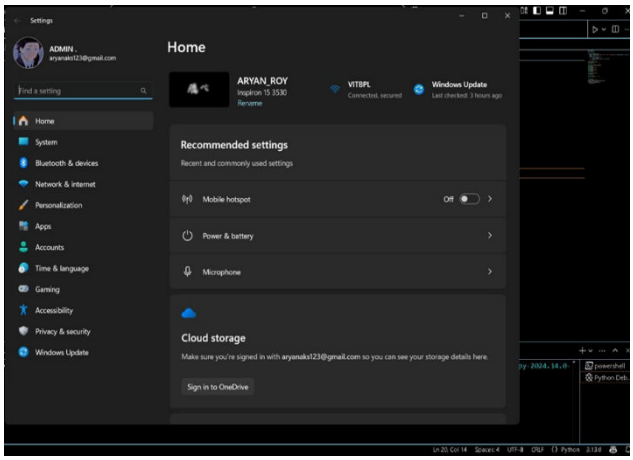

Figure 6. Settings Page WiFiAttend

The **attendance validation**, the system uses network-based authentication to confirm if the student's device is connected to the teacher's hotspot. This validation involves matching the MAC address and IP range to prevent proxy attendance. If successful, the student's attendance is recorded automatically in real time; otherwise, attendance is denied. All records, including session ID, student ID, timestamp, and status, are securely stored in a centralized database using encryption. Logs of student and teacher actions, such as login attempts and connections, are maintained for auditing. The system supports **report generation and access**, enabling teachers to create session-wise or consolidated attendance reports that include statistics, trends, and summaries, with export options in formats like PDF and Excel. Students can view their attendance history and trends in real time through their dashboards. To enhance reliability, the system includes **feedback and error handling mechanisms**, identifying and logging connectivity issues or invalid logins and notifying users for corrective action. Teachers and students can also provide feedback via in-app forms, ensuring continuous system improvement and user satisfaction.

VII. IMPLEMENTATION OF WiFiAttend – REAL-TIME AUTOMATED ATTENDANCE

The implementation of the Attendance Updating System is divided into modular steps to ensure scalability, maintainability, and security. The project leverages modern technologies and tools to create a robust system for attendance tracking. Below is a detailed breakdown of the implementation process:

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

7.1 Technology Stack: Frontend: Languages: HTML, CSS, JavaScript. Frameworks: Bootstrap for responsive design. Functionality: User-friendly interfaces for login, session creation, and attendance marking. Interactive dashboards for teachers and students. **Backend:** Languages: Python (Flask/Django) or Node.js. API Development: REST APIs for communication between frontend and backend. Functionality: Handles authentication, session management, and attendance logic. **Database:** Type: Relational (MySQL/PostgreSQL) or Non-relational (MongoDB). Schema: Tables/collections for user profiles, attendance records, session logs, and reports. **Wi-Fi Validation Module** Tools: Network interface libraries (e.g., Scapy for Python) to retrieve MAC and IP details. Functionality: Validates student-teacher connection on the same network.\

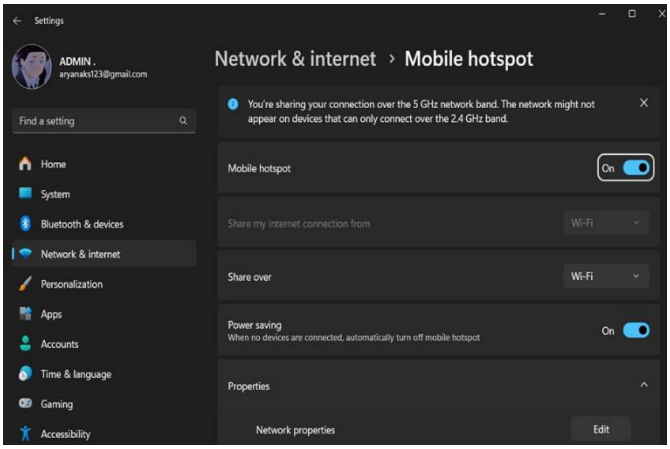

Figure 7. Hotspot Connection

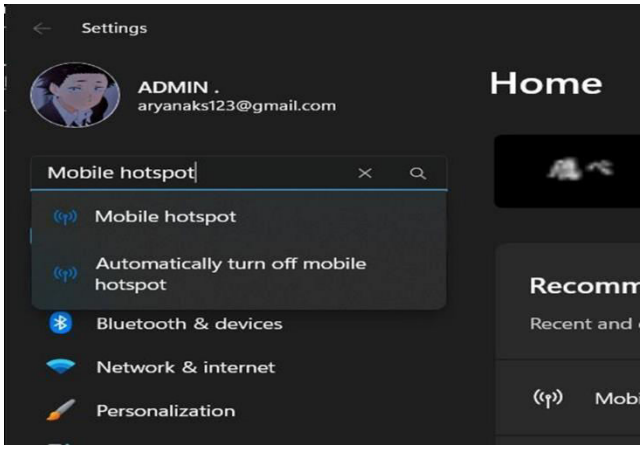

Figure 8. Hotspot Setting

7.2 System Development of Wifiattend – Real-Time Automated Attendance: User Authentication: Users (teachers and students) register with unique credentials. The system uses role-based access control (RBAC) to assign specific permissions. **Backend Implementation Steps:** Create user authentication endpoints (login, register). Use encryption (e.g., bcrypt) for password security. Implement session management with tokens (e.g., JWT for secure API calls). Wi-Fi Hotspot Setup and Validation. The teacher starts a Wi-Fi hotspot using their device or a configured router. The system captures the teacher's MAC address and IP range. Students connect to the hotspot, and the system retrieves their MAC and IP addresses. Network validation logic ensures both devices are on the same subnet. **Technical Implementation:** Use platform-specific network libraries: OS or subprocess modules in Python for command-line execution. APIs to retrieve device-specific network information. Attendance Session Management Teachers create a session, which generates a unique session ID or QR code. The backend stores session details, including the start time, end time, and participants. **7.3 Backend Implementation Steps:** Develop endpoints for session creation and management. Use UUID generation for unique session IDs. Implement real-time database updates when students join sessions. Attendance Marking. The backend validates student connectivity and marks attendance in the database. If validation fails (e.g., the student not connected to the hotspot), attendance is denied. **Implementation Steps:** Query database to match student device information with session records. Update attendance logs with timestamps. Data Storage and Security Attendance records are stored securely with encryption to prevent tampering. Logs maintain details of all activities (e.g., login, attendance status). **Database Schema:** Users: Stores user credentials and roles. Sessions: Tracks attendance sessions and associated metadata. Attendance: Records student attendance status for each session.

7.3 Frontend Development: Login and Registration Pages Simple, responsive forms for authentication. Real-time validation for input fields. Teacher Dashboard, Features: Create attendance sessions, view attendance logs, and generate reports. Interactive UI for monitoring student activity in real time. Student Dashboard. **Features:** Connect to WiFi, join sessions via session ID/QR code, and view attendance history. **Technical Implementation:** AJAX calls for dynamic updates without page reloads. Libraries like Chart.js for visualizing attendance trends. **7.4 Reporting and Analytics:** Teacher Reports, Teachers can generate detailed attendance reports with filters (e.g., date, student). Reports can be exported in formats like PDF or Excel. Student Reports, Students can view individual attendance summaries with session details. **Implementation Steps:** Backend queries attendance data for specific filters. Use libraries (e.g., ReportLab or pandas) for generating reports. **7. 5 Deployment:** Local Deployment, Host the system on a local server

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

for development and testing. Use tools like XAMPP for MySQL integration and Flask development server for API testing. Production Deployment Deploy on cloud platforms like AWS, Heroku, or Azure for scalability. Secure the system with HTTPS, firewalls, and access control policies. **7. 6 Testing and Debugging:** Unit Testing: Test individual modules (e.g., login, session creation). Use frameworks like pytest or Mocha. Integration Testing Ensure seamless interaction between frontend, backend, and database. Performance Testing Test system scalability with a large number of users. Use tools like Apache JMeter for stress testing.

Table 2 Test Results and Validation

Test Case	Input	Expected Output	Actual Output	Status
Wi-Fi Connection Test	Device MAC Address	Device detected	Device detected	Pass
Invalid MAC Address	Unregistered MAC Address	Connection denied	Connection denied	Pass
Report Generation	Attendance for a date	Accurate report generated	Accurate report generated	Pass

VIII. SPROTOTYPE RESULT ANALYSIS IMPLEMENTATION OF WIFIATTEND

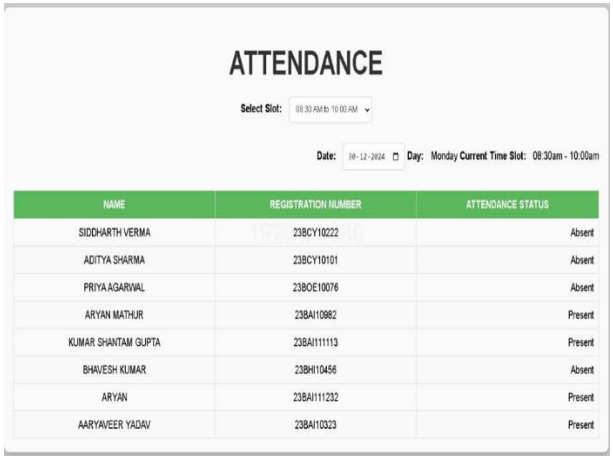

Figure 9. Attendance of Students Using Hotspot

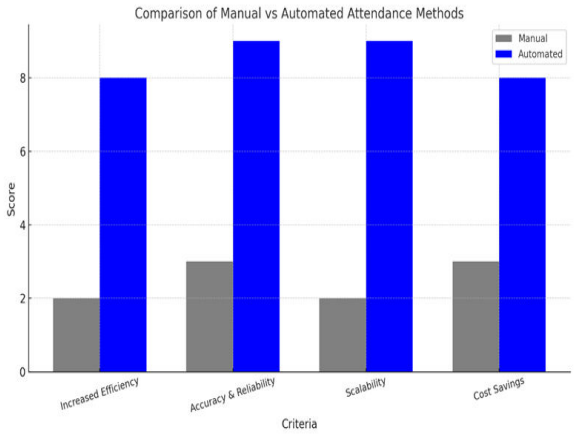

Figure 10. Manual Vs Automated WiFiAttend

IX. KEY OUTCOMES OF WiFiAttend -REAL-TIME AUTOMATED ATTENDANCE

The WiFI Attend system provides enhanced Efficiency, which leads to more accurate and reliable attendance data, which is essential for academic records. **Cost-Effective Solution**: Unlike RFID or biometric systems, this solution requires no additional hardware, making it a low-cost alternative for institutions. It utilizes existing WiFi infrastructure and personal devices, further lowering the financial barriers to adoption. **Scalability and Flexibility**: The system has demonstrated scalability, handling large numbers of students and multiple sessions simultaneously without performance issues. Its modular design also allows for easy integration with other systems (e.g., Learning Management Systems) in the future, further enhancing its adaptability. **User-Friendly:** Both students and teachers reported a positive experience with the system. The simple interface and ease of use, particularly the QR code feature for students to join sessions, made it accessible to users with minimal technical expertise. **Challenges and Limitations**: Despite its strengths, the system is not without challenges. The most notable limitation is its reliance on network quality. Poor WiFi connectivity can interfere with real-time validation, leading to potential attendance discrepancies. Additionally, the system currently does not address advanced spoofing techniques such as using VPNs to bypass the network-based validation, though this could be mitigated through the inclusion of GPS-based validation in future versions.

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

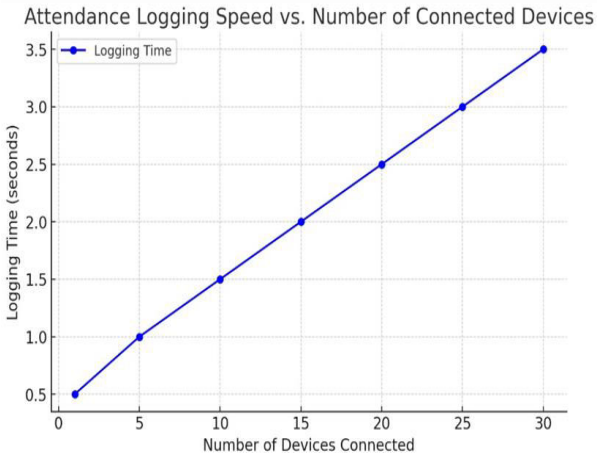

Figure 11. Graph of Attendance Logging Speed

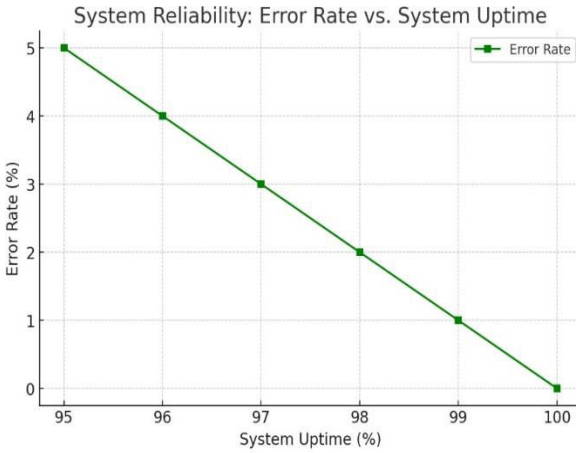

Figure 12. Graph of System Reliability

X. CONCLUSION

The Attendance Updating System Using WiFi Hotspot has proven to be an innovative and effective solution for modernizing the traditional attendance tracking system in educational institutions. By leveraging WiFi hotspot technology, the system ensures that only students physically present in the classroom are marked as present, offering a more secure and automated method of attendance tracking compared to traditional manual systems. Final Thoughts: In conclusion, the Attendance Updating System Using WiFi Hotspot is a promising technological solution for educational institutions seeking to improve the accuracy, efficiency, and security of attendance management. Its cost-effectiveness, ease of use, and scalability make it an attractive option for modern classrooms, and with future improvements, it could become an essential tool for educators worldwide. Future Improvements: Integration of GPS for Location Validation: To address potential spoofing risks, the system could incorporate GPS location verification, ensuring that students are not only connected to the WiFi network but also physically present in the classroom area. Offline Mode: To make the system more resilient, an offline mode could be developed. This would allow attendance to be recorded even when the WiFi network is unstable, and data can sync with the server once connectivity is restored. Advanced Analytics: The system could benefit from advanced data analytics, providing teachers with insights into attendance trends, student behaviour patterns, and early detection of irregular attendance, which could be valuable for both academic and administrative purposes. Integration with Learning Management Systems (LMS): Seamlessly integrating the attendance system with popular LMS platforms like Moodle or Google Classroom could enhance the overall workflow and automate the transfer of attendance data for academic records.

REFERENCES

1. Jawad Rasheed, Erdal Alimovski, Ahmad Rasheed, Wi-Fi Hotspot-based Attendance Application using Android Smartphone, 1st International Informatics and Software Engineering Conference (UBMYK)November 2019, URL: https://ieeexplore.ieee.org/abstract/document/8965588 DOI: 10.1109/UBMYK48245.2019.8965588
2. Suresh Kallam, M K Jayanthi Kannan, B. R. M.,(2024). A Novel Authentication Mechanism with Efficient Math Based Approach. International Journal of Intelligent Systems and Applications in Engineering, 12(3), 2500–2510. Retrieved from https://ijisae.org/index.php/IJISAE/article/view/5722.
3. R. Sivakumar, U. Hima Kiran, V. Rama Rao, B. Ganesh, B. Chandra Mouli, R. Chandrashekhar, Wi-Fi Based Attendance System, Anil Neerukonda Institute of Technology and Sciences (2018-2019), URL: https://ece.anits.edu.in/2019-20%20BE%20Project%20REPORTS/BCM_1920_PROJECT_2.pdf
4. Kavitha, E., Tamilarasan, R., Poonguzhali, N., Kannan, M.K.J. (2022). Clustering gene expression data through modified agglomerative M-CURE hierarchical algorithm. Computer Systems Science and Engineering, 41(3), 1027-141. https://doi.org/10.32604/csse.2022.020634
5. Pooja A, S.G.Pundkar. Waraikar, Shubham W. Bhorkar, Monica V. Kohale, Pranita S. Ngale, Wi-Fi Based Attendance, International Journal of Advanced Research in Computer and Communication Engineering

www.ijircce.com | e-ISSN: 2320-9801, p-ISSN: 2320-9798| Impact Factor: 8.625| ESTD Year: 2013|

International Journal of Innovative Research in Computer and Communication Engineering (IJIRCCE)

(A Monthly, Peer Reviewed, Refereed, Scholarly Indexed, Open Access Journal)

(IJARCCE), URL:DOI: 10.17148/IJARCCE.2019.8425

6. M. K. Jayanthi, "Strategic Planning for Information Security -DID Mechanism to befriend the Cyber Criminals to Assure Cyber Freedom," 2017 2nd International Conference on Anti-Cyber Crimes (ICACC), Abha, Saudi Arabia, 2017, pp. 142-147, doi: 10.1109/Anti-Cybercrime.2017.7905280.
7. G., D. K., Singh, M. K., & Jayanthi, M. (Eds.). (2016). Network Security Attacks and Countermeasures. IGI Global. https://doi.org/10.4018/978-1-4666-8761-5
8. Manoj Kumar, Ravi Kumar, Vijay, Pushpendra Kumar, Vaibhav Singh, Wi-Fi Based Attendance Application Using Hotspot, School of Engineering and Technology, IFTM University, Moradabad (2017-2018), URL: https://www.slideshare.net/slideshow/attendance-management-system-project-report/97157145
9. M. K. J. Kannan, "A bird's eye view of Cyber Crimes and Free and Open-Source Software's to Detoxify Cyber Crime Attacks - an End User Perspective," 2017 2nd International Conference on Anti-Cyber Crimes (ICACC), Abha, Saudi Arabia, 2017, pp. 232-237, doi: 10.1109/Anti-Cybercrime.2017.7905297.
10. Sam Newman, Building Microservices: Designing Fine-Grained Systems, 1st edition, O'Reilly Media, 2015.
11. Balajee RM, Jayanthi Kannan MK, Murali Mohan V. Image-Based Authentication Security Improvement by Randomized Selection Approach. In Inventive Computation and Information Technologies 2022 (pp. 61-71). Springer, Singapore.
12. Naik, Harish and Kannan, M K Jayanthi, A Survey on Protecting Confidential Data over Distributed Storage in Cloud (December 1, 2020). Available at SSRN: https://ssrn.com/abstract=3740465 or http://dx.doi.org/10.2139/ssrn.3740465
13. B. R. M, M. M. V, and J. K. M. K, "Performance Analysis of Bag of Password Authentication using Python, Java, and PHP Implementation," 2021 6th International Conference on Communication and Electronics Systems (ICCES), Coimbatore, India, 2021, pp. 1032-1039, doi: 10.1109/ICCES51350.2021.9489233.
14. Banu Santoso, Marti Widya Sari, Design of Student Attendance System Using Internet of Things (IoT) Technology, Journal of Physics: Conference Series (2019), https://iopscience.iop.org/article/10.1088/1742-6596/1254/1/012064, DOI: 10.1088/1742-6596/1254/1/012064
15. R M, B.; M K, J.K. Intrusion Detection on AWS Cloud through Hybrid Deep Learning Algorithm. Electronics 2023, 12, 1423. https://doi.org/10.3390/electronics12061423
16. A. Kumar, S. Samal, M. S. Saluja and A. Tiwari, "Automated Attendance System Based on Face Recognition Using Opencv", 2023 9th International Conference on Advanced Computing and Communication Systems (ICACCS), pp. 2256-2259, 2023.
17. Kavitha, E., Tamilarasan, R., Baladhandapani, A., Kannan, M.K.J. (2022). A novel soft clustering approach for gene expression data. Computer Systems Science and Engineering, 43(3), 871-886, https://doi.org/10.32604/csse.2022.021215, https://www.techscience.com/csse/v43n3/47676
18. N. Thaleeparambil, A. Biju and B. Prathap, "Integrated Automated Attendance System with RFID, Wi-Fi, and Visual Recognition Technology for Enhanced Classroom Security and Precise Monitoring," 2024 IEEE International Conference on Contemporary Computing and Communications (InC4), Bangalore, India, 2024, pp. 1-6, doi: 10.1109/InC460750.2024.10649192.

INTERNATIONAL STANDARD SERIAL NUMBER INDIA

INNO SPACE SJIF Scientific Journal Impact Factor

doi crossref

निस्केयर NISCAIR

INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN COMPUTER & COMMUNICATION ENGINEERING

9940 572 462 6381 907 438 ijircce@gmail.com

www.ijircce.com

Scan to save the contact details