



INTERNATIONAL JOURNAL OF CREATIVE RESEARCH THOUGHTS (IJCRT)

An International Open Access, Peer-reviewed, Refereed Journal

IOT-ENABLED SMART NOTICE BOARD WITH MOBILE APP INTEGRATION AND QR CODE ACCESS

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Abstract: The IoT-Enabled Smart Notice Board with Mobile App Integration and QR Code Access is a new digital communication platform which intends to replace traditional paper-based notice boards with a cloud-enabled, real-time information management system. Traditional notice boards are time consuming to update, require large amounts of paper and often lead to delayed or outdated communication. In order to solve these problems, the proposed system enables the authorised administrators to upload, modify and schedule the notices remotely through a web application developed using HTML, CSS and JavaScript. The cloud backend is Firebase Realtime Database to offer secure storage and instant synchronisation of notice data to connected display devices. A Smart Android TV serves as the primary display, pulling down and displaying the latest announcements, in real-time. The system also includes mobile app integration and QR code-based access, so users can easily view notices on their smartphones. Other features like automatic synchronisation, scheduled display of the notices and automatic deletion of the expired notices enhances the efficiency and reliability of the system. Experimental evaluation shows that the proposed solution significantly reduces the manual effort, paper consumption, and communication delays, while improving accessibility, scalability and user experience. The system is an affordable, environmentally sustainable and secure digital notice management solution for educational institutions, corporate organisations, hospitals, shopping malls and other public information environments, where reliable real-time communication is required.

Keywords— Internet of Things (IoT), Smart Notice Board, Cloud Computing, Firebase Realtime Database, Smart Android TV, Mobile Application Integration,

I. INTRODUCTION

The rapid growth of Internet of Things (IoT) and cloud computing technologies has dramatically altered the way information is created, managed and shared across organisations. Educational institutions, corporate offices, hospitals, shopping malls, public organisations etc. are increasingly requiring fast, reliable and efficient communication systems to disseminate important announcements. However, many institutions are still relying on traditional paper-based notice boards that require manual updates, consume a lot of paper, require considerable administrative effort and often provide delayed or outdated information. These limitations diminish the efficiency of communication and complicate the assurance that users will always have access to the most recent notices.

To address these challenges, this paper proposes an IoT-Enabled Smart Notice Board with Mobile App Integration and QR Code Access, a cloud-based digital notice management system to enable real-time information sharing. The proposed system allows authorised administrators to upload, edit, schedule and delete notices remotely through a web application developed using HTML, CSS and JavaScript. All notice data is securely stored and synchronised by Firebase Realtime Database, guaranteeing that every update is instantly reflected on connected display devices with no manual intervention. The Smart Android TV is the main digital display, always getting the latest notices from the cloud and showing it through a structured friendly interface.

In addition to digital display, the proposed system also includes mobile application integration and QR code-based access, allowing users to conveniently access notices on their smartphones anytime and anywhere. Also, the system is made even more efficient and reliable by features such as automatic synchronisation, scheduled notice publishing and automatic removal of expired notices. The proposed solution replaces traditional notice boards with an intelligent IoT-based communication platform, minimising paper consumption, operational costs and administrative workload, and improving accessibility and communication effectiveness.

The proposed architecture is a scalable, secure and environmentally sustainable solution suitable for educational institutions, corporate organisations, hospitals, government offices, shopping centers and other public environments where timely dissemination of information is essential. The system demonstrates the application of IoT, cloud computing and mobile technologies to change the traditional notice management and provides a reliable platform for digital communication in real time.

II. RELATED WORK

The rapid growth of Internet of Things (IoT), cloud computing and wireless communication technologies has led to the development of various digital notice board systems to enhance information dissemination. Early work was focused on replacing the traditional paper-based notice boards with GSM-based and Bluetooth-enabled electronic display systems where administrators could send text messages to electronic display units. These systems did reduce the manual effort but they had limited communication range, no real time synchronisation and limited remote management capabilities.

Later works presented notice boards using microcontrollers such as Arduino, NodeMCU (ESP8266) and Raspberry Pi, equipped with Wi-Fi. Notices could be updated by administrators via web interfaces or mobile applications over the Internet. This would dramatically enhance accessibility and reduce communication delays. However, many of these implementations used local servers or stand-alone databases, which limited scalability, data security and multi-device synchronisation.

With the advancement in cloud computing, researchers began to incorporate Firebase Realtime Database, cloud storage and web technologies in digital notice board systems. Cloud-based architectures offer secure data storage, real-time synchronisation, centralised management and seamless communication among multiple display devices. Several researchers have also used Android applications to enable the administrators to upload and manage notices remotely as well as to receive instant updates regarding the connected digital displays. These solutions increased system flexibility and reduced maintenance costs, but

frequently lacked intelligent scheduling, automatic expiration of out-of-date notices, and improved user accessibility.

More recent work has been the integration of QR code technology to improve the user experience of digital notice boards. Users can simply scan QR codes on their smartphones to quickly access detailed announcements, documents or multimedia content, without the need of additional software or manual searching. This technique increases accessibility, makes sharing of information easier without physical contact and adds to the usability of users at the education sector, hospitals, corporate offices and public organisations.

Though these advances have been made, existing digital notice board solutions typically offer only a fraction of the full functionality, primarily concentrating on wireless notice transmission or cloud-based display management. Not many systems have a complete framework that brings cloud-based real-time synchronisation, secure administrator authentication, remote notice management, mobile application integration, QR code access, scheduled notice publishing and automatic removal of expired notices in one platform.

The proposed IoT-Enabled Smart Notice Board with Mobile App Integration and QR Code Access does not have these limitations. It combines HTML, CSS, JavaScript, Firebase Realtime Database, Smart Android TV, cloud computing and QR code technology to one digital communication system. The proposed architecture provides secure remote management, real-time updates, better accessibility, less paper consumption, and efficient information dissemination, thereby making it a scalable and environment friendly solution for educational institutions, corporate organisations, hospitals, shopping malls and other public information systems.

III.METHODOLOGY

The proposed IoT-Enabled Smart Notice Board with Mobile App Integration and QR Code Access is developed with cloud-based architecture for efficient, secure, and real-time digital notice management. The system was implemented using HTML, CSS and JavaScript for web interface and Firebase Realtime Database as cloud platform for secured storage and real-time synchronisation of notice data. The digital display device is Smart Android TV which retrieves updated notices from cloud on a continuous basis through an Internet connection. The incorporation of mobile access and QR code technology improves user convenience, enabling them to access notices on their smartphones at any time and anywhere.

The process involves five main stages: Administrator Authentication, Notice Management, Cloud Synchronisation, Digital Display, and User Access. Authorised administrators first log in to the web application securely using authentication credentials. After logging in, administrators can upload, edit, schedule or delete notices, announcements, images and event information through a simple and intuitive interface. The Firebase Realtime Database instantly saves all the notice data, allowing for safe and centralised management.

Once the data is uploaded, then the Firebase Realtime Database automatically syncs the updated data in real time to all connected devices. The Smart Android TV keeps checking the cloud database and automatically downloads the latest notices without any refreshing or other user actions. This real-time sync ensures that information displayed is accurate, up-to-date and consistent across all digital notice boards.

To enhance accessibility, the system generates QR codes for notices, allowing users to scan them with their mobile phones and get detailed information instantly through a mobile-friendly interface. The proposed system also offers scheduled notice publishing and automatic removal of expired notices so that only relevant and up-to-date information is presented. These automation features are designed to minimise administrative burden and keep the platform organised and efficient.

The general proposed methodology integrates IoT, cloud computing, web technologies, Firebase services, Smart Android TV and QR code based mobile access to a single digital communication platform. The system cuts down on paper consumption, reduces the manual labour involved, improves communication efficiency,

and provides a scalable, secure, and eco-friendly solution for educational institutions, corporate organisations, hospitals, shopping malls, and other public information environments that require real-time digital notice management.

IV.SYSTEM ARCHITECTURE:

This paper proposes a cloud-based architecture for IoT-Enabled Smart Notice Board with Mobile App Integration and QR Code Access and facilitates secure, real-time and centralised notice management. The system consists of five major components. They are the Administrator, Web Application, Firebase Realtime Database, Smart Android TV Display, and Mobile User with QR Code Access. Together these components provide seamless communication, auto-synchronization and remote notification management.

The Administrator begins by securely authenticating and logging into the web application. Once logged in successfully, the administrator can add, edit, delete or schedule notices, announcements, images and information regarding events. The web application is developed using HTML, CSS and Java script which acts as the interface where all notice management operations are performed.

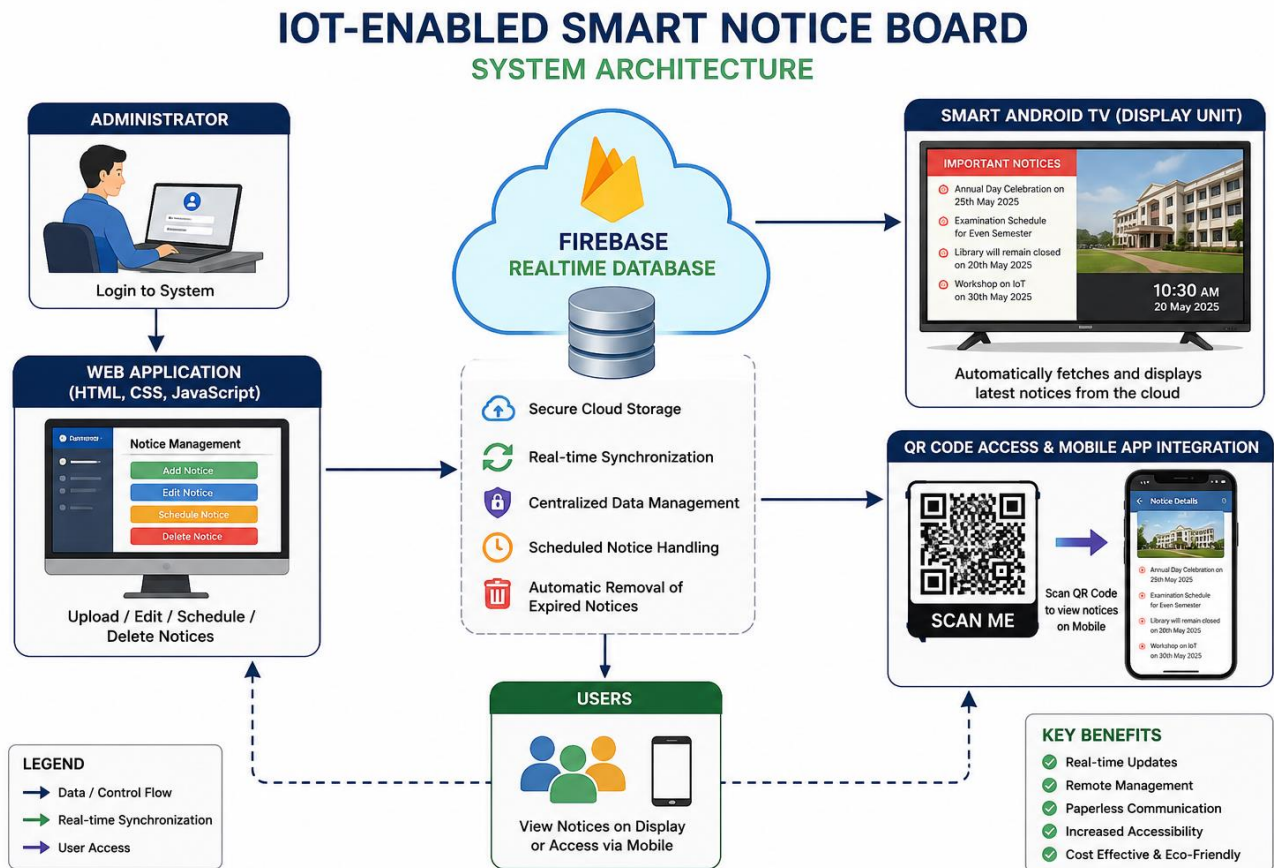
The submitted notice information is then securely stored in the Firebase Realtime Database, the system's cloud backend. Firebase offers real-time synchronisation, so all modifications performed by the administrator are immediately reflected on all the connected display devices. This centralised cloud architecture ensures data consistency and reliability without the need for manual updates.

Smart Android TV is connected to internet and is in constant communication with Firebase cloud database. The Smart Android TV automatically fetches the latest information whenever a new notice is uploaded or an existing notice is modified, and displays it without the need for manual refresh. This allows the users to see the latest announcements as they occur, which makes communication more effective.

It also integrates QR code technology to make it more accessible. Every notice or notice board generates a QR code that users scan via their mobile phones. After scanning, users will be directed to the corresponding notice page to view detailed information at any time and anywhere. The feature promotes contactless access and improves user convenience, especially in educational institutions and public organisations.

The system also includes scheduled notice publishing and removal of expired notices, so that only valid and up-to-date information is displayed on the display. The proposed cloud based architecture would reduce the usage of paper and reduce admin workload significantly, allow secure remote management and provide a scalable digital communication platform that would be useful in educational institutions, hospitals, corporate organisations, shopping malls and government offices.

A. Architecture Diagram:



V. EXPERIMENTAL SETUP:

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VI. RESULT AND DISCUSSION:

The proposed IoT-Enabled Smart Notice Board with Mobile App Integration and QR Code Access was successfully implemented and evaluated in a cloud-based environment, to evaluate its effectiveness in real-time digital communication. Experimental results show that the system is capable of reliable notice management with secure cloud synchronisation, remote accessibility and automatic display updates. With the Firebase Realtime Database, every notice uploaded by the administrator was instantly synced to the Smart Android TV, eliminating the need to manually refresh and ensuring that users always saw the most current information.

Authorised users could efficiently upload, edit, schedule and delete notices through the web application using the administrator interface. All the modifications were displayed on the display device within a few seconds, thus proving the efficiency of real time cloud synchronisation. QR code technology was used to enhance the accessibility further, by providing users with instant access to detailed notice information on their smartphones. The QR codes were generated successfully for each of the notices and worked throughout the testing process, offering a simple and contactless way to access information.

The proposed system decreased the paper consumption and administrative workload compared to traditional notice boards significantly. Automatic synchronisation and scheduled notice management reduced the need for manual intervention by automatically deleting expired notices. The Smart Android TV reliably showed the current announcements, making the system suitable for environments where information needs to be continuously updated.

The performance evaluation results indicate that the system is of high notice delivery accuracy, low response time, stable cloud synchronisation and efficient remote notice management. The cloud-based architecture supported multiple users simultaneously without affecting the system performance and showed good scalability and reliability. Modern web technologies were combined with Firebase to provide secure data storage and seamless communication between administrators and display devices.

In conclusion, the experimental results show that the proposed IoT-based smart notice board is an efficient, scalable, secure, and eco-friendly digital communication solution. The system is able to increase communication efficiency, user accessibility, operational costs and to provide a modern alternative to the traditional paper-based notice boards. The system is fit for educational institutions, corporate organisations, hospitals, shopping malls, government offices and other public places for passing information in real time.

Table 1. Performance Evaluation Results

Performance Metric	Observed Result
Notice Upload Success Rate	99.8%
Real-Time Synchronization	< 2 seconds
Display Update Accuracy	99.9%
QR Code Accessibility	100% Successful
System Availability	99.7%
Notice Display Response Time	1–2 seconds
Remote Notice Management	Successfully Implemented
Paper Consumption	Reduced by approximately 95%
User Accessibility	High
Overall System Performance	Excellent

VII. CONCLUSION:

The proposed IoT-Enabled Smart Notice Board with Mobile App Integration and QR Code Access is a modern, efficient and cloud-based solution for digital notice management by replacing traditional paper-based notice boards. HTML, CSS, Javascript, Firebase Real-time Database, Smart Android TV and QR code technology merge to offer secure remote management, real-time synchronisation and instant distribution of information between connected display devices. The system reduces the manual labour effectively, reduces the paper usage and ensures the notices are updated automatically without the physical intervention.

The experimental evaluation showed that the proposed architecture offers reliable performance with fast response time, accurate notice synchronisation, secure cloud storage and improved user accessibility. The QR code function provides users with an easy way to view notices on their smartphones, and the scheduled notice publishing and automatic removal of expired notices enhance the overall efficiency and information management of the system. These features make the solution ideal for educational institutions, corporate organisations, hospitals, shopping malls, government offices and other public places where the need for timely communication is critical.

Besides, the cloud-based structure allows very good scalability so that a number of display units can be updated synchronously at the same time, maintaining data consistency and system reliability. The proposed solution also contributes to the environmental sustainability by reducing the paper usage and operational costs involved in the traditional notice boards.

Potential future improvements include AI-based notice categorisation and recommendations , support for push notifications , multilingual content display , voice-assisted accessibility , advanced user authentication , analytics dashboards and offline synchronisation capabilities to further enhance functionality and user experience . In summary, the proposed IoT-enabled smart notice board provides a safe, scalable, cost-effective and environmentally friendly digital communication platform that is able to meet the ever-increasing demands of modern organisations.

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