Design and Implementation of an IoT based Smart Notice Board

A project report Submitted to the
Department of Computer Science and Engineering, Jahangirnagar University in
Partial Fulfillment of the Requirements for the Degree of Master of Computer
Science under PMSCS Program

Submitted By
MD. SAIHAM
Student Id No.: CSE202203048
Reg. No.:3167
Enrollment: Fall-2022
Batch: 30th

Under Supervision of
DR. MD. EZHARUL ISLAM
Professor

Department of Computer Science & Engineering
Jahangirnagar University

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Approval of Acceptance

The project report entitled "**Design and Implementation of an IoT based Smart Notice Board**" is written and submitted by **MD. SAIHAM**, Student ID No. **CSE202203048** to the PMSCS program, Department of Computer Science and Engineering, Jahangirnagar University in partial fulfillment of the requirements for the degree of Master's in Computer Science. This project is done under the supervision of **DR. MD. EZHARUL ISLAM, Professor,** Department of Computer Science and Engineering, Jahangirnagar University.
We have examined this report and recommend its acceptance.

●●●●●●●●●●●●●●●●●●●●●●●●●●●●●
DR. MD. EZHARUL ISLAM
Professor
Supervisor & 1st Examiner
Department of Computer Science
and Engineering
Jahangirnagar University
Savar, Dhaka, Bangladesh.

●●●●●●●●●●●●●●●●●●●●●●●●●●●●●
SARNALI BASAK
Associate Professor
2nd Examiner
Department of Computer
Science And Engineering
Jahangirnagar University
Savar, Dhaka, Bangladesh.

Accepted by:

●●●●●●●●●●●●●●●●●●●●●●●●●●●●●
DR. MD. HUMAYUN KABIR
Professor
Coordinator, PMSCS Program
Department of Computer Science
and Engineering
Jahangirnagar University
Savar, Dhaka, Bangladesh

Abstract

A notice board is an important part of an educational institution because it is a common means of communication with anyone in that educational institution. In educational institutes, signatures and permissions are generally taken from the academicians and institution authorities on the notice. However, this process creates several complexities in most cases. In this project, the main objective is to develop an IoT-based Raspberry Pi-equipped digital notice board that enables university authorities to display notices on the digital monitor. To meet the objectives, a digital notice board system has been developed for educational institutions that can minimize a big burden of paper and pencils while displaying the notices on the digital board in a nice way. Moreover, a web application has been set through which users can send data through the Internet of Things (IoT) technology. In addition to these, this system provides an easy, fast, and reliable way of making us see the notices attractively on an LCD monitor for an educational institution where faculty members, university administration, and students would be able to communicate conveniently. There is a mobile app for the e-notice board to increase user outreach to information.

Declaration

The project work with the title **"Design and Implementation of an IoT based Smart Notice Board"** has been done in the Department of Computer Science & Engineering, Jahangirnagar University is genuine and compliant with the regulations of this University.

I do understand the plagiarism policy of this University and declare that this project is a unique work and no part of it has been plagiarized from other sources or been submitted previously elsewhere for awarding any degree, diploma, or publication.

(Md. Saiham)
Roll No. - CSE202203048

Acknowledgment

I am extremely grateful and remain indebted to An Al-mighty Creator who has guided in all. Ventures to successfully complete my project. I am thankful to the grace and the help received from him. Special thanks go to our honorable supervisor **DR. MD. EZHARUL ISLAM**, Professor, Department of Computer Science & Engineering, Jahangirnagar University. I would address with immense gratitude for the cordial support of my supervisor whose instructions, advice, and sterling accent perfectly guided me towards the accomplishment of this project work. Besides, I would like to thank all my course teachers who were so kind to me in evaluation for the last three semesters of PMSCS program. Undoubtedly, we are under tremendous supervision of our Honorable PMSCS program Coordinator DR. **MD. HUMAYUN KABIR**, Professor, Department of Computer Science & Engineering, Jahangirnagar University. I am bound to acknowledge with heartiest thanks to all other faculty members of the Department of Computer Science & Engineering, Jahangirnagar University for their valuable time spent analyzing and evaluating my project. In addition, I would recall the memories of intimate cooperation and support from friends and family and the people of my surroundings who contributed directly or indirectly to the successful completion of this project. I am truly in debt to them for encouraging me to carry on the project work even in my hardest times. I am also grateful to the people who criticized my works and helped to identify and resolve errors in my working procedure and methodology in several phases during the development of this project and in report writing as well. Heartiest thanks to my batch mates who have contributed directly through their valuable opinions for the development work and its associated activities.

Contents

Chapter 1:   Introduction

1.1 Introduction

Digital notice board is very necessary in this era of Information and Communication Technology. For a very long time, in many educational institutions and organizations, announcements, memos, and communications have been always posted on notice boards. Conventional notice boards are wooden where information is disseminated in the papers and pins stuck to it usually seen in various places like educational institutions, railway stations, bus terminals, shopping malls, offices, airports, etc.

Unfortunately, all this communication means can be missed due to several factors like papers being pulled down for malice, pins falling off, overlap of newer communication information, and limited space for newer hot communication. Some information is not totally available on these boards. Another problem is that a large volume of papers and accessories are needed for displaying day-to-day communication information. Moreover, a specific person is required to place the notice on the wooden board. It uses the workforce as well as kills a huge time.

The solution to this is an IoT-based smart digital notice board. IoT-based notice board helps to access online notices on the go, either on mobile smartphones, laptops, or tablets. It is an online notice board where many people can easily communicate with each other by posting virtual notes, announcements, and information.Khan, M.A., Hassan, N.N., Sarker, K. and Jhuhaira, U.H. proposed in Design, Control & Performance Analysis of Electronic Noticeboard in [1].[2]. Jadhav, V.B., Nagwanshi, T.S., Patil, Y.P. and Patil, D.R., 2016. Digital notice board using Raspberry Pi. International Research Journal of Engineering and Technology, 3(5), pp.2076-2079. [3]. SIHABUL ISLAM, S., 2022. Development of an IOT-based digital notice board. [4]. Bhardwaj, G., Mishra, R.K. and Sahu, G., 2020. IOT-based Smart Notice Board. INTERNATIONAL JOURNAL OF ENGINEERING RESEARCH & TECHNOLOGY (IJERT), 9(06). [5]. Chouhan, H., Gilbile, A., Gargate, A. and Ingale, N., 2017. IOT-based Digital Notice Board using Raspberry Pi. International Journal, 5(4). However, these methods are suffering Pi. International Journal, 5(4). However, these methods suffer from several limitations, such as working in a smaller area, slow processing speed, and failure to support video or image in a supported user interface.

1.2 Objective

The objective is to design and develop a computer-controlled smart noticeboard system that can display digital notices, messages, and updates. To create a system that automates the process of updating and displaying notices, reducing the need for manual intervention.To design a user-friendly interface for administrators to easily add, edit, and delete notices from the notice board. To enable the notice board to connect to a computer or network, allowing for remote control and updates.To provide the capability for displaying dynamic content, such as news feeds, weather updates, and event schedules. To ensure that notices and updates are displayed in real-time, minimizing delays in information dissemination. To allow for customization of the notice board's appearance and layout, including colors, fonts, and templates.To optimize the system for energy efficiency, with the ability to turn off the display when not in use and reduce power consumption.

1.3 Goals

The goal is to create a fully functional prototype of the computer-controlled smart noticeboard system. Conduct user testing to evaluate the system's ease of use, performance, and reliability. Implement a remote management feature to enable administrators to update notices from a computer or mobile device. Ensure compatibility with various data sources and systems, such as email, calendars, and social media for automatic notice updates. Implement security measures to protect the notice board from unauthorized access and data breaches. Optimize the system to reduce power consumption and evaluate its environmental impact. Assess the system's scalability to accommodate larger display setups or multiple notice boards within an organization. Evaluate the cost-effectiveness of the system and identify areas for cost reduction without compromising functionality. Produce comprehensive documentation, including user manuals and technical guides, for future maintenance and development. Contribute to the field of human-computer interaction and digital signage through novel design and automation techniques.

Chapter 2 :   Related Works

2.1 Related Works

In an era marked by relentless technological advancement, traditional methods of disseminating information have rapidly given way to innovative and dynamic approaches. Among these transformative technologies, "Smart Notice Boards" have emerged as a solution that revolutionizes the way organizations, institutions, and public spaces communicate and share information. Smart notice boards represent a paradigm shift from static, paper-based bulletin boards to interactive, real-time digital displays that offer a multitude of benefits for both administrators and end-users.

Smart notice boards are a product of the fusion between technology and communication needs. They are digital displays equipped with the capability to broadcast a wide range of information, from simple text messages and announcements to rich media content, in an eye-catching and engaging manner. Unlike their static predecessors, these digital displays offer interactivity, real-time updates, and a versatile platform for content delivery.

The significance of smart notice boards lies in their capacity to provide a versatile and dynamic channel for information dissemination in various settings, including schools, businesses, healthcare facilities, transportation hubs, and public spaces. These boards empower administrators to efficiently and effectively convey important messages, events, and updates to a broad audience, all while reducing the resource-intensive processes associated with traditional bulletin boards.

We can divide the related works into three categories based on their main board used. They are:

- Arduino
- Raspberry Pi
- Others

2.2 Arduino based projects:

In the paper [1] Khan, M.A., Hassan, N.N. introduces an Electronic Noticeboard driven by user-friendly smart technology, controllable through a smartphone Android app. It serves as a digital replacement for traditional human-based notice posting services, with individual accounts for faculty members and students.
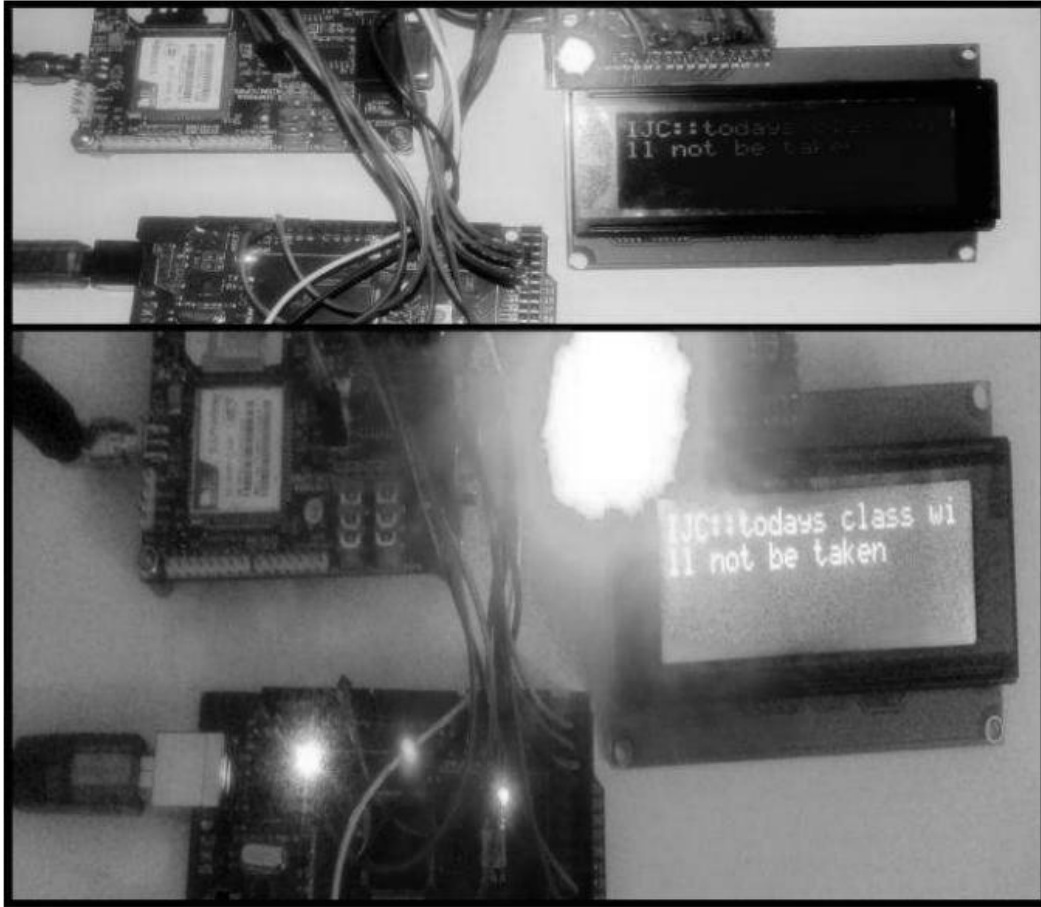
FIgure 2.2.1: Hardware interfacing of electronic from paper [1]

In the paper [8] Sakthieswaran, A., Ray, focuses on developing a notice board system using Arduino boards with Wi-Fi connectivity, controllable remotely through an Android OS smartphone. The aim is to replace conventional notice boards with a centralized control system that uses Wi-Fi technology. The system uses a master Arduino and four slave Arduino to receive and display information on LED notice boards. Data is transmitted wirelessly through Wi-Fi and controlled by a shift register, allowing for scrolling messages. Each slave Arduino displays different scrolling data received from the master.
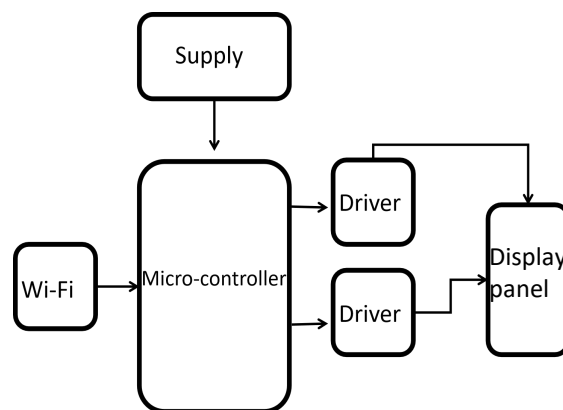

FIgure 2.2.8 : Notice board system from paper [8]

The author of [13] Kate, A., Kharat, IoT-based project aims to create a speech-to-text system for displaying notices on an LED matrix-based notice board. The project leverages Google Assistant's speech recognition capabilities to convert spoken messages into text, which is then displayed on the LED matrix board.
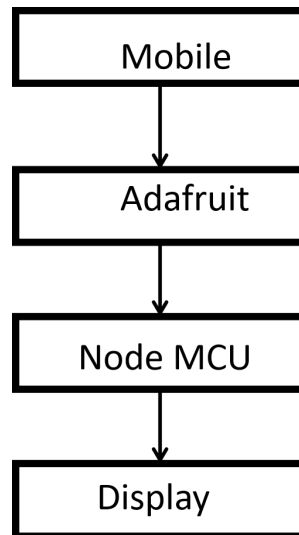
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│    Node MCU     │
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│    Display      │
└─────────────────┘
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Figure 2.2.13 : Figure of the system from paper [13]

In [14] Bhaldar, K., Chougule, focuses on creating a wireless notice board system to improve the process of sharing information in institutes, organizations, and public places like railway stations and bus stands. It utilizes Bluetooth connectivity and an Android application to update and display messages on an LCD screen.
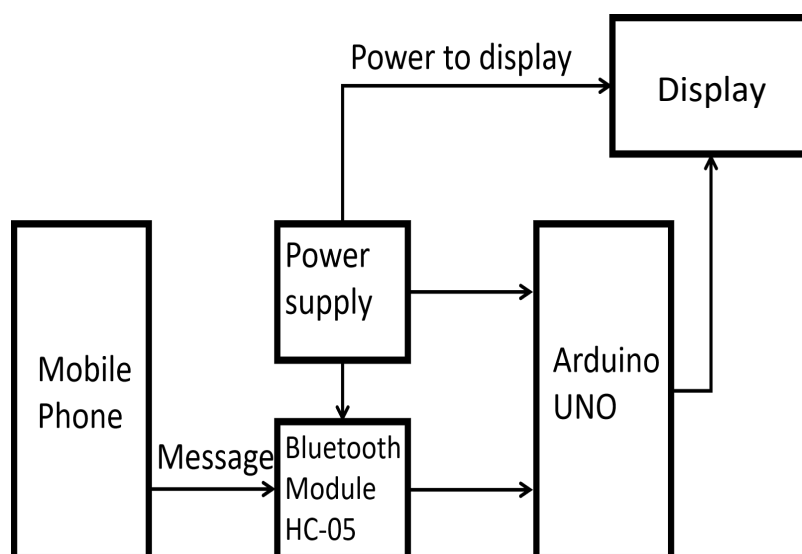
FIgure 2.2.14 : Block diagram of wireless notice board system from [14]

The summarized table of arduino boards are given in the following table:

Title	Advantage	Disadvantage	Components	Benifits
1. Design, Control & Performance Analysis of Electronic Noticeboard .	The Electronic Noticeboard streamlines notice distribution, reducing the need for physical posting and saving time.	Setting up the Electronic Noticeboard may require an initial investment in hardware, software, and installation.	Arduino Board (Arduino Mega 2560),Android Interface, Electronic Components,GSM Module,LCD Displays,Web Panel.	The Electronic Noticeboard streamlines notice distribution, reducing the need for physical posting and saving time.
8. Voice Based Digital Notice Board Using WI-FI.	Can be controlled using an Android smartphone, making it easy for authorized users to update information.	Users may require technical knowledge to set up and operate the system effectively.	Arduino Boards,Wi-Fi Connectivity,LED Notice Boards,Shift Register,Android Smartphone.	The system allows for remote control and updates of the notice board via Wi-Fi, eliminating the need for physical access.
13. Notice Board using LED Matrix Display.	Utilizes Google Assistant for accurate speech-to-text conversion.	Relies on an internet connection, specifically Google Assistant, for speech recognition.	LED Matrix Display,Node MCU Controller, Arduino,Google Assistant,Android Smartphone.	The project utilizes Google Assistant for precise speech-to-text conversion, ensuring accurate notice transcription.
14. DIGITAL NOTICE BOARD.	Eliminates the need for traditional paper notices, saving time and reducing paper wastage.	Limited discussion of hardware details and system architecture.	Arduino UNO Microcontroller,LCD Display, Bluetooth Module (HC-05),Android Application.	Eliminates the need for traditional paper notices, saving time and reducing paper wastage, which is environmentally friendly.

2.3 Raspberry Pi based projects:

In [2] Jadhav, V.B., Nagwanshi presents a system for remotely sending notices to a Digital Monitor using an Android application based on a Raspberry Pi card. The project consists of establishing the Notice Board and developing an Android application.
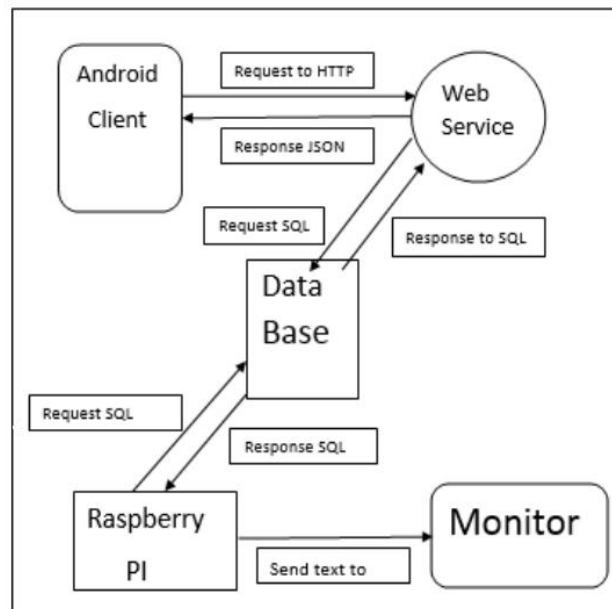

FIgure 2.3.2: Solution overview schema from [2]

In [3] SIHABUL ISLAM discusses the importance of notice boards in educational institutions and introduces a project to create an IoT-based Raspberry Pi-equipped digital notice board. The project aims to reduce paper usage and enable remote notice updates for improved communication within educational institutions.
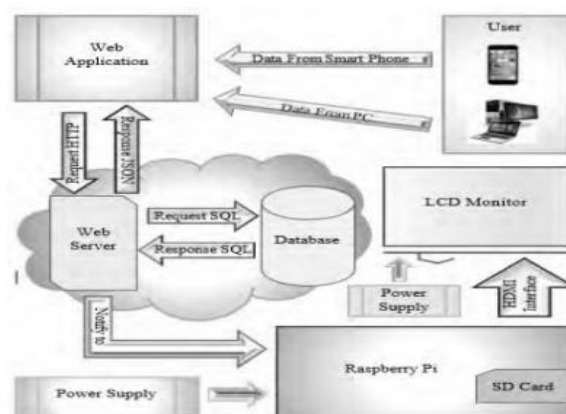

FIgure 2.3.3: The architecture of the system from [3]

In [7] Reddy, P.R., Kammanaboina, project introduces a Smart Notice Board using Raspberry Pi, designed to replace conventional paper-based notice boards. It allows authenticated users to convey messages or notices remotely, and it also provides accessibility features like LED message display and speech output through a speaker.
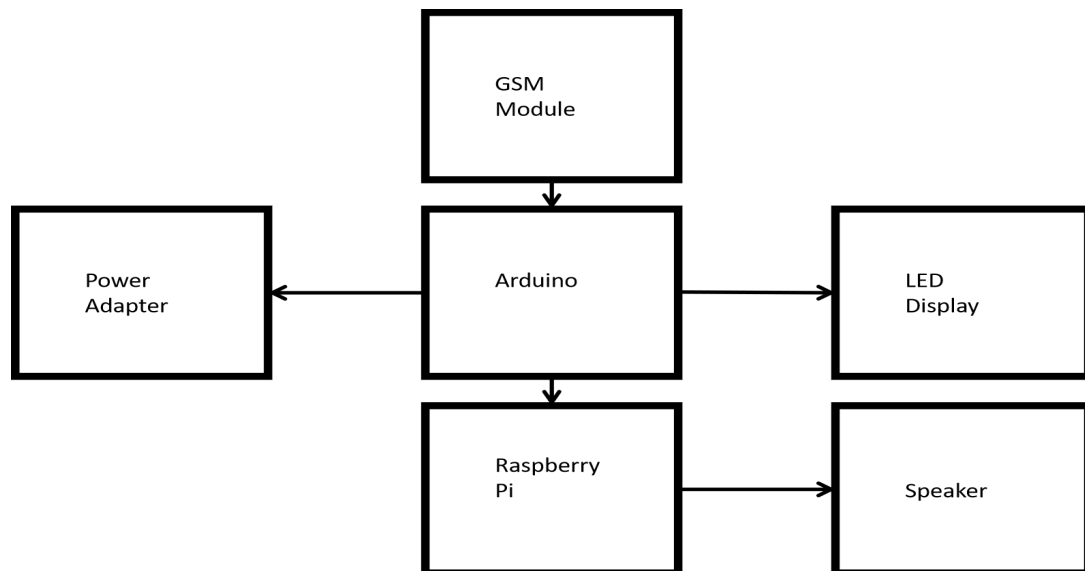

FIgure 2.3.7: Smart notice board from [7]

The author of [9] Suma, M.N., Kashyap focuses on improving the traditional manual notice board system by introducing a wireless smart notice board that wirelessly transmits short notices using campus Wi-Fi. The system aims to reduce resource wastage and time consumption associated with manual notice boards.
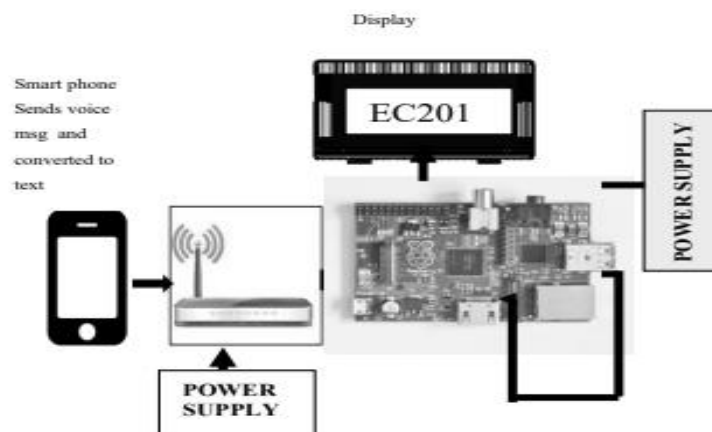

FIgure 2.3.9: Block diagram of VOIP Notification from [9]

The author of [11] Jayanthi, focuses on creating an advanced wireless notice board to replace traditional notice boards in various places such as institutions, bus stops, railway stations, colleges, and malls. The system is built around an ARM controller and Raspberry Pi, with display options on a projector or LCD monitor.
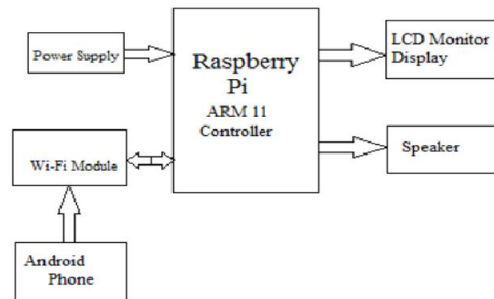

FIgure 2.3.11 : wireless notice board from [11]

The author of [12] Agarwal, A., Ray focuses on the development of a digital notice board system using Raspberry Pi, which also provides an Android app for notice posting and management. The system is based on the Internet of Things (IoT) and allows users to post notices through the Android app, which are then displayed on the digital notice board.
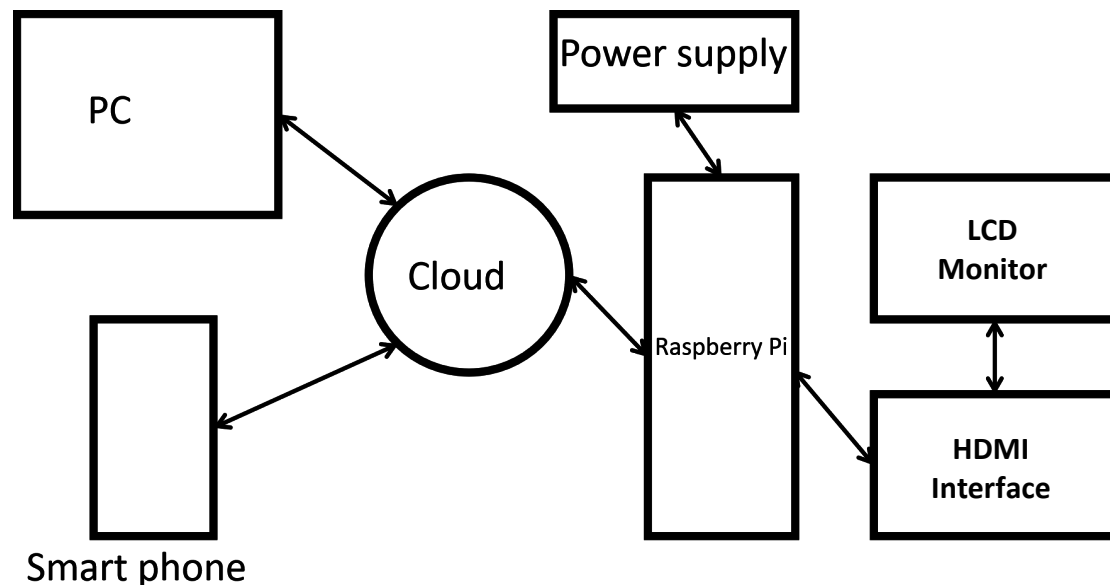

FIgure 2.3.12 : Methodology of IoT and raspberry system from [12]

The author of [16] Kurian, N.S., Kumar, narrated the IoT-based digital notice board offers several advantages, including global information dissemination, efficiency, and wide coverage, making it a powerful communication tool. Administrators can share announcements and notices from anywhere globally, ensuring instant communication and overcoming coverage limitations. However, there are some disadvantages, such as technical complexity, cost, and security concerns, that need to be considered when implementing such systems.
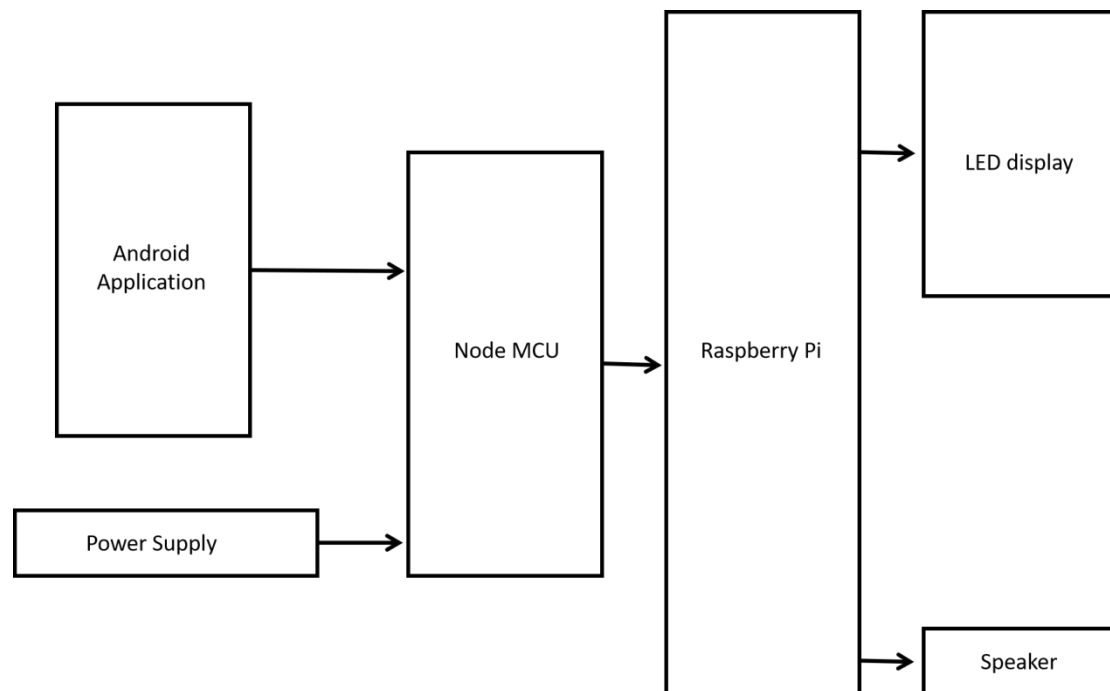

Figure 2.3.16: From [16] digital notice board

In [17] Singh, narrated the adoption of Raspberry Pi and IoT technology in academic libraries offers several advantages, including cost-effective solutions, enhanced user services, flexibility, global adoption, and eco-friendly practices. However, there are potential disadvantages, such as the technical knowledge gap, initial setup complexity, dependency on technology, ongoing maintenance, and the cost of experimentation.

In [18] Pabale talks about the adoption of Raspberry Pi and IoT technology in academic libraries and offers several advantages, including cost-effective solutions, enhanced user services, flexibility, global adoption, and eco-friendly practices. However, there are potential disadvantages, such as the technical knowledge gap, initial setup complexity, dependency on technology, ongoing maintenance, and the cost of experimentation.
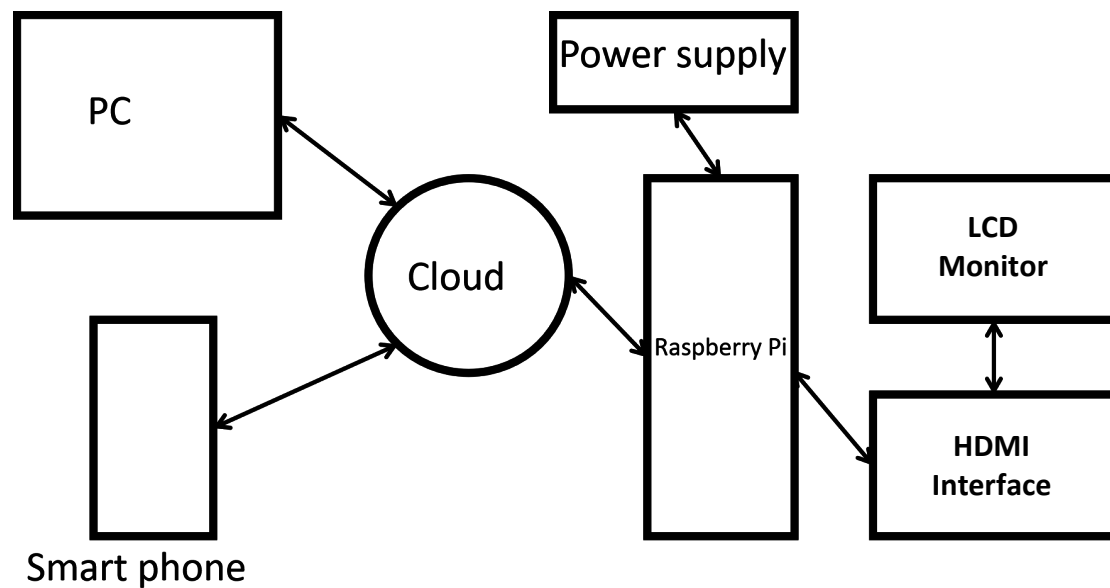
Figure 2.3.18 : Block diagram from [18]

In [19] Reddy, narrated about system described in the offers several advantages, including real-time and remote updates of display boards, efficient information display, user-friendliness, and IoT connectivity using technologies like NodeMCU and Wi-Fi. However, there are potential disadvantages, such as technical complexity during implementation and dependency on a stable internet connection.
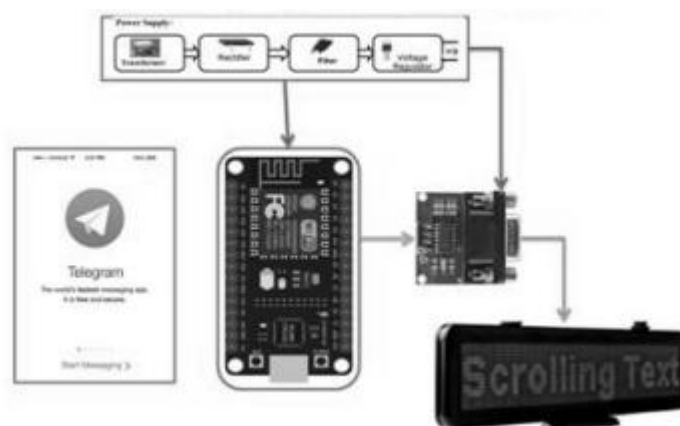

Figure 2.3.19 : Block diagram from [19]

In the paper [20] Keerthika made a smart noticeboard system that offers various advantages, including reduced workload, paper wastage reduction, efficient communication, IoT integration, user-friendliness, voice search capabilities, priority control, future accessibility, cost-effectiveness, and societal benefits. However, it may come with disadvantages related to technical complexity and dependency on a stable internet connection.
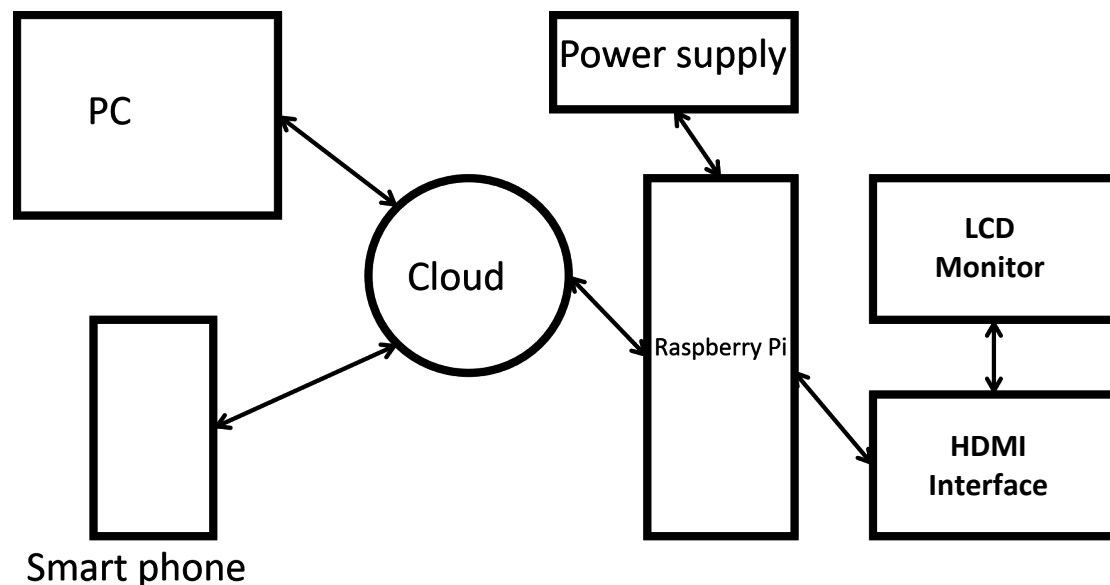

Figure 2.3.19 : Smart notice board system from [20]

The author of [21] narrated about the transition from traditional analog notice boards to digital notice boards offers several advantages. It contributes to digitalization, creating a paperless community, and provides efficient, customization, and real-time information dissemination. Digital notice boards are scalable, allowing multiple notices to be displayed, and they offer features for record tracking. Their attractiveness and eye-catching design make them more engaging.

The writer of [24] made digital notice board offers several advantages, including efficiency in displaying various content types, remote management, real-time updates, virtual assistant integration, and its contribution to environmental sustainability by eliminating paper usage.

The author of [25] made a smart electronic notice board system comprising several key components, including the central digital notice board, Raspberry Pi for enhanced functionality, wireless communication for message transfer, a web browser for user interaction, PHP language for website design, and a MySQL database for database development.

The author of [27]Bharath, M., made smart mirror, powered by a Raspberry Pi 3, offers several advantages. It serves as a personal assistant, providing calendar updates, reminders, weather information, news, and real-time data, enhancing users' daily routines. The mirror's interactivity through voice commands adds to its convenience and user-friendliness. It functions as an inquiry center, offering answers to basic questions and directions, particularly valuable to newcomers. The mirror also operates as a notice board, enabling real-time updates and remote content management, reducing manual efforts.

The author of [28] Kumbhar, P.Y., Mulla, A., Kanagi, P., and Shah, made the smart mirror project offers various advantages, including the provision of real-time information such as weather, time, location, and current events, making it a valuable source of data. It can connect to the internet to fetch and display up-to-date and relevant information. The mirror also supports voice control, allowing users to interact with it and control certain equipment, enhancing accessibility and convenience. Furthermore, the project provides IoT integration, opening the door to various IoT-based tasks and home automation, thereby expanding its functionality.

The author of [29] Nathan, S.S., Sulaiman, A., and Kamarulzaman, talks about smart mirrors offer numerous advantages, including an interactive user interface that displays contextual information directly on the mirror's surface, IoT integration for real-time data access, and customization features, enabling users to tailor the information to their preferences. Voice recognition technology enhances user-friendliness, allowing for voice commands and interaction. Smart mirrors can also provide motivational messages and compliments, promoting positivity, and saving time by consolidating various information sources onto one surface. They represent a bridge between the physical and digital worlds, embracing the latest technology trends.

The authors of [30] Viswanatha, V., Chandana, R.K., and Ramachandra, narrated that smart mirrors offer several advantages, including the ability to provide valuable information at a glance, customization to display relevant data, and applications in security, human monitoring, and interactive user experiences. They improve time efficiency by consolidating information sources, enhance personalization, and can be used for security and monitoring purposes. While versatile in application, smart mirrors can be relatively expensive and complex to set up. Privacy concerns may arise due to their camera usage, and they require regular maintenance and software updates.

The summarized table of raspberry pi boards are given in the following table:

Title	Advantage	Disadvantage	Components	Benifits
2. Digital Notice Board Using Raspberry PI.	Notices can be displayed in real-time, ensuring that information is current and up-to-date.	Setting up the hardware, software, and network components may require technical expertise and effort.	Raspberry Pi Card,Digital Monitor or Display,Android Device,Wi-Fi Module, GSM Module (Optional),Power Source, Cables and Connectors,Mounting Hardware.	Users can easily send, update, or remove notices remotely via an Android application, making it a hassle-free process.
3. DEVELOPMENT OF AN IOT BASED DIGITAL NOTICE BOARD.	The system significantly reduces the need for physical notices and paper, promoting environmental sustainability.	Users may face technical issues or require training to use the system effectively, which could pose a learning curve.	Raspberry Pi,LCD Monitor,Sensors, Internet Connectivity,Operating System, Web Application,Database,IoT Integration.	The system significantly reduces the need for physical notices and paper, promoting environmental sustainability.
5. IOT based Digital Notice Board using Raspberry Pi.	Users can send messages from anywhere, enhancing convenience and ensuring real-time updates.	Setting up and maintaining the system may require technical expertise.	PIC16F Microcontroller,GSM Modem LED Matrix,Max 232 Level Shifter.	The system reduces the need for manual posting and maintenance of notices, streamlining the process.
6. Secure Method of Updating Digital Notice Board Through Sms With Pc Monitoring System .	The system enables wireless transmission of notices through SMS, reducing the need for physical notices.	The 16x2 character LCD may have limitations in displaying lengthy or multimedia-rich notices.	AT89c52 Microcontroller,GSM Modem,MAX232 Level Converter 64K EEPROM,DS1307 Real-Time Clock,16x2 Character LCD Display, Embedded C and Keil,Visual Basic.	The system enables wireless transmission of notices through SMS, reducing the need for physical notices and associated maintenance.
9. Voice Over WiFi Based Smart Wireless Notice Board.	Reduces the consumption of paper and printer ink, leading to cost savings and environmental benefits.	Users may require technical knowledge to set up and operate the system effectively.	Raspberry Pi,Campus Wi-Fi,LCD or Terminal,Graphical User Interface (GUI).	The system reduces the consumption of paper and printer ink, leading to cost savings and environmental benefits.
11. Digital Notice Board in Schools and Colleges by Implementing IoT with Audio Alert System.	Eliminates the need for manual posting and maintenance of notices.	Reliance on an internet connection may limit functionality in areas with poor connectivity.	ARM Controller,Raspberry Pi,Display (Projector or LCD Monitor), Wi-Fi Connectivity,Web Application,Voice Message Capabilities.	The project eliminates the need for manual posting and maintenance of notices, reducing human intervention.
12. IOT Based Digital Notice Board.	Enables remote notice posting and management through an Android app.	Susceptible to hardware damage from natural calamities.	Raspberry Pi,Android App,Internet Connection,Web Server.	The project enables remote notice posting and management through the Android app, allowing administrators to change notices from anywhere.
16. IoT based Wireless Notice Board Using Raspberry Pi	The system is designed to provide instant communication, ensuring that information can be visualized in a matter of seconds.	Developing and deploying an IoT-based system, including the required hardware and software components, can be expensive, which might pose a financial challenge for some organizations or individuals.	Raspberry Pi, Node MCU, LED Display, Speaker, Text-to-Speech Software.	The digital notice board efficiently displays information in educational institutions and offices, ensuring that data reaches everyone quickly.
17. Smart Notice Boards using IoT and Single Board Microcomputers	Raspberry Pi and IoT technology offer a cost-effective solution for academic libraries facing budget constraints.	Implementing Raspberry Pi and IoT technology can be complex, and setting up the infrastructure may pose challenges.	Raspberry Pi,Internet of Things (IoT),Linux,Digital Signage,Kiosk,Library OPAC,Microcomputer.	Raspberry Pi and IoT provide a cost-effective solution for libraries with budget constraints.

Title	Advantage	Disadvantage	Components	Benifits
18. IOT Based Digital Notice Board	The digital notice board allows for remote posting and management of notices through an Android app.	The system relies on the proper functioning of technology, and any technical issues could disrupt its operation.	Raspberry Pi,Android App,PC,Web Server,Wireless Notice Board,Internet of Things (IoT),Speech-to-Text Converter.	Users can quickly and easily post and update notices, ensuring that information is current.
19. IoT Based Real Time Digital Led Notification Display Board using Node MCU via Telegram Messenger App.	The system allows for real-time and remote updates of display boards, ensuring that information is current.	Implementing IoT technology may require technical expertise for setup and maintenance.	NodeMCU,MAX232,LED Display,Wi-Fi Technology,Raspberry Pi.	The system simplifies and streamlines the process of displaying notices in public utility places.
20. A Social and Civilized Needy of Smart and Self-Regulating Digital Noticeboard Systems Using Raspberry Pi.	The smart noticeboard reduces the workload associated with traditional notice boards in schools and universities.	Implementing IoT and voice recognition technology may require technical expertise.	Raspberry Pi,Python,Google Drive,Internet of Things (IoT),JavaScript (JS) Backend,Voice Search.	The system contributes to the digitalization of notice boards, reducing paper wastage and workload.
21. Digital Notice Board in Schools and Colleges by Implementing IoT with Audio Alert System.	The system simplifies the process of managing and displaying notices in institutions and public utility places.	Implementing this system may require technical expertise for setup and maintenance.	ARM Controller 11 (Raspberry Pi),Projector or LCD Monitor,Wi-Fi Technology, Authorized PC or Mobile,Speaker, Web Application and Server.	The system reduces the need for manual updates and allows for real-time changes to notices, saving time and labor.
24.Android Controlled Smart Notice Board with Virtual Assistant	The digital notice board can display various types of content, including text, videos, and notices, efficiently.	The system relies on internet connectivity, and any disruptions in connectivity could affect its functionality.	Smart Digital Notice Board,Android Application,Raspberry Pi, Virtual Assistant,Internet of Things (IoT),High-Definition Display Devices.	The system streamlines the process of displaying and updating notices, saving time and effort.
25.Real Time Digital Display Notice Board on Multiple Screens	The system offers a more efficient and flexible way to display messages and images compared to traditional notice boards.	Setting up and configuring the system, especially when replacing traditional notice boards, can be complex, requiring technical skills.	The system offers a more efficient and flexible way to display messages and images compared to traditional notice boards	The paperless approach reduces the environmental impact of paper-based notice boards.
27.Design and Development of a Smart Mirror Based On IOT	The smart mirror can serve as a personal assistant, offering calendar updates, reminders, real-time date and time, weather information, and news. Users can rely on it for daily tasks and routines.	The initial setup, including a Raspberry Pi and additional components, can be relatively expensive.	Raspberry Pi 3,Microphone and Speaker,Glass with Reflective Coating,Android Device, Internet Connection,Database,IoT Devices.	The smart mirror simplifies daily routines and tasks, providing users with important information.
28.Smart Mirror Using Raspberry PI	It can connect to the internet and fetch data, ensuring that the information displayed is up to date and relevant.	The cost of the components, including Raspberry Pi and a two-way mirror, can be relatively high, potentially limiting accessibility.	Raspberry Pi 3,LED Monitor,Acrylic Mirror.	Users have easy access to real-time data, including weather, time, and current events, simplifying their daily routines.
29."Brilliantreflect": smart mirror for smart life	Smart mirrors offer an interactive user interface, providing contextual information directly on the mirror's surface, which enhances user engagement and convenience.	The components, including Raspberry Pi and a two-way mirror, can be expensive, limiting accessibility to some users.	Raspberry Pi 3,Smart Mirror,Voice Assistant.	Voice commands make it easy to interact with the mirror and perform various tasks, enhancing usability.

Title	Advantage	Disadvantage	Components	Benifits
30.IoT Based Smart Mirror Using Raspberry Pi 4 and YOLO Algorithm: A Novel Framework for Interactive Display	Users can personalize the mirror to display information and reminders that are relevant to them, enhancing its utility.	The setup and configuration of a smart mirror can be complex, especially for users with limited technical expertise.	Raspberry Pi 3 Model,Microphone,Touch Screen,Mobile Device,Camera,Passive Infrared (PIR) Sensors.	Users can save time by accessing essential information while getting ready, reducing the need to check multiple sources.

2.4 Others:

In [4] the author Bhardwaj, G., Mishra, R.K. and Sahu, discusses the use of IoT technology to create an advanced wireless notice board that allows users to send messages remotely through the internet.

FIgure 2.4.4: GSM module from [4]

In [5] Chouhan, H., Gilbile, discusses an IoT-based wireless notice board system that allows users to send messages remotely via the internet, which are then displayed on the notice board. It highlights the advantages, such as convenience and real-time updates, and disadvantages, including the need for technical expertise and a stable internet connection. The system's construction involves configuring the microcontroller, creating a web server, and testing the system thoroughly.
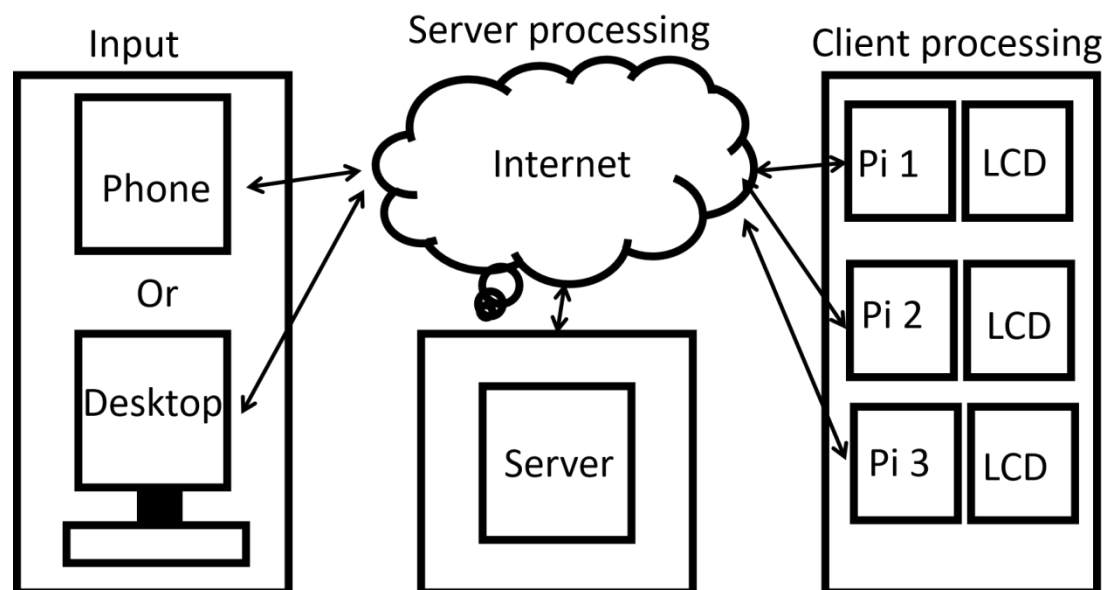
FIgure 2.4.5: IoT-based wireless notice board from [5]

In [6] Bhoyar, M.R., Chavhan, project involves the development of a digital notice board system for colleges. It operates by sending messages in the form of SMS through mobile devices, providing wireless transmission with minimal errors and maintenance.
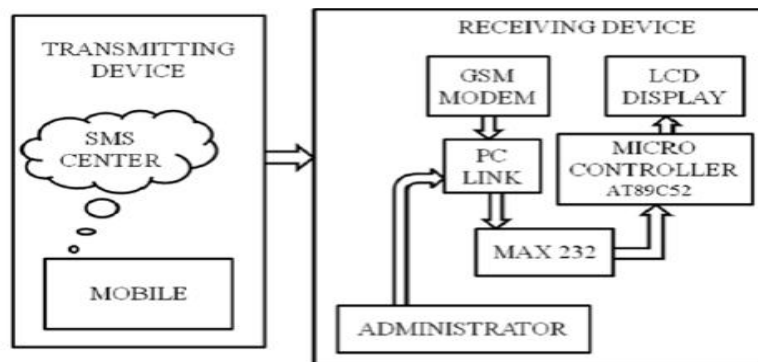

FIgure 2.4.6: Block Diagram of the System from [6]

The author of [10] Surendiran, S., Mathumathi focuses on the transition from traditional analog notice boards to digital ones, enabling more efficient information dissemination in various public places. The aim is to design a dot-matrix moving message display using a microcontroller and IoT, where characters continuously shift from left to right.
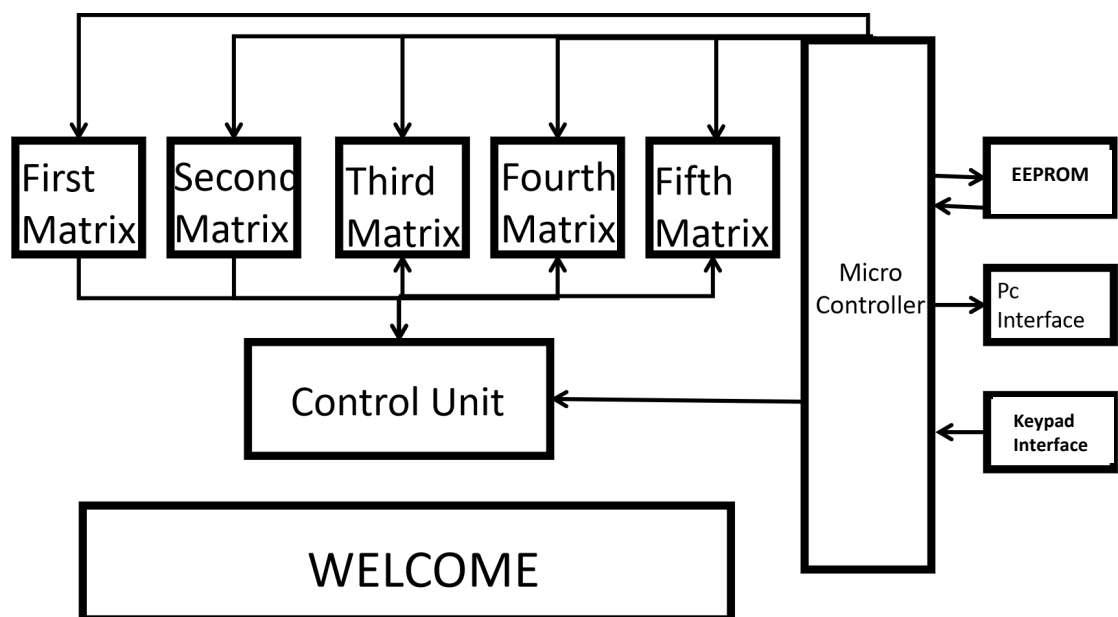

Figure 2.4.10: Circuit diagram of system from [10]

In [15] Vittal, K.S.N., Himabindu, focuses on the development of an IoT-based smart notice board that offers quick data transformation and access to information from anywhere in the world. Key aspects of this system include its autonomy, tone-enabled communication, and reliability.
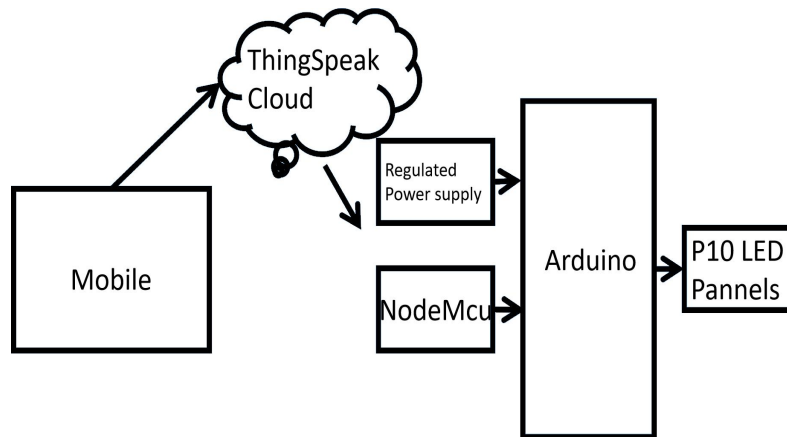

Figure 2.4.15 : Block diagram of proposed system from [15]

The author of [23] proposed a smart electronic notice board that aims to address the inefficiencies of traditional paper-based notice boards. It offers several advantages, including efficiency, convenience, the use of wireless technology, environmental benefits, and cost savings.

The author of [26] Balu, G.B., talked about smart bulletin board system primarily relies on the NodeMCU component to enable wireless communication and control of the 16x2 LCD display. It aims to provide real-time updates of information and remote access via the Internet, with the goal of improving efficiency and flexibility.

The summarized table of other boards are given in the following table:

Title	Advantage	Disadvantage	Components	Benifits
4. IOT based Smart Notice Board.	Users can send messages or information to the notice board remotely from anywhere, enhancing convenience and flexibility.	Building and maintaining the system may require technical expertise, which can be a disadvantage for users with limited technical skills.	PIC16F Microcontroller,GSM Modem,LED Matrix, Max 232 Level Shifter.	Users can send messages or information to the notice board remotely from anywhere, enhancing convenience and flexibility.
5. IOT based Digital Notice Board using Raspberry Pi.	Users can send messages from anywhere, enhancing convenience and ensuring real-time updates.	Setting up and maintaining the system may require technical expertise.	PIC16F Microcontroller,GSM Modem LED Matrix,Max 232 Level Shifter.	The system reduces the need for manual posting and maintenance of notices, streamlining the process.
6. Secure Method of Updating Digital Notice Board Through Sms With Pc Monitoring System .	The system enables wireless transmission of notices through SMS, reducing the need for physical notices.	The 16x2 character LCD may have limitations in displaying lengthy or multimedia-rich notices.	AT89c52 Microcontroller,GSM Modem,MAX232 Level Converter 64K EEPROM,DS1307 Real-Time Clock,16x2 Character LCD Display, Embedded C and Keil,Visual Basic.	The system enables wireless transmission of notices through SMS, reducing the need for physical notices and associated maintenance.
10. IOT BASED MESSAGE SCROLLING LED DISPLAY.	Facilitates efficient and paperless information dissemination.	Reliance on Wi-Fi technology may limit coverage and reliability.	ATMega8 Microcontroller,Wi-Fi Technology, 16x32 Dot-Matrix Display.	The system facilitates efficient and paperless information dissemination, reducing the need for physical notices and paper resources.
15. Sms Based Wireless Notice Board Monitoring System.	Enables quick data transformation and access to information from anywhere.	Limited discussion of hardware and circuit details.	Node MCU ESP8266, Atmega328,LED Matrix Display.	Enables quick data transformation and access to information from anywhere, providing real-time updates.
23. Design and Construction of Voice-Controlled Smart Electronic Notice Board	Users can control and display messages on the board through voice commands, making it a convenient way to update and manage information.	Implementing the speech-operated notice board may require technical expertise and the development of mobile applications.	Smart Electronic Notice Board,Android Application,Voice Recognition, Wireless Technologies,MCU Unit (Microcontroller Unit),LED Dot Matrix Display Screen.	The smart electronic notice board offers an efficient way to manage and display messages, reducing the time and effort required.
26. SMART DISPLAY USING NodeMCU	The system aims to enhance the efficiency of updating and accessing information, reducing the need for physical maintenance.	The use of IoT technology for message transfer and updates may raise privacy concerns.	NodeMCU, 16x2 LCD Display, Jumper Wires.	Users can upload data to the LCD display from anywhere, reducing the time required to update information.

Chapter 3 : Methodology

3.1 Methodology

The successful realization of the "Design and Implementation of an IoT based Smart Notice Board" project relies on a robust and structured methodology that encompasses the entire research and development process. This section outlines the approach, methods, and procedures that will be employed to design, develop, and evaluate the smart noticeboard system. The methodology is designed to provide a systematic framework for achieving the project's objectives and goals, ensuring rigor, reliability, and efficiency in the research and development processes. The foundation of this methodology is a research design that blends both qualitative and quantitative research approaches. Qualitative research will be employed to explore user requirements and preferences, while quantitative research will provide insights into system performance and usability. The project will commence with a comprehensive requirements analysis phase. During this stage, data will be gathered through surveys, interviews, and user observations to identify the specific needs, preferences, and challenges of potential users and administrators. This information will guide the design and development phases.

There are two segments in this project:

1. Hardware segment
2. Software segment

3.2. Hardware Segment:

The hardware segment of the "Design and Implementation of an IoT based Smart Notice Board" project forms the tangible foundation upon which the system's functionality and interactivity rest. Each component in this assembly serves a unique purpose, contributing to the seamless operation and user engagement of the smart notice board. Below, we provide a concise overview of the key hardware components.
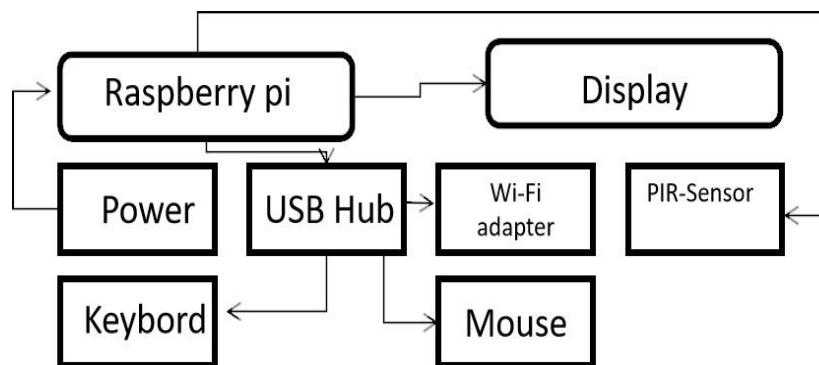

Figure 3.1.1: Computer controlled smart notice board (Hardware diagram)

The components we have used in our smart notice board are given below with their description:

Raspberry Pi: The Raspberry Pi acts as the central processing unit and brain of the smart notice board. It manages software, user interfaces, and system control, ensuring smooth operation.
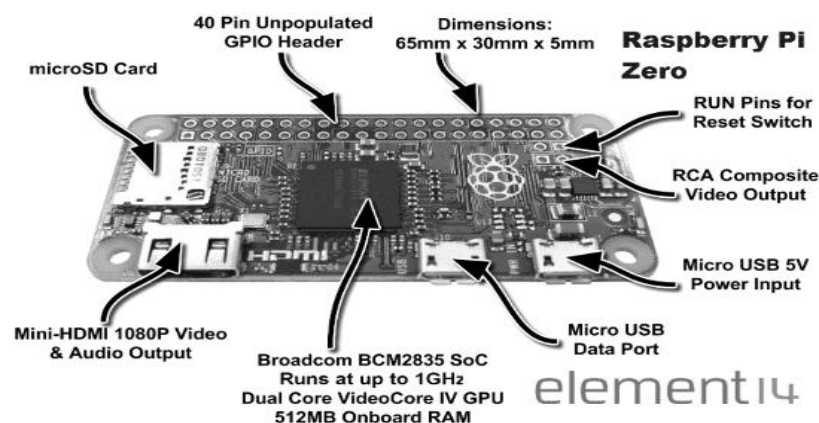

Figure 3.1.2: Raspberry pi circuit board

Display: The display, typically an LCD or LED screen, is the visual interface for showcasing notices, messages, and multimedia content. It is the primary means through which information is conveyed to users.

Figure 3.1.3 : 7" LCD Display

Figure 3.1.4 : LCD Display for raspberry pi

Power Source: A reliable power source, such as a power adapter or battery, provides the necessary electrical energy to operate the smart noticeboard. It ensures continuous functionality.

Figure 3.1.5: Power source equipment

USB Hub: The USB hub extends the connectivity of the Raspberry Pi by providing additional USB ports for peripherals, making it possible to connect input devices and external storage.

Figure 3.1.6: USB hub for connecting gadgets

Figure 3.1.7: USB hub for raspberry pi

Wi-Fi Adapter: The Wi-Fi adapter facilitates wireless communication, enabling the smart notice board to connect to the internet and remote management systems. It plays a crucial role in delivering real-time updates.

Figure 3.1.8 : Wi-fi adapter

Figure 3.1.9: Wi-fi adapter dongle

PIR Sensor (Passive Infrared Sensor): The PIR sensor serves as a motion detector. It detects user presence and triggers the display to wake up or turn off when users approach or leave, respectively, optimizing energy efficiency.

The code we used for the PIR sensor is given below:

```
from gpiozero import MotionSensor
from signal import pause

pir = MotionSensor(4)

def motion_function():
   print("Motion Detected")

def no_motion_function():
   print("Motion stopped")

pir.when_motion = motion_function
pir.when_no_motion = no_motion_function
pause()
```
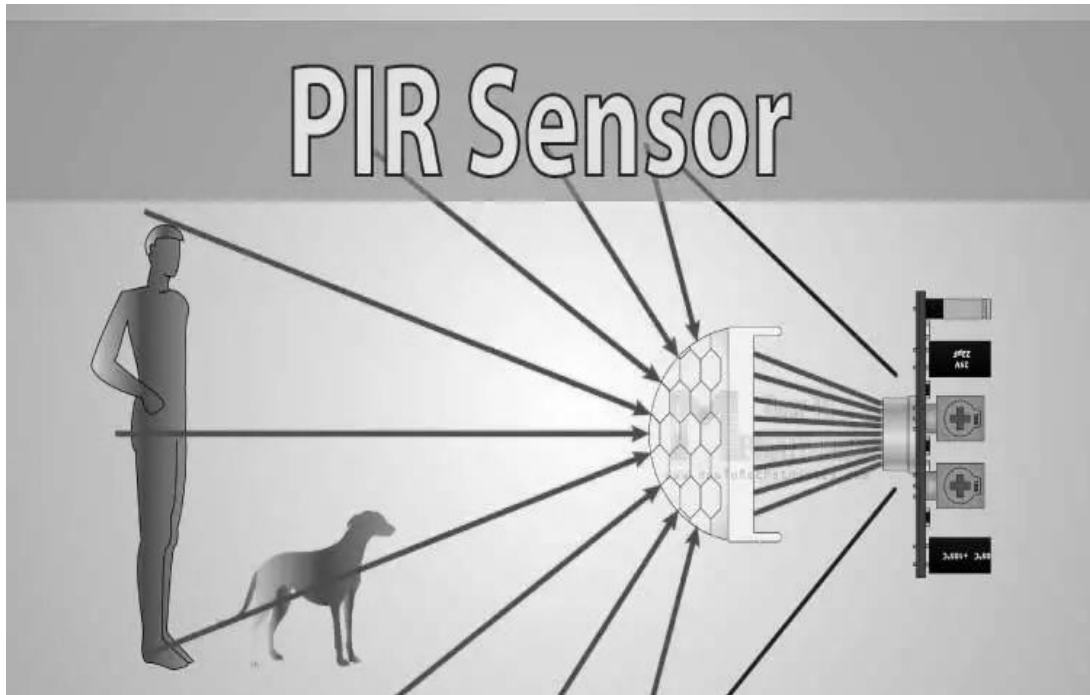
Figure 3.1.10 : Pir sensor module

Each of these hardware components plays a vital role in the seamless operation of the "Design and Implementation of an IoT based Smart Notice Board". Together, they create an integrated and user-friendly system that leverages technology to enhance the traditional notice board concept, providing real-time information dissemination and user engagement while ensuring energy efficiency and ease of use. The synergy of these hardware elements is a testament to the project's commitment to innovation and efficiency in modern communication solutions.

3.3 Software Segment:

The software segment of the "Design and Implementation of an IoT based Smart Notice Board" project forms the core of the system's functionality, user interaction, and content management. This segment is responsible for processing and presenting information on the digital notice board. The architectural flow encompasses several key elements, beginning with a web server and culminating in a user-friendly web interface.
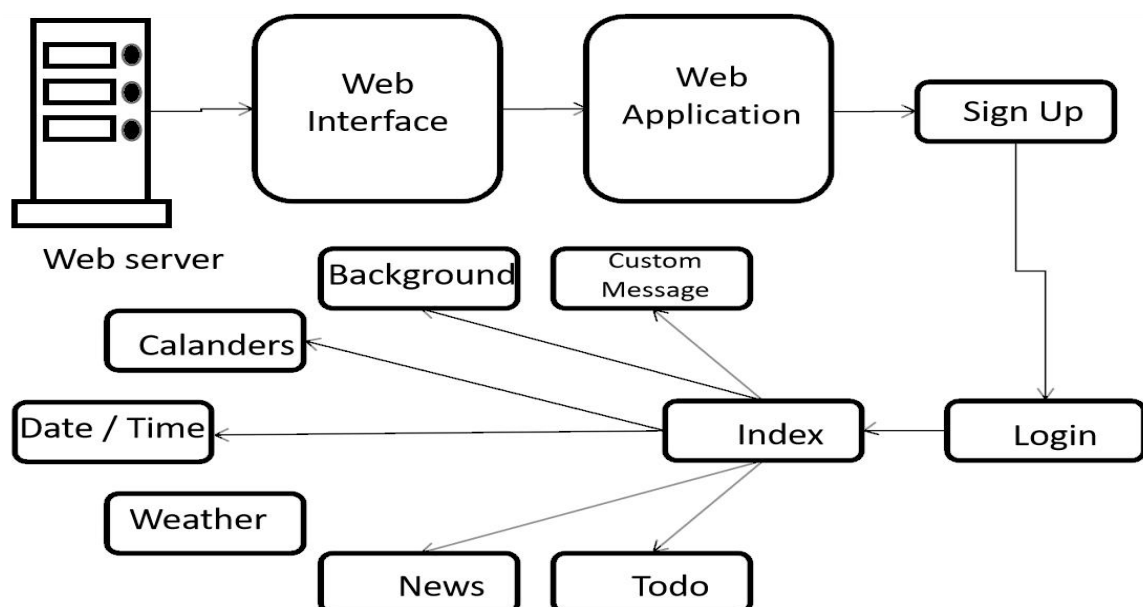

Figure 3.2.1: Software Diagram of Computer
controlled smart notice board using raspberry pi

Web Server: At the heart of the software architecture is the web server. It serves as the back end infrastructure, responsible for handling data and information flow to and from the smart notice board. The web server acts as a central hub, facilitating data processing and distribution.
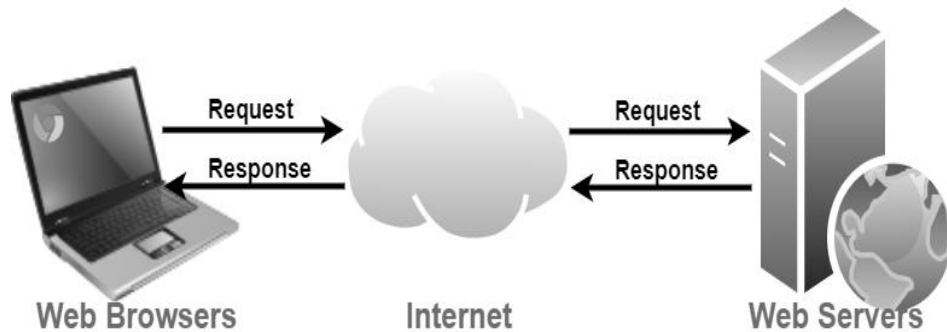

Figure 3.2.2: web server

Web Interface: The web interface is the primary user interaction point. It represents the visual front end of the smart notice board system, allowing administrators to control, manage, and customize the displayed content. The web interface is accessible through standard web browsers, making it user-friendly and easily accessible.

Figure 3.2.3: web interface

Chapter 4 :   System Implementation and Evaluation

4.1 System Implementation and Evaluation

The successful implementation and thorough evaluation of the "Design and Implementation of an IoT based Smart Notice Board" project are essential to ensure its functionality, user-friendliness, and effectiveness. Below is a concise description of how the system is implemented and evaluated.

4.2 Hardware part

The system implementation phase involves setting up the hardware components and developing the software to create a functional smart noticeboard. Here's an overview of the key steps:

The hardware components, including the Raspberry Pi, display, power source, USB hub, Wi-Fi adapter, PIR sensor, keyboard, and mouse, are carefully arranged and connected as per the hardware setup guidelines. This physical assembly is fundamental to the system's functionality. The software is developed with a focus on user-friendly functionality and content management. The web server is designed to manage data flow, while the web interface provides a visually appealing and intuitive platform for administrators. Features such as user registration, login, and the various index sections are integrated to create a cohesive and interactive user experience. The system is configured to connect to the internet via the Wi-Fi adapter. Secure networking protocols are implemented to facilitate real-time data updates and remote management capabilities. A Content Management System (CMS) is designed to enable administrators to easily add, edit, and schedule the display of notices, messages, and other content sections on the smart notice board.

The evaluation phase is vital for assessing the performance, usability, and security of the system, as well as gathering user feedback. Here's a brief overview of the evaluation process:

Real users, including administrators and end-users, interact with the system to provide feedback on its usability, functionality, and overall user experience. Their input guides further refinements and improvements. Rigorous performance testing is conducted to evaluate the system's responsiveness, scalability, and load-handling capabilities. Any performance issues identified are addressed to ensure optimal operation. The system undergoes a comprehensive security assessment to identify vulnerabilities and threats. Measures are taken to enhance data protection and system security. The user interface is scrutinized for user-friendliness, accessibility, and content customization capabilities.

User feedback guides refinements to make the system more intuitive and engaging.Data is gathered throughout the evaluation process, encompassing user

feedback, performance metrics, and security assessments. Analysis of this data helps uncover trends, issues, and areas for improvement. Based on the evaluation results, the system is optimized to enhance performance, usability, security, and energy efficiency. Any identified issues are addressed through refinements and adjustments.

Figure 4.1.1 : Computer Controlled Smart Notice Board

4.3 Software part

The software parts of this project are given below:

Sign up and Login: Users, typically administrators, can access the system by either signing up as a new user or logging in if they already have an account. This authentication process ensures that only authorized individuals can manage the content displayed on the notice board.
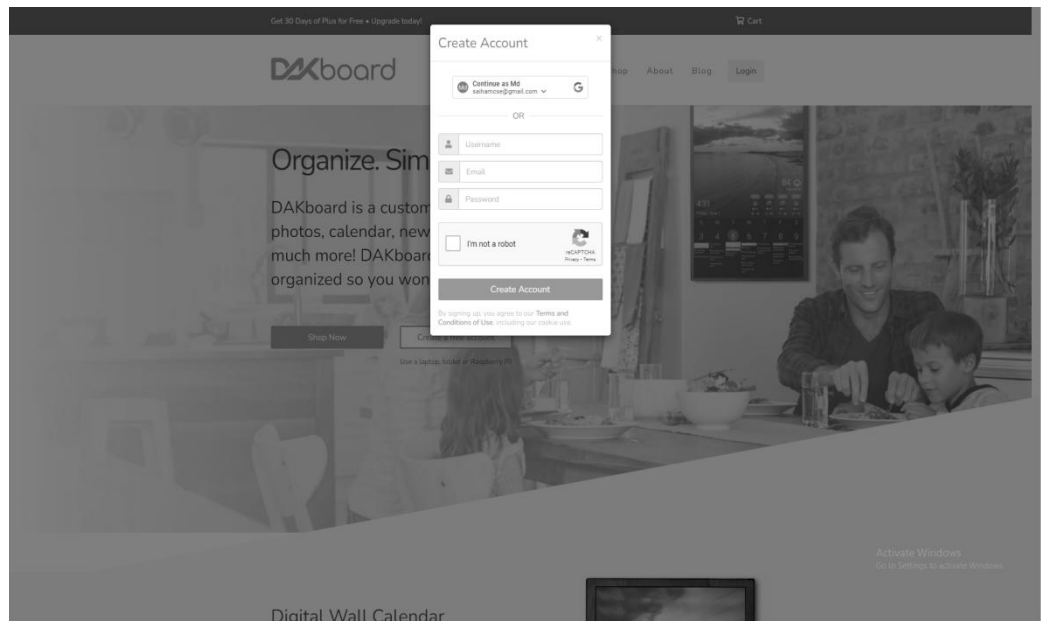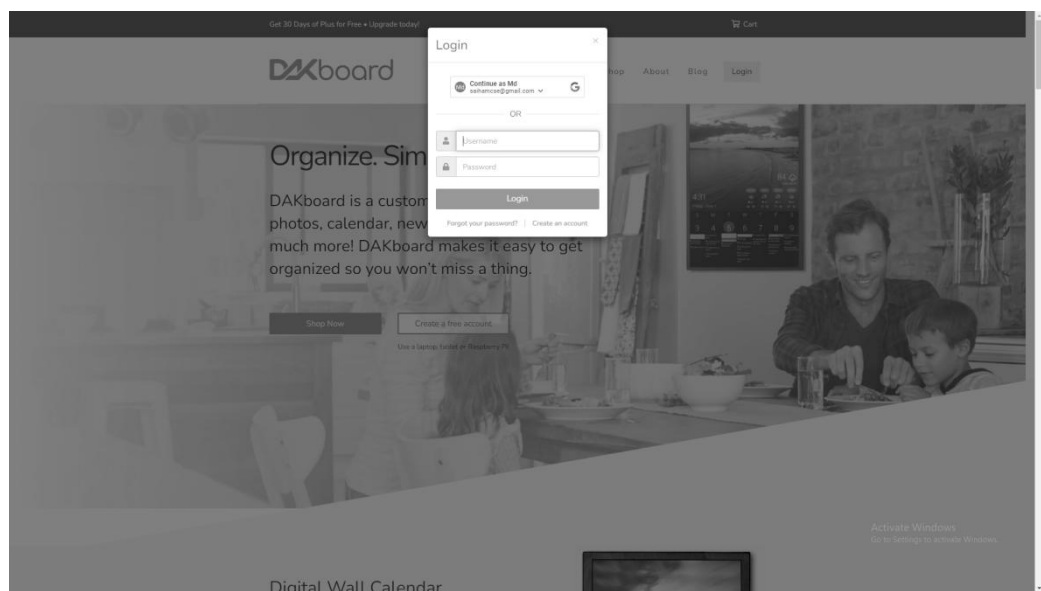

Figure 4.2.1: Signup page function

Figure 4.2.2: Login page function

Web Application: The web application is the page where the main source code runs for get the responses from the user or the expected one. The web application is the core software of a page where it is used to achieving the required goal.
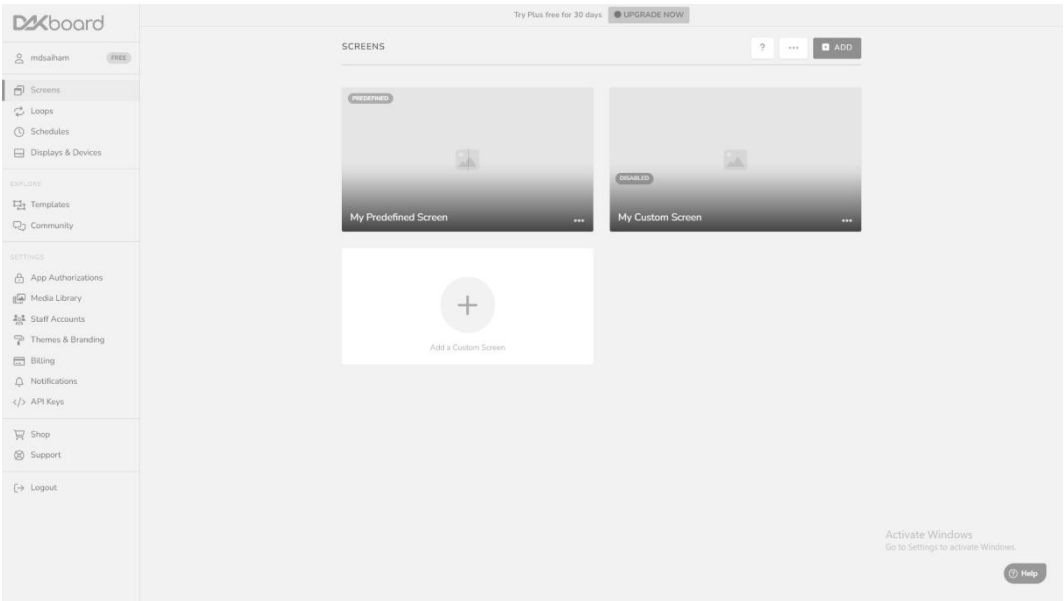

Figure 4.2.3: Web Application function

Index Page: The index page serves as the central dashboard where administrators can organize and customize the content displayed on the smart notice board. It provides an overview of the various sections and tools available for customization.
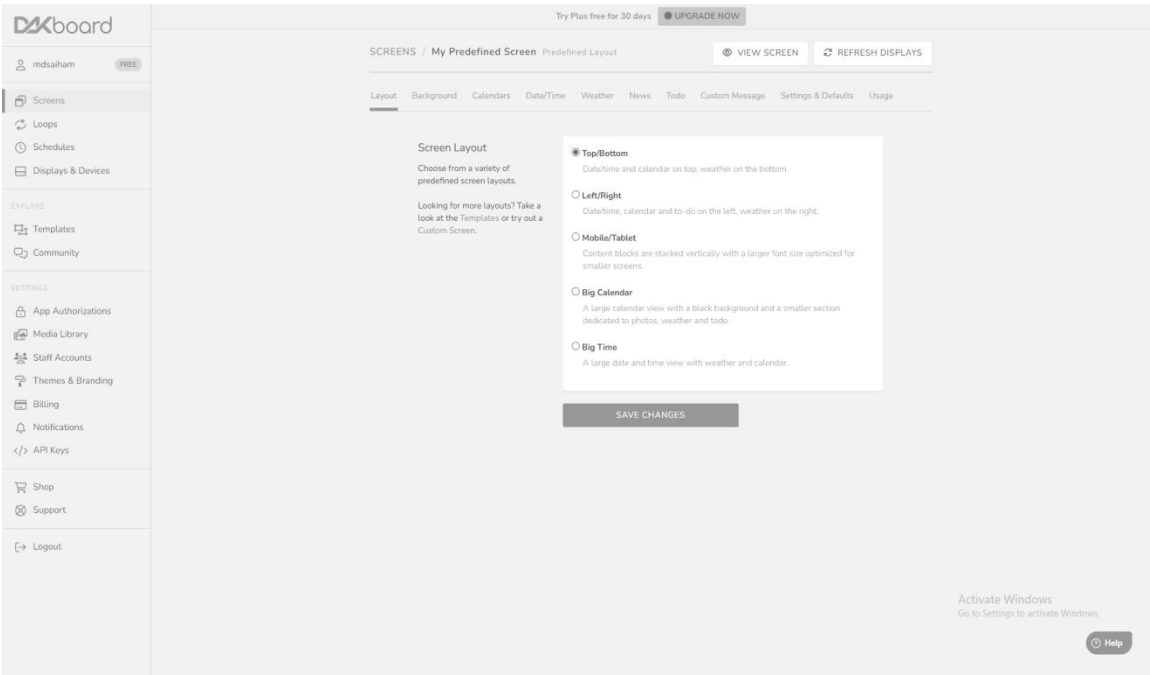

Figure 4.2.4: Index page function

Background: Administrators can choose background themes, colors, and layouts to customize the visual appearance of the notice board.
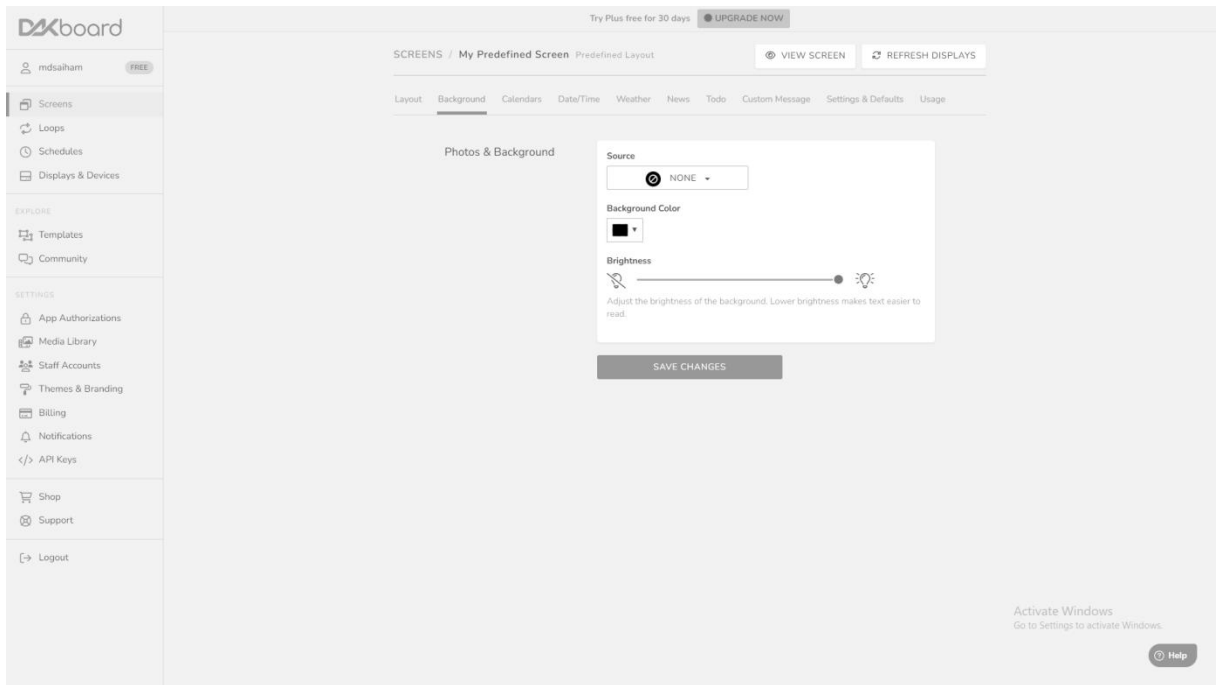

Figure 4.2.5: Background page function

Calendar: The calendar section enables the integration of event schedules and important dates for display.
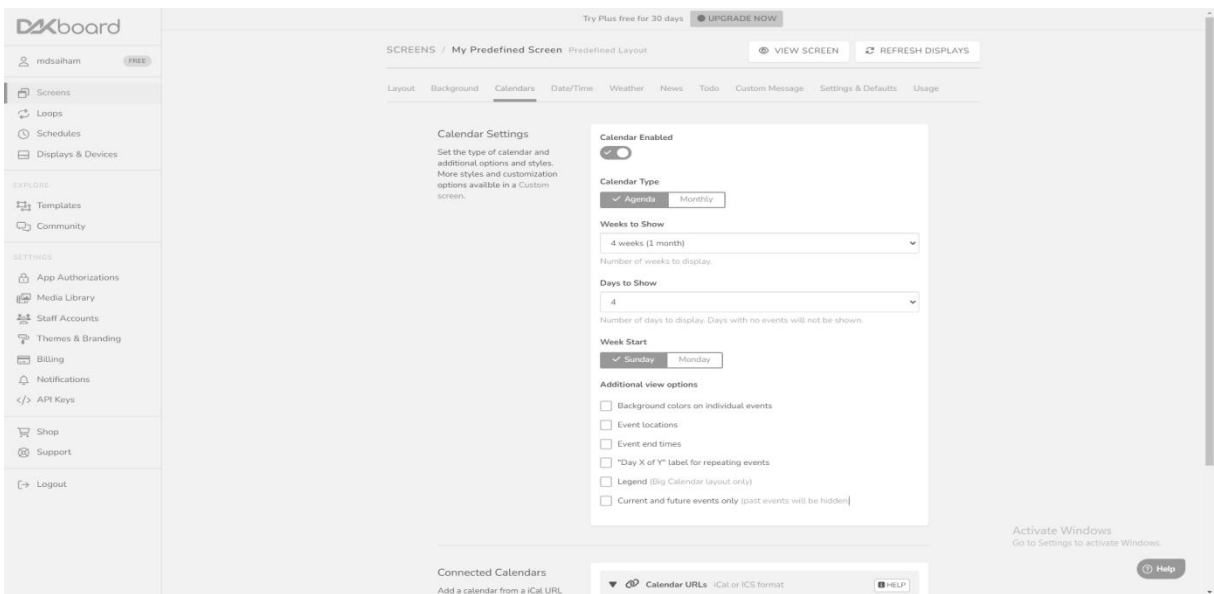

Figure 4.2.6: Calendar page

Date/Time: Administrators can customize the date and time format and settings, ensuring accurate timekeeping on the smart notice board.
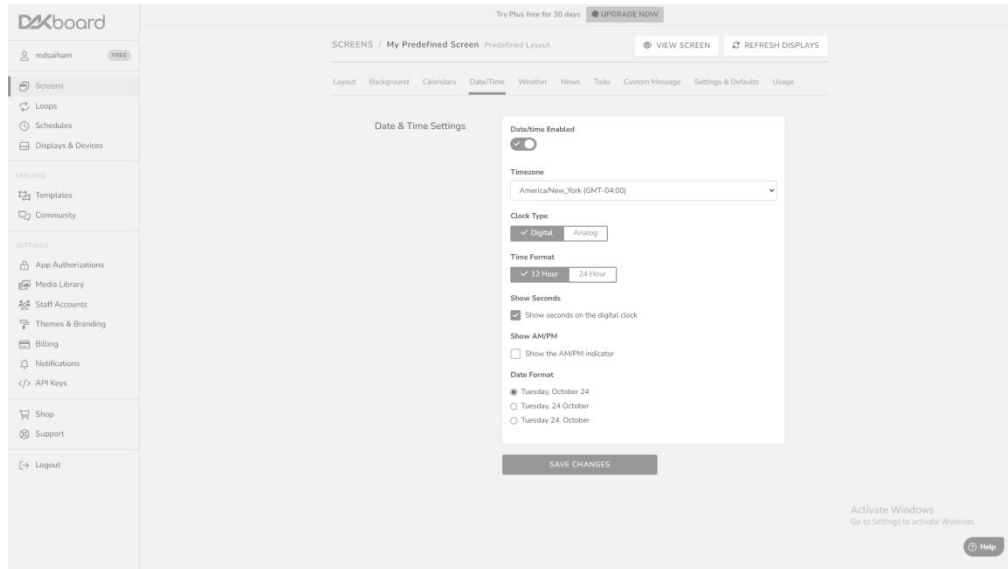

Figure 4.2.7: Date/Time function

Weather: This section displays real-time weather information, keeping users informed about current and upcoming weather conditions.
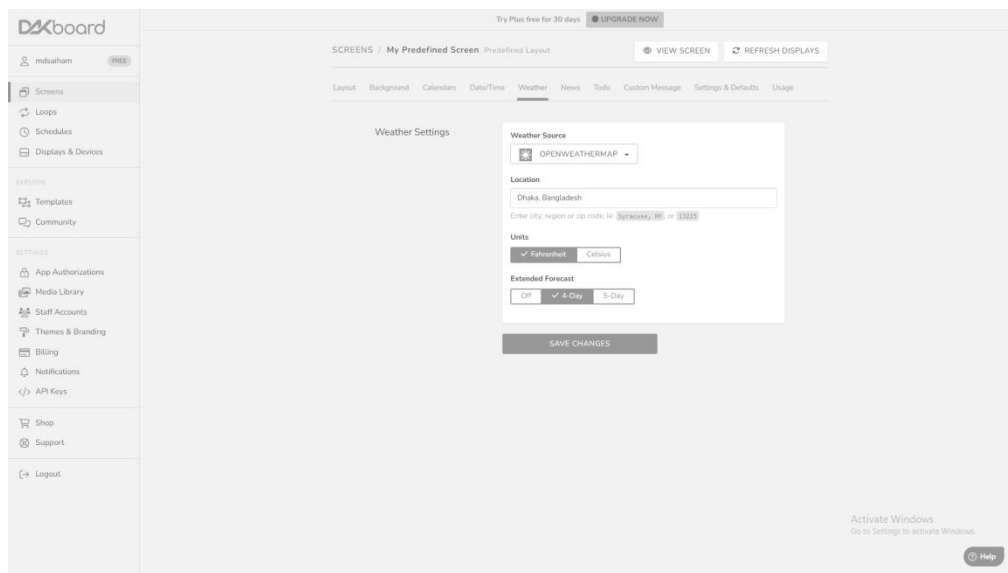

Figure 4.2.8: Weather function

News: Administrators can select and display news feeds or updates relevant to the audience, keeping them informed about the latest headlines.
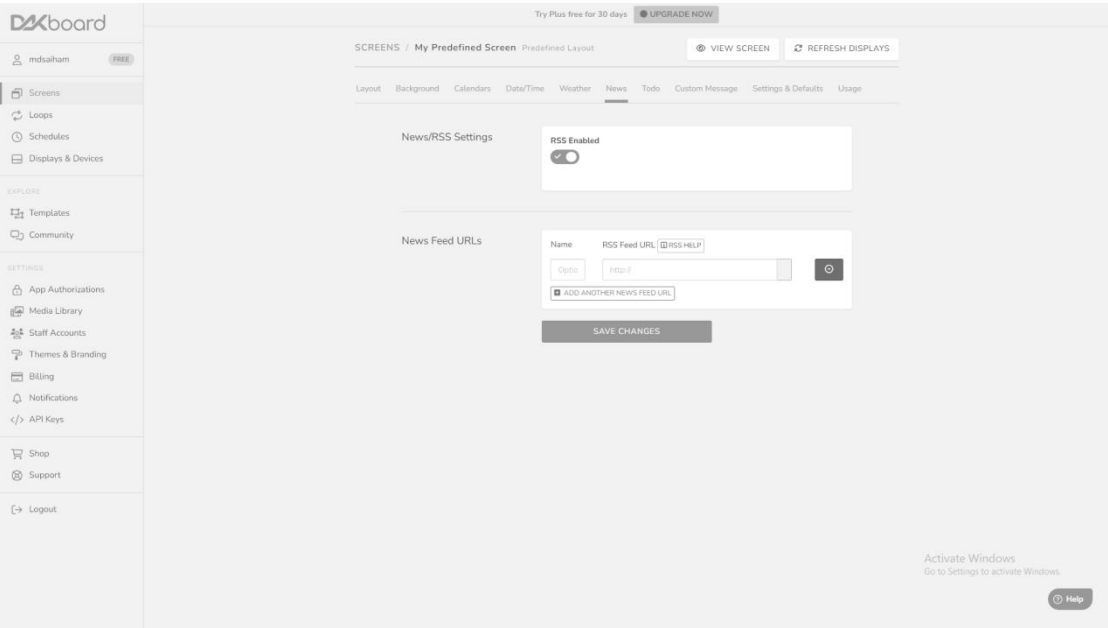

Figure 4.2.9: News page

To-Do: This section allows administrators to create and manage to-do lists and task reminders that can be displayed on the notice board.
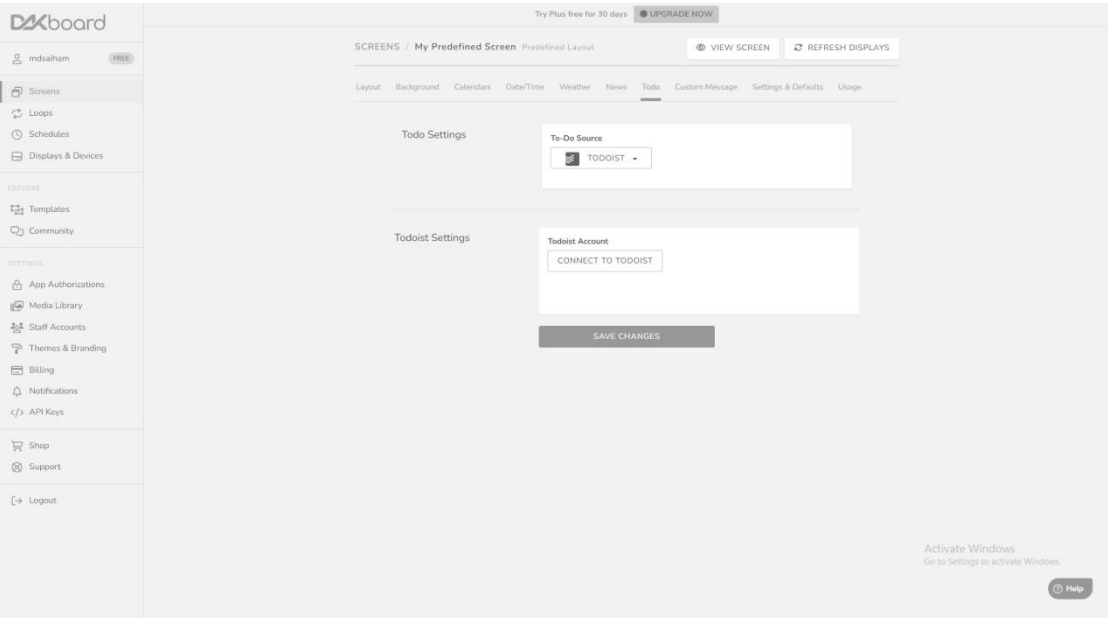

Figure 4.2.10 : To-Do function

In summary, the system design and implementation phases were executed with precision to create a smart notice board that not only meets the project's objectives but also focuses on user satisfaction, system efficiency, and security. This transformational project brings traditional notice boards into the digital age, offering real-time information dissemination and a user-friendly experience.

Chapter 5 :   Conclusion & Future Works

5.1 Conclusion

The "Design and Implementation of an IoT based Smart Notice Board" project represents a significant leap forward in modernizing traditional communication platforms, offering a dynamic and engaging solution for information dissemination and user interaction. This project, which combined innovative hardware and software components, aimed to provide an efficient, user-centric, and secure platform for administrators to manage and display content, and for end-users to access real-time information.

Through meticulous planning, design, and implementation, this project achieved its objectives and delivered an exceptional system. In conclusion, the "Design and Implementation of an IoT based Smart Notice Board" project is a testament to the power of technology to modernize and enhance traditional communication methods. It brings forth a digital platform that empowers administrators to efficiently manage content and engage end-users effectively. The successful implementation of this project demonstrates its potential to revolutionize information sharing in diverse settings, and it paves the way for continued innovation in the realm of digital signage and user interaction.

5.2 Future Works

We have made a "Design and Implementation of an IoT based Smart Notice Board". At first, we have chosen this specific topic because it has a lot of opportunities in the future. In the future, we will try to improve the user interface and make it more intuitive, interactive, and user-friendly. This could involve better touchscreen integration, more voice control features, and compatibility with mobile apps for seamless interaction. Expanding IoT (Internet of Things) integration to allow users to interact with and control other smart devices, such as home automation systems, thermostats, and security cameras. Adding more customization options for users to tailor the content and appearance of the notice board to their specific needs and preferences.

These future developments can help our smart notice board evolve and stay relevant in a rapidly changing technological landscape. Depending on the target users and the environment in which it's deployed, we can prioritize and tailor these enhancements to meet specific needs and expectations.

Thank you !

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