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Wi-Fi Bulletin Panel

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Abstract: This research pioneers an inventive digital communication solution through the development of a wireless notice board system. The primary aim is to enhance informationdissemination by employing cutting-edge technology. Utilizing the NodeMCU ESP8266 microcontroller, an LCD screen, and acustom Android application, this system allows users to remotely transmit messages for instant display on the notice board. This innovative approach transcends the limitations of conventional notice boards, offering real-time updates and fostering environmental sustainability by reducing the reliance on paper-based notices. By seamlessly integrating Wi-Fi technology, the proposed solution not only modernizes communication methods but also provides a user-friendly and efficient platform for conveying important information in various settings.

Index Terms **– Wireless Notice Board, Digital Communication, NodeMCU ESP8266, LCD Display, Wi-Fi Technology**

I. INTRODUCTION

In recent years, wireless technology has undergone a profound transformation, revolutionizing communication across various sectors. Among these advancements, wireless notice boards have emerged as versatile tools with extensive applications in education, healthcare, and organizational settings. Traditional notice boards, limited by fixed structures and manual processes, face challenges related to environmental impact and operational efficiency.

Addressing these challenges, wireless notice boards leverage advancements in wireless communication technologies to offer a sustainable solution that transcends global concerns associated with deforestation. By eliminating the need for physical paper notices and manual updates, these systems significantly reduce environmental footprints while optimizing communication processes.

The integration of wireless display technology with NodeMCU microcontrollers enables seamless access and updating of notices from any location, fostering convenience and environmental sustainability. Moreover, the adaptability of wireless notice boards to diverse environments ensures timely dissemination of crucial information, enhancing operational efficiency in educational institutions, healthcare facilities, and large organizations. Real-time updates on schedules and events can be efficiently communicated, thanks to the system's mobility and strategic positioning.

The reliability and programmability of NodeMCU allow for future enhancements and customization, ensuring a personalized communication experience tailored to specific organizational needs. This adaptability underscores the system's role as a cornerstone in ushering in a new era of technologically advanced and ecologically responsible communication platforms.

In conclusion, wireless notice boards represent a transformative shift towards eco-conscious efficiency in communication. Beyond their immediate benefits, they pave the way for continued advancements in smart communication technologies, aligning with contemporary sustainability initiatives and organizational needs.

II. LITERATURE SURVEY

[1] *Design of Electronic Bulletin* in this paper authored by Jianbo Zhang and Yin Qun introduces an electronic bulletin board system based on wireless sensors. The system utilizes existing GSM mobile base station coverage to establish communication. One of the primary features of the system isits ability to broadcast notice-information quickly through group messaging, allowing the public to access comprehensive information displayed on informationscreens.The system's core functions involve communication facilitated by the MAX232 interface between the microcontroller unit (MCU) and GSM modem. When a shortmessage is received,

requesting an update on data from a specific detection point, testing personnel can use their mobile phones to retrieve current data. This information is then sent back to the GSM modem, and the microcontroller interprets the message content using AT instructions. After processing the data, the MCU displays it on the LCD screen.In summary, the electronic bulletin board system presented in the paper combines wireless sensor technology with GSM infrastructure for efficient and timely dissemination of information to the public. The communication is established between the MCU and GSM modem, enabling data updates and display on an LCD screen.

[2] *MIT App Inventor: Objectives Design and Development*
The paper discusses MIT App Inventor, an online development platform designed to empower individuals to leverage smartphone capabilities for solving real-world problems. Authored by Evan W. Patoon, Mike Tissenbaum, and Farzeen Harunani, the paper provides an overview of MIT App Inventor, its design goals, and its impact on education. MIT App Inventor serves as a tool for learning computational thinking, allowing users to build mobile applications through a web-based WYSIWYG editor. The platform, based on a block-based programming language, hasbeen utilized by millions worldwide, with applications ranging from emergency services to robotics. The paper highlights the user interface, which includes design and blocks editors, along with the importance of fast iteration anddesign using the Companion app for real-time testing. The design goals of MIT App Inventor focus on introducingmobile app development in educational contexts, emphasizing component abstraction for platform behavior, and using blocks as a logical programming language. The paper delves into the concept of computational thinking and its integration into the educational strategy, including Massive Open Online Courses (MOOCs) and the Master Trainers Program. Extensions in MIT App Inventor allow users with programming experience to create custom components, and the platform has been applied in various research projects. The authors discuss the transition from theoretical to practical learning, emphasizing the importanceof computational action. Computational action involves creating artifacts with direct impact on students' lives and communities, fostering computational identity and digitalempowerment.The paper concludes by highlighting the App of the Month program, encouraging users to share their applications and recognizing their contributions. Overall, MIT App Inventor emerges as a powerful tool for democratizing technology, enabling individuals worldwide to engage in computational action and create meaningful solutions to real-world challenges.

[3] *Design and Realization of Node MCU Module Based on NB-IoT for General IoT Purpose* :The research paper discusses the design and implementation of an NB-IoT module integrated with a microcontroller unit (MCU) for general IoT purposes. The motivation for this research is to address the complexities associated with stand-alone NB-IoTmodules or shields that require additional Arduino boards, leading to complicated wiring and potential errors. The goal is to create a more practical and integrated solution similar tothe NodeMCU module. The methodology involves using the capstone design approach, incorporating PCB design, and implementing embedded systems for low-power devices. Theprototype NB-IoT module is tested for specifications, revealing that it can operate for 5 days with a 10,000mAh battery, considering a work cycle of 0.0575%. The spectrumprofile analysis indicates an average transmission power magnitude of -15.804dBm and an average bandwidth of 103.07 kHz at a frequency of 905.1 MHz.The paper contextualizes the research within the growing demand for IoT solutions in the industrial sector to meet the requirementsof Industry 4.0. With millions of devices predicted to be connected to IoT in the next decade, LPWA (Low Power Wide Area) technologies, including NB-IoT, are considered crucial. The emphasis is on the importance of LPWA technologies in addressing factors such as extensive coverage, long battery life, and minimal installation costs.

[4] *Design of Real Time Internet of Things monitoring platform based on cloud* : The paper authored by Shengjie Wang and Hairong Yan, titled "Cloud Platform-Based IoT Monitoring System Solution," addresses the challenges associated with traditional IoT web server communication platforms, such as high resource consumption, long responsetimes, and poor real-time information transmission. The authors propose a solution leveraging the advantages of cloudplatforms in terms of security, stability, and super-computingcapabilities. The system utilizes the MQTT protocol for compatibility with various devices, enabling remote control and data collection of IoT devices.A real-time push solution based on Redis and WebSocket is implemented to visualize collected IoT device data using the E-Chart plug-in. The paper outlines the framework's architecture and addresses challenges related to data communication, device concurrency, and the real-time nature of IoT data. The proposed solution is evaluated for real-time performance andreliability based on experimental data from a use case scenario. The system is highlighted for its simplicity, compatibility with both Windows and Linux platforms, and its ability to meet the monitoring system needs of the Internetof Things. Published in the 2020 IEEE 5th Information Technology and Mechatronics Engineering Conference (ITOEC), the research contributes to the evolving landscape of IoT deployment and management.

III. PROPOSED METHODOLOGY

System Overview: The wireless notice board system envisionsa shift from conventional paper-based notice boards to a digital platform, leveraging technologies like Wi-Fi, smartphones, and computers. The primary objective is to streamline information dissemination within educational andorganizational settings.

Hardware Components: The system incorporates NodeMCUas the central processing unit, integrating a Wi-Fi module forwireless communication. Visual representation is achieved through the inclusion of a Liquid Crystal Display (LCD) or Light Emitting Diode (LED) screen, ensuring compatibility with Android smartphones and computers.

Software Components: Implementation involves the development of a custom Android application, enabling usersto wirelessly send messages to the notice board. Additionally,a web-based interface accessible from computers is implemented, utilizing embedded programming languagessuch as Arduino IDE. Data communication and storage are facilitated through ThingSpeak or a similar platform.

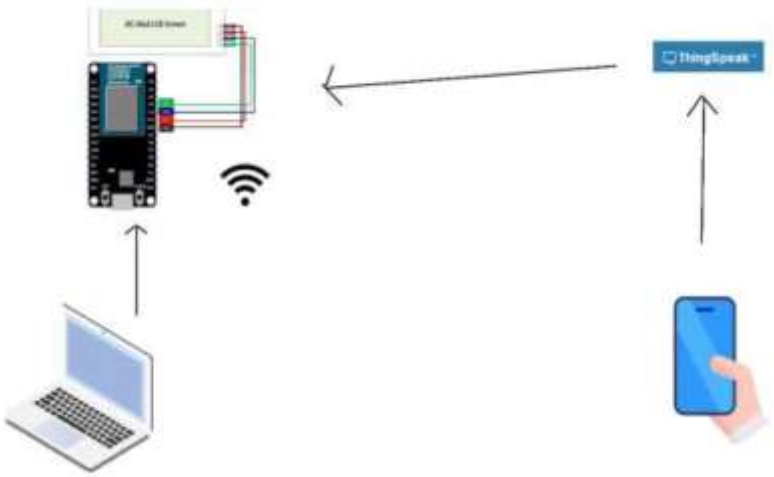

Fig.3.1 Pictorial Representation

Communication Protocol: The establishment of a secure Wi-Fi connection between the microcontroller and the notice board display is crucial. A dedicated protocol is developed tofacilitate message transmission from both the Android application and computers, ensuring seamless two-way communication for real-time updates.

Message Formatting and Encoding: To maintain consistency,a standardized message format is adopted for display. Encoding mechanisms are implemented to handle special characters, ensuring message integrity during transmission.

Fig.3.2 Screenshots from the app

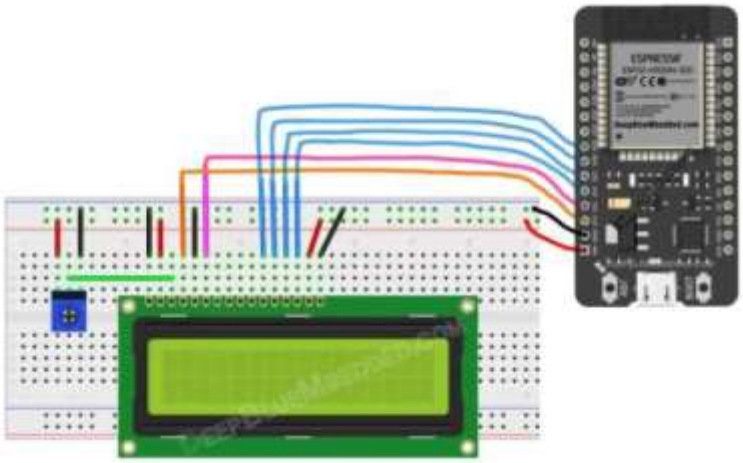

Fig.3.3 Structure

IV. FLOW CHART

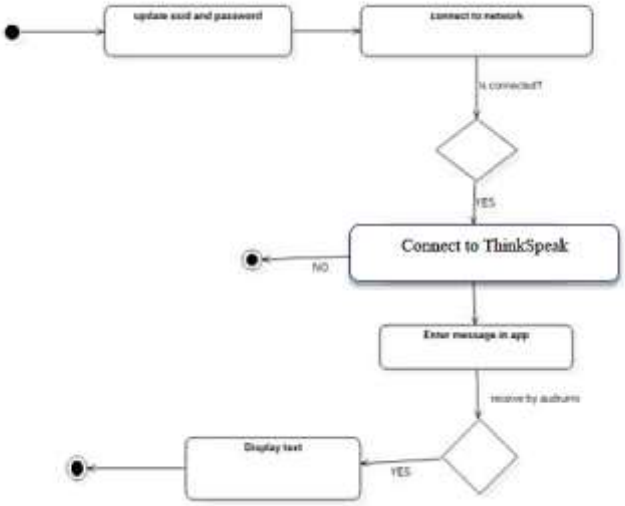

Fig.4.1 Flow chart

V. IMPLEMENTATION

Microcontroller Programming (Implementation): The microcontroller, NodeMCU, is configured to receive messages via Wi-Fi and update the display accordingly. Error-checking mechanisms are integrated to validate received data, and the microcontroller is programmed toretrieve messages from ThingSpeak or the designated web- based interface.

*Android Application Development (Implementation):*Implementation involves the design of an intuitive Android application that allows users to compose and send messages wirelessly. User authentication is implemented for added security, and Wi-Fi connectivity is utilized to establish a connection with the microcontroller.

Web-based Interface (Implementation): A web-basedinterface accessible from computers is developed to enable message sending. Compatibility with popular web browsers is ensured for seamless user interaction.

Data Storage and Retrieval (Implementation): The system utilizes ThingSpeak or a similar cloud platform for storing messages. Mechanisms are implemented to retrieve messagesfrom the cloud and display them on the notice board.

Testing and Iteration (Implementation): Comprehensive testing is conducted to assess Wi-Fi connectivity, message transmission, and display updates. Design and functionality are iterated based on user feedback and performance evaluations.

User Training and Documentation (Implementation): Users are provided with training for utilizing the Android application, web-based interface, and understanding the wireless notice board's functionalities. Comprehensive documentation is developed for troubleshooting and system maintenance.

Scalability Considerations: The system is designed with scalability in mind, accommodating future enhancements likelarger LED displays or additional functionalities. Compatibility with emerging technologies and communication standards is ensured.

VI. SYSTEM ARCHITECTURE

The system architecture of the Wi-Fi Bulletin Panel is a well-integrated framework designed to offer a seamless and efficient communication solution. Here's a detailed elaboration:

1. Wi-Fi Bulletin Panel:

The central component of the system, the Wi-Fi Bulletin Panel, is equipped with the capability of establishing successful connectivity to a Wi-Fi network. This wireless connection ensures flexibility and eliminates the need for physical cables, contributing to a cleaner and more organizedvisual landscape.

2. Android Application:

Serving as the user-friendly interface, the Android application plays a pivotal role in enabling users to interact with the Wi-Fi Bulletin Panel. Through the application, users can compose and send messages remotely to be displayed on the panel. This feature enhances the accessibility and convenience of information dissemination, allowing users to update notices from various locations.

3. ThingSpeak Cloud-Based Database:

ThingSpeak acts as the centralized cloud-based database within the system. It is responsible for storing and managingthe messages sent by users through the Android application. This cloud-centric approach provides advantages such asreal-time data storage, easy retrieval, and accessibility. ThingSpeak serves as the intermediary hub for communication between the Android application and the NodeMCU, ensuring a reliable and centralized repository formessages.

4. NodeMCU:

The NodeMCU, an integral hardware component, plays a crucial role in the communication flow. It retrieves messagesfrom the ThingSpeak cloud-based database, establishing a two-way interaction. Through a well-defined .set request, theNodeMCU ensures synchronized communication, accessing the stored messages in real-time. This retrieval process is essential for updating and displaying the messages on the physical bulletin board.

5. Real-Time Display on Physical Bulletin Board:

The ultimate output of the system is the real-time display of messages on the physical bulletin board. The NodeMCU, upon retrieving messages from ThingSpeak, updates the display accordingly. This ensures that the information presented on the bulletin board remains current and relevant. The real-time display feature enhances the responsiveness and dynamic nature of the communication platform. The real-time display feature enhances the responsiveness and dynamic nature of the communication platform.

6. Collaborative Framework:

The collaborative framework signifies the harmoniousintegration of both software and hardware components withinthe system. This synergy enables a transformative communication solution that leverages modern technologies.By seamlessly connecting the Android application, cloud- based database, and hardware components like NodeMCU, the system achieves a comprehensive and user-centric approach to notice board management.

7. Transformative Potential of Modern Technologies:

The integration of software and hardware components showcases the transformative potential of modern technologies in communication solutions. The elimination ofphysical wires, the use of a cloud-based database, and the real-time display feature collectively represent a shift towardsmore efficient, dynamic, and technologically advanced communication platforms. This forward-looking approachaligns with contemporary trends in smart systems and IoT applications, emphasizing sustainability, user-friendliness, and real-time responsiveness.

VII. FUTURE SCOPE

The envisioned future trends and advancements for the Wi-FiBulletin Board project represent a strategic and forward-thinking approach to ensure the system's continued relevanceand effectiveness. Here's an elaboration on the key aspects:

1. Larger Panel for Expanded Visual Impact**:**

The decision to enhance the system by making the panel considerably larger reflects a commitment to providing an even more impactful communication platform. A larger panel accommodates a greater volume of information, making it well-suited for environments where extensive or detailedmessages need to be conveyed. This aligns with emerging trends in digital displays, emphasizing scalability and increased visibility. The larger panel not only enhances the visual impact but also offers more flexibility in presenting diverse types of information on the notice board.

2. Scalability and Visibility in Digital Displays:

The choice to align with emerging trends in digital displays emphasizes the importance of scalability and visibility. Scalability ensures that the system can handle an increased load of information, catering to the potential growth in user requirements. Improved visibility contributes to the effectiveness of communication by making the displayedcontent more easily accessible and readable. These considerations position the Wi-Fi Bulletin Board as a modernand adaptable solution in the evolving landscape of digital communication platforms.

3. Smooth Transition and Minimal Disruptions**:**

The emphasis on compatibility serves to facilitate a smooth transition for users, ensuring that they can seamlessly adapt to the upgraded system. By minimizing disruptions during thesystem's evolution, the project team aims to maintain user satisfaction and engagement. This approach recognizes that user acceptance is integral to the success of any systemupgrade, and a well-managed transition contributes to the overall effectiveness of the Wi-Fi Bulletin Board.

VIII. RESULTS AND DISCUSSIONS

The project's current status signifies a notable progression in its development, marked by distinct achievements and identified challenges:

1. Successful Wi-Fi Connectivity with NodeMCU:

The NodeMCU has demonstrated successful connectivity to the designated Wi-Fi network, affirming the effectiveness of the implemented code. This accomplishment highlights the meticulous coding efforts and configuration settings, ensuring a robust and reliable connection between the NodeMCU and the Wi-Fi infrastructure.

2. Efficient Data Transmission to ThinkSpeak Server:

The ThingSpeak server has proven to be responsive, consistently receiving data transmitted from the Android application. This validation underscores the functionality of the API integration within the system. The seamless data transfer from the Android app to the ThingSpeak servershowcases the efficacy of the established communication protocol, affirming the project's capability to handle andmanage data in a cloud-based environment.

3. Successful Integration of LCD Display with NodeMCU:

A successful resolution to the LCD-NodeMCU connection issue has been achieved, enabling the effective display of data on the Liquid Crystal Display (LCD) screen. Through thorough investigation and troubleshooting, including examination of physical connections and refinement of coding logic, the integration between the NodeMCU microcontroller and the LCD has been optimized.

As a result, the wireless notice board system now reliably showcases messages and information on the LCD screen. This achievement underscores the importance of iterative hardware development, where persistent debugging and refinement lead to enhanced functionality.With the data now seamlessly displayed on the LCD, the project's objectives of providing timely and visible information

to users are met, ensuring the system's effectiveness in conveying messages and notifications. This successful outcome demonstrates the project team's dedication to overcoming challenges and achieving optimal performance in hardware integration.

Fig 8.1: Implementation

IX. CONCLUSION

The Wi-Fi Bulletin Board has exhibited commendable functionality, showcasing effective integration with the designated servers. Notably, the system has demonstrated itsability to record and store accurate data records, including timestamps and dates of messages sent. This observation underscores the project's success in establishing reliable communication channels between the various components, such as the Android application, ThingSpeak server, and NodeMCU. The recorded data not only serves as a testamentto the system's operational prowess but also lays the foundation for future analytics and performance evaluation.

The robust performance of the Wi-Fi Bulletin Board in termsof data recording instills confidence in its operational reliability. The successful handling of time and date records adds a layer of sophistication to the system, enhancing its utility for users who may require historical tracking of message dissemination. Overall, the observed effectiveness of the system establishes a strong foundation for its continueddevelopment and potential deployment in real-world scenarios.

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