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DEVELOPMENT OF AN IOT ENABLED WIRELESS SMART NOTICE BOARD USING NODEMCU

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ABSTRACT

Development of an IoT Enabled Wireless Smart Notice Board Using NodeMCU presents a modern communication solution designed to replace traditional paper-based notice boards with a real-time, internet-connected digital display system. The system is built around the NodeMCU (ESP8266) microcontroller, which provides integrated Wi-Fi capability for seamless wireless communication. A web-based interface or cloud server is used to input text messages remotely, which are then transmitted over the internet to the NodeMCU. Acting as an HTTP client, the microcontroller fetches the updated message and displays it instantly on a 16x2 or 20x4 I2C LCD screen using the I2C communication protocol. The use of I2C significantly reduces wiring complexity and enhances system efficiency. This architecture enables rapid information dissemination without requiring physical access to the display unit. The system offers low cost, low power consumption, scalability, and ease of deployment, making it suitable for educational institutions, offices, hospitals, and public transport systems. Experimental results demonstrate reliable Wi-Fi connectivity and minimal latency in message updates. Overall, the project provides an eco-friendly, paperless, and efficient solution for digital communication using IoT technology.

Keywords: IoT, Smart Notice Board, NodeMCU, ESP8266, Wireless Communication, I2C LCD, HTTP Client, Web Interface, Real-Time Display, Embedded Systems.

I.INTRODUCTION

The project focuses on creating a modern digital communication system that replaces traditional manual notice boards with a real-time wireless display platform. In today's fast-paced digital world, the need for instant information sharing has become essential in educational institutions, offices, hospitals, and public transportation systems. Conventional notice boards require physical presence to update information, which consumes time, effort, and resources such as paper and printing materials. This project addresses these limitations by integrating Internet of Things (IoT) technology with embedded systems to enable remote updating of messages. The NodeMCU (ESP8266) microcontroller serves as the core processing unit, providing built-in Wi-Fi connectivity for internet-based communication. By accessing a web interface or cloud server, users can send messages from any location, and the system displays them instantly on an LCD screen. The wireless nature of the system eliminates complex wiring between the sender and display unit. Furthermore, the project promotes eco-friendly communication by reducing paper usage. With low cost, compact size, and energy efficiency, the proposed system demonstrates how IoT can enhance real-time communication and modernize traditional display methods while maintaining simplicity and reliability.

The IoT Smart Notice Board system consists of three main functional layers: the user interface layer, the communication layer, and the display layer. The user interface layer includes a web-based portal or mobile application where the administrator enters the message to be displayed. Once submitted, the message is stored on a local server or cloud platform. The communication layer is handled by the NodeMCU (ESP8266), which connects to a Wi-Fi network using programmed credentials. Acting as an HTTP client, the NodeMCU periodically sends a GET request to the specified server or IP address to fetch the latest message. After receiving the response, the microcontroller processes and extracts the relevant text data. The display layer consists of a 16x2 or 20x4 LCD connected via the I2C protocol. The I2C interface reduces the number of required wires to just SDA and SCL lines, simplifying hardware connections. The processed message is transmitted from the NodeMCU to the LCD using this communication protocol. If the text exceeds the display width, scrolling functionality is implemented to ensure full visibility. This structured architecture ensures reliable wireless data transmission, efficient processing, and clear message visualization, making the system suitable for real-time notice broadcasting.

The primary objective of this project is to design and implement a wireless smart notice board that can be updated remotely using IoT technology. Another major objective is to develop a user-friendly web interface that allows authorized users to send announcements quickly and efficiently. The project also aims to utilize the built-in Wi-Fi capabilities of the NodeMCU to fetch real-time data from a cloud or local server without requiring additional communication modules. By incorporating the I2C communication protocol, the system minimizes wiring complexity and enhances hardware efficiency.

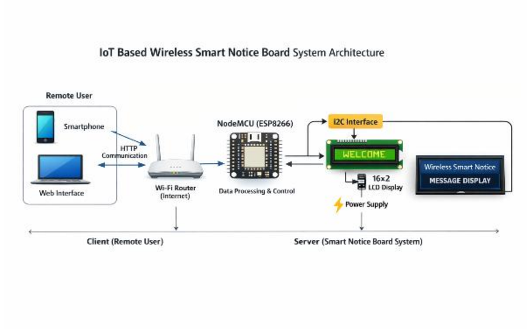

Fig 1: sytem model

As fig 1 the significance of this project lies in its ability to provide instant communication while reducing manual labor and operational costs. It offers an eco-friendly alternative to traditional paper-based notice boards and ensures that important information reaches the target audience without delay. Additionally, the modular design allows for future upgrades such as multi-language support, voice-to-text integration, GSM backup for network failure, and graphical display expansion using LED matrices or TFT screens. Overall, the project demonstrates a practical implementation of IoT principles in embedded systems, contributing to smarter and more efficient communication infrastructure.

II.LITERATURE REVIEW

1. IoT-Based Smart Communication Systems

The rapid evolution of the Internet of Things (IoT) has significantly transformed communication systems by enabling real-time data exchange between devices over the internet. Several researchers have proposed IoT-based digital display systems to replace traditional manual notice boards. Early implementations utilized GSM modules to send SMS-based updates to microcontroller-driven displays. Although effective, GSM systems incurred operational costs and were limited in scalability. With the advancement of Wi-Fi-enabled microcontrollers such as the ESP8266, modern systems now support internet-based message transmission, reducing dependency on cellular networks. Studies highlight that IoT-enabled communication platforms enhance efficiency, reduce human intervention, and enable centralized control. These systems are particularly useful in educational institutions and corporate environments where frequent information updates are required. The literature strongly supports the use of Wi-Fi-based IoT architectures for smart notice boards due to their cost-effectiveness and flexibility.

2. ESP8266 and NodeMCU in IoT Applications

The ESP8266 microcontroller has emerged as a popular choice for IoT-based embedded applications due to its integrated Wi-Fi capabilities and low cost. Research indicates that NodeMCU, built around the ESP8266, simplifies IoT development by providing compatibility with the Arduino IDE and supporting multiple communication protocols such as HTTP, MQTT, and WebSockets. Compared to traditional Arduino boards that require external Wi-Fi modules, the ESP8266 offers improved processing speed (80–160 MHz), higher flash memory capacity, and built-in TCP/IP stack support. Several studies demonstrate its successful application in home automation, smart monitoring systems, and wireless data logging. These findings validate the selection of NodeMCU for developing an IoT-enabled smart notice board, as it ensures reliable wireless connectivity and efficient data processing.

3. Wireless Digital Display Systems

Wireless digital display systems have gained attention for applications such as public announcements, transportation schedules, and institutional notifications. Earlier research focused on RF and Bluetooth-based communication for short-range data transmission. However, these systems were limited by range constraints and interference issues. Recent literature emphasizes the adoption of internet-based communication models using HTTP or MQTT protocols, which allow global accessibility and real-time updates. Studies also compare LED matrix displays and LCD modules, highlighting that LCDs offer low power consumption and cost efficiency for small-scale applications. The use of I2C communication further simplifies hardware design by reducing pin usage. These advancements directly support the development of an IoT-enabled smart notice board using an I2C LCD display for efficient message visualization.

4. Client-Server Architecture in IoT Systems

Client-server communication is a fundamental architecture in IoT systems. Research studies explain that microcontrollers such as the ESP8266 can function either as a server (hosting a web page) or as a client (fetching data from a cloud server). HTTP-based communication is widely adopted due to its simplicity and compatibility with web technologies. Some studies suggest MQTT as an alternative protocol for lightweight message transmission in IoT applications. Performance analysis in various research works shows that Wi-Fi-based IoT systems can achieve low latency and reliable message delivery under stable network conditions. These findings confirm that the HTTP client-server model implemented in the smart notice board project is suitable for real-time wireless communication.

5. Security and Future Trends in IoT Display Systems

Security remains a critical aspect of IoT-based communication systems. Research highlights potential vulnerabilities such as unauthorized access, unsecured HTTP communication, and network breaches. To mitigate these risks, modern IoT systems incorporate encryption protocols (SSL/TLS), authentication mechanisms, and secure cloud platforms. Emerging trends include integration with cloud databases, mobile applications, and voice-controlled interfaces. Studies also explore multi-language display support and graphical interfaces using TFT or LED matrix displays for enhanced user experience. The literature suggests that IoT display systems are evolving toward intelligent, scalable, and cloud-managed infrastructures. These advancements indicate that the proposed IoT-enabled smart notice board can be further enhanced with secure communication protocols, cloud storage, and advanced display technologies in future implementations.

III.WORKING METHODOLOGY

The working methodology of the Development of an IoT Enabled Wireless Smart Notice Board using NodeMCU is based on a structured wireless communication framework that integrates embedded processing, Wi-Fi networking, and digital display control. When the system is powered ON, the NodeMCU (ESP8266) initializes all essential hardware modules including GPIO pins, serial communication, Wi-Fi interface, and the I2C protocol used for LCD communication. The LCD display is initialized using the appropriate I2C library, and a default startup message such as

"Smart Notice Board Ready" is displayed to confirm proper system operation. During this stage, the SDA and SCL pins are configured (commonly D2 and D1), ensuring proper communication between the microcontroller and the LCD module. Since the NodeMCU operates on 3.3V logic, proper voltage regulation ensures stable and safe functioning of the display and other connected components.

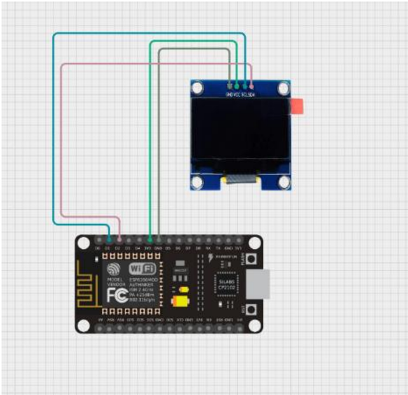

fig 2:Interfacing diagram

As fig2 After hardware initialization, the NodeMCU attempts to connect to a predefined Wi-Fi network using stored SSID and password credentials. The connection process continues until the device successfully connects and receives an IP address from the router. Once connected, the NodeMCU operates either as an HTTP client fetching data from a remote cloud server or as a local web server hosting a webpage for message input. In client mode, the system periodically sends HTTP GET requests to retrieve updated notice messages from a designated server. In server mode, users can directly access the NodeMCU's IP address through a web browser and input messages. The system continuously monitors Wi-Fi connectivity and automatically reconnects if the network connection is lost, ensuring uninterrupted service.

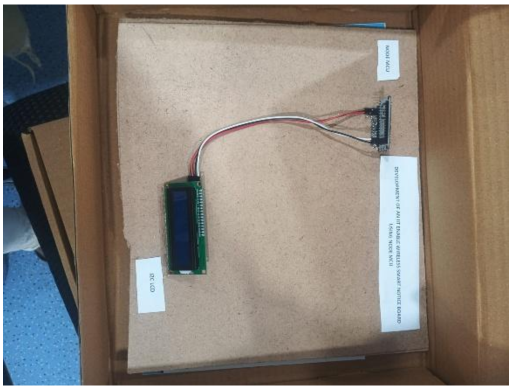

FIG 3: Hardware implementation/

As fig 3 Upon receiving the notice data from the server, the NodeMCU processes the incoming response by extracting the actual message content and removing unnecessary HTTP headers or formatting elements. The message is then formatted according to the LCD display capacity. If the text exceeds the screen width, scrolling logic is implemented to shift characters horizontally across the display. Finally, the processed message is transmitted to the LCD via the I2C communication protocol and displayed in real time. The system continuously repeats the cycle of fetching, processing, and updating, ensuring that the notice board always reflects the most recent information with minimal delay.

IV.CONCLUSION

The Development of an IoT Enabled Wireless Smart Notice Board using NodeMCU successfully demonstrates the integration of embedded systems and Internet of Things (IoT) technology for real-time digital communication. The project replaces traditional paper-based notice boards with a wireless, remotely accessible, and energy-efficient digital display system. By utilizing the NodeMCU (ESP8266) microcontroller and I2C-based LCD module, the system enables seamless transmission of messages over Wi-Fi using HTTP protocols. The client–server communication model ensures that notices can be updated instantly from any remote location, reducing manual effort and paper consumption. The implementation proves to be cost-effective, scalable, and easy to deploy in educational institutions, offices, hospitals, and public spaces. Furthermore, the system demonstrates reliable performance with low latency and stable connectivity. Future enhancements such as cloud database integration, multi-language support, GSM backup, and graphical LED displays can further increase its functionality and adaptability. Overall, the project highlights the practical application of IoT in modern communication systems and serves as a foundation for advanced smart display solutions in smart city infrastructure.

V.REFERENCES

[1] A. Nayyar and V. Puri, “Smart Notice Board Using Wi-Fi, Bluetooth and Zigbee,” International Journal of Advanced Research in Computer Science, vol. 7, no. 3, pp. 1–6, 2016.

[2] Espressif Systems, “ESP8266EX Datasheet,” Espressif Systems, Shanghai, China, 2023.

[3] Arduino, “ESP8266 Arduino Core Documentation,” Arduino Official Documentation, 2023.

[4] S. Monk, Programming Arduino: Getting Started with Sketches, 2nd ed. New York, NY, USA: McGraw-Hill, 2017.

[5] D. Norris, Internet of Things with ESP8266, Birmingham, U.K.: Packt Publishing, 2018.

[6] C. Bell, Beginning Sensor Networks with Arduino and Raspberry Pi, Berkeley, CA, USA: Apress, 2014.

[7] M. Schwartz, Internet of Things with the Arduino Yun, Birmingham, U.K.: Packt Publishing, 2014.

[8] I. F. Akyildiz and M. C. Vuran, Wireless Sensor Networks, Hoboken, NJ, USA: Wiley, 2010.

[9] H. Kopetz, Real-Time Systems: Design Principles for Distributed Embedded Applications, 2nd ed. Boston, MA, USA: Springer, 2011.

[10] L. Da Xu, W. He, and S. Li, “Internet of Things in Industries: A Survey,” IEEE Transactions on Industrial Informatics, vol. 10, no. 4, pp. 2233–2243, Nov. 2014.

[11] M. Margolis, Arduino Cookbook, 3rd ed. Sebastopol, CA, USA: O’Reilly Media, 2020.

[12] J. Blum, Exploring Arduino, Indianapolis, IN, USA: Wiley, 2013.

[13] LiquidCrystal_I2C Library Documentation, "I2C LCD Interface Guide," GitHub Repository, 2022.
[14] A. Al-Fuqaha et al., "Internet of Things: A Survey on Enabling Technologies, Protocols, and Applications," IEEE Communications Surveys & Tutorials, vol. 17, no. 4, pp. 2347–2376, 2015.
[15] R. Want, B. N. Schilit, and S. Jenson, "Enabling the Internet of Things," Computer, vol. 48, no. 1, pp. 28–35, Jan. 2015.
[16] O. Hersent, D. Boswarthick, and O. Elloumi, The Internet of Things: Key Applications and Protocols, 2nd ed. Hoboken, NJ, USA: Wiley, 2012.
[17] S. Madakam, R. Ramaswamy, and S. Tripathi, "Internet of Things (IoT): A Literature Review," Journal of Computer and Communications, vol. 3, no. 5, pp. 164–173, 2015.
[18] IEEE Standards Association, "IEEE Standard for Local and Metropolitan Area Networks," IEEE Std 802.11, 2020.
[19] T. Erl, Internet of Things: From Hype to Reality, Upper Saddle River, NJ, USA: Prentice Hall, 2018.
[20] P. Sethi and S. R. Sarangi, "Internet of Things: Architectures, Protocols, and Applications," Journal of Electrical and Computer Engineering, vol. 2017, pp. 1–25, 2017.
[21] K. Ashton, "That 'Internet of Things' Thing," RFID Journal, vol. 22, no. 7, pp. 97–114, 2009.
[22] M. Collotta and G. Pau, "A Solution Based on Bluetooth Low Energy for Smart Home Automation," IEEE Internet of Things Journal, vol. 2, no. 4, pp. 310–318, 2015.
[23] A. Whitmore, A. Agarwal, and L. Da Xu, "The Internet of Things—A Survey of Topics and Trends," Information Systems Frontiers, vol. 17, no. 2, pp. 261–274, 2015.
[24] J. Banks and D. Gupta, "MQTT Version 3.1.1," OASIS Standard, 2014.
[25] B. Galloway and G. P. Hancke, "Introduction to Industrial Control Networks," IEEE Communications Surveys & Tutorials, vol. 15, no. 2, pp. 860–880, 2013.