PORTABLE OUTDOOR DIGITAL BOARD USING IOT

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Abstract: This paper presents the is a smart, Compact display system for Outdoor Use. It replaces traditional signs with dynamic, remotely changeable content. A Raspberry Pi Powers the system and connects to the screen via HDMI. It runs on Raspberry Pi OS, supporting easy content management. A Slideshow App displays rotating images or messages. Users can update content wirelessly from anywhere. It's ideal for AD's Public Info or Event Updates in places like Schools, Colleges, Markets and Shopping Malls. It is very Cost-Effective, Energy-Efficient and easy to use in Outdoors. This IoT-based digital board is cost- effective, energy efficient, and highly adaptable for various outdoor use-cases such as educational campuses, transport hubs, marketplaces, and public gatherings. The compact design and remote operability make it a practical solution for modern digital signage needs

Key Words: Raspberry Pi, HDMI, digital board, LCD

1. Introduction:

In today's fast-paced world, the need for dynamic, real-time communication has significantly increased, especially in outdoor public spaces. Traditional static boards and printed posters are often limited by their inability to update information quickly and cost-effectively. To address this challenge, the Portable Outdoor Digital Board Using IoT offers an innovative solution that combines portability, digital display technology, and the Internet of Things (IoT) to create a modern, efficient, and interactive communication platform. This system is built using a Raspberry Pi, a compact yet powerful single board computer that acts as the control unit. It connects to a display screen through an HDMI cable and is powered by a standard power adapter, ensuring mobility and ease of installation in outdoor environments. The device runs on the Raspberry Pi OS, a lightweight and flexible operating system that supports various multimedia applications. One such application is a slide show software, which enables automated display of images or messages in a continuous loop.

In modern public communication, there's a growing need for real-time, flexible, and cost-effective messaging, especially in outdoor environments. Traditional methods like printed posters or static boards are limited in their ability to update quickly and require manual labor for each change. The Portable Outdoor Digital Board Using IoT is a smart, modern solution that addresses these limitations by integrating digital display technology, portability, and IoT connectivity. By utilizing IoT connectivity, the content on the digital board can be updated remotely, eliminating the need for manual intervention and physical replacements. This makes it ideal for applications such as public announcements, advertisements, event notifications, and real-time alerts. The compact and weather-friendly design ensures it can be deployed in various locations like schools, markets, parks, or transport stations, making communication more efficient, engaging, and smart.

2. **Literature Survey:** The concept of digital signage has evolved significantly over the past decade, transitioning from bulky, standalone systems to smart, IoT-enabled solutions. This project leverages low-cost, high- performance computing with the Raspberry Pi, combined with IoT connectivity, to create a portable, remotely controlled outdoor digital board. Several studies and existing implementations support the relevance and feasibility of this approach. Raspberry Pi in IoT Applications: The Raspberry Pi has become a popular choice for IoT-based projects due to its affordability, compact size, GPIO accessibility, and support for various programming languages. Researchers and developers have used it in multiple smart display systems, demonstrating its reliability in real-time applications like digital notice boards, smart kiosks, and public information systems.

   Raspberry Pi in IoT Applications: The Raspberry Pi has become a popular choice for IoT-based projects due to its affordability, compact size, GPIO accessibility, and support for various programming languages. Researchers and developers have used it in multiple smart display systems, demonstrating its reliability in real-time applications like digital notice boards, smart kiosks, and public information systems. Digital Signage Systems: Traditional digital signage systems often rely on proprietary hardware and software, which are expensive and difficult to scale. Recent work focuses on open-source and IoT-based platforms using Raspberry Pi and similar devices. HDMI and Multimedia Display: The use of HDMI with Raspberry Pi supports high-definition video and image output, making it ideal for visual content delivery. Studies emphasize that HDMI compatibility enables integration with a wide range of commercial display units, reducing hardware constraints and improving visual communication .A stable power adapter is essential for continuous operation. Some previous projects have explored portable power solutions, including battery and solar-powered options

3. **PROBLEM STATEMENT:** In many public and outdoor environments, traditional notice boards and printed banners are still widely used for sharing information, advertisements, and announcements. These methods are manual, time-consuming, costly, and inflexible, as they require physical access and reprinting for every update. Existing digital signage systems, although more dynamic, are often expensive, non- portable, and dependent on complex infrastructure, limiting their use in remote or temporary location

4. Methodology: The proposed methodology is a Portable Outdoor Digital Board designed using IoT technology to provide a modern, efficient, and remotely manageable alternative to traditional notice boards. This system uses a Raspberry Pi as the core processing unit, connected to an HDMI compatible digital display for visual output, and powered by a standard power adapter, ensuring portability and ease of deployment. Through Wi-Fi or internet connectivity, users can upload and update multimedia. Content such as images, announcements, or advertisements in real-time from any location. The display will use slideshow software on Raspberry Pi OS to present a continuous loop of dynamic content, making it more engaging than static displays. The system's small size and low power consumption make it ideal for outdoor installations, temporary events, or places with limited infrastructure. Content management can be done through a simple web interface or by accessing the Raspberry Pi via VNC/SSH, requiring minimal technical expertise. Designed for

easy deployment and relocation. Content can be updated remotely via Wi-Fi or internet connectivity. Supports images, announcements, and advertisements.

5. Hardware Components:

LCD Monitor: This is the main output device of the system. The 55-inch LCD monitor displays the content pushed from the cloud or controlled via the UI application. It is suitable for outdoor visibility and acts as the primary communication medium to the public

HDMI Interface: The HDMI interface connects the processing unit (like a Raspberry Pi, ESP32 with HDMI out, or mini-PC) to the LCD monitor. It ensures high quality transmission of video and UI data to be displayed on the screen.

Cloud: the cloud acts as a centralized storage and control unit. All content (ads, announcements, info, etc.) is uploaded to the cloud platform. From there, it is pushed or synced with the IoT-enabled digital board remotely, allowing dynamic content updates without physical interaction

Power Supply: The digital board runs on 5V DC power, but the available input is 230V AC (from wall sockets). Hence, a step-down power supply unit is used to convert 230V AC to 5V 2A DC, which powers the processor and supporting hardware

UI Application: The UI Application is a user-friendly web interface used by admins to manage the board. They can: Upload new content Schedule media Monitor status The UI communicates with the backend cloud and is accessible via any device

T WEB Domain: This is the unique web address or domain that serves as the entry point to access the UI. Its part of the IoT integration—allowing remote access and management of the digital board from anywhere via the internet. IoT devices connect to the web using protocols like HTTP, MQTT, or CoAP

Hardware Setup:

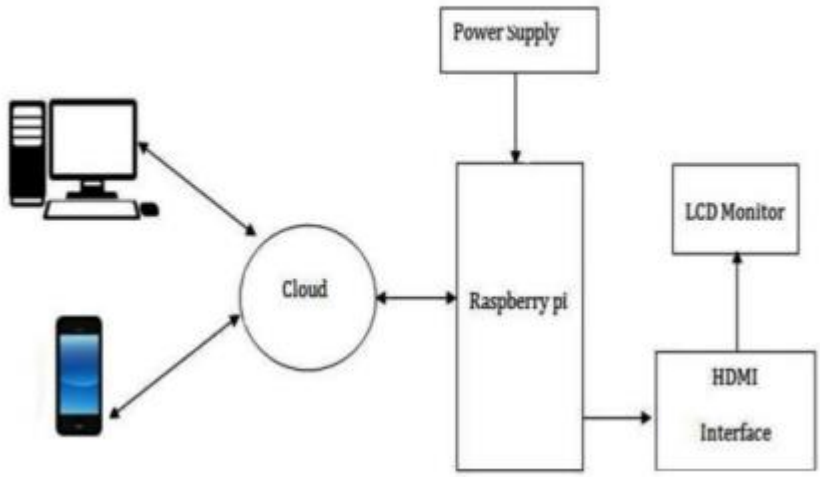

Figure: 1 Hardware setup

6. Software Used:

The Raspberry Pi primarily uses Linux-kernel-based operating systems. The ARM11 chip at the heart of the Pi (pre-Pi 2) is based on version 6 of the ARM. The current releases of several popular versions of Linux, including Ubuntu, will not run on the ARM11. It is not possible to run Windows on the original Raspberry Pi, though the new Raspberry Pi 2 will be able to run Windows 10. The Raspberry Pi 2 currently only supports Ubuntu Snappy Core, Raspbian, Open ELEC and RISC OS

7. Hardware implementation:

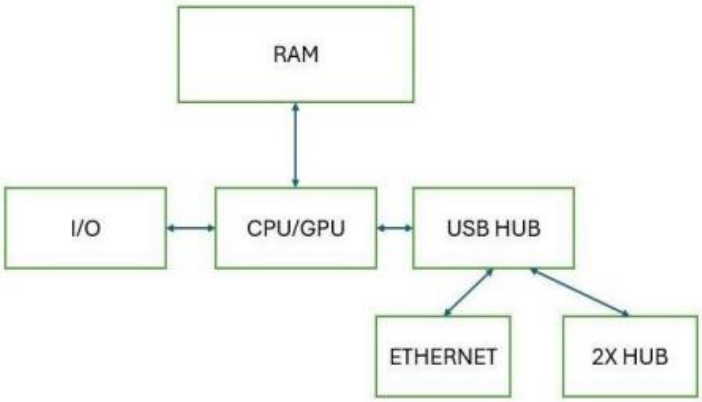

Figure 2: Block diagram

In the block diagram below for model A, B, A+, B+; model A and A+ have the lowest two blocks and the rightmost block missing (note that these three blocks are in a chip that actually contains a three-port USB hub, with a USB Ethernet adapter connected to one of its ports). In model A and A+the USB port is connected directly to the SoC. On model B+ the chip contains a five-point hub, with four USB ports fed out, instead of the two on model B.

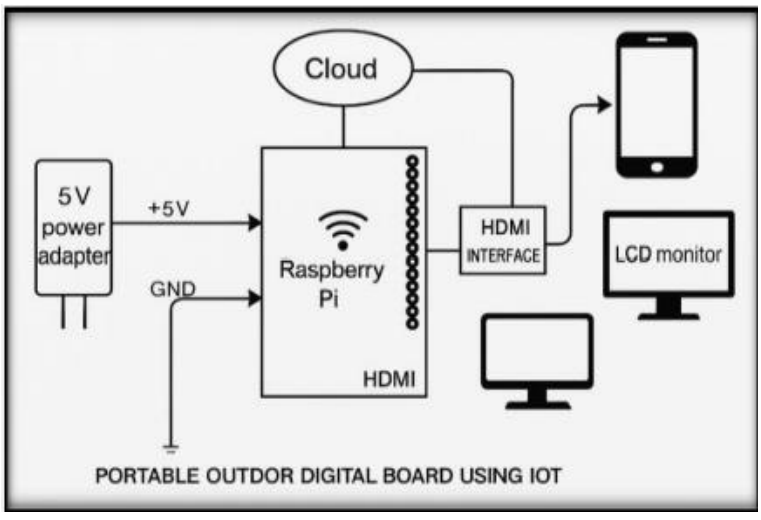

Figure 3: Circuit diagram

8. Results: The implementation of the Portable Outdoor Digital Board Using IoT was successfully carried out, and the system was tested in both controlled indoor and semi-outdoor environments. The results demonstrate that the system met its design goals in terms of functionality, portability, remote accessibility, and content display accuracy. Text messages sent via the Android app and web interface were successfully received and displayed on the screen within seconds. The scrolling text was clear, readable, and customizable in terms of font size and colour. Images were properly rendered on the LCD screen with high clarity. The web interface allowed for content updates, deletions, and modifications, all of which reflected automatically on the display with minimal delay. The system, powered via a compact power adapter, proved to be lightweight and easy to transport. It could be set up in various outdoor locations with access to power and Wi-Fi, making it suitable for campuses, public areas, and temporary events. The development of the Portable Outdoor Digital Board Using IoT presents a significant improvement over traditional notice boards by incorporating real time updates, remote access

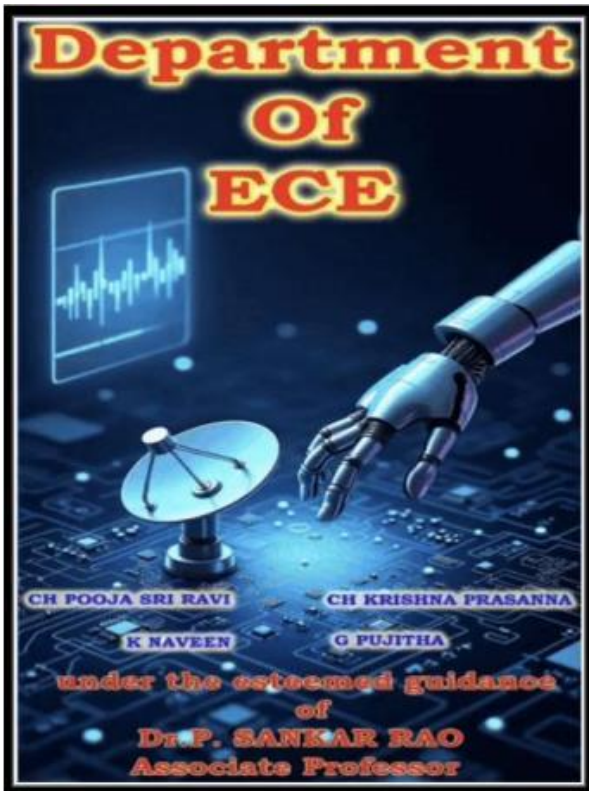

Figure: 4 final output

9. Conclusion: The paper “Portable Outdoor Digital Board Using IoT" has successfully achieved its aim of creating a smart, remotely accessible, and portable display system using readily available components and open-source software. By integrating the Raspberry Pi as the core processing unit, along with essential peripherals like the HDMI cable, LCD monitor, and power adapter, a compact and efficient hardware setup was developed to support digital notice display in real time. On the software side, the use of the Raspberry Pi OS enabled a stable and lightweight operating environment. The inclusion of slideshow and file handling software allowed seamless display of various content types including scrolling text, images, and PDFs—

ensuring that the system met multimedia communication requirements effectively. The cloud-based content delivery and remote update mechanism significantly enhanced the board's usability, allowing users to send updates from a web interface or Android app, complete with voice-to-text functionality for convenience. • In summary, the project successfully combines IoT technology, open-source software, and affordable hardware to deliver a low-cost system.

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