



IoT-Enabled Remote Management of an RGB LED Display

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ABSTRACT

Digital information boards are useful only when their displayed information can be updated conveniently. This work describes a network-connected RGB LED display in which the operator can prepare display material and send it to a remote controller instead of visiting the panel for every update. The proposed arrangement uses an SMD 3-in-1 RGB LED module, a C16 asynchronous controller, and Ethernet/LAN connectivity. Text, images, logos, and video material can be selected from a computer or mobile device and delivered to the display. The approach is intended to simplify digital-signage management in educational, commercial, public, event, and institutional environments.

Keywords: Internet of Things, RGB LED panel, remote display, cloud management, C16 controller, digital signage.

1. Introduction

Information displayed on conventional LED boards is commonly changed by accessing the local controller. For a screen installed at a distant or outdoor location, repeated physical access is inconvenient and can increase the time required for routine updates. A network-oriented display provides another approach: the operator can prepare new information at a computer or smartphone and transfer it to the display through a communication network. In the proposed concept, an RGB LED panel is connected to a controller capable of receiving display data over Ethernet or LAN. Access can be restricted to permitted users, allowing the same installation to serve as a centrally managed information board.

2. Problem Statement

Frequent manual modification of a digital sign creates a practical maintenance problem. Someone must reach the controller, load the required material, and verify the result at the display location. This procedure is not convenient when announcements, advertisements, or event information must be changed repeatedly. The proposed work therefore focuses on a remotely manageable display in which network communication separates the operator from the physical LED panel.

3. Objectives

- Develop a remotely manageable RGB LED display arrangement.
- Transfer display information through a network or cloud-based management layer.
- Allow common media such as text, pictures, logos, and video to be prepared for display.
- Reduce the requirement for repeated physical access to the LED controller.
- Provide an architecture that can be extended to larger or multiple signage installations.

4. Proposed System

The proposed display unit is based on an SMD 3-in-1 RGB module having a physical size of 320 mm × 160 mm and a pixel arrangement of 32 × 16. The panel is operated from a 5 V DC supply. A C16 asynchronous LED controller acts as the receiving and processing unit for the display information. Ethernet or LAN can provide the network path between the management side and the controller, depending on the installation. Once the required material reaches the controller, it is converted into the corresponding display data and delivered to the LED modules.

5. System Architecture

The communication path can be viewed as a sequence of five functional blocks: operator device, network/cloud connection, C16 controller, HUB/HUB75 interface, and RGB LED modules. The operator prepares the required information using a computer or mobile device. The information is transmitted through the available network to the



C16 controller. The controller handles the received data and forwards the required pixel information through the HUB or HUB75 interface. The LED modules then generate the visible output.

6. Hardware Specifications

Item	Details
RGB device	SMD 3-in-1 module containing red, green, and blue LED elements
Panel dimensions	320 mm × 160 mm
Pixel arrangement	32 × 16 pixels
Approx. pixel density	10,000 pixels per square metre
Specified brightness	Approximately 5,500–6,000 nits
Display controller	C16 asynchronous LED controller
Data interface	HUB / HUB75
Operating supply	5 V DC

7. Operating Method

Operation begins with content preparation. The user selects the message or media that should appear on the screen and sends the prepared information through the available network. The C16 controller receives this information and performs the processing required for the LED panel. Pixel data is subsequently supplied to the RGB modules through the HUB/HUB75 connection. The panel reproduces the selected visual information. Because the transfer takes place over a network, an operator does not have to stand beside the display for every content change.

8. Software and Cloud Management

The software side of the system provides the functions needed to prepare display material, control access, and communicate with the LED controller. A cloud-based arrangement can keep display programs in a central location so that an authorized operator can manage them remotely. Scheduling can also be incorporated when the selected software and controller support it. The exact communication process depends on the network availability, controller compatibility, and cloud service used in the installation.

9. Advantages

- Content can be changed without travelling to the display location.
- Routine digital-signage maintenance can require less physical effort.
- Programs for a display can be organized from a central management point.
- The arrangement is appropriate for information that changes regularly.
- The same basic concept can be expanded to additional display locations.

10. Applications

- Digital notice boards in colleges and schools.
- Advertising and promotional displays for commercial locations.
- Public-information screens.
- Event and traffic-related announcements.
- Information displays in shopping and business premises.
- Smart-campus communication systems.
- Industrial and institutional announcement boards.



11. Future Scope

The basic system can be developed further by introducing centralized control for several LED panels. Other possible additions include scheduled content playlists, user-account management, display-status monitoring, power monitoring, automatic brightness control, and sensor-based information. A browser-based dashboard or dedicated mobile application could provide a simpler interface for authorized operators. These additions would make the system more suitable for larger digital-signage networks.

12. Conclusion

This work presents a network-oriented method for managing an RGB LED display from a remote location. The combination of an SMD RGB panel, C16 asynchronous controller, network connection, and remote content management can reduce dependence on local access for routine updates. The approach is applicable to places where information must be changed frequently and can provide a foundation for future multi-display and cloud-managed signage systems.

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