P6 LED ADVERTISING BOARD BASED ON IOT FOR E-CIRCULAR NOTIFICATION FOR STUDENTS THROUGH WIFI

Samiran Chatterjee[*1], Anusri Chekuri[#2], G.Venu[#3], J. Lalitha Sai Kalyan[#4], D. Siva Reddy[#5]

[1]*Professor, ECE Department, Amrita Sai Institute of Science and Technology, Paritala, Vijayawada, Andhra Pradesh*

[2,3,4,5] *Student, ECE Department, Amrita Sai Institute of Science and Technology, Paritala, Vijayawada, Andhra Pradesh*

[1]*Samiran.Chatterjee@amritasai.org.in*
[2] *anusrichekuri99@gmail.com*
[3]*venugaridepalli9@gmail.com*
[4]*kalyanjanjanam63@gmail.com*
[5]*sr6208836@gmail.com*

***Abstract*- Notice boards are playing a very important role in our day-to-day life. By replacing conventional analog type notice board with digital notice-board we can make information dissemination much easier in a paperless community. Notice board could be a primary factor in any establishment or public places like bus stations, railway stations, colleges, malls etc. Sticking out numerous notices day to day could be a tough method. A separate person is needed to take care of this notice display. The objective of our project is to design a P6 dot-matrix LED display in which moving message display using microcontroller and IOT where the characters shift from left to write continuously. Project based notice boards are especially cumbersome to maintain due to many people posting information with no mechanism for removing them. In every institute or industry there is always an information desk that provides information about the staff, institute, and its departments and about everything related to that institute. The problem is that it requires some staff that is dedicated to that purpose and that must have up to date information about the institute and the recenthappenings in the institute.**

Keywords- Microcontroller, IOT, Digital Notice Board, Dot Matrix, P6 LED board.

I. INTRODUCTION

Now-a-days LED Message Scrolling Displays are becoming very popular for advertisements. These displays are used in shopping malls, theatres, public transportation, traffic signs, highways signs, etc., The big problem with these displays is to carry a computer or special keyboard for generating and sending messagesto LED moving display boards dynamically [1]. Carrying a host computer or special keyboard every time to generate message for LED display boards is big headache and also increase cost if it go for wireless based message sending. Notice boards are playing very important role in our day-to-day life. By replacing conventional Analog type notice board with digital notice board [2-4], we can make information dissemination mucheasier in a paperless community. Here the admin can control notice board through internet [9]. So, information can be send anywhere in the world and can be displayed within seconds. Information may be in the form of text, image, pdf etc.Educational institutions also have a similar situation wherein students can be present in any part of the campus and might miss important updates such as rescheduling of classes etc. Furthermore, students and employees might not to know important information in-time for it to be useful to them as they might not be able to pass through those notice boards regularly [5-6]. Project based notice boards are especially cumbersome to maintain due to many people posting information with no mechanism for removing them. In every institute or industry there is always an information desk that provides information about the staff, institute, and its departments and about everything related to that institute. The problem is that it requires some staff that is dedicated to that purpose and that must have up to date information about the institute and the recent happenings in the institute [7-8]. The second issue is that a person needs to go in the institute at the information desk in order to get information from them. Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message and turn it into an output - activating motor, turning on an LED, and publishing something online [10]. You can tell your boardwhat to do by sending a set of instructions to the microcontroller on the board. To do so you use the Arduino programming language and the Arduino Software (IDE) based on Processing. A world-wide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this opensource platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

II. P6 LED MODULE

The P6 module LED display is a modern digital display technology widely used for advertising, public information systems, and communication in various environments. The term "P6" refers to the pixel pitch of 6mm, which determines the distance between two adjacent pixels. This spacing provides a balanced combination of resolution and viewing distance, making it suitable for indoor and semi-outdoor applications such as schools, railway stations, shopping malls, and event displays.

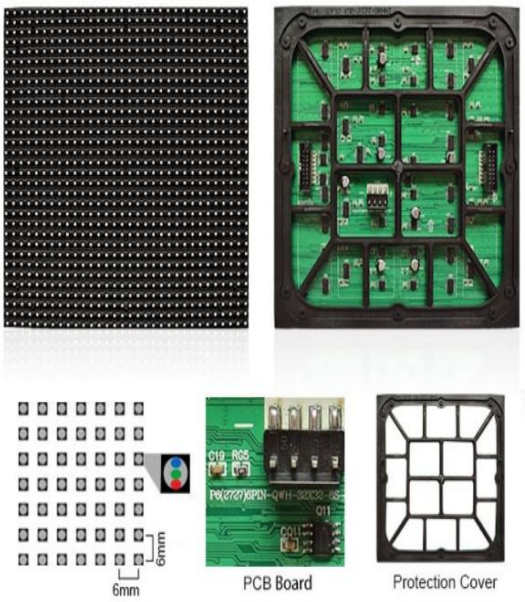

Figure 1: P6 LED internal diagram

1. Pixel Pitch:

P6 denotes the pixel pitch of the LED modules, which represents the distance between the centres of adjacent pixels. In this case, it is 6 milli-meters. A smaller pixel pitch generally results in higher resolution and better image quality, making P6 modules suitable for applications where closer viewing distances are common.

2. Resolution:

The pixel pitch of P6 LED modules contributes to a higher resolution compared to larger pitch modules. This makes P6 displays suitable for applications where detailed and crisp images or text are essential, such as advertising, information displays, and events.

3. Indoor and Outdoor Usage:

P6 LED modules are versatile and can be used for both indoor and outdoor applications. Outdoor P6 displays are often designed to withstand various weather conditions, offering high brightness to ensure visibility in direct sunlight.

4. Brightness and Contrast:

LED displays with P6 modules typically have high brightness levels, allowing them to deliver vibrant and clear visuals even in well-lit environments. Additionally, they often feature good contrast ratios for enhanced image quality.

5. Energy Efficiency:

LED technology is known for its energy efficiency, and P6 modules are no exception. They consume less power compared to traditional display technologies, contributing to lower energy costs and a reduced environmental footprint.

6. Modular Design:

P6 LED modules are often designed with a modular structure, allowing for easy assembly and maintenance. This modular design facilitates scalability, enabling users to create displays of various sizes by combining multiple modules.

7. Application Areas:

P6 LED modules find applications in a wide range of settings, including retail environments, sports arenas, transportation hubs, and corporate spaces. They are popular for advertising displays, information boards, scoreboards, and any scenario where dynamic and eye-catching visuals are required.

8. Refresh Rate:

The refresh rate of P6 LED displays is an important factor for smooth video playback. Higher refresh rates contribute to reduced motion blur, making these displays suitable for applications involving video content.

III. METHODOLOGY

The methodology of the P6 LED display system explains the step-by-step process of designing, developing, and implementing the display unit. The system is mainly designed to show scrolling text, advertisements, and notifications using LED matrix technical. First, the system design is prepared byselecting essential components such as the P6LEDmodule, a microcontroller (Arduino or ESP8266), a power supply unit, and a controller board. These components are interconnected using proper wiring and interfaces like HUB75.Next, the working principle is established. The P6 LED module operates on a matrix arrangement of LEDs organized in rows and columns. The microcontroller sends data signals to the module, and through rapid scanning of rows and columns, specific LEDs are turned on and off to form characters or patterns. This high-speed switching creates a continuous visual display due to persistence of vision. The data input method is then defined. Messages can be sent to the display through Wi-Fi (for IoT-based systems), USB or serial communication, or can be pre-programmed into the microcontroller memory. Programming is carried out using Arduino IDE, where libraries such as DMD or Px Matrix are used to control the LED panel. The code is developed to display scrolling text, adjust brightness, and update content dynamic. Display control is achieved through multiplexing, which reduces power consumption and improves efficiency. The system requires a stable 5V DC power supply to ensure proper functioning. The system then undergoes testing and debugging. The display is checked for brightness, clarity, and smooth functioning. Any issues in wiring, programming, or communication are identified and corrected. Special attention is given to synchronization and refresh rate to ensure flicker-free. Finally, testing and implementation are performed by checking connections, uploading the code, and verifying output quality such as brightness, clarity, and speed. This ensures the system works effectively for real-time display applications consumption

and improves efficiency. The system requires a stable 5V DC power supply to ensure proper functioning.

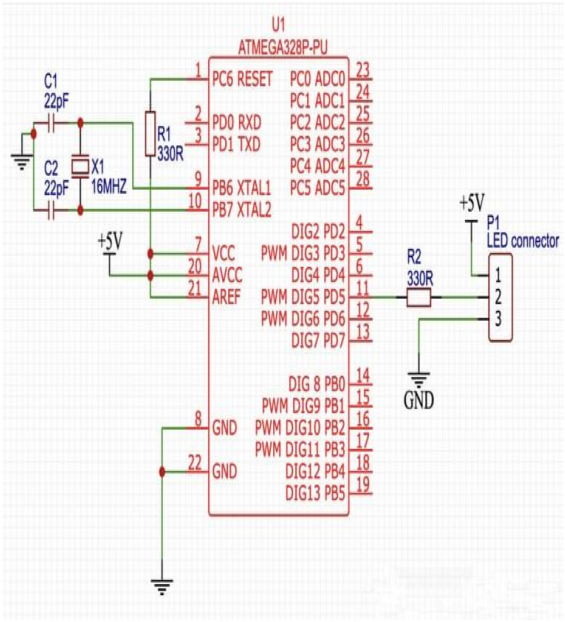

Figure 2: Block Diagram of the project

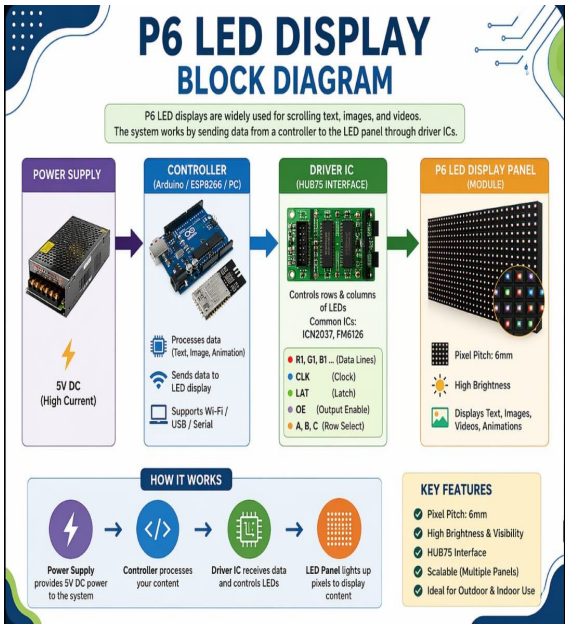

Figure 3: P6 LED block diagram

IV. WORKING PRINCIPLE

The given block diagram represents the working principle and structure of a P6 LED display system. This system is widely used for displaying dynamic content such as scrolling text, images, videos, and animations in applications like advertisements, public information boards, and digital signage. The diagram consists of four main sections: Power Supply, Controller, Driver IC, and P6 LED Display Panel, along with a flow that explains how the system works. The given block diagram represents the working principle and structure of a P6 LED display system. This system is widely used for displaying dynamic content such as scrolling text, images, videos, and animations in applications like advertisements, public information boards, and digital signage. The diagram consists of four main sections: Power Supply, Controller, Driver IC, and P6 LED Display Panel, along with a flow that explains how the system works.

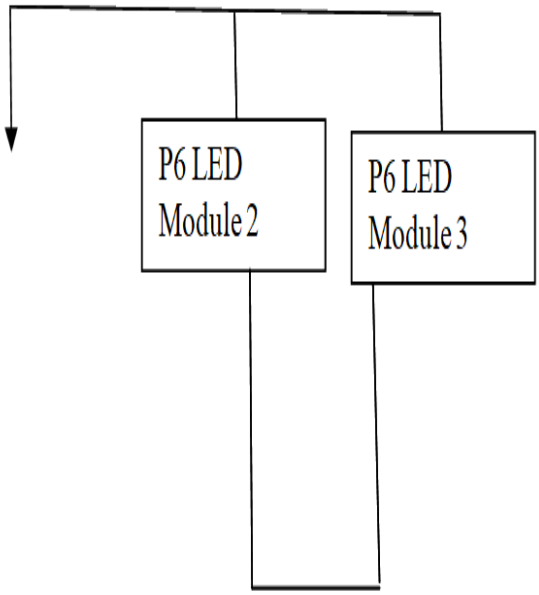

Figure 4: P6 LED Module connected in series

POWER SUPPLY:

The first block in the diagram is the Power Supply. It provides a regulated 5V DC output required for the proper functioning of the entire system. Since LED panels consume high current, the power supply must be capable of delivering sufficient current to ensure stable operation. Any fluctuation in power can affect brightness and performance, so a reliable SMPS (Switched Mode Power Supply) is typically used. This power is distributed to the controller, driver IC, and LED display module.

CONTROLLER:

The next block is the Controller, which acts as the brain of the system. It can be a microcontroller like Arduino, ESP8266, or even a computer. The controller is responsible for processing input data such as text, images, or animations. This data can be sent through various communication methods including USB, serial communication, or Wi-Fi. In IoT-based systems, the controller can receive data remotely through internet platforms, making the display capable of real-time updates. After processing, the controller converts the content into digital signals suitable for the LED display.

DRIVER IC:

The third block is the Driver IC, which plays a crucial role in controlling the LED matrix. The driver IC acts as an interface between the controller and the LED panel. In this system, the HUB75 interface is commonly used. The driver IC receives signals from the controller and distributes them across rows and columns of LEDs. It controls which LEDs should turn on or off and manages brightness and refresh rate. Important signal lines include R1, G1, B1 (color data lines), CLK (clock signal), LAT (latch), OE (output enable), and A, B, C (row selection lines).

These signals ensure proper scanning and synchronization of the LED matrix, resulting in smooth and flicker-free display output.

P6 LED DISPLAY:

Figure 5: P6 LED Display

The final block is the P6 LED Display Panel (Module). This is the output unit where the actual content is displayed. The panel consists of an array of RGB LEDs arranged in a matrix format. Each LED can produce different colors by combining red, green, and blue light. The pixel pitch of 6mm determines the distance between pixels, which affects resolution and viewing distance. A smaller pixel pitch gives higher resolution, while P6 offers a balanced performance for medium viewing distances. The display panel is capable of showing high brightness content, making it visible even in daylight conditions.

HOW IT WORKS:

The diagram also includes a section titled “How It Works”, which explains the step-by-step operation of the system. First, the power supply provides the necessary electrical energy to all components. Then, the controller processes the input data and prepares it for display. Next, the driver IC receives this data and controls the LEDs by scanning rows and columns rapidly. Finally, the LED panel used specific pixels to form the desired text or image in this project. This process happens continuously at a very high speed, creating a smooth visual output. The P6 LED display system works by processing and displaying digital content through a series of components. First, the power supply provides a stable 5V DC current to the entire system, ensuring proper operation. The controller, such as Arduino or ESP8266, receives input data in the form of text, images, or animations from a computer, mobile device, or IoT platform. It processes this data and converts it into digital signals suitable for the LED panel.These signals are sent to the driver IC through the HUB75 interface. The driver IC controls the LED matrix by scanning rows and columns rapidly and determining which LEDs should turn on or off. It also manages brightness and refresh rate to ensure smooth display.Finally, the P6 LED module lights up specific RGB LEDs to form the required content. This process repeats continuously at high speed, creating a clear and flicker-free visual output.

KEY FEATURES:

Additionally, the diagram highlights some key features of the P6 LED display system. These include a 6mm pixel pitch, high brightness and visibility, use of HUB75 interface, scalability by connecting multiple panels, and suitability for both indoor and outdoor applications. The modular design allows multiple panels to be combined to form larger displays; making it highly flexible. The P6 LED display offers several important features that make it suitable for modern digital communication. It has a 6mm pixel pitch, which provides a good balance between image clarity and viewing distance. The display supports full-color RGB output, allowing it to show bright and attractive text, images, and videos. It has high brightness and visibility, making it effective even in daylight conditionsThe system uses a HUB75 interface, which ensures easy connection with controllers like Arduino or Raspberry Pi. It supports dynamic content such as scrolling messages and animations. The display is energy-efficient and consumes less power compared to traditional display.Its modular design allows multiple panels to be connected to form larger screens. It also features a fast refresh rate for smooth and flicker-free performance. Additionally, with IoT integration, the display content can be updated remotely, making it highly flexible and user-friendly.

V. Result And Discussion

The P6 LED display system was successfully designed and implemented, achieving its objective of displaying dynamic content such as scrolling text, images, and simple animations. The display provided high brightness and clear visibility, making it effective for both indoor and semi-outdoor environments. The 6mm pixel pitch ensured a good balance between resolutions and viewing distance, allowing the content to be easily readable from a moderate range, during testing, the controller efficiently processed input data and transmitted it to the LED module through the HUB75 interface. The driver IC performed accurate row and column scanning, resulting in smooth and flicker-free output. The system maintained stable performance with the help of a regulated power supply, although minor brightness variations were observed when power supply capacity was insufficient. The integration of a Wi-Fi module enabled remote updating of display content, demonstrating the system’s capability for real-time communication. However, network delays slightly affected update speed in some cases. Overall, the system proved to be reliable, energy-efficient, and cost-effective, making it suitable for applications such as digital notice boards, advertisements, and public information displays.

Figure 6: Output of P6 LED Display

VI. CONCLUSION

In conclusion, the P6 LED display system is an efficient and versatile digital display solution. The coordination between power supply, controller, driver IC, and LED panel ensures seamless operation. This system is widely used due to its ability to display real-time content, energy efficiency, and adaptability to different applications. The block diagram clearly illustrates how each component contributes to the overall functioning of the display system. The P6 LED display project was successfully designed and implemented, demonstrating an efficient and flexible solution for digital communication. The system effectively displayed dynamic content such as scrolling text, images, and animations with high brightness and clarity. The use of a 6mm pixel pitch ensured a good balance between resolution and viewing distance, making it suitable for indoor and semi-outdoor applications. The integration of a controller and driver interface enabled smooth and flicker-free operation, while the regulated power supply ensured stable performance. Additionally, the optional IoT feature allowed remote updating of content, enhancing the system's usability and real-time functionality. Overall, the project proved to be cost-effective, energy-efficient, and scalable. It can be widely used in applications such as advertising boards, educational institutions, and public information systems. Future improvements can include higher resolution modules, advanced graphics support, and enhanced wireless connectivity for better performance.

ACKNOWLEDGMENTS

We would like to express my sincere gratitude to all those who supported and guided us throughout the completion of this P6 LED Display project. First and foremost, we deeply thankful to my project guide for their valuable suggestions, continuous encouragement, and technical guidance, which helped us to successfully complete this work. We would also like to thank the faculty members of my department for providing the necessary knowledge, resources, and support during the project development, their insights and motivation played an important role in enhancing my understanding of the project. We extend my heartfelt thanks to my friends and classmates who assisted me in various stages of the project, from planning and designing to testing and troubleshooting, their cooperation and teamwork made this project easier and more enjoyable. We are especially grateful to my family for their constant support, patience, and encouragement throughout my academic journey, their belief in me gave me the confidence to complete this project successfully. Finally, we would like to thank everyone who directly or indirectly contributed to the successful completion of this project.

REFERENCES

[1] Arduino Official Website. Arduino Documentation and Resources. Available at: https://www.arduino.cc

[2] Raspberry Pi Foundation. Raspberry Pi Documentation. Available at: https://www.raspberrypi.org

[3] Px Matrix Library Documentation. LED Matrix Control Library for ESP8266/ESP32.

[4] MD_Parola Library. LED Matrix Display Library for Arduino.

[5] HUB75 LED Matrix Interface Guide. Technical Guide for LED Panel Interfacing.

[6] Datasheets of P6 LED Display Module and Driver ICs (e.g., ICN2038, FM6126).

[7] Blynk IoT Platform. IoT Control and Monitoring Platform. Available at: https://blynk.io

[8] ThingSpeak IoT Platform. Cloud-Based IoT Analytics Platform. Available at: https://thingspeak.com

[9] K. Ogata, Modern Control Engineering, Prentice Hall.

[10] Research papers and online tutorials related to LED display systems and embedded systems.