Displaying a Message on the Notice Board Using a PC

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***Abstract* – Background: Traditionally, marketing depended on numerous advertising strategies such as newspapers, posters, and glow signboards. However, owing to their dependability and multiple benefits, digital LED display boards have recently emerged as a popular alternative.**

Objective: This article aims to show how to make a clock using a P10 display and an Arduino. The goal is to highlight the adaptability of digital LED display boards for various applications such as advertising, prayer schedules, warning boards, queue management, and more.

Methods and materials: The study adopts an approach that merges a P10 display with Arduino and a DS3231 RTC to design and construct a working clock. The article discusses the advantages of digital LED display boards for advertising and other applications, highlighting features like durability, customisation choices, and user-friendliness.

Results: The main result of this post is a hands-on demonstration of building a clock using a P10 display and Arduino. Furthermore, the paper delves into the beneficial and practical use of digital LED display boards for advertising and other informative purposes.

Conclusions: As an advertising medium and digital notice board, digital LED display boards have several advantages. Their toughness, versatility, and simplicity of usage set them apart. The offered example of a clock created using a P10 display and Arduino shows the adaptability of these displays, emphasising their potential for a wide range of uses other than advertising.

I. INTRODUCTION

Almost every element of our everyday lives has been altered by technology in today's fast-paced society. We are surround by gadgets that make our daily tasks simpler and more productive, from mobile phones to computers. The way we talk to one another has changed dramatically as a result of technological advancements. People may now contact with one another more swiftly and readily than ever before thanks to the web and social networks

Nonetheless, despite all the developments in telecommunications, there are still numerous circumstances when conventional forms of communication are favored. To reach broad audiences, community boards are still widely utilized in various institutions, including schools, workplaces, and public areas. Whether it's a reminder from the principal, a directive from the head of the company, or a warning about a potential risk, notice boards serve an important purpose in informing the community.

Historically, notice boards were maintained manually using printed texts or handwritten notes. But, with the development of digital technology, it's now feasible to use a computer to show messages on a notice board. As compared to the time-consuming and inefficient techniques of manually updating bulletin boards, this solution is clearly superior [1], [2].

First off, utilizing a computer to update the notice board is far more efficient. You may write the latest information on your computer and post it to the notice board instead of printing out or handwriting fresh announcements. This allows for far more frequent notice board updates, which is very helpful for communicating time-sensitive information [3], [4].

Second, posting notices on a computer means you may provide more detailed information. In contrast to conventional ways, you may now include media such as photos, videos, and links directly into your message [5]. If you're attempting to convey a complicated or technical subject, this may help create your message more interesting and educational.

Saving cash over time by employing a computer to modify the notice board. You may update the notice board using your current computer and display system rather than continuously print out new messages or purchasing new materials [6], [7].

It is possible to save money by switching to digital clocks and watches, which use digital mechanics and displays instead of the more conventional ones. The availability of speaking clocks and clocks with touch screens may also give cost-effective alternatives for the visually handicapped or others who need alternate means of timekeeping [3].

As was previously indicated, utilizing a personal computer to update a notice board may assist save money on paper and ink. Without regularly printing out new messages or purchasing new materials, you may update the notice board using your current computer and display equipment [8], [9].

Similar to this, employing digital clocks and watches with electronic mechanisms and displays may assist cut down on maintenance expenses and replace conventional clock mechanisms [10]. Speaking clocks and clocks with touch screens are two examples of accessible and affordable alternatives for those who need to keep track of time in a different way.

In today's environment, when sustainability and cost-effectiveness are becoming more important, employing digital technology in clocks, watches, and notice boards may give useful solutions that save time, enhance efficiency, assist cut expenses, and encourage more sustainability practices.

LCD, LED, and VFD screens are commonplace in modern digital clocks. For those who have trouble seeing the time, talking clocks are also available. Touch-screen or Braille displays are available in clocks for the visually impaired [11].

Horology, the study of timekeeping, includes not only the mechanics of keeping time but also the cultural significance of clocks and watches throughout history. Horology is a fascinating discipline that integrates physics, engineering, and design, and it continues to improve as new technologies and materials are created.

A. Problem Statement

The use of paper and ink for displaying messages on notice boards may not fit with an organization's sustainability objectives due to the inconvenient need to update the board regularly, the restricted amount of space available on the board, and the expense of printing fresh messages on paper. For businesses that often change their notice board material, using standard notice boards may also be expensive, particularly if they need specialist printing equipment.

Thus, there is a need for a more effective, economical, and ecologically friendly method of posting notices on notice boards in public spaces and workplaces. This characterization of the issue emphasizes the need for a digital solution that is both affordable and sustainable, and that allows for more creative freedom in terms of what is shown. The suggested approach of employing a computer to display messages on a notice board provides a workable answer to these problems.

B. Aim of the Article

The aim of the article is to provide a simple and cost-effective solution for displaying messages on a notice board in a public place or an office environment. The traditional method of displaying messages on notice boards involved the use of cork or pin boards, which had several drawbacks, such as the inconvenience of having to update the board frequently, the limited amount of space available on the board, and the cost of printing new messages on paper.

With the advancement of technology, digital displays have become an increasingly popular alternative to traditional notice boards, offering several advantages, such as the ability to display multiple messages simultaneously, the ease of updating messages remotely, and cost-effectiveness. The proposed method in this study involves the use of a PC connected to a display screen and a network, making it a simple and cost-effective solution for displaying messages on a notice board.

By providing a practical solution for displaying messages on a notice board using a PC, this article aims to improve communication and reduce costs for organizations, such as libraries, schools, and office environments. The proposed method is easy to use and maintain, and it eliminates the need for paper and ink, making it a more environmentally friendly solution. Additionally, the use of a software application developed in-house makes the system easy to update and control, providing greater flexibility and control over the content displayed on the notice board.

II. LITERATURE REVIEW

Through their versatility, low cost, and simple operation, digital LED displays have gained popularity for usage as notice board displays. The potential of digital LED displays beyond advertising was shown by Ye, Z., Cheng, Y., Liu, K., & Yang, K [12], when they created a multicolored LED matrix display system with audio output. Created a smart digital bulletin board with IoT-based message-scrolling LED display. Digital LED displays have been the subject of these research because of their potential use in a wide range of areas, from retail stores to corporate conference rooms [13], [14].

There have been other investigations on the feasibility of utilizing a personal computer as a notice board. For example, Qasim and Pyliavskyi [4], [15] proposed a color temperature line forward and inverse transformation approach that showed how a personal computer may be used to increase the energy efficiency of digital broadcasting. Dhule [16]created a low-cost Android-based wireless notice board, while Nair et al. [17] presented a GSM-based smart home and digital notice board. These studies add to the growing body of information supporting the feasibility of using a PC-based solution for digital bulletin board posting.

The suggested technique of employing a personal computer as a notice board expands upon the prior art by providing a workable solution that is intuitive, adaptable, inexpensive, and favorable to the environment. The literature analysis as a whole emphasizes the potential of digital LED displays and PC-based technologies for displaying messages on notice boards in varied environments [1]. The literature analysis also shows that LED displays have a long lifespan, making them an affordable and long-lasting option for bulletin board displays. LED displays also provide a great deal of flexibility in terms of layout, content management, and the ability to show numerous notes at once.

The literature analysis also emphasizes the use of microcontrollers like Arduino for powering LED displays. Nair et al. [17] created an electronic notice board with numerous output displays, whereas Yuanjing Wang et al. [18] designed a PIC-based LED display. These researches show that microcontrollers are a viable option for powering LED displays, and that these systems may be used in a variety of contexts.

The literature analysis shows that digital LED displays and PC-based systems may help businesses save money and time by updating noticeboard material often. This article adds to the body of knowledge by proposing a way for displaying notices on a PC notice board that is both practical and inexpensive.

Through their versatility, low cost, and simple operation, digital LED displays have gained popularity for usage as notice board displays. The potential of digital LED displays beyond advertising was shown by Adhikari, Beyragh, and Pahlevani [19] when they created a multicolored LED matrix display system with audio output. Keh, Wang, and Yan [20] created a smart digital bulletin board, while Surendiran et al. (2020) showed an IoT-based message-scrolling LED display. Digital LED displays have been the subject of these research because of their potential use in a wide range of areas, from retail stores to corporate conference rooms.

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III. METHODOLOGY

A display screen linked to a PC and a custom-built software program are used in the suggested method for displaying a message on a notice board using a PC. User-generated content (UGC) may be posted to the digital bulletin board and edited in real time from any location using the accompanying software application.

The following procedures outline the specifics of how to put this solution into action:

Hardware configuration entails connecting the monitor to a computer via a network connection. The computer monitor has to be compatible with the system and have the appropriate software drivers installed. The computer should also include an in-house software program to manage the display screen.

The software application's notice board functionality should provide the ability for users to compose and post their own messages. The software program for the bulletin board should function intuitively and provide the user options for how information is presented.

Message creation: The software program allows the user to generate messages. The user should be able to change the backdrop color of the message as well as the font, color, and size of the text inside the software program. Also, the user has the option to include photos or graphics in the message.

Message Scheduling: The software program allows the user to schedule messages to be shown at certain times and dates. This function enables the user to organize the notice board's content in advance and guarantees that the information is accurate and current.

Message Display: The software program shows the messages on the notice board. The user may quickly and simply alter the notice board's content by updating the messages remotely.

System Upkeep: The system needs little upkeep, and the user can handle most chores from afar. To guarantee compatibility with the most recent hardware and software changes, the software program should be updated on a regular basis.

The procedure for posting an announcement on a computerized bulletin board entails the usage of a personal computer (PC), an external display screen (DS), and custom-written software. Messages on the electronic bulletin board may be edited from afar thanks to the app's convenient remote editing features. The system is user-friendly, flexible, and affordable, making it an excellent choice for posting notices in public spaces or workplaces.

A. Hardware Requirement

With a P10 LED display module and an Arduino UNO, you can build a bulletin board that shows the current time, date, and scrolling text. The Arduino UNO is a microcontroller board that is used to run the P10 LED display module and read the time and date from a real-time clock module. P10 LED Display Module: This 32x16 LED dot matrix display may be cascaded to create a hoarding of any size.

Real-time clock module: This module is used to provide the Arduino UNO with the current time and date, which is subsequently displayed on the notice board. Jumper wires are needed to link the P10 LED display module, Arduino UNO, and real-time clock module [22].

Power Source: The bulletin board needs a power source to function, which may be a battery or an AC adapter.

Enclosure: To protect the hardware components and give the bulletin board a polished look, an enclosure is employed.

The notice board project's hardware needs are often straightforward and inexpensive, making it a viable option for

businesses who need to regularly change the information shown on their notice boards.

B. Arduino Nano

The Arduino Nano board, a small microcontroller board based on the Atmega168 or Atmega328 microprocessor, is the hardware mentioned in this article. In addition to 2 reset pins and 6 power pins, the board has 14 digital pins and 6 analogue pins for connecting with external components.

The Arduino Nano's operational voltage is 5V, with an input voltage range of 6V to 20V and a suggested input voltage range of 7V to 12V. The board's clock frequency is 16MHz, and it is used to produce a clock with a fixed frequency by applying a steady voltage.

The board is distinct from typical Arduino boards in that it offers a USB interface but utilises a mini-USB connector. It cannot be powered by an external power source since it lacks a DC power jack.

The flash memory of the Atmega168 is 16KB (of which 2KB is needed for the bootloader), whereas the flash memory of the Atmega328 is 32KB. With the Atmega168 and Atmega328, the EEPROM and SRAM sizes are 512KB and 1KB, respectively [23].

The Arduino Nano board is a small and flexible microcontroller board that may be used in a variety of electrical applications. It is perfect for applications that need a tiny and portable microcontroller board due to its modest size and breadboard compatibility.

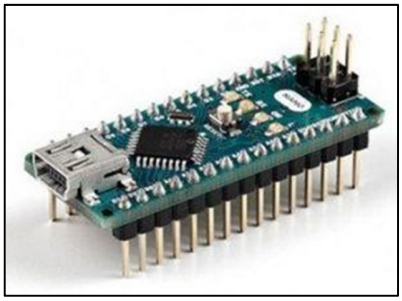

Fig. 1. Arduino Nano Microcontroller

C. P10 - Outdoor LED Display Panel - 32x16

The P10 outdoor LED display panel is a 32x16 LED dot matrix display module that is widely utilized in advertising and information display applications. Every pixel in the module is lighted by a red, green, and blue LED, enabling for the projection of exceptionally sharp visuals.

The P10 LED display panel can be cascaded to create any size advertising board, giving it a versatile and adaptable option for displaying messages in public spaces or workplace settings. The module is built to endure the elements and is thus ideal for use in outdoor advertising and signage.

The module may be programmed to do a variety of tasks and is compatible with a wide variety of microcontroller boards, including the Arduino UNO [24]. The software application allows for the modification of the message presented and may be adjusted for the display of scrolling text.

The P10 LED display panel also supports real-time clock modules, enabling for the display of time and date information on the notice board. The module needs a power source to function, which may be either a battery or an AC adapter [30].

The P10 LED display panel is a flexible and adaptable option for displaying messages in a public or private setting. It can be programmed in a variety of ways and is compatible with a wide variety of microcontroller boards, making it a great choice for advertising and information display applications in both indoor and outdoor settings.

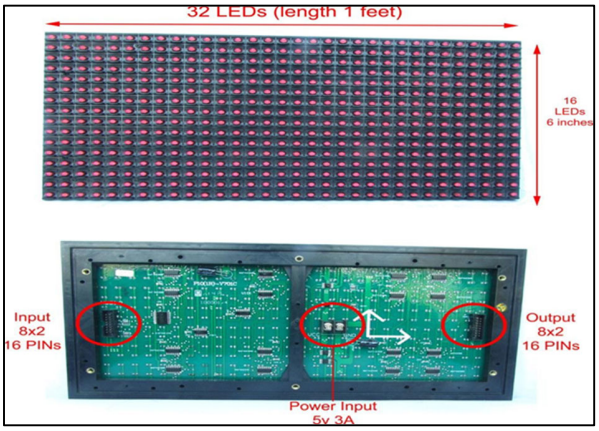

Fig. 2. LED Display Panel

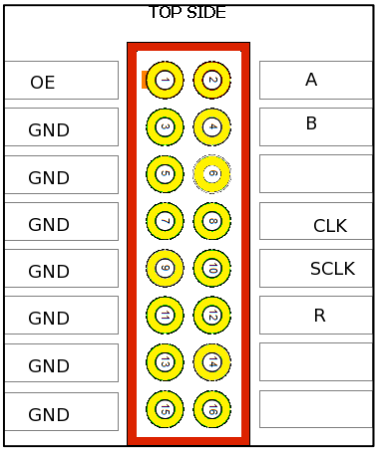

Fig. 3. Connection Pin p10

D. Power supply +12 Volt

A steady voltage of 12 volts is provided by the +12 Volt power supply to power electrical devices or components. The +12 Volt power source is used to power the LED display module in the context of the bulletin board project, which uses a P10 LED display module and Arduino UNO to show scrolling text, the time, and the date.

Depending on the application and power needs of the LED display module, the +12 Volt power source might be either an AC adapter or a battery. To guarantee that the LED display module works properly and shows the scrolling text, time, and date appropriately, the power source must deliver a steady and constant voltage.

Make sure the +12 Volt power source is compatible with the LED display module and has enough power to suit the project's needs. To guarantee that the notice board functions smoothly and consistently, the power source should also be carefully selected.

E. RTC DS1307 Module

The Arduino UNO receives its current time and date from the RTC DS1307 real-time clock module. The module has a DS1307 chip that has a crystal oscillator, a battery backup, and an I2C interface for talking to the Arduino UNO [25].

The RTC DS1307 module has a battery backup to make sure the clock keeps working even when the power goes off and utilizes a 32.768 kHz crystal oscillator to provide accurate time and date information. The I2C interface used by the module makes it simple to integrate with other sensors and components using the Arduino UNO [26].

The module needs a 5V power source and is simple to incorporate into a project by connecting the SDA and SCL pins to the equivalent pins on the Arduino UNO using jumper wires. The DS1307 chip may be programmed using the Arduino IDE to set the time and date, as well as account for changes in time zones and DST.

The RTC DS1307 module is a simple and dependable option for giving correct time and date information to Arduino UNO projects. It is often used in a broad variety of applications, including clocks, timers, and data loggers [27].

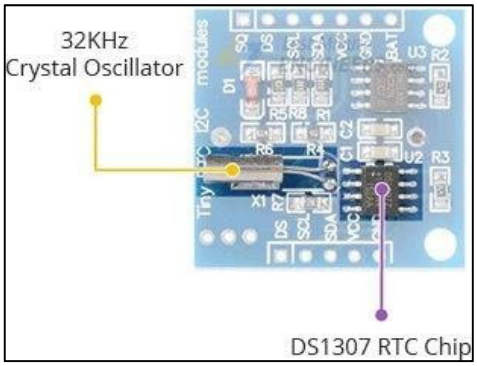

Fig. 4. DS1307 RTC Chip

The DS1307 chip on the RTC DS1307 module not only provides accurate time and date information, but also offers a number of other capabilities that make it a handy component for a variety of Arduino UNO applications.

The chip's ability to store time information up to the year 2100, including seconds, minutes, hours, days, dates, months, and years, with automatic adjustment for months with fewer than 31 days and leap year adjustments, is a standout feature. Because of this, it is well-suited for use in timepieces and data recorders that need accurate time and date data.

The RTC DS1307 module can display the time in either 12- or 24-hour formats, and it can also tell you whether it's the morning or the afternoon. For tasks that call for accurate timing data, this provides a variety of convenient presentation possibilities.

The SQW pin of the RTC DS1307 module is another neat extra. When enabled in code, it can emit a square wave at one of four different frequencies (1Hz, 4kHz, 8kHz, or 32kHz). This makes it an excellent choice for use in timers and other devices that depend on a precise clock signal.

F. Battery Backup

Battery backup is a crucial element for the real-time clock (RTC) in the context of the alert message project that uses a P10 LED display module and Arduino UNO to show scrolling text, the time, and the date.

Even in the case of a power outage or when the notice board is disconnected, the RTC DS1307 module's battery backup capability keeps the time and date correct. A coin cell battery is often used as the backup power source to keep the RTC module operational [28].

Applications such as data recording and monitoring depend on accurate time and date information, thus the battery backup capability is crucial. Without a battery to keep track of the time and date, the RTC module would be rendered incorrect or unreliable anytime the power went off [9].

In the case of a power outage or when the bulletin board is disconnected, the RTC DS1307 module and other comparable real-time clock modules will keep the time and date correct thanks to their built-in battery backup.

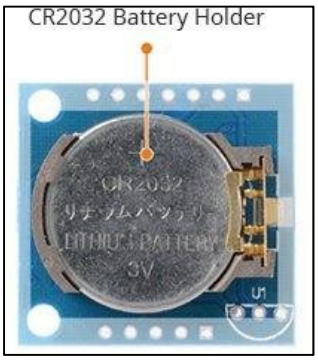

Fig. 5. Battery Backup

The RTC DS1307 module's battery backup is provided by the battery slot on the board for 20mm 3V lithium coin cells, such as the widely used CR2032 battery. The CR2032 battery is a common and affordable battery that can run the RTC module for a long time.

A new CR2032 battery is placed into the battery holder on the board's bottom to utilize the battery backup capability. When power is off, the battery keeps the RTC module working and correct time and date.

The battery holder secures the battery, guaranteeing a stable connection and prevents it from slipping out. Battery replacement is straightforward since the holder is accessible.

The RTC DS1307 module's battery slot for 20mm 3V lithium coin cells ensure correct time and date information even when the notice board is disconnected.

G. Onboard 24C32 EEPROM

The RTC DS1307 module has a practical and trustworthy battery backup option in the form of a battery holder on the underside of the board for 20mm 3V lithium coin cells, such as the widely used CR2032 battery. The RTC module may be powered for an extended period of time by the commonly accessible and cheap CR2032 battery.

A new CR2032 battery must be placed in the battery holder on the underside of the circuit board in order to activate the battery backup capability. When the power is cut off, the battery supplies a tiny amount of power to the RTC module, enabling it to keep operating and retaining correct time and date information.

The battery holder is designed to keep the battery firmly in place, maintaining a strong connection and keeping the battery from slipping out. The battery may be replaced quickly and easily because to the holder's accessibility [29].

The battery attachment for 20mm 3V lithium coin cells on the RTC DS1307 module offers a simple and dependable battery backup option for the RTC module, guaranteeing that correct time and date information is retained even in the event of a power loss or while the notice board is disconnected.

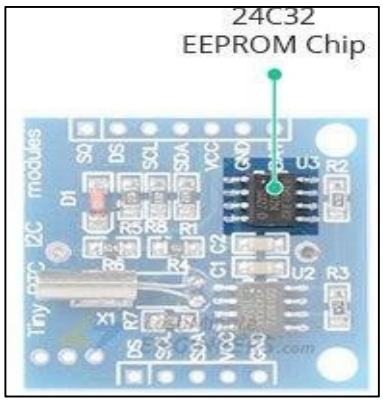

Fig. 6. Onboard 24C32 EEPROM

H. DS1307 RTC Module Pinout

The DS1307 RTC module pinout typically includes 8 pins, each of which serves a specific function in the module's operation. The pinout may vary slightly depending on the specific manufacturer and model of the module, but the following pinout is a common configuration [13] (Fig. 8). The DS1307 RTC module pinout includes several important pins that enable the module to perform its functions. These pins and their functions include:

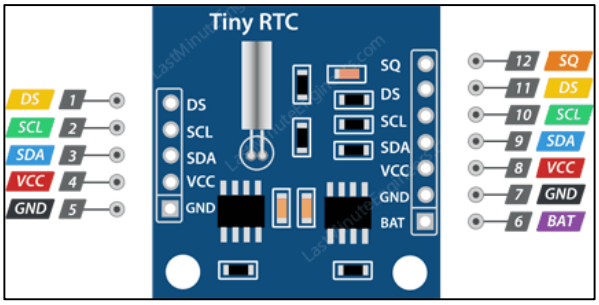

Fig. 7. DS1307 RTC Module Pinout

- SQW This pin outputs a square wave signal with a frequency that can be programmed using the module's internal registers. The available frequencies are 1Hz, 4kHz, 8kHz, or 32kHz.
- DS This pin outputs temperature readings if a DS18B20 temperature sensor is installed next to the battery holder (U1) on the module.
- SCL This pin is the clock input for the I2C interface and is used to synchronize data movement on the serial interface.
- SDA This pin is the data input/output for the I2C serial interface.
- VCC This pin supplies power for the module and can be anywhere between 3.3V to 5.5V.
- GND This pin is a ground connection.
- BAT This pin is a backup supply input for a standard 3V lithium cell or other energy source to maintain accurate timekeeping when main power to the device is interrupted.

It's important to note that the pinout for the DS1307 RTC module may differ for different models or manufacturers. Additionally, if you're using a Mega board, you'll need to use different pins for SCL and SDA (digital 21 and 20, respectively).

TABLE I. DS1307 RTC MODULE WHEN USING AN ARDUINO MEGA BOARD

Pin name	Arduino Uno/Nano	Arduino Mega
SQW	A4	21
DS	Not connected	Not connected
SCL	A5	21
SDA	A4	20
VCC	5V	5V
GND	GND	GND
BAT	BAT	BAT

The DS pin is typically not connected on the DS1307 RTC module, but if it is connected and used for temperature readings, it will not function when using an Arduino Mega board.

The following diagram shows you how to wire everything.

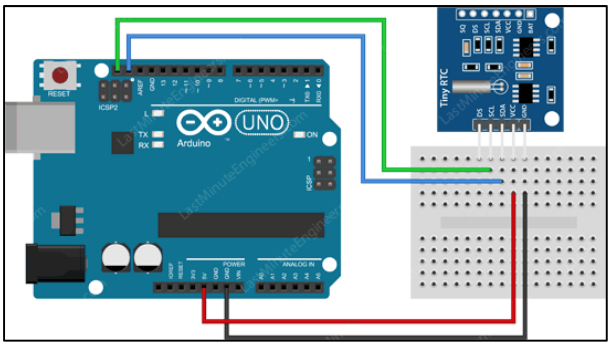

Fig. 8. Arduino DS1307 Real Time Clock Module Wiring

Here are the steps to install the RTClib library:

1) Download the RTClib library from the Adafruit Github repository: https://github.com/adafruit/RTClib.

2) Extract the downloaded zip file to a folder named RTClib.

3) Copy the RTClib folder to the Arduino libraries folder. On Windows, this folder is typically located in "Documents/Arduino/libraries", while on a Mac it's located in "~/Documents/Arduino/libraries". Restart the Arduino IDE

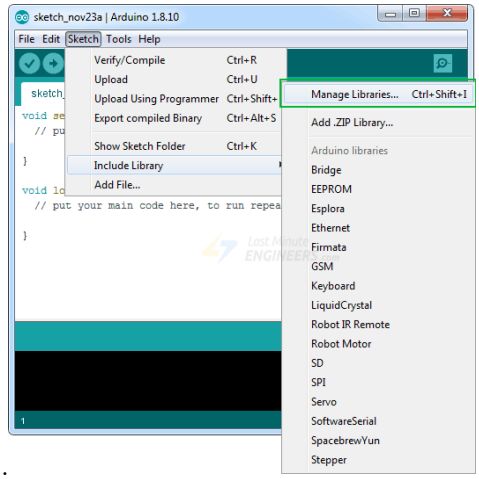

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Fig. 9. Installing RTClib Library

4) In the Arduino IDE, navigate to "Sketch" > "Include Library" > "RTClib" to include the library in your project.

5) To verify that the library is installed correctly, you can try compiling one of the example sketches provided in the library by navigating to "File" > "Examples" > "RTClib".

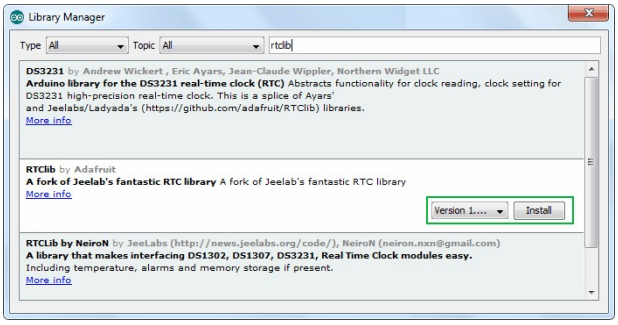

Fig. 10. Installing Library

Once the RTClib library is installed, you can use it to interface with the RTC module and perform various functions such as setting the time and reading the time values [30].

IV. RESULTS

To connect the circuit for displaying a message on the notice board using a PC with a P10 LED display module and an RTC module, follow these steps:

1) Connect the VCC pin of the P10 LED display module to the 5V pin of the Arduino Uno board.

2) Connect the GND pin of the P10 LED display module to the GND pin of the Arduino Uno board.

3) Connect the DIN pin of the P10 LED display module to digital pin 12 of the Arduino Uno board.

4) Connect the CS pin of the P10 LED display module to digital pin 10 of the Arduino Uno board.

5) Connect the CLK pin of the P10 LED display module to digital pin 11 of the Arduino Uno board.

6) Connect the VCC pin of the RTC module to the 5V pin of the Arduino Uno board.

7) Connect the GND pin of the RTC module to the GND pin of the Arduino Uno board.

8) Connect the SDA pin of the RTC module to the A4 pin of the Arduino Uno board.

9) Connect the SCL pin of the RTC module to the A5 pin of the Arduino Uno board.

10) Insert a CR2032 battery into the battery holder on the RTC module, ensuring that the positive (+) side of the battery is facing up.

Once the circuit is connected, you can upload the code to the Arduino Uno board to display the message on the P10 LED display module and keep track of the time using the RTC module.

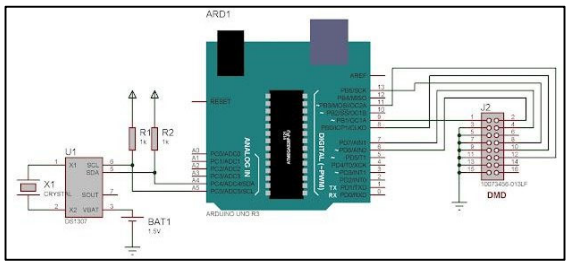

Fig. 11. Connect the Circuit

The P10 LED display module has two main inputs and one output:

1) Data Input: This input is used to receive data from the microcontroller. It is connected to the DIN pin of the module.

2) Control Input: This input is used to receive control signals from the microcontroller. It is connected to the CS and CLK pins of the module.

3) LED Matrix Output: This output consists of a matrix of LEDs that can display different patterns and messages based on the data received from the microcontroller.

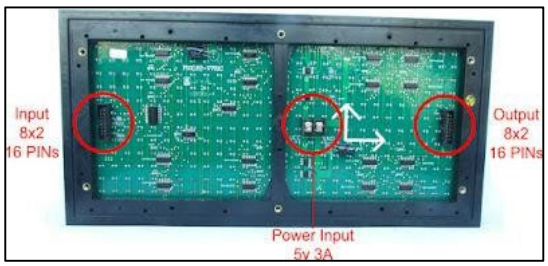

Fig. 12. Input and Output in P10 Board

To display a message on the P10 LED display module, the microcontroller sends data to the module through the Data Input pin. The module then uses this data to turn on and off the individual LEDs in the LED matrix to create the desired pattern or message.

The Control Input pins are used to send control signals to the module to conFig. the display settings, such as brightness and refresh rate.

The P10 LED display module provides a flexible and customizable platform for displaying messages and graphics in a variety of settings.

By following the wiring and programming procedures outlined above, we can create a fully functional system for displaying messages on a P10 LED matrix display module using an Arduino microcontroller. With the help of the RTC module and a PC, we can create dynamic messages that change based on the time of day or other external factors. This system is highly customizable and can be adapted to a variety of different use cases, such as displaying information in public spaces or advertising products in a store. Overall, the combination of the Arduino microcontroller and the P10 LED matrix display module provides a powerful platform for creating eye-catching displays and delivering important messages to a wide audience, shown on Fig. 13.

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Fig. 13. Digital Notice Board

The details how to utilize an ATMega328 to control and show animated messages, time, and date on a 16x32 LED display. Even if the device's power is suddenly stopped, the time and date will be preserved thanks to an on-board battery and time and date sensor, preventing data loss.

This project demonstrates how to use an ATMega328 to control and show animated messages, time, and date on a 16x32 LED display. The gadget has a battery with a time and date sensor, so even if the power goes off, the time and data may still be saved. In turn, it guards against data loss in the event of a power failure.

The 16x32 LED Display is a matrix of LEDs that may be set to show any combination of text, images, and animations, providing even more detail on the undertaking. The ATMega328 is the project's brain and is responsible for driving the LED display. The MAX7219 driver connects the microcontroller to the LED display and is configured using the Arduino IDE.

A real-time clock (RTC) module is included into the project to maintain accurate timekeeping in the event of a power outage. This guarantees that, even in the event of a power interruption, the display will always display the proper time and date. The I2C protocol is used to establish a connection between the microcontroller and the RTC module.

The project also includes a software application that enables users to submit messages and animations to be shown on the LED display. The software is installed on a personal computer and connects with the microcontroller through a USB connection. Users may preview their messages and animations before they are shown on the LED display, and the interface is designed to be as intuitive as possible.

Overall, this initiative offers a fun and engaging approach to post notices and animations in public spaces. It is possible to keep the display up to date even after a power interruption by using a module that can keep the time. The intuitive interface of the software facilitates the production of one's own personal messages and animations.

V. Discussion

The article is a digital screen with 512 LEDs, similar to those used in giant billboards. It is linked in novel ways to give the impression of an oasis panel and to display the text inside it as a single piece. The user may customize the displayed text's time, date, font style, and size by programming it in the Arduino C programming language, which is comparable to C ++.

The study offers a fresh approach to showcasing content on a notice board or in a public setting. This project uses a 16x32 LED Display to show messages, animations, and time and date information in a stylish and eye-catching manner. A real-time clock (RTC) module also ensures that the display always displays the correct time and date, even during a power interruption.

The article effectively uses the ATMega328 microcontroller, a superb control center for the LED display, enabling users to tailor their messages and animations. The Arduino IDE programs the microcontroller, and a MAX7219 driver operates the LED display.

The fact that it can be programmed remotely using a personal computer is one of the project's most essential features. The software application allows users to insert their own words and animations, and the letters may be reviewed before being shown on the LED screen. Users may instantly refresh the display with new information thanks to this function, which is highly useful.

Another significant benefit is the project's RTC module, which guarantees that the displayed time and date are always accurate. The I2C protocol links the RTC module to the microcontroller, making it simple to include in the system. For public areas that need precise information at all times, an RTC module is a must-have.

The study might have a downside if it is too complicated for the average person to set up and program. Yet, almost anyone interested in electronics and programming can learn the necessary skills using the Arduino IDE and the plethora of online tutorials and instructions.

The article offers a fresh and efficient method for displaying information publicly or on a notice board. It's an excellent option for showing up-to-date data with personalized messages and animations, thanks to its RTC module and intuitive software.

The implementation of a message display system using an Arduino Nano microcontroller for notice boards holds great potential in various applications. This technology enables users to easily update and display messages on the notice board without physical intervention. The system offers a rapid and efficient means of disseminating information to a broader audience, rendering it a valuable asset in educational institutions, corporate environments, public spaces, and various other settings. One of its notable advantages is the user-friendly interface, enabling individuals to input messages directly onto the electronic display screen via a PC, making information sharing seamless and effortless.

This feature eliminates the need for manual updates and minimizes human intervention, reducing the chances of errors or delays in communication. The utilization of an Arduino Nano microcontroller ensures that the system is compact, cost-effective, and easily customizable, making it suitable for various setups and environments.

In addition to the technical aspects, the adoption of such a display system can significantly enhance communication and collaboration among different stakeholders. For instance, in educational institutions, teachers can promptly share important announcements, class schedules, and event details with students and staff. In corporate offices, management can use the system to relay updates, meeting schedules, and other relevant information to employees, fostering better internal communication.

References [9], [14], [18], [23], and [27] have discussed the role of technology in improving communication channels. The use of a notice board display system aligns with the concept of interactivity and the need for efficient information sharing. This aligns with the findings of Fungo [6], who emphasized the significance of community interaction and communication through online platforms.

The system's capability to display messages in multiple languages can cater to diverse audiences, making it suitable for international organizations, airports, and public places where multilingual communication is crucial. The integration of language support aligns with research by [1] and [4], highlighting the importance of natural language dialogue-based chatbots for better interaction.

The system also holds the potential for emergency notifications and critical alerts, such as fire alarms or disaster response instructions. This real-time communication can be lifesaving in emergency situations and enhances overall safety and security measures.

Despite its numerous advantages, the implementation of this system may face challenges related to power consumption, scalability, and maintenance. Research [20] and [28] have investigated power-efficient solutions for display technology, and similar principles could be applied to enhance the energy efficiency of the display system.

The integration of an Arduino Nano microcontroller for displaying messages on notice boards offers a promising solution for efficient communication across various sectors. The system's ability to provide real-time updates, multilingual support, and convenient message dissemination makes it a valuable asset for organizations and public spaces. As technology continues to evolve, further research and development in this area can address the challenges and open new possibilities for more advanced and widespread adoption of such display systems.

VI. Conclusions

The paper provides a fresh approach to using public bulletin boards to disseminate information. The system can show personalized messages, animations, and time and date information thanks to a 16x32 LED display, a microprocessor, and a real-time clock module.

The article's intuitive software is a great fit for high-traffic areas that need regular changes to their information displays since it makes it simple for people to submit their own messages and animations. The project's usage of an RTC module guarantees that the display always displays the right time and date, even in the event of a power loss, which is crucial for public venues that need up-to-current information.

One of the biggest benefits of the project is how readily it can be modified to meet specific needs and tastes. It is a great option for many apps since users may customize it to add new features or functions.

The initiative may also improve participation and communication in public places. Passersby may be drawn in and encouraged to engage with the content on a dynamic LED display. This may be especially helpful in promotional and instructional contexts, as the display can be used to highlight items or get across vital points to the target audience.

The project's usage of an RTC module also guarantees that the information being shown is accurate and up-to-date. In public places, where information accuracy and timeliness are crucial, this is especially crucial.

The project may be simply extended or updated to incorporate new features or functions, making it very scalable. For instance, the LED display may be modified to be bigger or smaller, or other sensors can be added to the system to gather more data. Because of this, the project may be used in a wide variety of contexts and applications.

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