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Smart Multipurpose Digital Clock

Proff. M. M. Kolap[1], Miss. Shweta Jadhav[2], Miss. Sejal Kadam[3], Miss. Snehal Ilake[4]

[1]Department of Electronics and Telecommunication, Dr. J. J. Magdum College of Engineering, Jaysinghpur 416 101
[234]UG Student, Department of Electronics and Telecommunication, Dr. J. J. Magdum College of Engineering, Jaysinghpur 416 101

ABSTRACT:

The Smart Multipurpose Digital Clock is an innovative timekeeping device designed to go beyond traditional clock functions. This project integrates multiple features into a single compact system, offering not only real-time time and date display but also smart functionalities such as temperature and humidity monitoring, reminder, and home automation system. Built using A PIC16F877A microcontroller, the clock incorporates sensors (e.g. temperature and humidity), a real-time clock (RTC) module, an intuitive display (LCD and LED) to present information clearly, a Bluetooth module to give a reminder message through user's phone, and an ESP8266 to control home/office appliances via Wi-Fi. Additionally, it can include wireless connectivity for syncing time over the internet or integrating with smart home systems. The goal of this project is to provide users with a reliable, multifunctional device that enhances daily productivity and convenience through automation and real-time data access.

Keywords: PIC16F877A, RTC Module, Bluetooth Module, Relay Module, ESP8266

INTRODUCTION

In an increasingly fast-paced world, time management has become essential for productivity, efficiency, and overall well-being. The conventional digital clock, while useful, often lacks the integration and intelligence needed to meet the demands of modern users. To address this gap, we introduce the Smart Multipurpose Digital Clock a next-generation timekeeping device that goes far beyond merely displaying hours and minutes.

This project focuses on designing and implementing a smart multipurpose digital clock that integrates various functionalities into a single, user-friendly device. The core components include a PIC16F877A microcontroller for processing, a Real-Time Clock (RTC) module for accurate timekeeping, and sensors for environmental data collection Bluetooth module to display reminder message, and a relay module and ESP8266 for controlling home appliances. The clock will feature a clear display interface, such as an LCD or LED screen, to present information like time, date, day of the week, ambient temperature and humidity, and customizable alarms. It is built with an emphasis on both form and function, targeting everyday use in homes, offices, classrooms, and even industrial environments.

At the heart of the smart clock is a PIC16F877A microcontroller that governs the operation of all modules. Timekeeping is maintained using a real-time clock (RTC) module, which ensures accuracy even during power interruptions. A digital display such as an LED or LCD screen provides a clear and easy- to-read interface for the user.

In addition to time, the clock is capable of showing current indoor temperature and humidity, thanks to integrated environmental sensors such as temperature and humidity sensors. This makes it not only a timekeeping tool but also an environmental monitor. Such features are particularly useful in maintaining optimal living or working conditions.

The smart clock is also equipped with alarm functionality, allowing users to set multiple alarms for different purposes, such as waking up, taking medications, or attending meetings etc. Alarms can be customized with sound or vibration alerts and even linked to external devices via Bluetooth for broader smart home integration.

The smart multipurpose digital clock also provides a home automation system, which allows users to control lights, fans, air conditioning, and other appliances using touch buttons, a mobile app. The smart clock connects to home Wi-Fi and can also operate through Bluetooth, allowing remote control from smartphones or PCs.

Another standout feature is the calendar and event reminder system. Users can view the current date and get alerts for upcoming events. This makes the clock a helpful personal assistant, ideal for users with busy schedules.

This project not only demonstrates technical skill and innovation but also addresses real-world needs through practical, user-centric design. . It reflects the growing demand for smart home devices that simplify daily life and enhance user experience.

METHODOLOGY

A. Block Diagram:

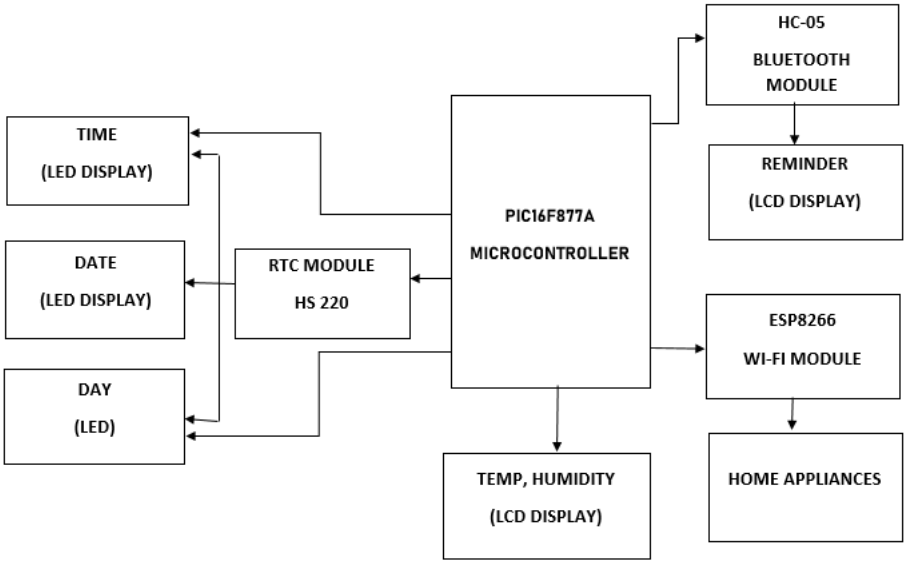

Fig. 1) Block Diagram of Smart multipurpose Digital Clock

B. Circuit Diagram:

- *Figure A):-*

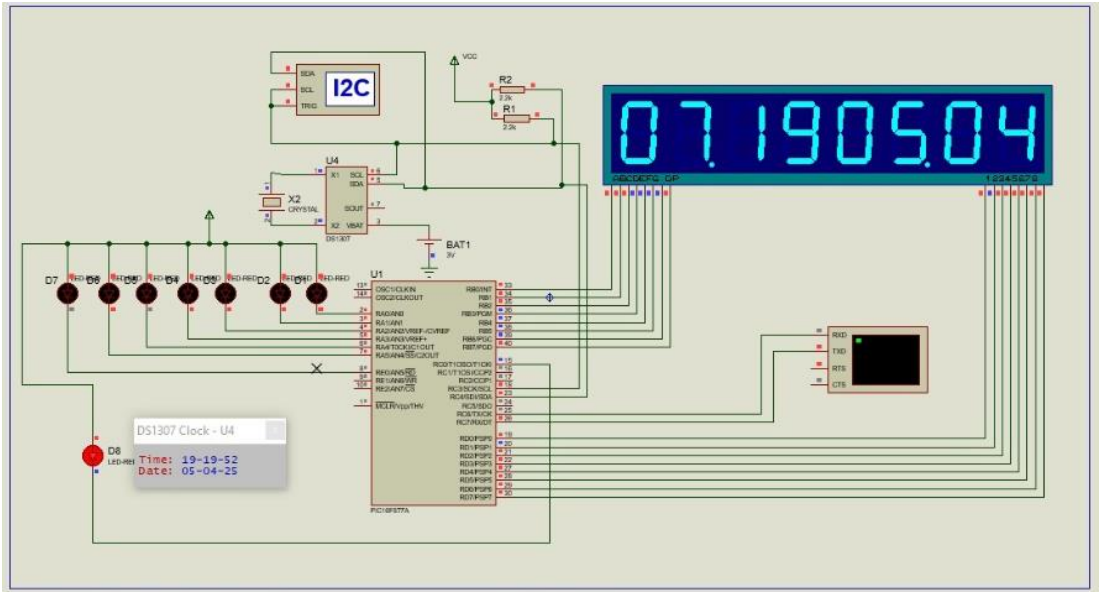

Fig. 2.A) Circuit Diagram of Digital Clock

This circuit 2.A) is a digital clock system using a PIC16F877A microcontroller and a DS1307 real-time clock (RTC) module. The DS1307 keeps track of time and date, powered by a coin cell battery for backup. Communication between the RTC and microcontroller is through the I2C protocol. The microcontroller processes the time data and displays it on a 7-segment display. Push buttons are used for setting the time and date. An RS232 interface allows communication with a PC for monitoring or setting time via serial communication.

- *Figure B):-*

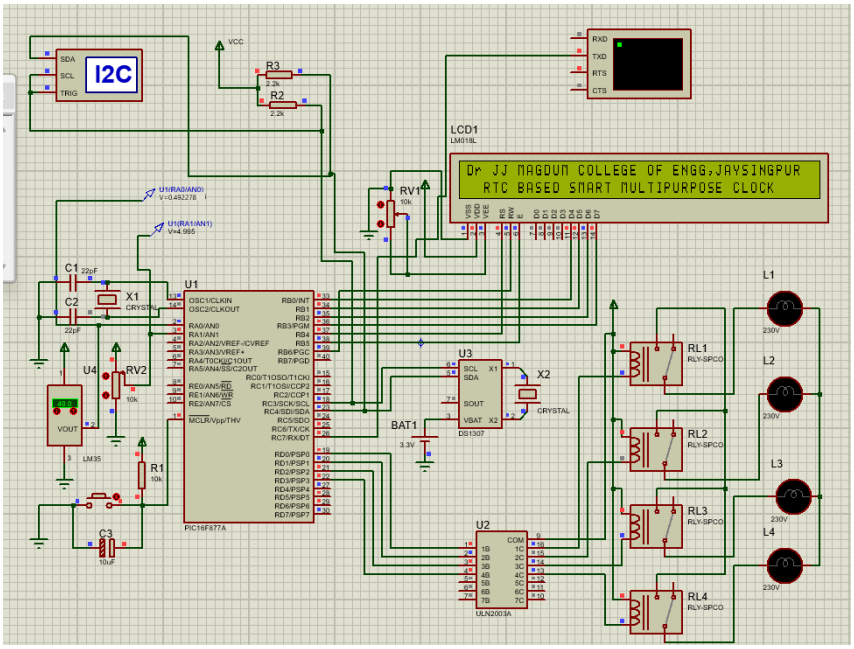

Fig. 2.B) Circuit Diagram of Reminder and Home Automation System

This circuit diagram 2.B) represents an RTC-based Smart Multipurpose Clock project, designed using a PIC16F877A microcontroller. The system incorporates a HS220 Real-Time Clock module that communicates with the microcontroller via the I2C protocol to maintain accurate timekeeping. . A 40x2 LCD is used to display real-time data such as date, time, and system messages. Additionally, an LM35 temperature sensor is included to monitor environmental temperature, with the analog signal processed by the microcontroller. The circuit controls four electrical loads (L1–L4) through relays, which are driven by a ULN2003A relay driver IC based on predefined timing and temperature conditions supporting components like crystal oscillators, and variable resistors ensure reliable and stable operation. This smart clock setup can be effectively used in home automation or industrial systems where timed control of devices is required.

RESULT AND DISCUSSION

RESULT:

- *Figure A):-*

Fig. 3.A) Implementation of Digital Clock

- *Figure B):-*

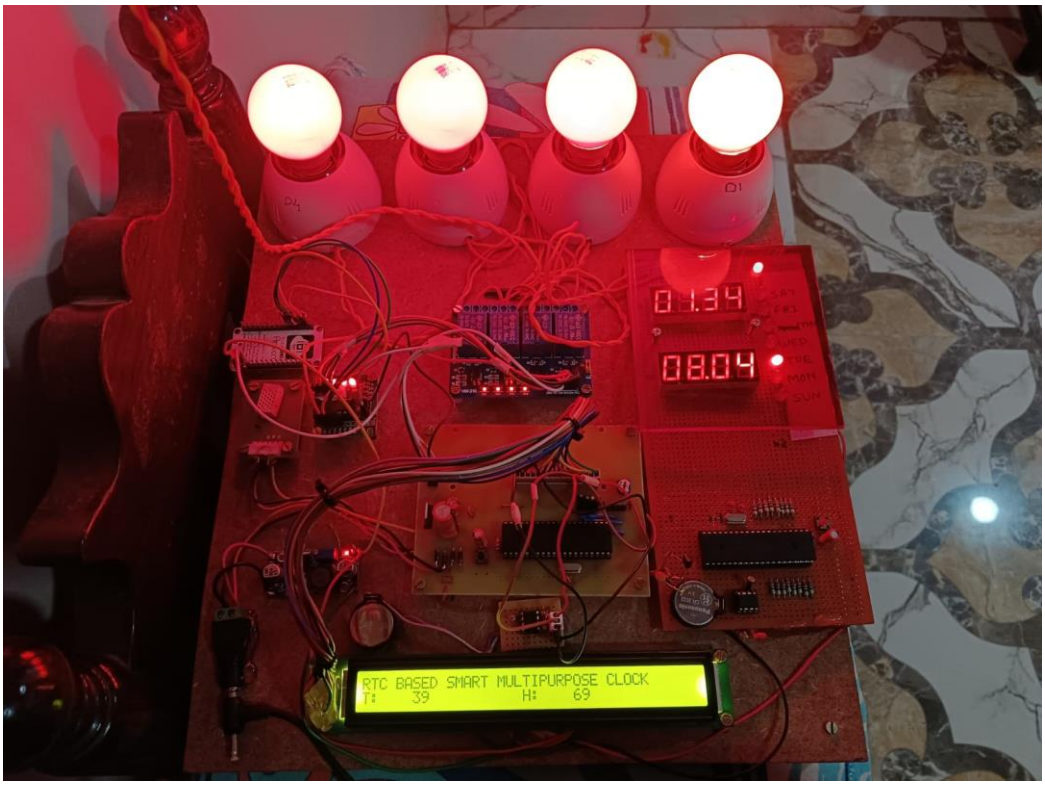

Fig. 3.B) Implementation of Reminder and Home Automation System

DISCUSSION:

The proposed smart multipurpose digital clock was successfully implemented and tested. The system performed all intended functions with accuracy and stability. The LED display correctly showed the real-time clock data, including time and date, indicating proper communication with the RTC module. The 40x2 LCD screen effectively displayed environmental parameters such as temperature and humidity, along with reminder messages received via the HC-05 Bluetooth module.

Appliance was controlled using the ESP8266 Wi-Fi module, where a connected bulb responded accurately to control signals, simulating a real home appliance. The PIC16F877A microcontroller served as the central processing unit, managing all data transmission and control operations among the modules.

The system exhibited quick response times and consistent performance during testing. However, it was observed that the Bluetooth module had a limited operating range, and the stability of the Wi-Fi module was influenced by the strength of the available internet connection. Despite these limitations, the prototype demonstrated reliable operation and meets the basic requirements of a smart home system.

Overall, the results confirm the feasibility and functionality of the proposed design. Future enhancements may include the integration of a mobile application for remote control and improvements in wireless communication for extended range and efficiency.

CONCLUSION

A smart multipurpose digital clock was designed and implemented using the PIC16F877A microcontroller. The system successfully integrates real-time monitoring, wireless communication, and appliance control. It uses an RTC module for accurate time and date display, sensors for environmental monitoring, and both Bluetooth and Wi-Fi modules for communication and control. The system was tested under standard conditions and performed its intended functions effectively, including time-based reminders and remote appliance switching.

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