REAL-TIME-CLOCK USING ARDUINO

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ABSTRACT:

This project aims to develop a real-time clock (RTC) using the DS3231 module and display the time and date information on an LCD screen. The DS3231 module is a highly accurate RTC that can maintain timekeeping even in the absence of power. The module communicates with the Arduino microcontroller using the I2C protocol, which allows for easy integration with the Arduino platform. The primary objective of this project is to develop a functional RTC that provides accurate time and date information and displays it on an LCD screen. To achieve this goal, the project involves connecting the DS3231 module and the LCD screen to the Arduino, programming the Arduino to read the time and date information from the module, and displaying it on the LCD screen. The project also involves incorporating a battery backup system to ensure that the RTC can maintain accurate timekeeping even in the event of power failure. The battery backup system consists of a small lithium-ion battery that is connected to the DS3231 module. When the primary power source is unavailable, the battery backup system provides power to the DS3231 module, ensuring that the RTC can continue to maintain accurate timekeeping. In addition to displaying the time and date information, the LCD screen also displays a menu system that allows the user to adjust the time and date settings. The menu system is navigated using four push buttons that are connected to the Arduino. The push buttons allow the user to scroll through the menu options and make adjustments to the time and date settings as needed. The project also involves incorporating a temperature sensor to measure the ambient temperature and display it on the LCD screen. The temperature sensor is connected to the Arduino and provides accurate temperature readings that are displayed in real-time on the LCD screen . The final result of the project is a functional RTC that provides accurate time and date information, displays the temperature in real-time, and includes a menu system for adjusting the time and date settings. The project is a testament to the versatility and effectiveness of the DS3231 module and the Arduino platform as a solution for timekeeping and offers significant potential for use in a wide range of applications. In conclusion, the RTC using the DS3231 module and LCD display developed in this project offers a reliable and accurate solution for timekeeping. The integration of the temperature sensor and the menu system adds significant functionality to the system and provides added value for a wide range of applications

1.INTRODUCTION

A real-time clock (RTC) is a battery-powered clock that measures time even when there is no external power or the microcontroller is reprogrammed by using Arduino. Arduino-based real-time clock is a digital clock to display real-time using an RTC DS 3231 which works on I2C protocol. This project is to display 'REAL TIME' using microcontroller Arduino as well as RTC IC DS3231 such that it gives the time in terms of hours, minutes, and seconds and displays the date as "DD/MM/YY" and temperature in "C. The term is used to avoid confusion with ordinary hardware clocks which are only signals that govern digital electronics, and do not count time in human units. RTC should not be confused with real-time computing, which shares its three-letter acronym but does not directly relate

to the time of day. In this circuit we have used a 16×2 LCD module to display the time in (hours, minutes, seconds, dates, months and years) format. Real time clock is commonly used in our computers, houses, offices and electronics device for keeping them update with real time. It is not only a real time clock but also a temperature and humidity sensing circuit. The temperature and humidity are major concern as global warming. In this circuit, the weather data measuring system is designed to investigate temperature and humidity intensities. The measurement values are also displayed on LCD.

2. LITERATURE REVIEW

2.1MICROCONTROLLER ARDUINO UNOR3

The Arduino UNO R3 is the perfect board to get familiar with electronics and coding. This versatile microcontroller is equipped with the well-known Processor.This board will give you a great first experience within the world of Arduino.

Features

Memory

- AVR CPU at up to 16 MHz
- 32KB Flash • 2KB SRAM
- 1KB EEPROM

Security

- Power On Reset (POR)
- Brown Out Detection (BOD)

Peripherals

- 2x 8-bit Timer/Counter with a dedicated period register and compare channels
- 1x 16-bit Timer/Counter with a dedicated period register, input capture and compare channels
- 1x USART with fractional baud rate generator and start-of-frame detection
- 1x controller/peripheral Serial Peripheral Interface (SPI)
- 1x Dual mode controller/peripheral I2C
- 1x Analog Comparator (AC) with a scalable reference input
- Watchdog Timer with separate on-chip oscillator
- Six PWM channels
- Interrupt and wake-up on pin change 3 Memory

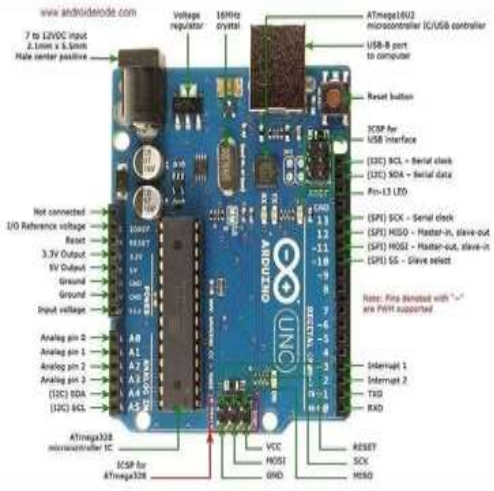


Fig 2.1 ARDUINO UNO

2.2 RTC

A Real Time Clock (RTC) is basically just like a watch it runs on a battery and keeps time for you even when there is a power outage. Using an RTC, you can keep track of long timelines, even if you reprogram your microcontroller or a power plug The real time clock (RTC) is widely used device that provides accurate time and date for many applications. Many systems such as IBM pc come with RTC chip on mother board. RTC chip uses an internal battery which keeps time and date even when the power is off. In some microcontrollers have inbuilt RTC while others require interfacing.See reference [2] for future

DS3231

The DS3231 is a low-cost, extremely accurate 12C real-time clock (RTC) with an integrated crystal. The device incorporates a battery input, and maintains accurate timekeeping when main power to the device is interrupted. The integration of the crystal resonator enhances the longterm accuracy of the device as well as reduces the piece-part count in a manufacturing line. The RTC maintains seconds, minutes, hours, day, date, month, and year information. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with an AM/PM indicator.

Fig.2.2 RTC DS3231

FEATURES:

- Highly Accurate RTC Completely Manages All Timekeeping Functions
- Real-Time Clock Counts Seconds, Minutes, Hours, Date of the Month, Month,Day of the Week, and Year, with Leap-Year Compensation Valid Up to 2100.
- Accuracy +2ppm from 0°C to +40°C.
- Accuracy ±3.5ppm from -40°C to +85°C.
- Digital Temp Sensor Output: #3°C Accuracy
- Register for Aging Trim
- RST Output/Pushbutton Reset Debounce Input
- Two Time-of-Day Alarms
- Programmable Square-Wave Output Signal
- Simple Serial Interface Connects to Most Microcontrollers Fast (400kHz) 12C Interface
- Battery-Backup Input for Continuous Timekeeping
- Low Power Operation Extends Battery-Backup Run Tim.

3.3V Operations

- Operating Temperature Ranges: Commercial (0°C to +70°C) and Industrial (-40°C to+85°C)

2.3 DS3231 Pin Configuration:

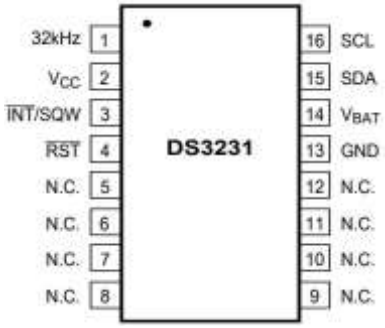


Fig.2.3 DS3231 Pin Configuration

3 WORKING:

The DS3231 is a serial RTC driven by a temperature-compensated 32kHz crystal oscilator. The TCXO provides a stable and accurate reference clock, and maintains the RTC to within +2 minutes per year accuracy from -40°C to +85°C. The TCXO frequency output is available at the 32 kHz pin. The RTC is a low-power clock/calendar with two programmable time-of- day alarms and programmable square-wave output. The INT/SQW provides either an interrupt signal due to alarm conditions or a square-wave output. The clock/calendar provides seconds, minutes, hours, day, date,

month, and year information. The date at the end of the month is automatically adjusted for months with fewer than 31 days, including corrections for leap year. The clock operates in either the 24-hour or 12-hour format with an AM/PM indicator. The internal registers are accessible though an 12C bus interface.A temperature-compensated voltage reference and comparator circuit monitors the level of VCC detect power failures and to automatically switch to the backup supply when necessary. The RST pin provides an external pushbutton function and acts as an indicator of a power-fail event.

3.1 ADDRESS MAP

The address map for the DS3231 timekeeping registers. During a multi-byte access, when the address pointer reaches the end of the register space (12h), wraps around to location 00h On an 12C START or address pointer incrementing to location 00h, the current time is transferred to a second set of registers. The time information is read from these secondary registers, while the clock may continue to run. This eliminates the need to reread the registers in case the main registers update during a read.

ADDRESS	BIT 7 MSB	BIT 6	BIT 5	BIT 4	BIT 3	BIT 2	BIT 1	BIT 0 LSB	FUNCTION	RANGE
00h	0	10 Seconds			Seconds				Seconds	00–59
01h	0	10 Minutes			Minutes				Minutes	00–59
02h	0	12/$\overline{24}$	$\overline{AM}$/PM 20 Hour	10 Hour	Hour				Hours	1–12 + $\overline{AM}$/PM 00–23
03h	0	0	0	0	0	Day			Day	1–7
04h	0	0	10 Date		Date				Date	01–31
05h	Century	0	0	10 Month	Month				Month/ Century	01–12 + Century
06h	10 Year				Year				Year	00–99
07h	A1M1	10 Seconds			Seconds				Alarm 1 Seconds	00–59
08h	A1M2	10 Minutes			Minutes				Alarm 1 Minutes	00–59
09h	A1M3	12/$\overline{24}$	$\overline{AM}$/PM 20 Hour	10 Hour	Hour				Alarm 1 Hours	1–12 + $\overline{AM}$/PM 00–23
0Ah	A1M4	DY/DT	10 Date		Day				Alarm 1 Day	1–7
					Date				Alarm 1 Date	1–31
0Bh	A2M2	10 Minutes			Minutes				Alarm 2 Minutes	00–59
0Ch	A2M3	12/$\overline{24}$	$\overline{AM}$/PM 20 Hour	10 Hour	Hour				Alarm 2 Hours	1–12 + $\overline{AM}$/PM 00–23
0Dh	A2M4	DY/$\overline{DT}$	10 Date		Day				Alarm 2 Day	1–7
					Date				Alarm 2 Date	1–31
0Eh	$\overline{EOSC}$	BBSQW	CONV	RS2	RS1	INTCN	A2IE	A1IE	Control	—
0Fh	OSF	0	0	0	EN32kHz	BSY	A2F	A1F	Control/Status	—
10h	SIGN	DATA	DATA	DATA	DATA	DATA	DATA	DATA	Aging Offset	—
11h	SIGN	DATA	DATA	DATA	DATA	DATA	DATA	DATA	MSB of Temp	—
12h	DATA	DATA	0	0	0	0	0	0	LSB of Temp	—

Table.3.1.Address Map

3.2 LCD

The Oriole Display Module (ODM) is a dot matrix liquid crystal display that displays alphanumeric, Kanu (Japanese) characters and symbol. The built-in controller and driver LSI's provide convenient connectivity between the dot matrix LCD and most 4 or 8 bit microprocessors or microcontrollers. All the functions required for a dot matrix liquid crystal display drive are manually provided. Internal refresh is provided by ODM. The CMOS technology makes the device ideal for application in hard held, portable and the other battery powered instruments with low power consumption.

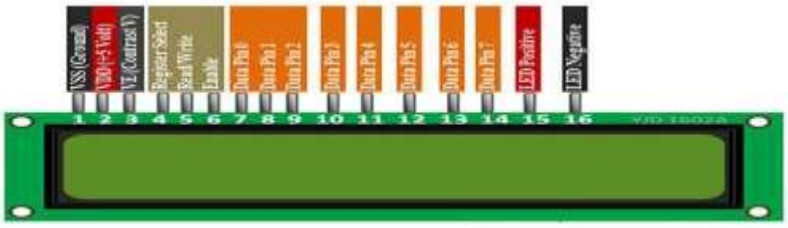


Fig.3.2LCD display

LCD PINOUT

PIN NO	Symbol	Fuction
1	VSS	GND
2	VDD	+5V
3	V0	Contrast adjustment
4	RS	H/L Register select signal
5	R/W	H/L Read/Write signal
6	E	H/L Enable signal
7	DB0	H/L Data bus line
8	DB1	H/L Data bus line
9	DB2	H/L Data bus line
10	DB3	H/L Data bus line
11	DB4	H/L Data bus line
12	DB5	H/L Data bus line
13	DB6	H/L Data bus line
14	DB7	H/L Data bus line
15	A	+4.2V for LED
16	K	Power supply for BKL(0V)

TABLE 3.2 LCD PINOUT

3.3 CIRCUIT DIAGRAM

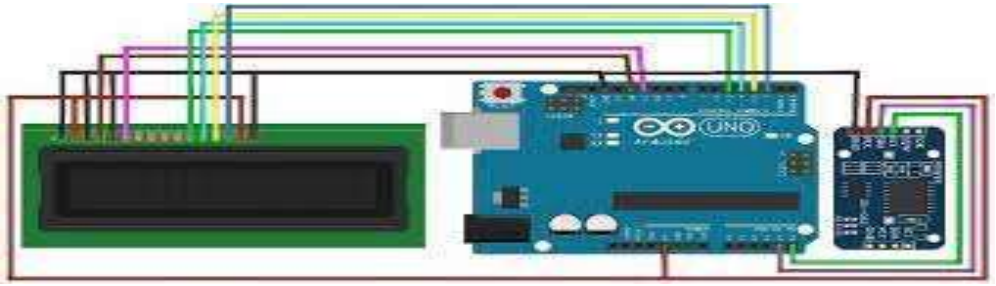
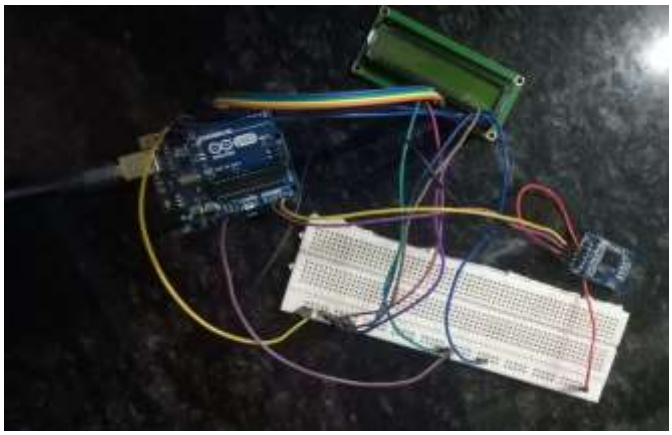


FIG 3.3 CIRCUIT DIAGRAM

HARDWARE SETUP



CONCLUSION

In this project for real-time application Le, to show the time, date, day, and temp according to the environment, a DS3231 chip was used in which a program was preinstalled using the Arduino board. The program was compiled and tested using the Arduino software. After connecting all the components in the Vero board the program was nm successfully and LCD and buzzer showed the required output. In this way, our aim of showcasing the daytime date and temp in a single device and notifying the time by using the buzzer was achieved. This can become handy in case of a power failure as it does not require any power supply for its operation and can be used in areas where a power supply is not present like in remote areas and army camps. It has a great future scope and further work can be done to improve its application.

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