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Design and implementation of Electronic Calendar

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ABSTRACT: This Project Electronic Calendar using Microcontroller is an advanced digital calendar, which displays the Date, Day and Month over the 16X2 LCD display. The system has a battery backup so that it can run over all the time even during the power failure. Liquid Crystal Display is provided to display the day, date, month and year. All the above systems are controlled by the 8051 Microcontroller. The AT895C1 is 8051 Microcontroller from Atmel with on chip flash. The Microcontroller reads the time value from RTC (Real Time Clock) continuously and displays the time value on Liquid Crystal Display. Real Time Clock (RTC) uses a 3V Lithium battery so that it runs on the battery even in power failures. Real Time Clock (RTC) runs perfectly for almost 1000 years. The BQ4802LY is a parallel RTC has a built-in power-sense circuit that detects power failures and automatically switches to the backup supply. Timekeeping operation continues while the part operates from the backup supply.

KEYWORDS: 8051 Microcontroller, 16X2 LCD, Electronic Calendar, BQ4802LY parallel RTC

I. INTRODUCTION

Now a days electronic clocks havepredominately substituted the mechanical clock. Theyare much reliable, accurate, maintenance free andportable. In general, there are two kinds of electronicclocks. They are analog clock and digital clock. Butdigital clocks are more common and self-governing ofexternal source. It would need the controlled devicesand implementation of software for microcontrollercontrolled system because the hardware devicescannot do any wanted task to execute in a real timesystem.Digital clocks that run on mains electricity andhave no battery must be reset every time the power iscut off or if they are moved. Even if power is cut offfor a second, most clocks will still have to be reset.This is a specific problem with alarm clock thathave no battery backup, because even a verybrief power outage during the night usually results inthe clock failing to trigger the alarm in the morning.To reduce the problem, here we have designed adigital clock that operates on household electricityand include a battery backup to maintain the timeduring power outages and during times ofdisconnection from the power supply. More recently,some devices incorporate a method for automaticallysetting the time, such as using abroadcast radio signal from an atomic clock gettingthe time from an existing satellitetelevision or computer connection, or by being set atthe factory and then maintaining the time from thenon with a quartz movement powered by an internalrechargeable battery.Also RTC (Real time clock) are available now, so these are Digital clocks that run on mains electricityand have no battery and therefore must be reset everytime the power is cut off or if they are moved. Even ifpower is cut off for a second, most clocks will stillhave to be reset .But there are RTC in the form ofintegrated circuits also along with battery backup andshow accurate time even after power is cut off.

Examples are DS1307 which runs on I2C protocoland DS1306 uses SPI protocol.The aim of our system is to provide accuratetime during or after any condition of mains (or VDD)supply. The main aim of this work is to design and electroniccalendar with 12 hours digital clock of the year. The user canselect and set any day, date and time of the day to the systemand it would pick from the inputs [2]. The LCD display would be used todisplay the days of the week (Monday through Saturday), dateand time of the year.

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II. RELATED WORK

In 2008, Pan Thu Tun has designed a digitalClock using microcontroller with seven-segment display [1].However, there are some limitations in his design. It couldnot display year, month or day. Moreover, his system becamerelatively expensive due to using external decoder. Fewresearches have been done for displaying Bangla numerals.M. S. Arefin et al. [2] designed a 24 segment display forBangla characters and Numerals. But this design is redundantwhen it comes to display only numerals. Similarly SabbirAhmed et al [3] designed a 10-segment display for Bangladigits but their segment were not uniform and in addition to ittheir design has some controversy regarding portraying digits "1", "2", "3" and "7" accurately. In our design, we correctedthose problems. M.O Rahman and et al. [4] also designed an11-segment display for Bangla, Arabic and English numerals.

III. SYSTEM ARCHITECTURE

As shown in fig.1 the circuit Port 2 of microcontroller connected to the data pins of 16x2 LCD display and bit P3^0 and P3^1 of port 3 connected to the command pin of 16x2 LCD display RS and EN respectively. And parallel data BQ4802LY connected to P1^0 and P1^1 of microcontroller respectively. 4 switches/ push buttons also used to set time and alarm. Bits P3^2, P3^3, P3^4 and P1^2 are configured as increment digit, increment value, set time and set alarm respectively. And an alarm indicator LED also connected to P1^3 for indicating alarm. When alarm time will match with the real time of clock then led will be activate. In this clock the RTC is used in 24 hour mode which gives accurate time and can be displayed on LCD through microcontroller. The microcontroller continuously reads the data from the RTC. Program continuously read the data from BQ4802LY and show on display. Bit P3^4 is made active low when and low signal comes to program calls time set function and bits P3^2 and P3^3 is also made active low to set time/date/day as well as alarm time after pressing bit P1^2.

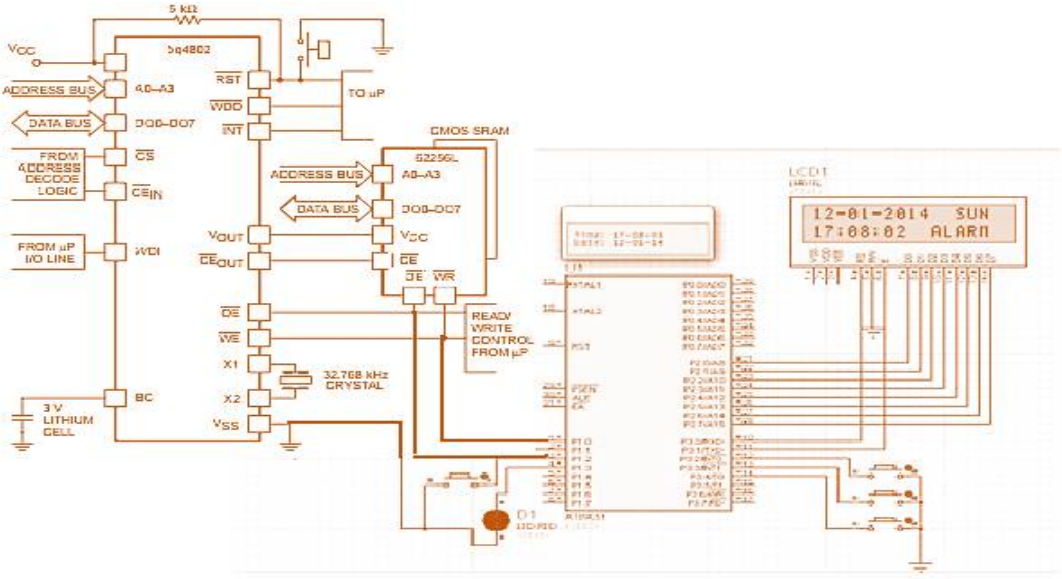

Fig. 1: 8051 functional blockdiagram

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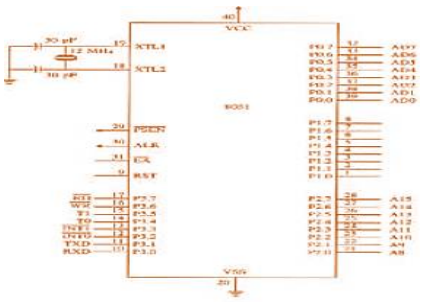

Fig.2pin configuration of 8051

The 8051 Microcontroller incorporates all the features that arefound in microprocessor. The microcontroller has built inRead Only Memory, Random Access Memory, Input Outputports, Serial Port, timers, interrupts and clock circuit [3]. Amicrocontroller is an entire computer manufactured on asingle chip, usually dedicated devices embedded within anapplication. The pin configuration is shown in fig.2.

A. ALPHANUMERIC LCD

LCD's are very simple to interface with the controller as well as are cost effective. The alphanumericdisplay usedin proposed design here is 2× 16(two lines &sixteen characters per line) as shown in Fig. 4.The LCD requires 3 controllines (RS, R/W & EN) & 8 (or 4) data lines. The number on data lines depends on the mode of operation. If operated in8-bit mode then 8 data lines + 3 control lines i.e. total 11 lines are required. And if operated in 4-bit mode then 4 datalines + 3 control lines i.e. 7 lines are required. How do we decide which mode to use? It's simple if you have sufficientdata lines we can go for 8 bit mode & if there is a time constrain i.e. display should be faster than we have to use 8-bitmode because basically 4-bit mode takes twice as more time as compared to 8-bit mode.When RS is low (0), the data is to be treated as a command. When RS is high (1), the data being sent is consideredas text data which should be displayed on the screen. When R/W is low (0), the information on the data bus is beingwritten to the LCD. When RW is high (1), the program is effectively reading from the LCD. Most of the times there isno need to read from the LCD so this line can directly be connected to GND thus saving one controller line. TheENABLE pin is used to latch the data present on the data pins. A HIGH - LOW signal is required to latch the data. TheLCD interprets and executes command at the instant the EN line is brought low. If EN is not instantiated, instructionwill never be executed. [5]

B. BQ4802LY PARALLEL RTC

The CMOS bq3285ED/LD [3]is a low-power microprocessor peripheral providing a time-of-day clock and 100-year calendar with alarm features and battery operation. The architecture is based on the bq3285/7 RTC with added features: low-voltage operation, 32.768kHz output, 128 additional bytes of CMOS, and a day-of-month alarm to be compliant with the ACPI RTC specification. A 32.768kHz output is available for sustaining power-management activities. The bq3285ED/LD 32kHz output is always on whenever VCC is valid. In VCC standby mode, the 32kHz is active, and the bq3285LD typically draws 100uA while the bq3285ED typically draws 300uA. Wake-up capability is provided by an alarm interrupt, which is active in battery-backup mode. In battery-backup mode, current drain is less than 550nA. The bq3285ED/LD write-protects the clock, calendar, and storage registers during power failure. A backup battery then maintains data and operates the clock and calendar. The bq3285ED/LD is a fully compatible real-time clock for IBM AT-compatible computers and other applications. The only external components are a 32.768kHz crystal and a backup battery. The bq3285ED is intended for use in 5V systems. The bq3285LD is intended for use in 3V systems; the bq3285LD, however, may also operate at 5V and then go into a 3V power-down state, write-protecting as if in a 3V system.

Features

- Real-Time Clock Counts Seconds ThroughCenturies in BCD Format

– bq4802Y: 5-V Operation
– bq4802LY: 3.3-V Operation

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- On-Chip Battery-Backup Switchover CircuitWith Nonvolatile Control for External SRAM
- Less Than 500 nA of Clock Operation Currentin Backup Mode
- Microprocessor Reset With Push-ButtonOverride
- Independent Watchdog Timer WithProgrammable Time-Out Period
- Power-Fail Interrupt Warning
- Programmable Clock Alarm Interrupt Activein Battery-Backup Mode
- Programmable Periodic Interrupt
- Battery-Low Warning

C. POWER SUPPLY UNIT

Power supply is a device that powers all the chips andcomponents used in the design. The system requires a +5VDirect Current (DC) supply as the operating voltage for the8051 microcontroller unit, integrated circuit, and sevensegments display. This was achieved by designing differentstages that makes +5V DC power supply.This System is proposed based on the design considerations required for the implementation of embedded Systems. To meet the design constraints such as

1. To reduce the complexity of the system.
2. To make it cost effective.
3. To reduce the time to implement.
4. To increase the speed of execution the two components mentioned in the existing system are replaced by parallel real time clock and 16X2 LCD.

1. **Keil compiler:** Keil development tools for the 8051-micro controller architecture support every level of software developer from the professional applications to the learning about embedded software development. The industry standard keil C compiler, micro assembler, debuggers, real time kernels, single-board computers and emulators support all 8051 derivatives.
2. **Flash magic:** "flash magic is a tool which used to program hex code in EPROM of microcontroller. it is a freeware tool. It only supports the microcontroller of Philips and NXP. We can burn hex code in to those controllers which supports ISP feature".
3. **Proteus**: Proteus combines ease of use powerful features to help you design, test and layout professional PCBs like never before. With nearly 800 micro controller variants ready for simulation straight from the schematic, one of the most intuitive professional PCB layout packages on the market and a world class shape based AutoRoute included as standard, proteus design suite 8 delivers the complete software package.

IV. RESULTS & DISCUSSION

Firstly, power supply module was designed and simulated to ensure accurate +5V DC output is achieved. Secondly, 8051 Microcontroller interface to latch and memory was designed, linked to power supply and then tested. Thirdly, the program module of the Electronic Calendar display was written and tested gradually. Any bugs found during testing were corrected.The expected result was achievedstarting from digital clock, day, date, month, and year as seenon the simulation display. The date, month, and year displayevery 24 hours which is expected from the specification.Indicators for Sunday through Saturday lights ON accordingly.The select and set buttons perform their functions properly.

Digital clock module works: When the circuit is switched ON, the first display on the LCD would be 01:00 (the program default set point for time).01 represents hours, (:) represents seconds and 00 representsminutes which signifies 1pm dot. The second (:) starts tocounts immediately the switch is ON. The user is providedwith soft push button to select and set the correct time at anymoment if not correct. It follows the counting process of ourtime and the output is seen on the LCD meant for the hours.

Select & Set Panel: This module comprises of two stages namely: Select and setbuttons including LCD display for date, month, year, hour, minutes,and day. Two soft push switches are used to select and set anydigit number as needed by the user. Pressing any switchinterrupts the 8051 and must service the interrupt beforepreceding its normal operation.

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Select & set module works: The select and set button is used to select and set on LCD display corresponding to either date, month, year, hour, minute or dayand enable any selected device to function as the user desiredinput/staring point. After the settings, the 8051 takes the newinput value and activate the system to start from it.

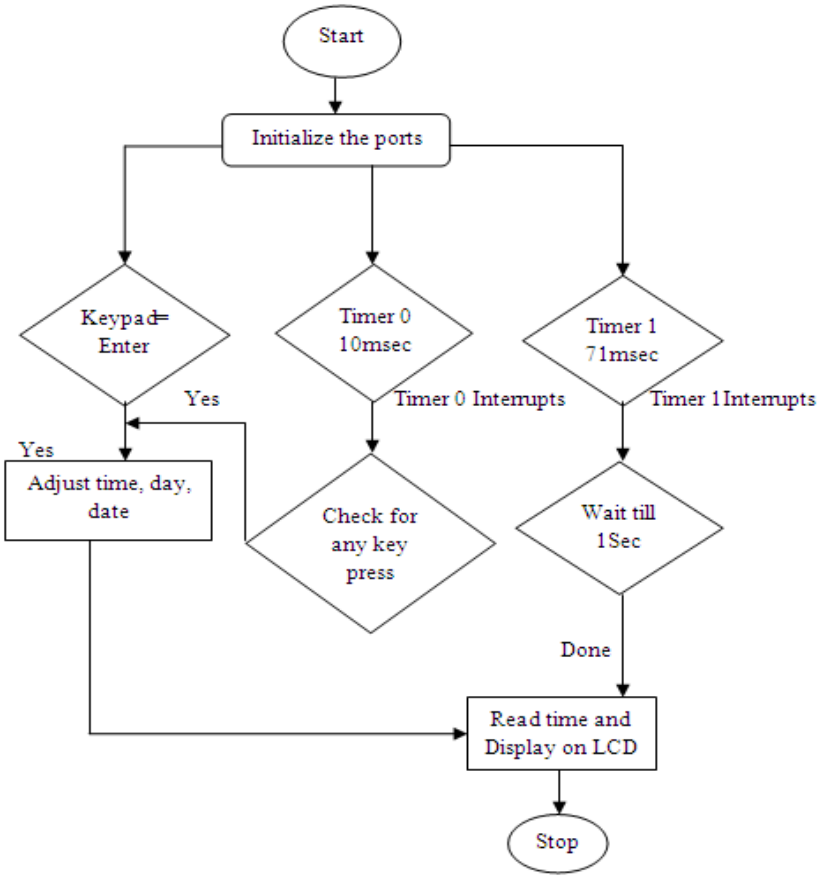

Fig.3 Flow chart

V. CONCLUSION

Microcontroller based electronic calendar is a devicethat help individual, company etc. at all level to keep time,date, month, and year.It consists of five modules namelypower supply, 8051 interface, digital clock, data, month andyear, select set and day. Each module has roles to play in thecircuit to ensure the objective is met.The day, date, time andtemperature displayed well on the 16X2 LCD module.The backlight of LCD module can be made offduring day time as it consumes most of the power in thecircuit developed. The BQ4802LY parallel RTC continuously keeps onupdating the time even in the absence of main supply foryears. This is due the backup supplied by the coin cell batteryto the real-time clock integrated chip.

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BIOGRAPHY

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