

Microcontroller Based Smart Alarm System with PC Interface

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ABSTRACT: A novel and economical design of an automatic microcontroller controlled alarm system has been cited here. This design can be offformidable use at schools and colleges. The advantages of this design include a greater degree of accuracy, along with helping to reduce human labour by heralding an automatic triggering of alarms at the prerequisite time. A PC application, with an accessible and simple user interface allows for convenient setting of any number of alarms, as per the requirement of the user.

KEY WORDS: Alarm system, Microcontroller based, PC interface.

I. INTRODUCTION

An Alarm device or system of alarm devices gives an audible, visual or other form of a signal about a condition. Alarm devices include alarm clocks, distributed control systems, alarms in an operation and maintenance monitoring system etc. [1]. In most schools and colleges across the world, especially in India, bells act as alarm devices, which are rung in accordance to the daily schedule implemented by the school authorities. The bells, in most cases, are rung manually, to indicate the start or end of periods, with the help of a person. While this helps to get the job done, but it also raises several questions. Firstly, the looming questions of accuracy remain persistent. For the purposes of maintaining the daily schedule and maintaining the bell, an individual needs to be tasked with the job, which raises the question of necessity of manpower and the increased costs, as per of his monthly wages, that comes with it.

The design of an easily configurable alarm system, presented as part of this paper, will help to eliminate all of the above shortcomings. While such designs are currently available today, [2] [3], a PC application has been added to our design to eliminate the hassle faced by users. The alarm system can be set and configured with the greatest of use through the application of a user friendly and simple interface. The system presented is also economically and technologically feasible, making it an affordable and long-term substitute.

II. SYSTEM DESCRIPTION

Fig 1 shows the basic block diagram of the alarm system. It includes a microcontroller, an LCD unit, an RTC (real time clock), an EEPROM, [4] a relay and a bell which is connected to it. The microcontroller sends control signal to the RTC to get or set date through the SDA pin. After receiving the valid data from the RTC, we get the result displayed on the LCD. Whenever the microcontroller gets a new time from the RTC, it compares with the list of predefined time sets. If it encounters any predefined time which is equal to the current RTC values, it activates the I/O PIN P3.7, [5] which is connected to a switching transistor SN2222 through a 470 ohm resistance. The output of the transistor, i.e. the collector of the transistor, is connected to one terminal of the relay coil, while the other terminal of the coil is connected to 12V. Whenever the relay coil gets energized, it pulls the lever attached in the relay to complete the circuit attached with the bell. The bell is activated for a short moment only.

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Vol. 6, Issue 10, October 2017

The system is fully configurable and manageable through serial communication, i.e. it can be directly connected with a laptop or desktop through an USB cable or can be connected wirelessly for easy configuration. For this purpose, a software has been developed using Microsoft Visual Studio 6. Relational Database Management System has been used to manage the relational data [6]. There are number of RDBMS packages (soft) available in the market including ORACLE, SQL Server, MY SQL, DB2, MS Access, etc. MS Access has been used because it is suitable for low volume data as well as it has the portability option. As the application for bell management required a small amount of data, MS access was the more preferable option.

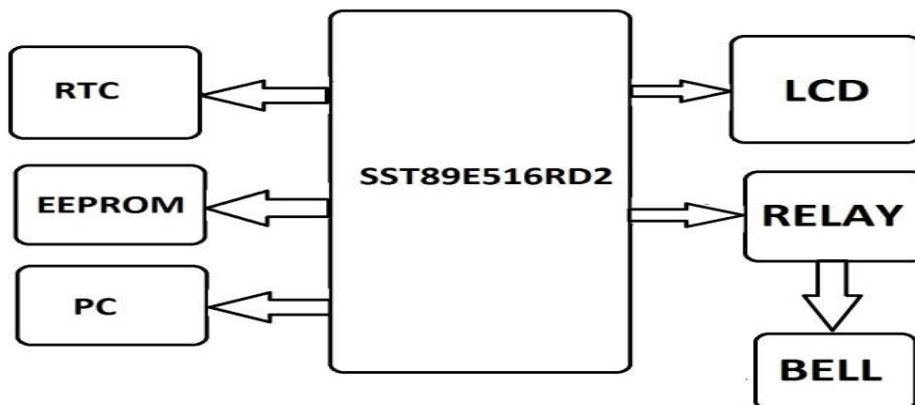


Fig 1: Block Diagram of System.

III. DESIGN FRAMEWORK

The system design is divided into two parts:

III.1 HARDWARE DESIGN

The circuit design is based around 8052 based microcontroller SST89E [7], which has a 64k flash memory, with 32 I/O pins and 4 ports. The main supporting component in our circuit is the RTC and EEPROM. Most of the components in the circuit require regulated +5 V including the microcontroller, LCD, RTC, EEPROM and the relay driver circuit. To provide regulated power supply, we have used +5V regulator KA7805 (LM7805). To display the output of the system, we have used a 16*2 LCD [8] display module. The RTC used is the RTC DS1307/IN1307 [9]. It is an 8 PIN DIP package which requires +5V as power supply. Now, in order to store timetables which must not be lost due to power loss or CPU reset, an EEPROM has been used. For this purpose, we have used an external CMOS I2C 2-wire bus 1K/2K electrically erasable programmable ROM 128/256X 8 BIT EEPROM [10].

After completing the initial part of our model, we have decided to implement remote slave bell activation through which the master system will activate the remote alarms, with the help of R-F communication. To implement R-F communication, a 433 MHz transmitter and receiver unit has been used, with 8-bit encoder and decoder HT12E [11] and HT12D [12] respectively. The system is designed in such a way that when the master unit, as seen in Fig 2., activates the buzzer with the help of a relay driver it actually changes the status of specific I/O pin connected with the relay driver transistor. In the receiving section, we are using a matching 433 MHz receiving unit with decoder HT12D. The output of the receiver is connected to the base of a switching transistor 2N222 through a 470 ohm resistor. The transmitter and receiver units are shown in Fig 3 and Fig 4 respectively.

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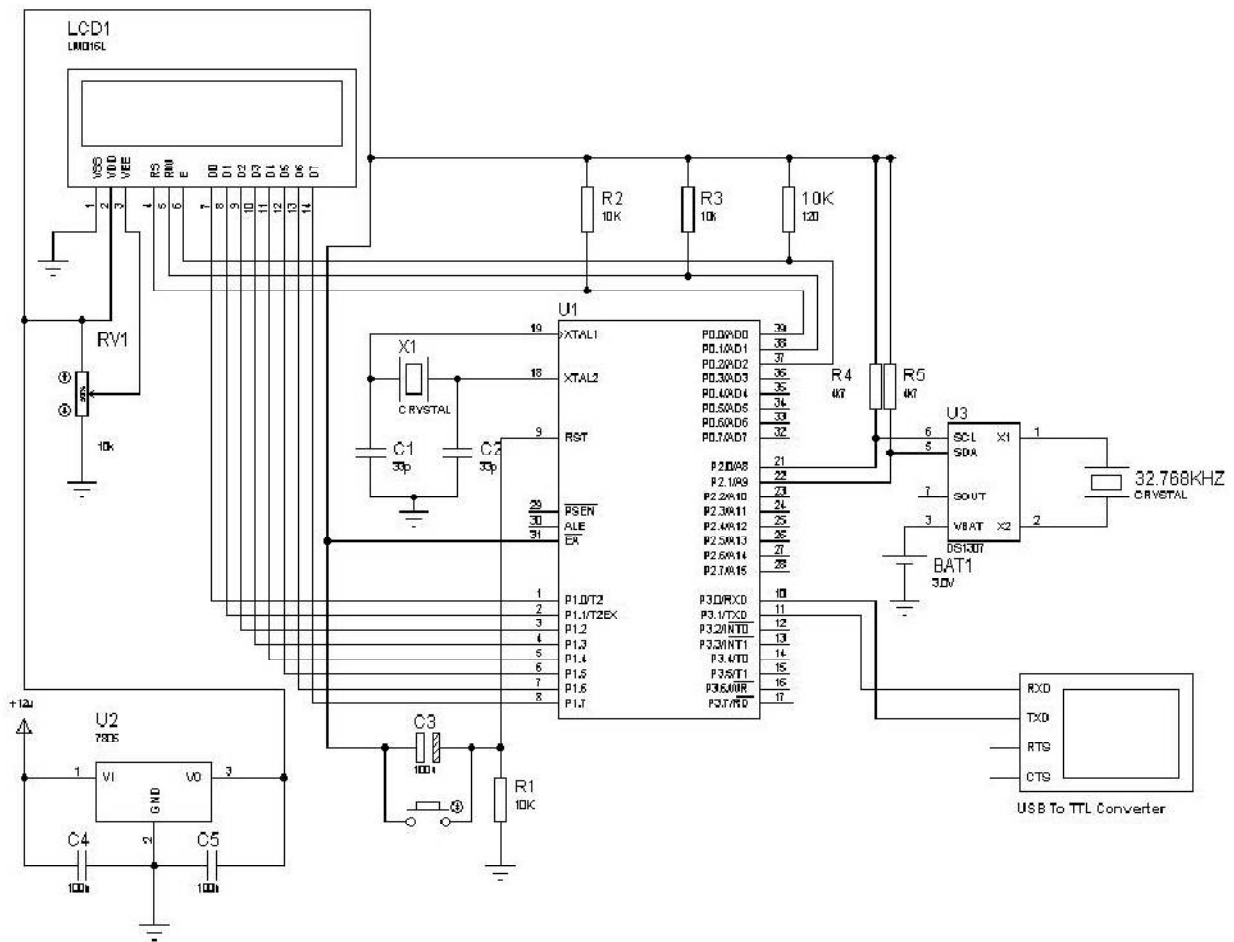


Fig 2: Circuit diagram of master unit

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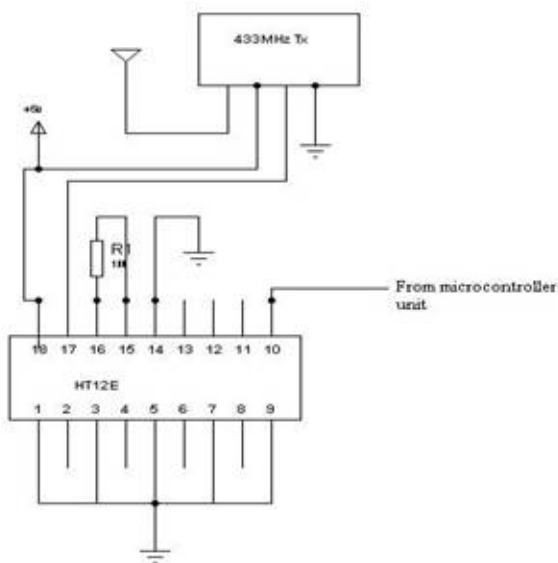


Fig 2: Circuit diagram of transmitter unit.

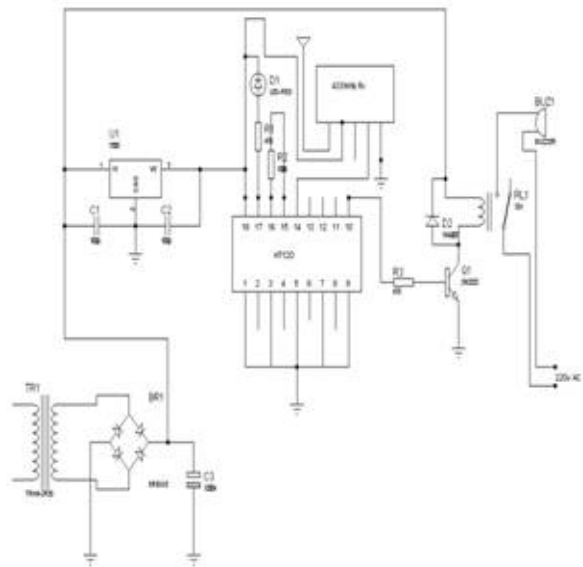


Fig 3: Circuit diagram of the receiver unit.

III.II SOFTWARE DESIGN

Microsoft Visual Studio is an integrated development environment from Microsoft. It is used to develop computer programs for Microsoft Windows, as well as web sites, web apps, web services and mobile apps. [6]. Visual Studio 6.0 has been used here to create a user friendly interface, as can be seen in Fig 4. It consists of a frame box which shows the time as read from the RTC. Availability of the open serial ports is shown as the top right hand corner. A label box entitled “Bell Settings” enables adding of new alarm times and updating of the new schedule. “Set Time and Date” option box enables synchronising of the RTC time with current time and date.

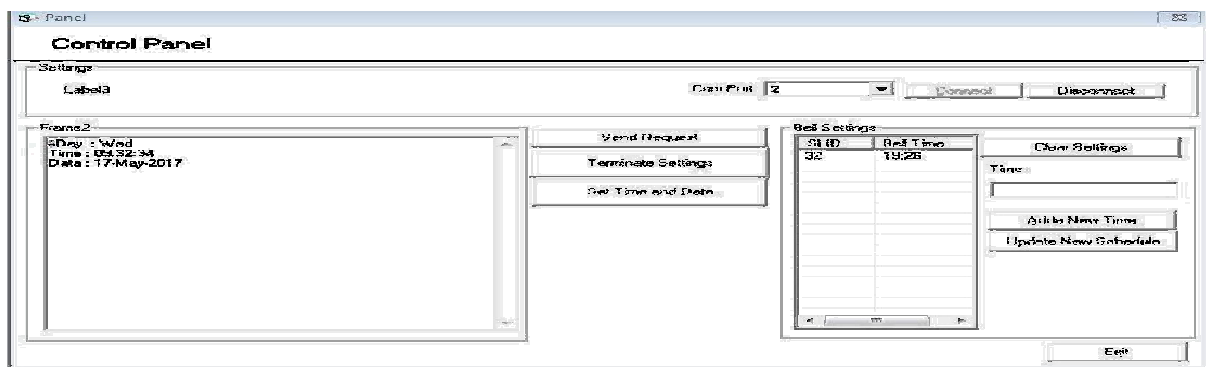


Fig 4: PC interfacing software.

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Vol. 6, Issue 10, October 2017

III.III CREATING DATABASE IN MS ACCESS

Two tables have been created, with one named “users” and the other named as “Bell Settings”. Two more fields are created for “users”, named as “userid” and “password”. The “userid” enables a user with a valid username and password to access the bell management software. The fields for “Bell Settings” table are named as “SLID” and “Bell Time”. The “SLID” field shows the bell number and the field “Bell Time” sets the alarm time. A database named “BADA” is thus created and saved in 2002 or 2003 MS Access format. Filetype (.mdb) has been used in this case.

III.IV ACCESSING THE DATABASE ON MICROSOFT VISUAL STUDIO

In Visual Studio, we first access the database named “BADA” from the drive that it has been saved. Then, in user DSN menu, we select the database that was created. The designing of the main project is then initiated. The project is named as “College Bell Manager”. It is a single document project. The database with the appropriate file support i.e. (.mdb) is selected. The database thus gets successfully accessed.

III.V FLOWCHART OF THE PROCESS

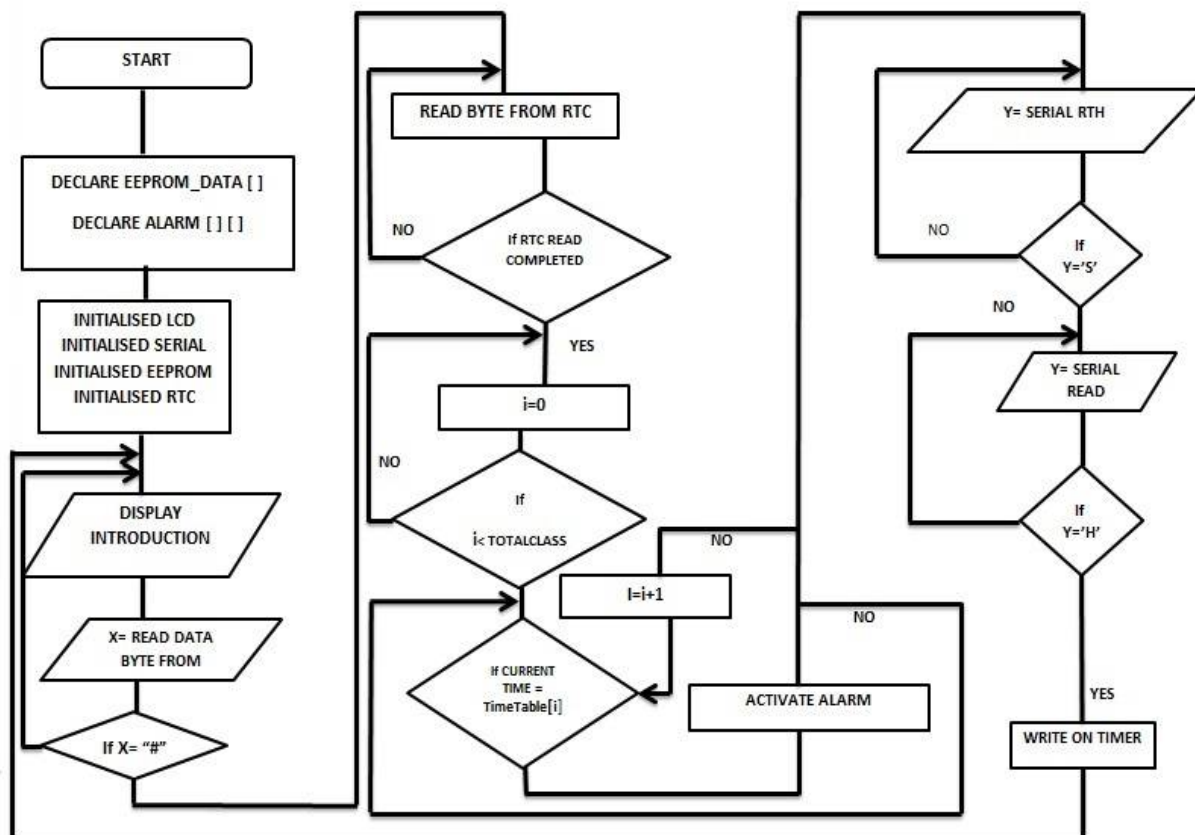


Fig 5: Flowchart for the entire process.

IV. PERFORMANCE EVALUATION AND TESTING

After several run outs and tests, during which each sub unit was evaluated and confirmed efficient, the alarm system was finally installed in the college premises of Assam Engineering College, Assam. The alarms (two at the time of instalment) were configured by using the software designed. Initially about 4 alarms were set, in accordance to college schedule. The real satisfaction was achieved when the alarms triggered off, keeping deft accordance with the time set. The interface since, has been running efficiently, and the design proved to be a success. Fig 6 shows the actual microcontroller unit where the LCD displays the current date and time. Fig 7 and Fig 8 show the RTC (REAL TIME CLOCK) unit and the EEPROM unit.

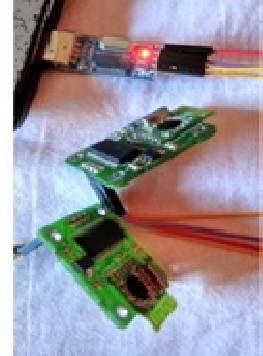
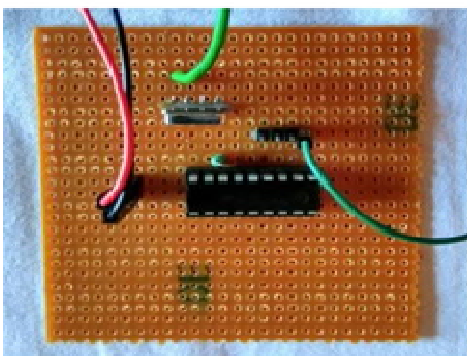
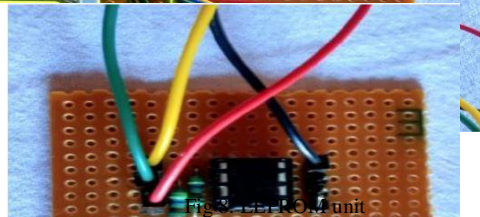
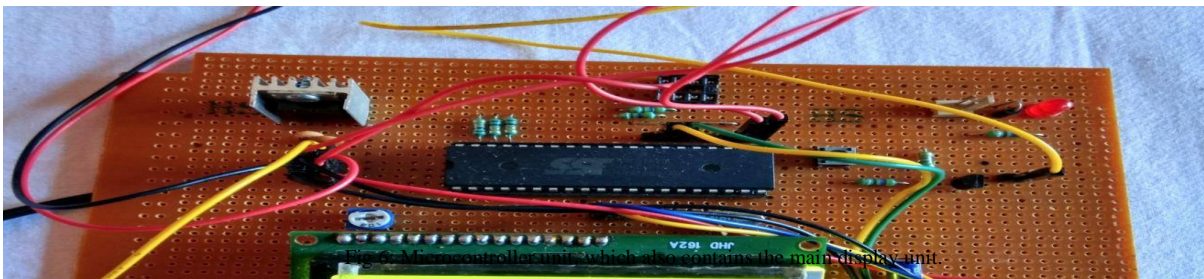


Fig 9: Transmitter unit for bell

Fig 10: Bell with receiver

Fig 11: Transmitter-receiver pair

Fig 9 displays the transmitter unit for the bell, which consists of a 433 MHz transmitter coupled with an 8-bit encoder. Fig 10 shows the bell units, containing an identical 433 MHz receiver unit and an 8-bit decoder each. Finally, Fig 11 shows the transmitter-receiver pair.

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V. CONCLUSION

Every design comes with an aim to help reduce human effort. The design proposed was made, keeping certain outcomes in mind, and the final established system has helped achieve those goals, namely reduction of human effort and increased accuracy. The PC software integrated with the design helps to achieve a friendly and simple to comprehend interface, which greatly reduces effort and added costs. Being an economical and technology feasible model, this alarm system design can be implemented with the greatest of ease at schools and colleges.

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