Automatic college bell system

Sheenu Choudhary[1], Shrikant[2] and Priyanka Sharma[3]
1,2,3- B.Tech(4th year) EC, M.I.T. Moradabad
sheenuchaudhary.india@gmail.com

Abstract: The world over the decades has made considerable advancement in automation; automation is employed in every sector whether it is home or industry. Here a new and inexpensive design is being presented. This design finds a tremendous use at primary and secondary school levels as well as in colleges where the teaching sections can span over eight periods including breaks. The advantage of this design is that the bell rings at the start of each period without any human intervention to a great degree of accuracy and hence takes over the manual task of switching on/off the college bell with respect to time. It uses Real Time Clock (DS1307) which tracks the real time. The scheduled time results are compared with that of a clock, however, some drift is noticed, which is negligible. The microcontroller AT89S52 is used to control all the functions, it gets the time through the keypad and stores it in its memory. When this programmed time equals the real time then the bell is switched on via a relay for a predetermined time. The bell ringing time can be edited at any time, so that it can be reused again and again at normal class timings as well as at exam times. Also it can be made password protected so that no unintended person can operate this system except for the operator. For this a microcontroller has to be programmed using the C language or assembly language for controlling the circuit.

Keywords: Automation, microcontroller AT89S52, time selecting unit, break period, keypad.

1. INTRODUCTION

In today's life, everyone gives importance to time. Time does not wait for anybody. Everything should be performed in time & with accuracy. Now a day's school/college bells are operated manually. Hence there is a big question of accuracy. Also there is necessity of manpower and money. Hence here we have presented a system, which saves our manpower and money & also give highest accuracy. A bell is a percussion instrument used in schools and colleges that indicates the students when it is time to go to the class in the morning and when it is time to change classes during the day. No other instrument can do such a work. So it is an important instrument in both primary and secondary schools and even in the industries and other businesses where the bell timer plays a critical role throughout the day. Clock towers can be heard over long distance which was especially important in the time when clocks were too expensive for widespread use. And also due to literacy awareness the number of colleges, schools and institutions are rapidly increasing. At present bells for periods in schools are operated manually. After every class, one employee is engaged into operating the bell. Automatic college bell helps us to avoid this. This design takes over the task of ringing the bell in colleges as the bell would ring automatically at the schedule time. It has a Real Time Clock (DS1307) which tracks over the real time. When this time equals to the bell ringing time, then the relay for the bell is switched on. The real time clock is displayed on LCD display. This is very wonderful design to control the working of college bell.

2. HARDWARE MODULES:

The automatic control system adopted the AT89S52, the principle of the hardware chart as shown in fig.1.The core function modules are power module, RTC, LCD module, MCU, alarm module, keypad.

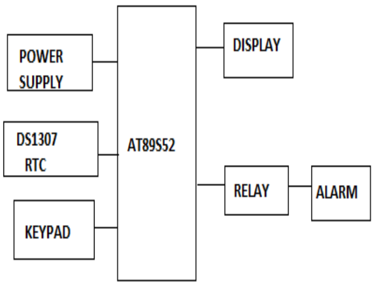

Fig.1: Block diagram of automatic bell system

2.1 Microcontroller AT89S52: The AT89S52 is a low-power, high-performance CMOS 8-bit microcontroller with 8K bytes of in-system programmable flash memory. The device is manufactured using Atmel's high-density nonvolatile memory technology and is compatible with the industry-standard 80C51 instruction set. The on-chip Flash allows the program memory to be reprogrammed in-system or by a conventional nonvolatile memory programmer. By combining a versatile 8-bit CPU with in-system programmable Flash on a monolithic chip, the Atmel AT89S52 is a powerful microcontroller which provides a highly-flexible and cost effective solution to many embedded control applications. The AT89S52 provides the following standard features: 8K bytes of Flash, 256 bytes of RAM, 32 I/O lines, Watchdog timer, two data pointers, three 16-bit timer/counters, a six-vector two-level interrupt architecture, a full duplex serial port, on-chip oscillator, and clock circuitry. In addition, the AT89S52 is designed with static logic for operation down to zero frequency and supports two software selectable power saving modes. The Idle Mode stops the CPU while allowing the RAM, timer/counters, serial port, and interrupt system to continue functioning. The Power-down mode saves the RAM contents but freezes the oscillator, disabling all other chip functions until the next interrupt or hardware reset.

The microcontroller is the heart of the circuit. It controls all the functions. It interfaces the RTC serially and retrieves the time and day from it. Any input through the keypad is detected by the microcontroller and corresponding actions are taken. The microcontroller sends the real time, alarm time as well as the day to the display unit. When the real time and alarm time becomes equal, the alarm unit is triggered by the controller. Moreover, the alarm timings are stored in the internal EEPROM of the microcontroller. The pin diagram is given in the fig.2

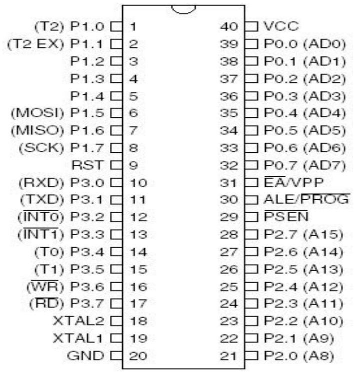

Fig.2: Pin diagram of AT89S52

2.1.1 Oscillator Characteristics: In this design, a quartz crystal is used. From the datasheet of AT89S52, it is noted that the capacitors C1 and C2 are 30 pF ± 10 pF for crystals. Therefore, since a crystal was used, 33 pF was chosen for both capacitors C1 and C2 as shown in Fig.3.

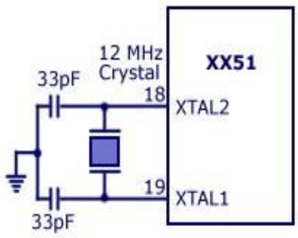

Fig.3: Crystal oscillator

2.2 Real Time Clock: The DS1307 is a low-power full binary coded decimal (BCD) clock/calendar with 56 bytes of SRAM. Clock/calendar provides seconds, minutes, hours, day, date, month, and year information. The date at the end of the month is automatically adjusted including corrections for leap year. The DS1307 operates as a slave device on the I2C bus. Address and data are transferred serially through an I^2C, bidirectional bus. Access is obtained by implementing a START condition and providing a device identification code followed by a register address. Sub STOP condition is executed. When VCC falls below 1.25 x VBAT, the device terminates an access in progress and resets the device address counter. Inputs to the device will not be recognized at this time to prevent erroneous data from being written to the device from an out tolerance system. When VCC falls below VBAT, the device switches into a low backup mode. Upon power-up, the device switches from battery to VCC when VCC is greater than VBAT +0.2V and recognizes inputs when VCC is greater than 1.25 x VBAT. The pin diagram is given in fig.4. The time and calendar are set or initialized by writing the appropriate register bytes and is obtained by reading the appropriate register bytes. The contents of the time and calendar registers are in the BCD format. The day of week register increments at midnight. Values that correspond to the day of week are user-defined but must be sequential (i.e., if 1 equals Sunday, then 2 equals Monday, and so on.). Bit 7 of Register 0 is the clock halt (CH) bit. When this bit is set to 1, the oscillator is disabled. When cleared to 0, the oscillator is enabled. On first application of power to the device the time and date registers are typically reset to 01/01/00 01 00:00:00 (MM/DD/YY DOW HH:MM:SS). The CH bit in the seconds register will be set to a 1. The clock can be halted whenever the timekeeping functions are not required, which minimizes current. The DS1307 can be run in either 12-hour or 24-hour mode. Bit 6 of the hours register is defined as the 12-hour or 24-hour mode-select bit. When high, the 12-hour mode is selected. In the 12-hour mode, bit 5 is the AM/PM bit with logic high being PM. In the 24-hour mode, bit 5 is the second 10-hour bit (20 to 23 hours). The hours value must be re-entered whenever the 12/24-hour mode bit is changed.

The time and calendar information is obtained by reading the appropriate register bytes. The time and calendar are set or initialized by writing the appropriate register bytes. The contents of the time and calendar registers are in the BCD format. The day of week register increments at midnight. Values that correspond to the day of week are user-defined but must be sequential (i.e., if 1 equals Sunday, then 2 equals Monday, and so on.). Bit 7 of Register 0 is the clock halt (CH) bit. When this bit is set to 1, the oscillator is disabled. When cleared to 0, the oscillator is enabled. On first application of power to the device the time and date registers are typically reset to 01/01/00 01 00:00:00 (MM/DD/YY DOW HH:MM:SS). The CH bit in the seconds register will be set to a 1. The clock can be halted whenever the timekeeping functions are not required, which minimizes current. The DS1307 can be run in either 12-hour or 24-hour mode. Bit 6 of the hours register is defined as the 12-hour or 24-hour mode-select bit. When high, the 12-hour mode is selected. In the 12-hour mode, bit 5 is the AM/PM bit with logic high being PM. In the 24-hour mode, bit 5 is the second 10-hour bit (20 to 23 hours). The hour value must be re-entered whenever the 12/24-hour mode bit is changed.

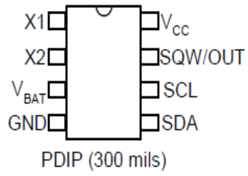

Fig.4: Pin diagram of RTC

The Real Time Clock DS1307 is used to track over the real time and day with the help of its internal registers. It needs to be initialized only once. The battery backup provided helps it to keep track of time even when power is switched off.

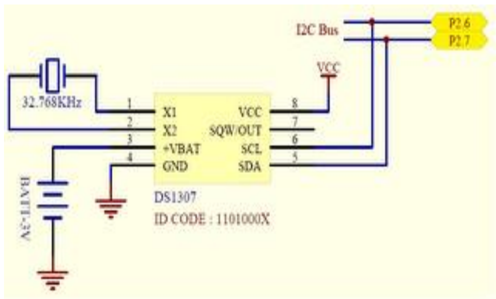

Fig.5: Interfacing of RTC with AT89S52

2.2.1 Oscillator Circuit: The DS1307 uses an external 32.768 kHz crystal. The oscillator circuit does not require any external resistors or capacitors to operate.

2.3 Relay: Relay is electro-mechanical device which is used to isolate one electrical circuit from another. It allows a low current control circuit to make or break an electrically isolated high current circuit path. Total isolation is provided by the relay between the triggering source applied to the terminal and the output. This total isolation is a feature that makes relay different from other integrated circuits and is also important in many digital applications. It is a feature that certain semiconductor switches (e.g. transistors, diodes and integrated circuits) cannot provide. In this circuit a 12V magnetic relay is used. In magnetic relay, insulated copper wire coil is used to magnetize and attract the plunger .The plunger is normally connected to N/C terminal. A spring is connected to attract the plunger upper side. When output is received by relay, the plunger is attracted and the buzzer is on.

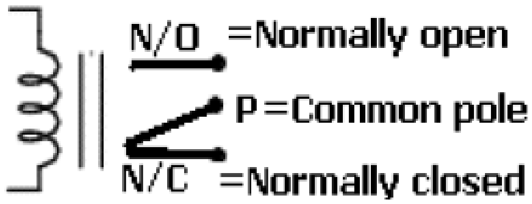

Fig.6: Relay

2.4 Keypad: Keypad is a set of buttons that are arranged in a block or "pad" which usually bear digits, symbols and a complete set of alphabetical letters. If it mostly contains numbers then it is called a numeric keypad. Keypads are found on many alphanumeric keyboards and on other devices such as calculators, push-buttons, telephones, combination locks, and digital door locks which require mainly numeric input.

The working of the keypad is described as:

The four pins of the microcontroller are used as outputs, and other four pins are used as inputs. In order for keypad to work properly, pull down resistors should be placed on the microcontroller's input pins, thus defining logic gates when input pin is pressed. Then, output pins are set to logic 1 and input pins logic state is read. By pressing any button, a logic 1 appear on same input pin.

By combining zeros and ones on the output pin, it can be determined which button has been pressed.

Table 1: Keypad inputs and readings

Columns/ Rows	0111	1011	1101
0111	1	2	3
1011	4	5	6
1101	7	8	9
1110	*	0	#

A 4X3 keypad unit is used here. It is used to initialize the RTC, display day, display/modify the alarm timings.

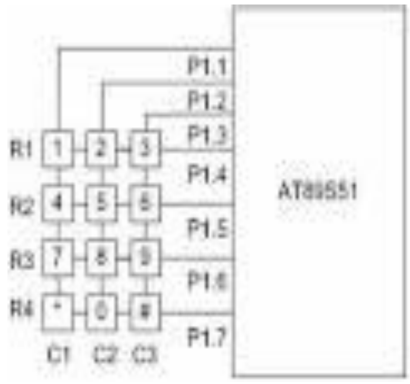

Fig.7: Interfacing of keypad with AT89S51

2.5 Display Unit: This is the first interfacing example for the Parallel Port. This example doesn't use the Bi-directional feature found on newer ports, thus it should work with most, if not, all Parallel Ports. It however doesn't show the use of the Status Port as an input. These LCD Modules are very common these days, and are quite simple to work with, as all the logic required to run them is on board. The LCD panel's Enable and Register Select is connected to the Control Port. The Control Port is an open collector / open drain output. While most Parallel Ports have internal pull-up resistors, there are a few which don't. So we can add external pull resistors which makes the circuit more portable. Therefore by incorporating the two 10K external pull up resistors, the circuit is more portable for a wider range of computers, some of which may have no internal pull up resistors. We hard wire the R/W line of the LCD panel, into write mode. This will cause no bus conflicts on the data lines. As a result we cannot read back the LCD's internal Busy Flag which tells us if the LCD has accepted and finished processing the last instruction. This problem is overcome by inserting known delays into the program. The 10k Potentiometer controls the contrast of the LCD panel. The power supply can be set to 5v or on onboard +5 regulator. The 2 line x 16 character LCD modules are available from a wide range of manufacturers. It is used to display the day, real time and alarm timings. The time is displayed in the HH:MM format.

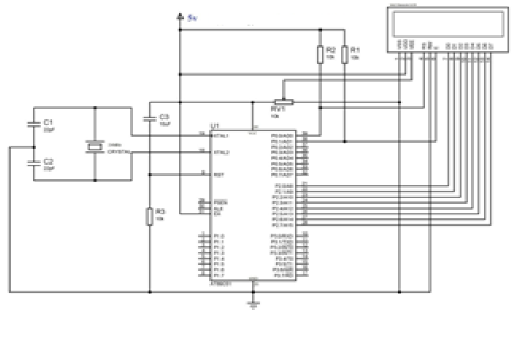

Fig. 8: LCD interfacing with the Microcontroller

2.6 Alarm Unit – When the real time and alarm time becomes equal, the alarm unit is invoked. It consists of a relay and a buzzer. When the time becomes equal, the relay is switched and buzzer sounds.

2.7 Power supply unit: A power supply of +12V and +5V is required for circuit operation. A supply of +12V is required by the relay. +5V supply is required by the microcontroller, RTC and the pull-up resistors. A step-down transformer of 12V rating and Power regulator IC LM7805 is used. The AC mains power supply of 230V, 50Hz is step-down using the transformer to +12V. A bridge rectifier circuit using diodes is connected at the secondary of the transformer. This is fed to the relay and power regulator.

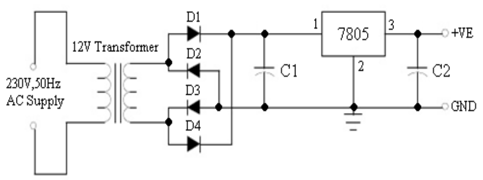

Fig.9: Power Supply Circuit

2.7.1 Voltage regulator: Voltage regulator ICs 7805 are available with fixed (typically 5, 12 and 15V) or variable output voltages. The maximum current they can pass also rates them. Negative voltage regulators are available, mainly for use in dual supplies. Most regulators include some automatic protection from excessive current (over load protection) and overheating (thermal protection). Many of fixed voltage regulator ICs has 3 leads. They include a hole for attaching a heat sink if necessary.

3. Future development: A lot more advancement can be done in this design. The advantage of this design is that the timings can be edited according to an individual's requirement. Hence it can be reused infinite number of times. Another advantage is that it provides security since it uses a password. It can also be made by using gsm. Through gsm the RTC can be controlled and so the timings can be edited. Automatic bell system with announcement can be made. In future much advanced automatic bell system can be made.

4. Conclusion: Present day ringing the bell in colleges or schools are carried out manually. The main disadvantage of this is that one person has to be alert for this. At the same time during that time he could not be engage in another task. To overcome from this, we have decided to prepare the circuit which will be operated automatically and the ringing of bell will start by its own time. The time input can be edited as per requirements. This circuit is simple to prepare and easy to install. We can say that it will be much useful for colleges or schools or other educational institutions.

5. References:

- 2N3904. 2011. Datasheet. Available: <http://www.makershed.com/v/vspfiles/as se ts/images/2n3904.pdf>.
- AT89S51. 2011. Datasheet. Available: <http://www.alldatasheet.com/datasheet-pdf/pdf/77368/ATMEL/AT89S51-24AC.html>.
- Boylestad, R.L.; and Nashelsky, L. 2007. Electronic Devices and Circuit Theory. 9th ed., Dorling Kindersley, New Delhi, India.
- Encyclopedia. 2011. Bell. Available: <http://www.encyclopedia.com/topic/Bell.as px>.
- Mehta, V.K.; and Mehta, R. 2008. Principles of Electronics. 11th ed., S. Chand, Ram Nagar, New Delhi, India.
- Theraja, B.L.; and Theraja, A.K. 2003. A Textbook of Electrical Technology. S. Chand, Ram Nagar, New Delhi, India.
- Wikipedia. 2011. Bell (school). Available: <http://en.wikipedia.org/wiki/School_bell >.
- “Intel’s MCS51 Data Book ”, Intel Inc.
- Joan B. Peatman, “Design with Microcontroller”, Mc Graw Hill.
- V. K. Mehta & Rohit Mehta“Principle of Electronics”
- 8051 Microcontroller and Embedded Systems by Mazidi and Mazidi
- www.google.com
- www.students3k.com
- www.alldatasheet.com
- Applied Electronics by R. S. Sedha
- www.sciencetoday.com
- www.crutchfield.com

AUTHORS

First author: Sheenu Choudhary was born on 22nd Jan 1993 in Meerut city. Her father's name is Mr. Gajendra Pal Singh. She completed her schooling from St. John's Sr. Sec. School, Meerut. She is doing B.tech from Moradabad Institute of Technology, Moradabad

Email : sheenuchaudhary.india@gmail.com

Second author: Priyanka Sharma was born on 13th Aug 1993 in Chandpur district, Bijnor. Her father's name is Mr. Ashram Sharma. She did her schooling from GGIC, Bijnor. She is doing B.tech from Moradabad Institute of Technology, Moradabad.

Email address: priyankasharma4522@gmail.com

Third author: Shrikant was born on 1st Jan 1993 in Moradabad. He completed his schooling from A P Inter College. He is doing B.tech from Moradabad Institute of Technology, Moradabad.

Email address: mitshrikant@gmail.com