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Microcontroller Based Automatic College Bell

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Abstract: 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 in colleges/ schools where the teaching section 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. The microcontroller ATmega16 is used to control all the functions, it gets the time through the server via Max232 and stores it in memory. The Max232 is used to converts signals from a RS-232 serial port to signals suitable for use in TTL-compatible digital logic circuits. When this programmed time equals the real time then the bell is switched on via a relay for a predetermined time. In this project we not only send the data but send a data with a pass code also which enable us to prevent the unauthorized use of LED display board and only the person having passcode can have access to LED display board. For this microcontroller has to be programmed using the C language or assembly language for controlling the circuit.

Keyword: ***ATmega16, Max232, RS-232, bell, relay, LED display board***

I. INTRODUCTION

Now in modern world also there are many educational institutions are present who still rungs their college/school bells manually after each hour of class. Manually controlled bells can cause many problems in accuracy and sometimes the person in charge might forget to ring the bell. After analyzing this problem we have come out with a solution to use an automatic microcontroller based electronic college bell which does not require any human intervention. With this the time accuracy will be maintained and the bell will ring at the exact scheduled time. One more advantage of it is that we can store the schedule of whole day and able to change it as per our requirement.The project mainly focuses on automation of college bell, in which the bell will ring automatically and the data will be displayed on the LED screen. The data will be displayed on LED only after entering unique pass key. In addition to that address matching is done and data can be received only by the dedicated receiver.

II. WORKING

The block diagram of automatic microcontroller based college bell is shown fig 1. Firstly we have developed the hardware circuit which is used to operate our bell and LED's. To operate the Dot matrix display and other components of our hardware we have design a power circuit to convert 230V Ac to 12V and 5V DC. This voltage is used by the relay, Dot matrix display and other components of the circuit.

The master device is our microcontroller ATmega16 and the slave device is Max232. The Max232 is being interfaced with the microcontroller which is used to convert signals from a TIA-232 (RS-232) serial port from a PC/Laptop to signals suitable for use in TTL-compatible digital logic circuits. The interval of time after which the bell should ring is already programmed and loaded in the microcontroller. If the present time matches the time scheduled in the PC/Laptop, logic high is driven to the output port of microcontroller and the bell rings (6 to 10 seconds). The small voltage (12v) acts as a enable to the relay circuit, which turns on the 230v to the bell and the bell rings.

On the other side we are able to view time, day, date, period etc. on the Dot matrix display by programming the microcontroller. We have programmed this project as to hear the bell sound every after one hour class (6 class in a day) and half hour break (2 in a day) and can also display the data as per the schedule in the program. As per our requirements we can schedule the timing in the program.

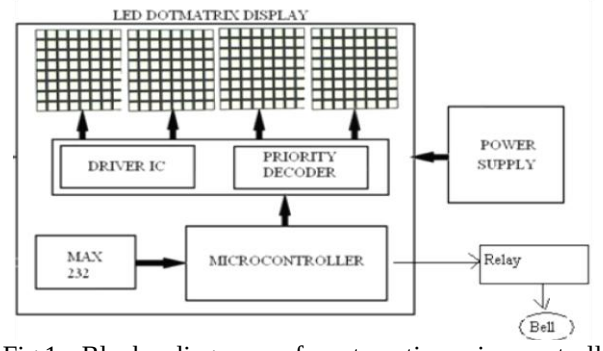

Fig.1 Block diagram of automatic microcontroller based college bell system.

III. HARDWARE MODULES

The automatic control system is adopted by the Microcontroller ATmega16, the principle of the hardware chart is as shown in Fig.1. The core functional modules are power module, Msx232, LED module, MCU, alarm module, RS232 module.

A. MICROCONTROLLER ATmega16

The high-performance, low-power Atmel 8-bit AVR RISC-based microcontroller combines 16KB of Programmable flash memory, 1KB SRAM, 512B EEPROM, an 8-channel 10-bit A/D converter, and a JTAG interface for on-chip debugging. The device supports throughput of 16 MIPS at 16 MHz and operates between 4.5-5.5 volts. By executing instructions in a single clock cycle, the device achieves throughputs approaching 1 MIPS per MHz, balancing power consumption and processing speed.

ATmega16 is a 40 pin microcontroller. There are 32 I/O (input/output) lines which are divided into four 8-bit ports designated as PORTA, PORTB, PORTC and PORTD. ATmega16 has various in-built peripherals like USART, ADC, Analog Comparator, SPI, JTAG etc. Each I/O pin has an alternative task related to in-built peripherals.

The microcontroller is the heart of the circuit. It controls all the functions of the circuit. It interfaces the Max232 serially and retrieves the data coming from PC/Laptop via Max232. Max232 is explained in part B of section III. Any input data from the PC/Laptop is detected by the microcontroller and according to that data frequent actions will be taken. The microcontroller sends the real time, alarm time and data to be displayed on the display unit. When the alarm time matches with the real time then the bell will ring and the data will be displayed on the display unit. The pin diagram is shown in Fig.2

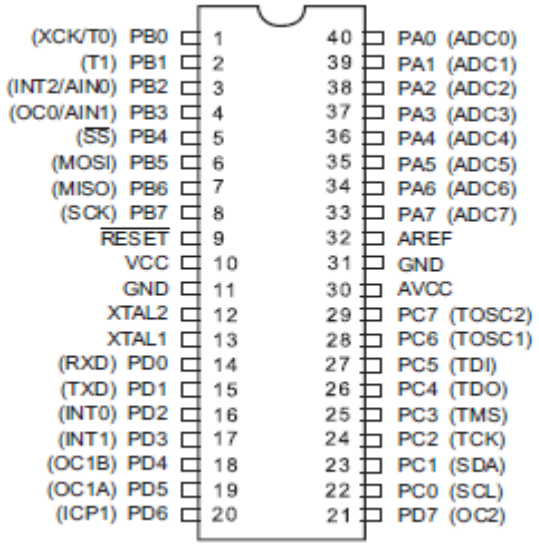

Fig.2 Pin diagram of Microcontroller ATmega16

B. Max232

Max232 is an IC (Integrated Circuit) that converts TTL (Transistor- Transistor Logic) logic level signal in to its equivalent RS-232c level signal and Rs-232c level to its equivalent TTL level signal. This IC is very important in case when we need to make connection and transfer data between devices that works on different signal level wave forms (TTL, Rs232c).

For example, most of the microcontrollers 8051(89c51, 89c52), PIC (16f877), AVR works on TTL logic waform These microcontrollers have a build in UART (Universal Synchronous-Asynchronous Receiver & Transmitter) which can send and receive serial data. Since they work on TTL level so they transmit and receive data comprised of TTL wave form. Whereas Standard PC (Personal Computers) works on RS-232 level wave form. Now in our circuit we want to send data from PC to microcontroller. So, we have to convert data from Rs-232 to TTL. Max-232 is solution to this problem.

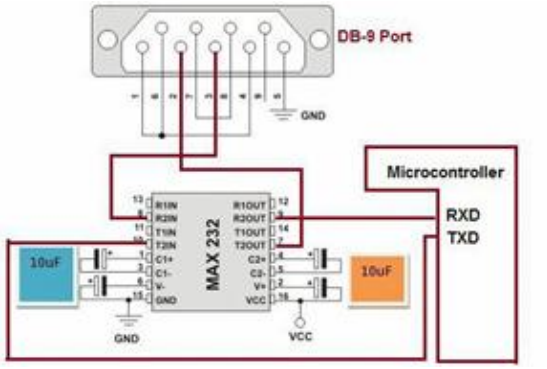

Fig. 3 Max232

The above figure shows the interfacing of Max232 with RS232 and microcontroller. Max232 has 16 pins. It requires four external capacitors for its proper configuration. Capacitors can range between 8uf to 10uf and are of up to 16v. The four capacitors are being connected to pins C1+, Vs+, C1-, C2+, C2-and Vs-. PIN 7(T2OUT)outputs the converted TTL signal in RS-232 form. TTL signal is received from Microcontroller at T2IN Pin. Connect this pin to Pin#2 of DB-9 (RS232) serial port of your PC. Pin#2 of DB-9 port is Rxd (Rxd means this pin receives Transmitted Signal (data)).PIN 8(R2IN) receives RS-232 signal as input and outputs the converted signal in TTL form on pin R2OUT. Connect this pin to Txd pin of DB-9 Port. Pin#3 of DB-9 port is Txd (Txd means this pin transmits data).PIN 9(R2OUT) outputs the converted signal in TTL form. Signal is received from PC/Laptop at R1In Pin. Connect this pin to your microcontroller (TTL) Rxd pin which receives the signal.PIN 10(T2IN) receives the transmitted signal from microcontroller (TTL Level) and outputs the converted RS-232 signal on T2OUT pin. Signal is transmitted from Txd pin of microcontroller serial port. Connect this pin to Txd pin of microcontroller.

C. RS232

In telecommunications, RS-232 is a standard for serial communication transmission of data. It formally defines the signals connecting between a DTE (data terminal equipment) such as a computer terminal, and a DCE (data circuit equipment), such as a modem. The RS-232 standard is commonly used in computer serial port. The

standard defines the electrical characteristics and timing of signals, the meaning of signals, and the physical size and pinout of connectors.An RS-232 serial port was once a standard feature of a personal computer, used for connections to modems, printers, mice, data storage, uninterrupted power supply, and other peripheral devices. However, RS-232 is hampered by low transmission speed, large voltage swing, and large standard connectors. In modern personal computers, USB has displaced RS-232 from most of its peripheral interface roles. Many computers do not come equipped with RS-232 ports and must use either an external USB-to-RS-232 converter or an internal expansion card with one or more serial ports to connect to RS-232 peripherals. Nevertheless, RS-232 devices are still used, especially in industrial machines, networking equipment, and scientific instruments.

In this circuit we have interfaced RS232 cable with Max232 because we required a data which is compatible for microcontroller. The data is transmitted from PC/Laptop and that data is being converted by Max232 in TTL level signals. Pin 2 (Rxd) and 3 (Txd) of RS232 cable is connected to Pin 7 (T2out) and 8 (R2in)of Max232 respectively to receive and transmit the data.

D. LED Display Unit

LED Display systems are used to transfer visual information for Mass Communication. Information like Flash News, Online Production status, Arrivals & Departures, Graphical Presentation, Animated messages and Pictures can be displayed for effective and immediate understanding in LED display boards.An LED display is a flat panel display, which uses an array of light-emitting diodes as pixels for a video display. Their brightness allows them to be used outdoors in store signs and billboards, and in recent years they have also become commonly used in destination signs on public transport vehicles. LED displays are capable of providing general illumination in addition to visual display, as when used for stage lighting or other decorative (as opposed to informational) purposes.

We have used a complete panel of 48*8 Dot matrix in which 6 Dot matrix display of 8*8 are interconnected with each other. This LED panel is used to display the programed scheduled data. In this panel there are 48 columns and 8 rows of LED's. We are also using a unique pass key to display the data so that the unauthorized person will not be able to use it. Without the pass key the data will not be displayed on the display unit. The receiver pin of LED panel is connected with the Txd pin of microcontroller from where the data is being transferred.

E. OSCILLATOR CHARACTERISTICS

In this design we used an external quartz crystal of 16 MHz. According to the datasheet of ATmega16 the maximum limit of internal crystal oscillator is 8 MHz, but we can run the chip up to 16 MHz with an external crystal.

Two main reasons of using external crystal is we want to run our design at higher clock speed than available internal oscillator because we need precise and accurate timing as our design is completely based on timing. Another thing is the internal oscillator is sensitive to temperature and voltage changes, so an external crystal will be more stable.

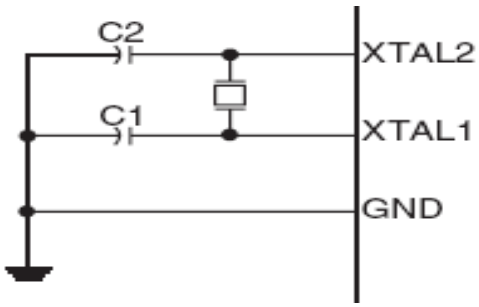

Fig. 4 Crystal Oscillator

F. 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.

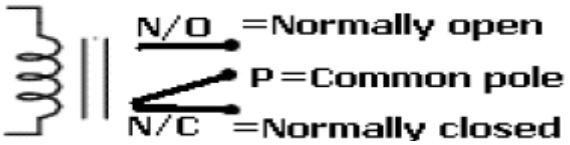

Fig. 5 Relay

G. *ALARM UNIT*

An electric bell is a mechanical bell that functions by means of an electromagnet. When an electric current is applied, it produces a repetitive buzzing or clanging sound. Electric bells have been widely used at railroad crossings, in telephones, fire and burglar alarms, as school bells, doorbells, and alarms in industrial plants. In this project we have used an electric bell to sound it loud and clear. 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.

H. 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, Max232, Dot

matrix display and the components of circuit. 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.

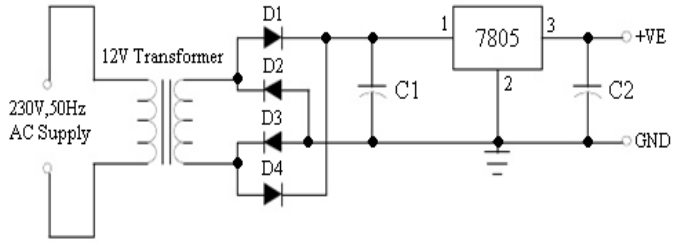

Fig.9: Power Supply Circuit

I.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.

IV. SPECIFICATIONS

As we have specially developed this project for our college. Our college, JD College of Engineering and Management, has its working hours from 11:00 am to 6:00 pm. There are 6 lectures each is of 1 hour and 2 breaks, first one is of 45 minutes and second is of 15 minutes. The day starts with a lecture at 11:00 am. We have programed a complete schedule of our college timings and lectures with the help of .net programming in the Microsoft visual studio. This program is being installed in the PC/Laptop and with the help of RS232 cable we are able to send the schedule in the microcontroller and according to the data the bell rings and the data will also being displayed on the display unit. Altogether the bell should ring at least 9 times in a day but with the help of program we are able to make changes in the schedule. At each instant the current time matched with the time scheduled when the bell should ring and when a match occurs, logic HIGH is obtained at the output port pin, which is given to the transistor. The 20mA current from the microcontroller pins when passed through the transistor is given to relay circuit which switches on relay circuit. Now the bell gets a direct connection to the 230V power supply and bell rings. To ring the bell there is also a pass key used to allow only the authorized person to use the system. The time for which the bell should ring is also programmed in the Microsoft Visual Studio. We have given the time period of 10 seconds.

V. 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.

VI. 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.

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