Security access control system using-PIC16877A

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***Abstract* – Security is a prime concern in our day today life. Everyone wants to be as much secure as possible. An electronic lock allows activation of an electric appliance only on entering the correct password. This is also such an electronic locking system in which PIC16F877A microcontroller plays the role of the central processing unit. The microcontroller is interfaced with 4*4 matrix keypad and a 16*2 LCD to form the user interface. The job of the microcontroller in this project is to receive signals from the input device (keypad) and take corresponding actions. Whenever any key is pressed on the keypad, The software program in the microcontroller identifies the pressed key and accordingly turns on or turns off the appliance on entering a four digit password set by the user and displays message "password accepted" on LCD screen for 2 seconds followed by the message "lock open". If the entered password is not correct then the message "lock denided" should be displayed on LCD screen for 2 seconds and followed by the message "lock closed". The user can also change the password by using corresponding key. Using this circuit any electrical appliance can be made as password protected. It can also be used as an electronic door lock by interfacing the output of the circuit with an electrically actuated door lock.**

Keywords*: *LCD, PIC16F877A, MCU

1. IN TRODUCTION

An electronic lock or digital lock is a device which has an electronic control assembly attached to it. They are provided with an access control system. This system allows the user to unlock the device with a password. The password is entered by making use of a keypad. The user can also set his password to ensure better protection. The major components include a Keypad, LCD and the controller PIC16F877A. This article describes the making of an electronic code lock using the 16F877A microcontroller. The system is fully controlled by the 8 bit microcontroller 16F877A which has an 8Kbytes of ROM for the program memory.

The password is stored in the EPROM so that we can change it at any time. The system has a Keypad by which the password can be entered through it. When they entered password equals with the password stored in the memory then the relay gets on and so that the door is opened.

The code is built in a modular style to allow a user to find ways to modify project. In start the D Lock programs loads with a default code of "2345" format is *2345# which can be enter to unlock the door, the code cam be change by entering the master code in the format *23455#new 4 digit code. In this program i only display the result on LCD and lock will be placed at PORTA bit 0 where i put led for simulation.

2. PERIPHERAL UNITS DISCRIPTION

The circuit is based on PIC micro controller. It can be divided into five sections: input (4×4 matrix keypad), processing unit (PIC16F877A MCU), appliance controller (relay driver), display (16×2 LCD), and power supply. The PIC16F877A is an 8-bit micro controller. It has 8k×14-bit flash program memory, 368 bytes of RAM and many other internal peripherals like analogue-to-digital converter, USART, timers, synchronous serial port, compare captures and pulse width modulation modules, EEPROM and analogue comparators. The job of the MCU in this project is to receive signals from the input device (keypad) and take corresponding actions. Whenever any key is pressed on the keypad, the software program in the MCU identifies the pressed key and accordingly turns on or turns off the appliance. Simultaneously, it also displays a message on the LCD screen.

2.1 Matrix keypad

A 4×4 matrix keypad is used to give commands and the password to the MCU. It consists of 16 keys arranged in the form of a square matrix of four rows and four columns. Each key in the matrix is labeled according to the operation assigned to it.

2.2 LCD

A 16×2 LCD is used to display various messages. It also displays an asterisk mark (*) for each digit of the password entered. Control lines EN, RW and RS of the LCD module are connected to pins RA1, RA2 and RA3 of Port A of the MCU, respectively. Commands and the data to be displayed are sent to the LCD module in nibble mode from Port D of the MCU. The higher four data bits of the LCD (D4 through D7) are

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connected to the lower nibble of Port D (RD0 through RD3) of the microcontroller.

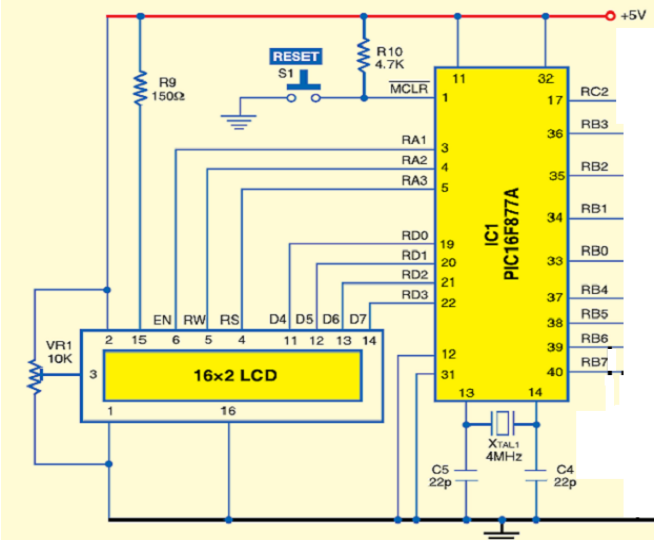

Fig 1. User interference keypad and LCD

2.3 Relay driver

RC2 pin of Port C of the microcontroller is interfaced with the relay driver circuit to switch on or switch off the AC load (appliance). A relay driver circuit is nothing but a simple electronic circuit that drives an electromechanical relay. In this project, a 6V, single-changeover relay is used for switching the appliance 'on' or 'off.' Whenever the user enters the correct password, RC2 pin goes high. The relay energies and the appliance turn 'on.' When RC2 is low, the appliance turns 'off.' Free-wheeling diode 1N4007 protects the relay driver circuit from the reverse voltage developed in the relay coil.

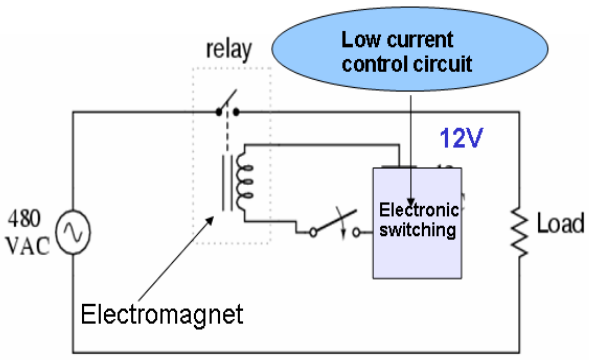

Fig 2Relay driver

2.4 Power supply

The 230V AC mains supply is stepped down to 9V AC using step-down transformer X1. The output from the secondary of the transformer is rectified by a bridge rectifier and filtered by capacitor. The filtered output is regulated by ICs to obtain the required 5V and 6V, respectively.

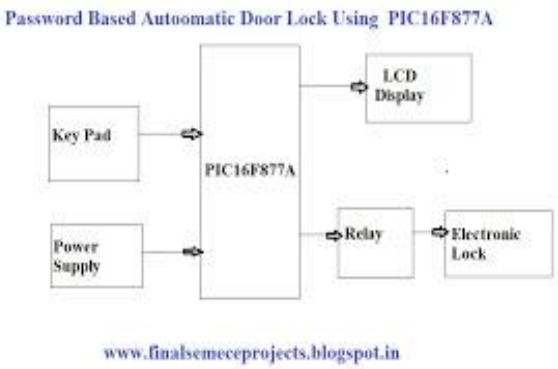

Fig 3. Block diagram of password based door lock using PIC16F877A

3. WORKING

The PIC-16F877A is an 8-bit micro controller. It has 8k×14-bit flash program memory, 368 bytes of RAM and many other internal peripherals like analogue-to-digital converter, USART, timers, synchronous serial port, compare captures and pulse width modulation modules, EEPROM and analogue comparators. The job of the MCU in this project is to receive signals from the input device (keypad) and take corresponding actions. Whenever any key is pressed on the keypad, the software program in the MCU identifies the pressed key and accordingly turns on or turns off the appliance. Simultaneously, it also displays a message on the LCD screen. 4×4 matrix keypad. A 4×4 matrix keypad is used to give commands and the password to the MCU. It consists of 16 keys (S2-S17) arranged in the form of a square matrix of four rows and four columns. Each key in the matrix is labeled according to the operation assigned to it. 16×2 LCD. It also displays an asterisk mark (*) for each digit of the password entered. Control lines EN, RW and RS of the LCD module are connected to pins RA1, RA2 and RA3 of Port A of the MCU respectively. Commands and the data to be displayed are sent to the LCD module in nibble mode from Port D of the MCU. The higher four data bits of the LCD (D4 through D7) are connected to the lower nibble of Port D (RD0 through RD3) of the MCU. Relay driver. RC2 pin of Port C of the MCU is interfaced with the relay driver circuit to switch on or switch off the AC load (appliance). A relay driver circuit is nothing but a simple electronic circuit that drives an electromechanical relay. In this project, a 6V, single-changeover relay is used for switching the appliance 'on' or 'off.' Transistor SL100 plays the role of the relay driver. Whenever the user enters the correct password, RC2 pin goes high. Consequently, transistor SL100 is triggered to energies

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the relay and the appliance turns 'on.' When RC2 is low, the appliance turns 'off.' Free-wheeling diode 1N4007 protects the relay driver circuit from the reverse voltage developed in the relay coil. The 230V AC mains supply is stepped down to 9V AC using step-down transformer X1. The output from the secondary of the transformer is rectified by a bridge rectifier comprising diodes D3 through D6 and filtered by capacitor C1.

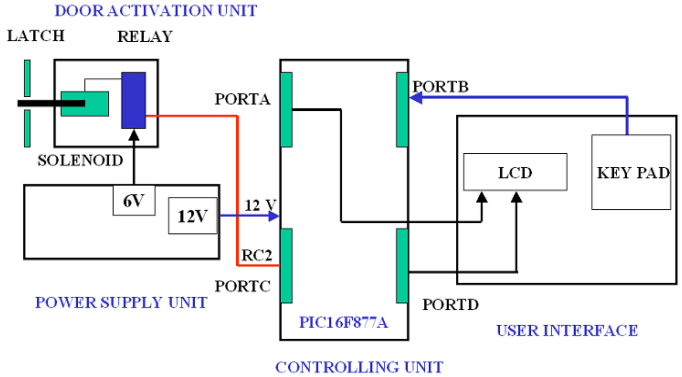

Fig 4.Representation of each unit

4. COMPONENT OVERVIEW

4.1 PIC16F877A

The PIC micro families of RISC microcontrollers are designed to provide advanced performance and a cost effective solution for a variety of applications. The PIC16F8XX Microcontroller family has numerous peripherals and special features to better address user applications.

4.2 Voltage regulator

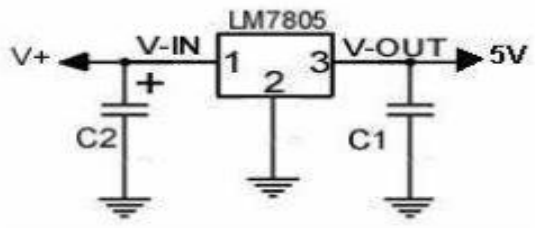

Fig 5.Voltage regulator

In electronic circuits voltage regulators are employed for providing regulated voltage . The function of the regulator is to maintain the voltage at a pre determined level irrespective of changes in the line voltage (Line regulation)and load current (Load regulation) ..Two types of voltage regulators using active devices are there , they are Series regulator and Shunt regulator . However , "Fixed" three-terminal linear regulators are commonly available to generate fixed voltages of plus 3 V, and plus or minus 5 V, 6V, 9 V, 12 V, or 15 V .The "78xx" series (7805, 7812, etc.) regulate positive voltages while the "79xx" series (7905, 7912, etc.) regulate negative voltages. Often, the last two digits of the device number are the output voltage; eg, a 7805 is a +5 V regulator, while a 7915 is a -15 V regulator. There are variants on the 78xx series ICs, such as 78L and 78S, some of which can supply up to 1.5 Amps.

Two fixed regulators 7805 and 7812 have been used in the project . 7805 voltage regulator has been used for most of the units of the project as they require 5 volts for their working . 7812 voltage regulator has been used for LCD back light operation .

4.3 LCD

More microcontroller devices are using 'smart LCD' displays to output visual information. LCD displays designed around Hitachi's LCD HD44780 module, are inexpensive, easy to use. Hitachi LCD displays have a standard ASCII set of characters plus mathematical symbols.

Each of the 640 pixels of the display must be accessed individually and this is done with a number of surface-mount driver/controller chips mounted on the back of the display. This saves an enormous amount of wiring and controlling so that only a few lines are required to access the display to the outside world. For a 4-bit data bus it only requires the supply lines plus seven extra lines. When the LCD display is not enabled, data lines are tri-state which means they are in a state of high impedance (as though they are disconnected) and this means they do not interfere with the operation of the microcontroller when the display is not being addressed.

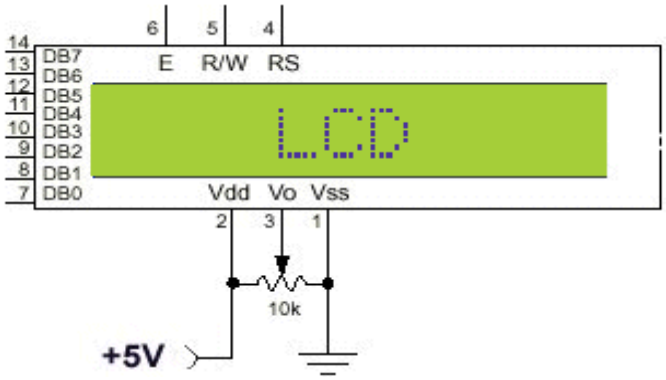

Fig 6.LCD display

4.4 555 Timer

The 8-pin 555 timer is a very useful chip and popular chip with the hobbyist as with just a few external components it can be used to build many circuits

The Pin diagram of the device is given in the figure

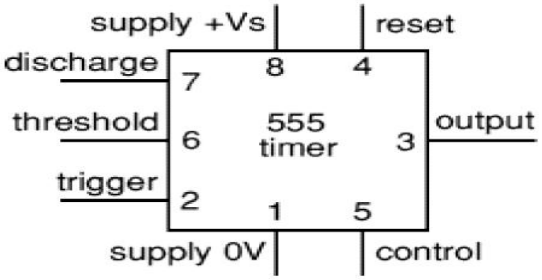

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Fig 7. Pin diagram of 555 timer

The 555 can be used with a supply voltage (Vs) in the range 4.5 to 18V

Trigger input: The output will be high (+Vs) when input < 1/3 Vs . Monitors the discharging of the timing capacitor in an astable circuit.

Threshold input: The output is low (0V)*when>2/3 Vs .Monitors the charging of the timing capacitor in astable & monostable circuits.

Reset input: when less than about 0.7V, the output will be low (0V),overriding other inputs. When not required, it is connected to +Vs.

Control input: this can be used to adjust the threshold voltage which is set internally to be 2/3 Vs. Usually this function is not required and the control input is connected to 0V with a 0.01µF capacitor to eliminate electrical noise. It can be left unconnected if noise is not a problem.

The discharge pin 7 provides path to the timing capacitor to discharge in astable and monostable circuits. It is connected to 0V when the timer output is low

4.5 Solenoid

Solenoid switches are used to switch high power circuits on and off using a much smaller electrical control signal to actuate the switching. This allows extensive logic and decision making circuitry to be performed on inexpensive microchips and small electronic parts, with the actual switching of the high power signals being limited to the very last step. The result is cooler running of less sophisticated equipment. It also enables the high power switching equipment to be limited to a remote location. Solenoid switches which are typically used on automotive engine starting systems can be suitably modified to open the door latch

Solenoids are wound wire magnetic coils with an open core to receive a sliding cylindrical plunger. When the coil is energized with an electrical current, a magnetic field is created in the hollow opening which pulls the plunger into it or pushes it out, based on the orientation of the solenoid and the poles of the plunger.

Most solenoid switches have only one switched pole due to the amount of current being passed through them. Some are only momentarily operated, such as is the case with starter solenoids on automobiles. Solenoid switches perform both electrical switching and coordinated mechanical motion.

Solenoid switches are used to mechanically engaging or disengaging their shafts. This allows latching and opening mechanisms for windows, doors and hatches .Coils inside the solenoid are energized by electricity, they create a magnetic field which attracts and pulls a plunger. Solenoid switch are expensive, therefore, a three phase contactor was modified for the project, schematic is shown in the figure for door open as well as closed.

The possibilities are numerous and can be explored further. If his technology can be put into practical use, every bulb can be used something like a Wi-Fi hotspot to transmit wireless data and we will proceed toward the cleaner, greener, safer and brighter future. The concept of Li-Fi is currently attracting a great deal of interest, not least because it may offer a genuine and very efficient alternative to radio-based wireless. As a growing number of people and their many devices access wireless internet, the airwaves are becoming increasingly clogged, making it more and more difficult to get a reliable, high-speed signal. This may solve issues such as the shortage of radio-frequency bandwidth and also allow internet where traditional radio based wireless isn't allowed such as aircraft or hospitals. One of the shortcomings however is that it only work in direct line of sight.

Fig 8.Electronic lock system

5. APPLICATIONS

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1) Key control, giving the owner of the lock the ability to add and remove keys without having to incur the expense of rekeying.
2) Fine access control, meaning that time and place can be factors in allowing the electronic lock to be disengaged.

3) Transaction logging, so a record is kept of all activity that occurs.

4) Its a keyless lock system.

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