Application of Microcontroller in Door Locking System and Smart Home

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Abstract - **Microcontrollers have variety of applications. Microcontrollers are used in automatically controlled products and devices. One such application is the use of microcontrollers in door locking system. The fundamental use of this project is to provide security in houses, ATM etc. So, the system works in such a way that first we need to set a password which then gets stored in the database. Whenever the correct password will be entered with the help of keypad the controller will send instruction to the DC motor and the door will be unlocked. This electronic technology can be used to create a fully customized and personalized door locking system. Smart homes are gaining importance with time as they have become more advanced and reliable. To make life easier, the user can switch off all the appliances while going out just by a touch from the smart phone.**

INTRODUCTION

Many a times we forget to carry our house keys or misplace the keys wherever we go. Sometimes the door latches close automatically [4]. In such conditions it is not an easy task to open the door. Thus, if door latch can be opened using a password entered with the help of a keypad then the owner will not need to carry house keys and has to just remember the password. People are facing certain security issues all over the world. The main component in door locking system is the 8051 microcontrollers. A 4*4 Matrix keypad is used to enter password. Then are the entered password matches with the one stored in the database the door gets unlocked.   Further the status of the door is displayed on the LCD screen connected to the circuit [7]. If wrong passcode is entered for 3 times the alarm rings.

The door locking system is controlled by the 8-bit microcontroller 8051 which has a 2Kbytes of ROM for the program memory [8]. The password is saved in the EPROM so that we can change it at any time. This 8-bit controller requires a supply voltage of +5V DC.

COMPONENTS

1. Microcontroller: it is the central processing unit (CPU) of the door locking system. The 8051 has a number of applications, such as:
   a. Reading the digital input from the keypad.
   b. Sending the data to LCD so that the person operating the system can read the instruction.
   c. Sensing the password using keypad and to check whether it is a correct password or a wrong password and rotate the stepper motor if the password entered is correct.
2. LCD: we are going to use an alphanumeric liquid crystal display (LCD). This means that it can display alphabets and numbers
3. Buzzer: the buzzer is used to buzz the alarm if the password is entered incorrectly.
4. Keypad: the password is entered using keypad in the system to unlock the door system. A 4x4 keypad is used in our system for input.

MOTOR DRIVER IC (L293D)

The Actuator's are those devices which actually gives the movement or to do a task like DC motor. There are various types of motors available which works on different voltages thus, we need motor driver for running the microcontroller. To get interface between motor and microcontroller [4] we use L293D motor driver IC in our circuit.

To simplify use as two bridges each pair of channels is equipped with an enable input. A separate supply input is provided for the logic, allowing operation at a

lower voltage and internal clamp diodes are included. This device is suitable for use in switching applications at frequencies up to 5 kHz [9]. The L293D is assembled in a 16-lead plastic package which has 4 Centre pins connected together and used for heat sinking The L293D is assembled in a 20-lead surface mount which has 8 Centre pins connected together and used for heat sinking.

Microcontroller based system with external circuit to switch on/Off appliances.

In smart homes automatic night lights are used. To make one LDR and Passive Infrared Sensor is used. The LDR works as a light sensor and PIR sensor detects human body. During daytime, the resistance of LDR is low which causes less voltage drop. In absence of bright light, the voltage drop is high as resistance is high. Thus, the automatic night light does not remain on the whole night and saves a lot of energy.

While going out it is very time consuming to turn off all the devices manually. So here the user can switch off all the devices by a single tap on the app. The working principle is based on resetting the D flip-flops connected to the loads and makes their present state to logic zero. An external circuit has been designed that uses only four digital pins of the ATmega328 based Arduino UNO board and can control (switch on/off) up-to 208 appliances. The external circuit is comprised of D flip-flops and 4-to-16-line decoders that needs 5 back-to-back 4-bit input from the microcontroller to turn on/off any appliance. The entire home can be divided into at most 13 locations (rooms) and in each location, a maximum of 16 appliances can be controlled. The circuit is designed in such a way that it contains a central decoder whose output pins are connected to D flipflops and those D flip-flops are connected to the enable pins of other decoders located at their corresponding locations. Two output pins of the central decoder are being used to switch control between the central decoder and location-based decoders with the help of D flip-flops. These two output pins are common control pins for all the location-based decoders. The output pins are connected to D flip- flops operating in 'Toggle Mode' and outputs of these D flip–flops are connected to relays to turn on/off loads. Manual push switches are connected to the clock of the D flip-flops so that we can switch on/off any load manually.

METHODOLOGY

Electronic Code Lock System Circuit Design: there are five major components of Password Based Door Locking System – a microcontroller, an L293D motor driver, a DC motor, a 4X4 matrix keypad and an LCD. For the process, an 8-bit microcontroller AT89C52 is used. The demand of +5V DC voltage is taken care by using 7805 power supply circuit. For power source, 9V DC battery or 12V, 1A adaptor can be availed.

Reset Circuit Design: Till the power supply is in the detailed range and a minimum oscillation level is sustained, the reset pin of the microcontroller is kept active. A specific value of 10k resistor and a 10uF capacitor is used so that RC>=100ms. This is done to ensure that the supply voltage does not fall below the threshold level of 1.2V and the reset pulse width is greater than 100ms (recommended for 89C51).

Oscillator Circuit Design: The purpose of a crystal oscillator is to provide external clock signal to the microcontroller. Two ceramic capacitors ranging from 20pF to 40pF is connected to establish smooth operation. The place amidst pin 18 and 19 of the microcontroller is secured with crystal oscillator.[9]

Compilation of Microcontroller Code: writing and compiling the code is the subsequent step after designing the circuit. Kiel Vision software is used to write program in C language. A set of general steps is followed prior to writing code. For example, creating a new project and selecting the target device or the required microcontroller. As soon as the writing of code is finished, it is saved with .c extension and then added to the source file group under the target folder. For compiling the code, F7 key is used. A hex file is created when the code compilation is over. Subsequently, to draw the circuit, the Proteus software comes in handy. The code, then exported into the microcontroller by right clicking on the IC and then adding the hex file.

Hardware Components Required:
1. 8051 Microcontroller (AT89S52)
2. Capacitor 10uf ,33pf
3. Pot 10k ohm
4. DC battery or 12V-1A Adaptor
5. Voltage regulator 7805 6. 16×2 LCD
6. L293D Motor Driver board
7. DC gear motor
8. Indication –LED and buzzer

9. Hex keypad
10. Pullup resistor

Software Requirements:
1. Kiel compiler
2. Proteus
3. Flash magic

Operation Principle

8051 microcontrollers is the main component in the circuit. The password is entered using keypad. The system opens the door if the entered password matches the predefined one. It displays the status of door on the LCD.

The LCD displays – 'the password entered is wrong' if some other password is entered. This new microcontroller based locking system is taking over the mechanical lock. This system is made using a blend of mechanical and electronic devices. These devices are highly efficient and simple.

Circuit Description

The total functioning of the—password lock system is based on the software program which is burned inside the microcontroller IC 8051[3]. The at89c51 IC is heart of the given circuit because this IC is programmable 40pin dip IC in which we burn the program in ROM. This IC has a 32 input lines through which we take the output pin no 9 is used for resetting the microcontroller and is RESET to its initial condition. pin no. 31 is ENABLE pin, it requires low pulse for activating the microcontroller and depends on the crystals connected to the xtal1 & xtal2[7]. pin no. 18&19 are used for providing the VCC of +5V. pin no. 20 is grounded.[6]

The operating frequency of the controller is set by the external oscillator of crystal having frequency of 12MHZ. Capacitor having 33pF in parallel connection with ground is for the non-comparable frequency. The keypad used to give input signal is been interfaced with microcontroller are port0 (p0.1- p0.7). The controller fetches the hex code according to the instruction. The LCD is used for display. It is a 16-slot device usually used to show output status from the microcontroller. The output signal which can be fetched by relay status followed by on/off status of electronic lock.

RESULT

- The user can easily reset the password by entering the previous password.
- The user can make various user ids and keep different passwords for each user id to enhance security.
- When the user types the password, the LCD displays the password in the form of '****'thus the privacy of the user is also kept in mind.
- If the password entered is correct, then personalized message is displayed by the LCD for example 'welcome home' and if it is entered incorrectly then it displays password error and asks the user to retry.
- If the password entered is incorrect several times continuously then an alarm starts ringing.

Advantages
- It provides security.
- Power consumption is less.
- The components used in the system are easily available.
- The problem of carrying keys of house wherever we go is solved.
- It provides easy means of convenience.
- Users can control their houses more efficiently.

Future Scope
1. We can send the data to any location of the user with the help of internet/mobile, this will enhance the security of the property.
2. Fingerprint sensors can be added to the door locking system to provide access to the authorised persons only.
3. Fire sensors and smoke detectors can be added to the door locking systems so that the doors are automatically opened in case of emergency.
4. Heating, ventilation and air conditioning can all be controlled through a single device.
5. All the lightings and high-power consuming devices can be automated so that there is minimal power loss.

CONCLUSION

The work was done successfully. It is evident that the use of keypad with the right circuit can be used to operate the door locking system. These systems have the ability to protect a secure place (house, ATM, industries, office etc.). A password-based recognition

system can easily perform variation. In variation the system compares an input password to the pre-defined password of a specific user. Features such as smart app with user friendly graphical user interface (GUI), switching appliances remotely, smart night light, outside mode and smart security system have made the system a complete package. Owing to the wide range of switching capability and the smart features, this system can be also introduced in large scale environments like offices and industries to make our working places better and smart. Due to very less installation cost and affordable price, we believe that smart home systems unlike ours will occupy a large share on the market in near future by disrupting the hegemony of existing costly smart home products.

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