Arduino Based Door Access Control

Janaki Venukumar[1], Naveen.S[2]

PG student, Dept. of ECE, LBS Institute of Technology for Women, Trivandrum, India[1]
Assistant Professor, Dept.of ECE, LBS Institute of Technology for Women, Trivandrum, India[2]
Email: janakivks@gmail.com[1] , nsnair11176@gmail.com[2]

Abstract-Security is the major issue faced by everyone when we are away from our households. In the present scenario satisfactory solution for the above problem is not yet discovered. Presented here is an electronic locking system in which Arduino plays the role of the processing unit. Arduino which is a microcontroller board belongs to Atmega family. It is an open source simple tool. It has the ability to sense, monitor, store and control applications. Access control for the door is achieved using Arduino Uno board. This project exhibits a keyless system for locking and unlocking purposes using a pre defined password. The circuit consists of transistor PN2222A, BD139, 4×4 matrix keypad, solenoid lock, LED and diode. Unauthorised access is ensured by setting a password by the user. It is entered through the 4×4 matrix keypad. If the entered password matches, door will be opened automatically otherwise a message showing incorrect password will be displayed on LCD display. This hardware project achieves security with commonly available components and also consumes less power.

Index Terms- Arduino Uno board, ATMega 328, Servomotor, Arduino IDE.

1. INTRODUCTION

Arduino Based Door Access Control provides security for home, office, shops, banks etc through a security password which is profidencial for the user alone. Users have the freedom to set a predefined code for their locking systems. The system will allow access to the person who knows the password and will not allow access to unauthorized person. This is an optimal solution for protecting one from the hassle of unauthorized entry.

This project is realised using an ATMega 328 board using Arduino kit which is the most popular microcontroller having 6 analog pins and 14 digital pins. Each pins can provide or receive 20mA in operating condition and has an internal pull up resistor of 20-50K ohm. It has a flash memory of 32KB of which 2KB used by bootloader. SRAM of capacity 2KB and EEPROM of 1KB.

2. COMPONENTS REQUIRED

2.1. *Arduino Uno Board*

Arduino is a microcontroller kit for building digital devices and interactive objects that can sense and control physical devices. These systems provide set of digital and analog pins that can interface to various expansion boards. The first arduino was introduced in 2005 aiming to provide a low cost, cost effective devices that interact with environments using sensors and actuators. An arduino's microcontroller can be preprogrammed with a bootloader that simplifies the uloading of programs to the on-chip flash memory.

Arduino boards were designed by American companies. As on 2016, 17 versions of Arduino hardware had been commercially produced. Some of them are shown in figure below.
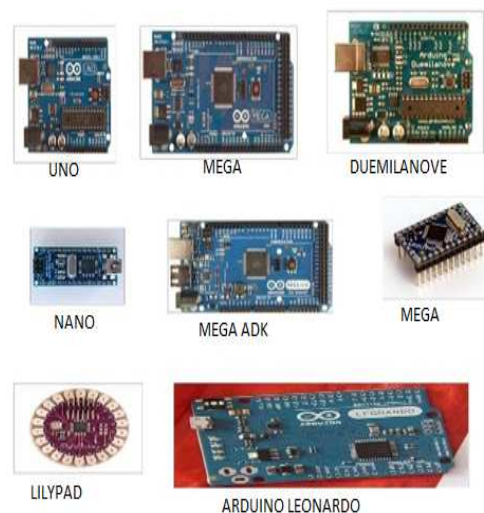

Fig: 1 Various Arduino boards

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2.2. 4×4 Matrix Keypad

Interface 4×4 matrix keypad to an arduino board is the main aspect of this project. Most of the electronics devices use them as user inputs. Knowing how to connect a keypad to a microcontroller like arduino is very valuable for building commercial products. Whenever a key is pressed corresponding action will be visible on the LCD screen.
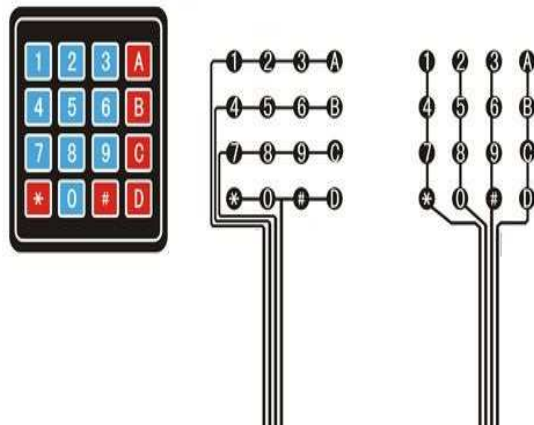

Fig: 2 Schematic of keypad

KEYPAD PINS	ARDUINO DIGINAL PINS
1	D9
2	D8
3	D7
4	D6
5	D5
6	D4
7	D3
8	D2

Fig: 3 Interfacing table

Matrix keypad has an encoding scheme that has less output pins than there are keys. Thus less number of connections that have to be made in order to work. Once the code is compiled and uploaded to the arduino board, during a key press it will show up on the serial monitor of the arduino software.

2.3. Universal Serial Bus

Arduino Uno board can be powered via USB connection or with an external power adapter. External (non USB) power can be either from an AC-to-DC adapter (wall -wart) or battery. The adapter can be connected by plugging a 2.1mm center positive plug into the board's power jack.

2.4. Solenoid Lock

When a door or a device is locked using solenoid, it is using the electromagnetic forces to control the lock. The solenoid fits in the locking mechanism and when locked, it will expand so that the device cannot be unlocked by sheer force.
Password entered by the user is serially authenticated by the arduino. If the entered password matches with the predefined set then the solenoid door lock opens automatically. Access will be denied by entering a wrong set of password.
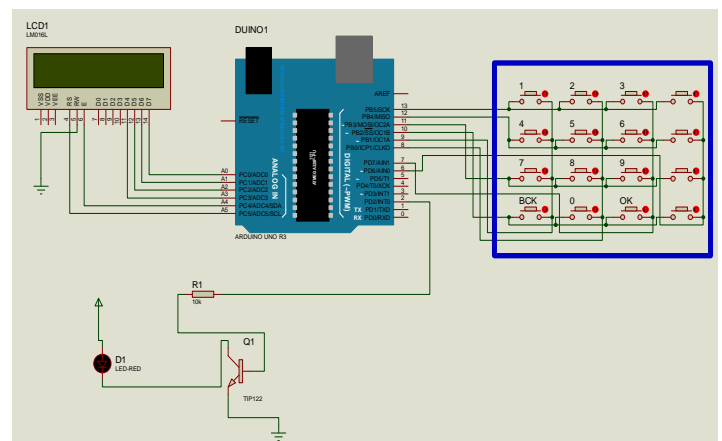
3. CIRCUIT DIAGRAM

Fig: 4 Circuit Diagram

3.1. Working

Using a microcontroller cuts down the number of external components. The circuit comprises of Arduino Uno board, transistors PN2222A and BD139, a 4×4 matrix keypad , solenoid lock and a few other components. The 4×4 matrix keypad is connected to the arduino digital pins D5 through D12. The keypad is simply an arrangement of 16 push button switches in a 4×4 matrix form.
Typically a hex keypad will have keys for numbers 0,1,2,3,4,5,6,7,8 and 9.The hex keypad will have eight connection wires, through resistors R1,R2,R3,R4 and capacitors C1,C2,C3,C4 representing the rows and columns respectively.
The matrix encoding scheme requires fewer output pins and thus fewer connection that have to be made for the keypad to work. The schematic diagram of the electronic door lock system is shown in fig. Arduino receives parallel data from the keypad. Arduino

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software scans the keypad to see if a button is pressed .Upon receiving a valid code input digital pin D4 goes high and fires up to 1.5 ampere current to the solenoid LED1 indicates that the lock has been opened . Entered an invalid code causes it to blink a few minutes or times. Diode D5 protect the circuit from any back EMF that might be created when the lock is turned off.

4. ARDUINO SOFTWARE

Arduino Uno can be programmed wth Arduino software (IDE). keypad.h header file is added to the library for the functioning of the keypad. The ATMega 328 on the arduino uno can be preprogrammed with a bootloader that allows to upload new code to it without the use of an external hardware programmer. It is also possible to bypass the bootloader and program the microcontroller through the ICSP (In Circuit Serial Programming) header using Arduino ISP. The software serial library allows serial communication on any of Uno digital pins. The ATM328 also support 12C and SPI communication. Rather than requiring a physical press of the reset button before an upload the Arduino uno board is designed in a way that allows it to be reset by software running on a connected computer.

5. ALGORITHM

The user can use their passwordl code to enter the home with just a few simple pushes of some buttons. The keypad lock functions by entering a secret code, which is user programmable.

Initially the solenoid lock will be locked and the status LED connected on digital pin D3 of Arduino will be off. When the user enters the right password, the solenoid lock gets unlocked for five seconds and LED glows. After five seconds, both LED and solenoid lock will be in the initial off state. If the password is incorrect LED will blink a few times, indicating that a wrong password has been entered.

6. CONCLUSION

This hardware project has performed the locking and unlocking functions as expected. Any Arduino-Uno or Nano compatible board can be used for this project. The main hurdle to overcome in this project is to interface the Arduino Uno Board with the hardware components. Some new digital locks take advantage of technologies like fingerprint scanning, iris scanning, rectinal scanning, voiceprint identification to authenticate users. Arduino based door locking system provides advance and fastest accessible security with ease of use for home doors and gates.

7. Acknowledgement

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