Password-Based Door Locking System

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Abstract. The password enabled door locking system can be used for households, offices, deskunits, etc. The system will check for the validity of the password entered by the user and willunlock only for the authorized users. This system proves to be an optimal solution for preventing the unauthorized entries. The door lock is a two unit system, where one unit monitors the entry of the user and the other monitors the exit of the user. The number of passwords in practice would depend on the user. Each user gets his/her unique 5digit password which he/she will use to unlock the door. With different users having different passwords, this enables us to maintain a log ofpeople who have used the door lock. This log will be stored on a document on the cloud. Thedocument will comprise of the name, time of entry and time of exit of the user. This feature helps provide an added security to the door locking system. The door lock also comes equipped with anti – guess mechanism, where the system is blocked after 5 wrong attempts. The system has to be reset in order to re-use the lock.

Keyword: Security, Door Locking, Arduino, Safety lock.

1. Introduction

The password-based door-locking system can be used for households, offices, desk units, etc. The system will check for the validity of the password entered by the user and will unlock only for authorized users. This system proves to be an optimal solution for preventing unauthorized entries.

In our daily lives, safety is a major concern. Every person requires a sense of safety.Our security pattern includes an access control system for doors. Traditional locks are no longer as secure as they once were; anyone can gain access by breaking these locks. We need to create a system that will assist 24 hours a day, seven days a week. Only authorizedindividuals have access to restricted areas thanks to a password-based door lock system. Arduino is in charge of the entire system. A keypad can be used to enter the password. Thedoor opens if the password matches the password entered in Arduino. This password-basedbolt structure will provide clients with a more secure and low-effort locking-opening mechanism.

Everyone desires a private place where no one can enter without their permission, thus we need to secure our room, office, locker, etc. that preserve our valuable accessories,documents, data, and jewelry, and for that purpose, the proposed work has developed a "Password-based door lock system by using Arduino.". This device is a digital door lock with a password or pin code. Which prevents the user from opening the door unless they input the correct password or pin code.

In this project, a password-based door-locking system is used. It is used for households, offices, desk units, etc. This device is a digital door lock with a password or pincode. Which prevents the user from opening the door unless they input the correct passwordor pin code.

The term "door lock" refers to a device that prohibits a door from being opened and that can only be opened with a key, fingerprint, retina scanner, smart card, or other similar devices. Door locks have played a vital

role in human life for a long time. As the rate of theft rises, security has become a top priority in recent years. Door locks are intended to keep us and our belongings safe and secure from thieves.The scope of password-based door-locking systems increases by the day because it isa growing technology.

People use many types of security locks to provide better security for our homes or lockers. Most people use key locks for the door of their homes, their lockers, cabinets, andother things. But the key lock can be easily opened and broken by someone. That's why we are doing this new project to allow people to know the lock state whether the lock is locked or unlocked So, it will be protected.

2. Literature Survey

A literature review surveys books, scholarly articles, and any other sources relevant to a particular issue, area of research, or theory, and by so doing, provides a description, summary, and critical evaluation of these works in relation to the research problem being investigated. A literature survey, or literature review, is a proof essay of sorts.It is a study and review of relevant literature materials. Literature reviews are designed to provide an overview of sources you have explored while researching a particular topic andto demonstrate to your readers how your research fits within a larger field of study.

Akshaya Krishnadas Bhat et al. [1] - This article illustrates how a password-protecteddoor lock can be used in a variety of settings, including the home, office, and desk. The system will check the user's entered password for validity before unlocking it for the authorized user. This method could be a less expensive alternative to expensive door lock systems that use retina scans, iris scans, or fingerprints, among several other technologies.

Prof . A.Y. Prabhakar et al. [2] - This article shows how an ARDUINO UNO-basedpassword-based door lock system is created, where the door is unlocked and the user who input the right code is authorized to enter the zone. And the common individual can bid onsuch a locking system for a low price in order to ensure the protection of their valuables.

Dr. Manish kumar et al. [3] This study states how we may use an Android-based smart door lock system to address the issues of unwanted access, trespassing, and instruction. Also included in this concept is a Bluetooth module that serves as a communication channel between the Arduino Uno and a mobile phone. This application is simple to set up and maintain.

Shruti Jalpur et al. [4]– This paper depicts a secure and protected door lock system,with network security supplied by the use of cryptographic algorithms such as SHA-128 and SHA-512. The technology also allows the authorized user to access the information remotely. The user input is encrypted and hashed using the algorithms AES-128 and SHA- 512. If the sensor detects unauthorized access, it will send a notification to the smart phoneapplication placed on the authorized user's smartphone.

Aleksander IBRO et al. [5]- This article depicts a door lock system that allows usersto unlock the door using face recognition and data stored on the cloud via a camera installedon the door. This work will be quite costly, and it will necessitate the installation and employment of qualified experts.

Shuhad Natashab Bint Mohd Zainot [6]- "The door entry system utilizing Arduinois created to overcome cannot be replaced," according to this research. It also saves time and provides a high level of security.

Halliru, Umar Muhammad [7] - "Design And Construction of Smart Door Security System Using Arduino And Bluetooth Application" explores the development of an advanced security system that combines Arduino and Bluetooth technology for a smart door lock solution.

3. Methodology

Smart locks are electromechanical devices that provide a locking and unlocking mechanism, often supplemental to a traditional lock. The password enabled door locking system can be used for households, offices etc. This system demonstrates a Password-basedDoor Lock System using Arduino, wherein once the correct code or password is entered, the door is unlocked.

In this project, we used an Arduino and a keypad to create a password-based securitysystem. Thefts and frauds are becoming more common by the day; therefore, security is becoming a serious worry. As a result, a smart lock with a digital code can simply secure our home, business, locker, and other valuables. It only unlocks a door when the correct password is supplied. Due to a password-based door lock mechanism, only authorized personnel are permitted access to the restricted areas. The Arduino is in charge of the project's overall operation. A 4×4 keypad can be used to input the necessary password B.

Working Principle There are two cases for this experiment. The purpose of this experiment is to implement a door-locking mechanism that opens or closes the lock on the door automatically with password.

Case 1: The lock will open and close When a password is entered via keypad, the system checks the password and finds out if it is right or wrong. If the password matches with the stored password in the microcontroller chip, the microcontroller sends the signal to the LCDdisplay for showing "The door is open" as well as the microcontroller sends the signal to Solenoid lock .Opens the lock, allowing the door to be unlocked. Later, by pressing '#'button, closing the door.

Case 2: The lock will not open If the wrong password is entered, the system shows "Passworddoesn't match –Please try again". A bit of time the system automatically starts again from the beginning.

Advantage

This lock provides better security and safety because of it has automatic relocking process. It consumed very less power for locking and unlocking the door. It is a simple andeasy to operate. The response time also very good for locking and unlocking and automatically relocking process.

Disadvantage

In rural areas this lock cannot be suited as best lock. Because, there is not much availability of power supply.

4. Software

Arduino IDE

The Arduino IDE is an open-source software, which is used to write and upload codeto the Arduino boards. The IDE application is suitable for different operating systems suchas Windows, Mac OS X, and Linux. It supports the programming languages C and C++. Here, IDE stands for Integrated Development Environment. The program or code written inthe Arduino IDE is often called as sketching. We need to connect the Genuino and Arduinoboard with the IDE to upload the sketch written in the Arduino IDE software.

Toolbar Button

The icons displayed on the toolbar are New, Open, Save, Upload, and Verify.

Upload

The Upload button compiles and runs our code written on the screen. It further uploads the code to the connected board. Before uploading the sketch, we need to make sure that the correct board and ports are selected. We also need a USB connection to connect the board and the computer. Once all the above measures are done, click on the Upload button present on the toolbar. The latest Arduino boards can be reset automatically before beginning with Upload. In the older boards, we need to press the Reset button present on it. As soon as the uploading is done successfully, we can notice the blink of the Tx and Rx LED. If the uploading is failed, it will display the message in the error window. We do not require any additional hardware to upload our sketch using the Arduino Bootloader. A Bootloader is defined as a small program, which is loaded in the microcontroller present on the board. The LED will blink on PIN 13.

Save

The save button is used to save the current sketch or code.

New

It is used to create a new sketch or opens a new window.

Verify

The Verify button is used to check the compilation error of the sketch or the written code**.**

Serial Monitor

The serial monitor button is present on the right corner of the toolbar. It opens the serial monitor

5. Software Description

Embedded C

Before the C language was introduced, developers used basic programming (assembly-level) to develop embedded applications. These assembly level programming were not portable in nature, which acted as a restriction for the developers, as they were notable to fully engage in the process of the development of embedded applications. With the improvements in the embedded programming language many new programming languageswere introduced such as C, BOCOL and Pascal, these relatively newer languages helped inovercoming many problems that were faced by the developers when working with assemblylevel programming. One of the most noticeable breakthroughs in the development of embedded programming was seen with the introduction of the C programming language. There are many advantages that can be exploited by developers when developing embeddedapplications such as the embedded c programming provides portability and is easy to workwith due to its simplicity. Embedded c programming is more reliable and scalable when compared to assembly level programming. Embedded systems are able to perform various assigned tasks with the help of embedded c programming, as the programming guides the processor of the respective embedded systems. Embedded C language is one of the most widely used embedded programming languages for programming microcontrollers. The process is explained in Figure 1.
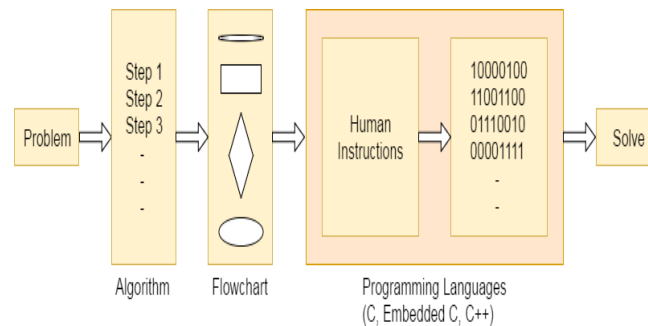
Figure 1: Methodology.

Working process

Embedded systems are able to perform various assigned tasks with the help of embedded c programming, as the programming guides the processor of the respective embedded systems. Embedded C language is one of the most widely used embedded programming languages for programming microcontrollers. The microcontroller programming is different for each type of operating system. Even though there are many operating system is existing such as Windows, Linux, RTOS, etc. but RTOS has several advantages for embedded system development**.**

6. Project Description

Hardware:

6.1 Arduino Uno

The Arduino Uno is a microcontroller board based on the ATmega328p. It is simple, inexpensive, open source prototyping platform extensible to hardware and software. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz ceramic resonator, a USB connection, a power jack, and a reset button. It contains everything needed to support the microcontroller. We either need to connect it to a computer using a USB cable or power it with an AC-to-DC adapter. The Arduino circuit acts as an interface between the software part and the hardware part of the project.

Arduino is an open-source electronics platform based on easy-to-use hardware and software. Arduino boards are able to read inputs - light on a sensor, a finger on a button, or a Twitter message - and turn it into an output - activating a motor, turning on an LED, publishing something online. User can send a set of instructions to the microcontroller on the board. To do so use the Arduino programming language (based on Wiring), and the Arduino Software (IDE), based on Processing.

Over the years Arduino has been the brain of thousands of projects, from everyday objects to complex scientific instruments. A worldwide community of makers - students, hobbyists, artists, programmers, and professionals - has gathered around this open-source platform, their contributions have added up to an incredible amount of accessible knowledge that can be of great help to novices and experts alike.

Arduino was born at the Ivrea Interaction Design Institute as an easy tool for fast prototyping, aimed at students without a background in electronics and programming. As soon as it reached a wider community, the Arduino board started changing to adapt to newneeds and challenges, differentiating its offer from simple 8-bit boards to products for IoT applications, wearable, 3D printing, and embedded environments.

The diagram of Arduino is shown in Figure 2.

Figure 2: Arduino – UNO.

Arduino also simplifies the process of working with microcontrollers, but it offers some advantage for teachers, students, and interested amateurs over other systems:

- **Inexpensive** - Arduino boards are relatively inexpensive compared to other microcontroller platforms. The least expensive version of the Arduino module canbe assembled by hand, and even the pre-assembled Arduino modules cost less than\$50

- **Cross-platform** - The Arduino Software (IDE) runs on Windows, Macintosh OSX, and Linux operating systems. Most microcontroller systems are limited to Windows.

- **Simple, clear programming environment** - The Arduino Software (IDE) is easy- to-use for beginners, yet flexible enough for advanced users to take advantage of as well. For teachers, it's conveniently based on the Processing programmingenvironment, so students learning to program in that environment will be familiar with how the Arduino IDE works.

- **Open source and extensible software** - The Arduino software is published as open source tools, available for extension by experienced programmers. The language can be expanded through C++ libraries, and people wanting to understand the technical details can make the leap from Arduino to the AVR C programming language on which it's based. Similarly, you can add AVR-C code directly into your Arduino programs if you want to. Open source and extensible hardware - The plans of the Arduino boards are publishedunder a Creative Commons license, so experienced circuit designers can make their own version of the module, extending it and improving it. Even relatively inexperienced users can build the breadboard version of the module in order to understand how it works and save money.

6.2 4X4 Matrix Keypad Module

The 4x4 Matrix Keypad module is interfaced to the Arduino Mega to take the input from the user. This input is then matched with the preset password to check the validity of the password. If the password is valid, the door lock will be unlocked. If invalid, the door lock will remain locked. The 4x4 Matrix Keypad Module consists of 4 rows and 4 columns.There is a switch that connects each row and column. The same is shown in the Figure 3.

Figure 3: 4x4 Matrix Keypad.

6.3 Solenoid Lock

Solenoid lock, also known as Actuator Lock, is used for the actual locking. Solenoids are basically electromagnets: they are made of a big coil of copper wire with an armature (a slugof metal) in the middle. When the coil is energized, the slug is pulled into the center of the coil. This makes the solenoid able to pull from one end. This solenoid in particular is nice andstrong, and has a slug with a slanted cut and a good mounting bracket. It's basically an electronic lock, designed for a basic cabinet or safe or door. Normally the lock is active so you can't open the door because the solenoid slug is in the way. It does not use any power inthis state. When 9-12VDC is applied, the slug pulls in so it doesn't stick out anymore and thedoor can be opened. This is shown in Figure 4.

Figure 4: 4x4 Solenoid Lock.

6.4 16×2 Alphanumeric display

An LCD (Liquid Crystal Display) screen is an electronic display module and has a wide range of applications. A 16x2LCD is a very basic module and is very commonly used in various devices and circuits. A 16x2 LCD means it can display 16 characters per line and there are 2 such lines. In this LCD each character is displayed in a 5x7 pixel matrix. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 differentcharacters and symbols. This LCD has two registers namely , Command and Data. This is shown in the Figure 5.

Figure 5: 16×2 Alphanumeric Display.

6.5 Jumper Wires

Jumper Wires Simple terms, jumper wires are wires with connection pins on both ends. A jumper wire is sometimes referred to as a jumper, a jumper cable, a DuPont, or a cable. Without soldering, jumper wires are used to connect electronic components or a testcircuit. Jumper wires come in a variety of colors, and the fact that they all work the same colors doesn't mean anything.

Jumper wires typically come in three different versions

- Male-to male jumper wire

- Male-to-female jumper wire

- Female-to-female jumper wire

Jumper wires types: The end points of male jumper wires have a pin that is used to connect to other components, whereas female jumper wires do not. Female jumper wires do not have pins on their ends and are used to plug into items. The most common type of jumper wire used to connect components is male-to-male jumper wires. This is shown in the Figure 6.

Figure 6: Jumper wire types.

7. Result

Working Principles

When the power is ON, the microcontroller sends commands to the LCD to display "Enter Password" on LCD. So, enter the password using key pad. Once password is entered, it displays stars on LCD to indicate that it reads the password correctly. It displays the message "enter password" on LCD

- At starting, the system is waiting for the four-digit password from the user. This lock support only numeric value for password. If password will be wrong a message will show on the display " Code incorrect Try Again!! " Figure 7 Smart Locking system – Step1

Figure 7: Smart Locking system – Step.

- After entering the password, system detect that wither password is correct or not, If password is correct that it generates the command to the servo motor (Servo motor will rotatein anticlockwise direction from position 0° to 360°) to open the door at the same time LCD display the message "Access Granted You r welcome" as shown in Figure 8.

Figure 8: Smart Locking system – Step2.

- Once door will open than after some delay, count-down will be started, which to close thedoor automatically after some delay and the system display the message "Re -Locking" on LCD as shown in Figure 9.

Figure 9: Smart Locking system – Step3.

- If the password is wrong, then the system displays the message "Code incorrect TRYAGAIN!!" on LCD as shown in Figure 10.
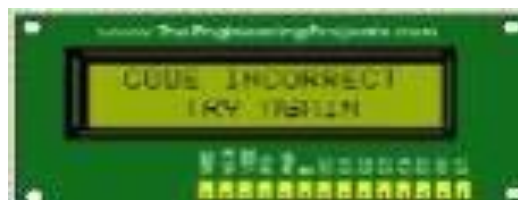

Figure 10: Smart Locking system – Step4.

- After some delay again, the system asks the user to enter correct password. This lock provides better security and safety because of it has automatic relockingprocess. It consumed very less power for locking and unlocking the door. It is a simple and easy to operate. The response time also very good for locking andunlocking and automatically relocking process. Sometimes, In rural areas this lock cannot be suited as best lock. Because, there is not muchavailability of power supply. It can be taking some time to change the password and reset again in case of forgetpassword.

8. Conclusion

This project is mainly used to provide safety and security to very important and valuables things in the home to avoid illegal attacks and theft. And one way of knowing thata house is safe if the door of the house is locked properly. This system includes an ArduinoUNO, LCD display,3*4 keypad. This type of lock is best for all types of houses and lockers.It is a low-budget lock so everybody can afford this. As it is already mentioned this lock consumes very less power and its battery also rechargeable. So, Everyone can use and operate easily.

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