

# Design of Smart Door Locking System

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**Abstract:** A smart lock is an IOT based locking system that is developed to achieve the locking and unlocking function on a door as per the commands received from the user. In this project, the pre-defined password acts as a locking key for the system. This technology easily replaced the older locking system with the new IoT-based techniques for the locking system. These techniques are combinations of mechanical and electronic devices and based on IoT. The output is performed by a servo motor to open and close the door.

**Keywords:** Smart locking system, Arduino, IoT, Smartphone, Servo motor

## 1. Introduction

This project is mainly developed using Arduino, electrical and mechanical components and it is the advanced and easiest way for locking system which is secure for everyone. It performs the locking system using a keypad where the password and operations are already programmed in the microcontroller. If someone tries to break the lock it will directly off the keypad and can't open the door and we have to reset again.

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, and other things. But the key lock can be easily open broken by someone.

That's why we are doing this new project to allow the people to know the lock state whether the lock is locked or unlocked by a Bluetooth interface. So, it will be protected.

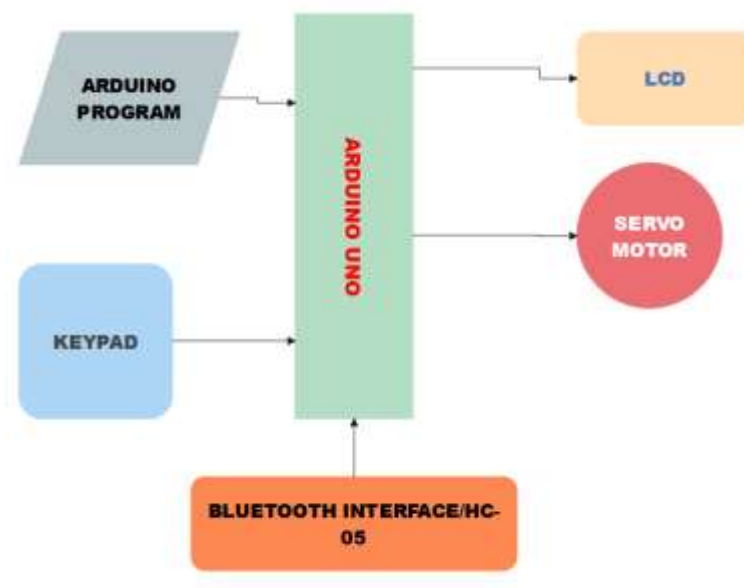


Fig. 1 Block diagram of smart locking system

## 2. Components Description

### 2.1 Components working sequence

- Arduino (sense input from user and compare wrong/right command as per that it provide output to servo motor to lock or unlock the locker.)
- Servo motor (It receive input from Arduino, accordingly rotate).
- 16x2 LCD Display (It will display all the messages or input/output command that is given by the user).
- Connecting wires (use to connect every component to perform complete action).

e) Bluetooth HC-05 (It will provide a

Bluetooth interface from locker to a smart The Arduino Uno based microcontroller with 6 analog and 14 digital input/output pins is used for this project. It consists of 16 MHz quartz crystal that defined the operating speed and an USB connection. It is also provided with a power jack, an ICSP header and a reset button. Arduino is an open-source platform and consists of both a physical programmable circuit. It has the IDE (Integrated Development Environment)

### b) Servo Motor



Fig. 3 Servo motor

A servo motor is a rotatory motor and it gives response very quickly. This motor is controlled by closed loop feedback. And it has high efficiency that helps for rotating mechanism. So, the lock can be locked and unlocked by the servo motor. This is an automatic closed loop control system. Here instead of controlling a device by applying the variable input signal, the device is controlled by a feedback signal generated by comparing output signal and reference input signal.

### c) 16X2 LCD Display

LCD modules are very commonly used in the most embedded projects to display characters, numbers and etc., the reason being its cheap price, availability and programmer friendly. This lcd

Bluetooth device).

### a) Arduino UNO

is used for designed the coding for the microcontroller.



Fig. 2 Arduino UNO

display has 16(from 0 to 15) columns and 2 rows (from 0 to 1).



Fig.4 LCD display

### d) 3X4 Key Pad

Keypad 3x4 is used for loading numeric into the microcontroller. It means it has 3 column and 4 rows in the X and Y matrix.

There is total seven output pins (1 to 7) in this keypad.



Fig. 5 3X4 Keypad

Table 1: Bluetooth details

Pin No	Name of pin	Details
1	Enable / Key	Set between Data Mode (Set 0) and AT command mode (Set 1).
2	Vcc	5V supply
3	Ground	Ground pin
4	TX	Transmits the Serial Data.
5	RX	Receive the Serial Data.
6	State	Check the mode of Bluetooth working or not
7	LED	Show status (paring/connected)
8	Button	control the Key/Enable pin

**e) HC-05 Bluetooth**

HC-05 based Bluetooth device is used in this project as shown in Fig. 6, It is made for transparent wireless serial communication setup. Its interface is via serial communication which makes an easy way to interface with controller and smartphone or PC. And the detailed system configuration given in Table 01.

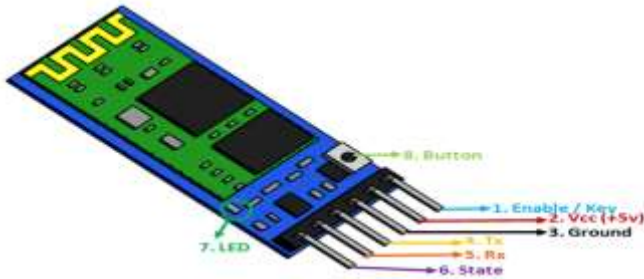


Fig. 6 HC-05 Bluetooth

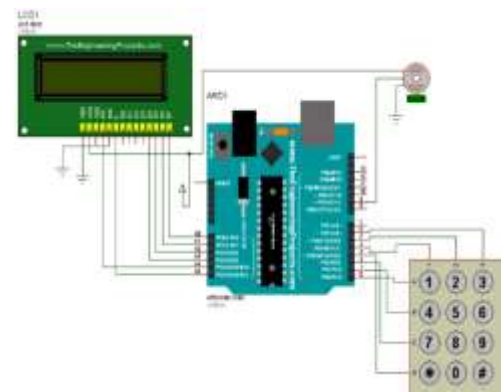


Fig. 7 Smart Locking system

**3. Methodology**

To run the module, first, need to connect Arduino with all components as like the Arduino pins (A0, A1, A2, A3) connected through a wire to the LCD pins (D7, D6, D5, D4), the keypad pins connected to the Arduino pin 0,1,2,3,4,5,6, the servo motor connected to the Arduino in pin no 9, one power source of 5V connected to the LCD display as shown in Fig. 7. After that Arduino code is fed to the Arduino

Uno board in Proteus software. This coding was done by Arduino IDE software and the hex file of this code was uploaded on Arduino Uno board in Proteus software

In this project, a pre-defined password is used to control the operation of the servo motor. The code design by us has the following step as shown in Fig. 8. First, enter the password, then the system would detect that. if the password is matching with the user pre-defined password or

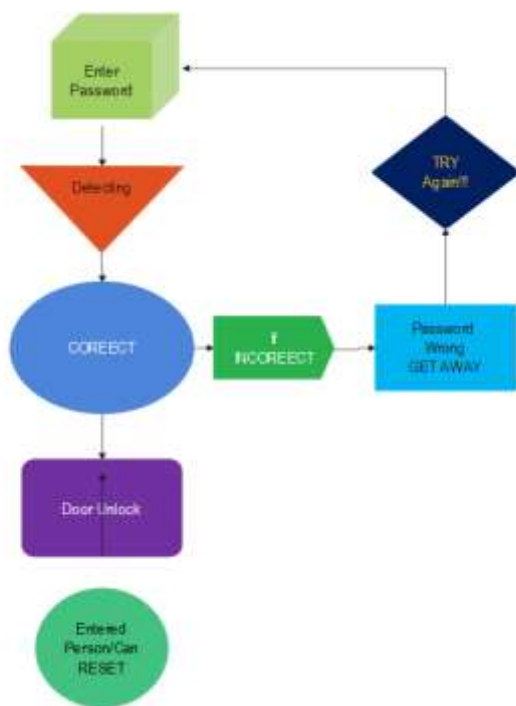


Fig. 8 Flow Chart

If the password is correct then the servo motor connected through Arduino will rotate in an anticlockwise direction (from 0° to 360°) and open the lock. If the Password is wrong then the command provides by the code is “ wrong password Try Again!!” will show on the LCD 16\*2 display. After unlocking the lock, the countdown process would start, which will automatically be locked by rotation of the servo motor in a clockwise direction (from 0° to

360°). And a message will show on the display “Locked”. All the processes are easily controlled via Bluetooth interface to operate this lock system by our smartphone.

#### 4. Results and Discussions

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

1. 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 shown on the display “ Code incorrect Try Again!! ”



Fig. 9 Smart Locking system – Step1

2. After entering the password, system detect that wither password is correct or not, If password is correct that it generate the command to the servo motor (Servo motor will rotate in 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 Fig. 10.



Fig. 10 Smart Locking system – Step2



3. Once door will open than after some delay, count-down will be started, which to close the door automatically after some delay and the system display the message “*Re - Locking*” on LCD as shown in Fig. 11.



Fig. 11 Smart Locking system – Step3

4. If the password is wrong, then the system display the message “*Code incorrect TRY AGAIN!!*” on LCD as shown in Fig. 12.



Fig. 12 Smart Locking system – Step4

5. After some delay again the system asks the user to enter correct password.



Fig. 13 Smart Locking system – Step5

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 and easy to operate. The response time also very good for locking and unlocking and automatically relocking process.

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

It can be take some time to change the password and reset again in case of forget password.

### Comparison between Ordinary lock and Smart lock

- i. In Ordinary lock people can not reset the password there is single key that can be used for locking and unlocking the door. While In the smart locking system people can reset password or password can be change easily.
- ii. People no need to break the lock if they forget their password in Smart lock because they can reset the password through other device such as smartphone. whereas in ordinary lock people have to break the lock if the key of lock is lost.
- iii. These type Smart lock can be operated through online/Bluetooth connectivity system to provide better security in our home whereas Simple lock can not operate through any interface.
- iv. In ordinary lock no need of power supply to operate the lock whereas Smart lock need power supply to operate. But, this is not a big issue because there is a battery installed inside the smart lock, people can recharge this battery.

### 3. 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 that a house is safe if the door of the house is locked properly. This system includes an Arduino UNO, LCD display, 3\*4

keypad, Bluetooth Technology components. 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. In case of forgot password they can reset it by smartphone through Bluetooth connectivity.

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