

DEVELOPMENT OF GSM BASED ADVANCED DIGITAL DOOR LOCKING SYSTEM

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Abstract. Security has become very important, but along with that, people also need a system that is highly secure and more consistent. As conventional door locks can be easily opened, people are vulnerable to security threats. Door locks we use have evolved from metal door locks of primitive keys to latest controlling structure with up to four levels authentications to ensure maximum safety for the user. Multifactor authentication is often used in situations where more strong security is required. In many cases, this multilevel mechanism is complex and less user-friendly because it needs a greater number of steps as far as end users are concerned. With the advancement of technology, digital door locks have become very common these days. For this project two factors i.e., Password and OTP are used for authentication. With this in addition to entering a password (first factor) users need to enter a Onetime Password (second factor) manually that they receive to their mobile phones that is generated by a hardware. Hence two factors are implemented for authentication. It also alerts the user whenever the wrong details are entered through notification. Buzzer is used to alert the neighbors' or people nearby. The security increases with this model. Resetting password is additional feature which is very useful.

INTRODUCTION

These days offices and houses need security since many faces threat of burglary, if individual is available or not at place. When it comes to security systems, it is one of the primary concerns in this competitive world, where humans cannot find ways to provide security to his secret belongings manually. Instead, an individual finds an alternative solution which provides better, reliable and atomized security.

Automatic door locks have become a basic feature in most type of buildings (offices, armament rooms, etc.) and homes. And these locks are gaining popularity each day which develops provides high security than old locks. Due to increase in crime rate house security has been a major concern and everyone wants to safeguard their house to prevent unauthorized access. In past couple of decades various locking systems have been designed. The main reason for providing security for our home, school, office, and building is to safeguard of our lives as well as property. It is therefore important to have a way of achieving this goal.

The purpose of this advanced digital locking system is to develop a unique system through mobile technology which provides a security system for houses, industries. We know various appliances can be utilized by managing them remotely by using GSM technology, which enables the user to remotely control this locking system. Just by pressing passwords on keypad of mobile the user can perform LOCK/UNLOCK operations on the door lock. Unlock the door by using pre-defined password. Increase the security level to prevent an unauthorized unlocking of the door by using an additional level to open it. This prevents opening of the door by unauthorized persons. Flexibility to the user to change or reset the password and send OTP to multiple persons is used. It is more secure yet cost-effective way of door locking-unlocking system.

Arduino Uno

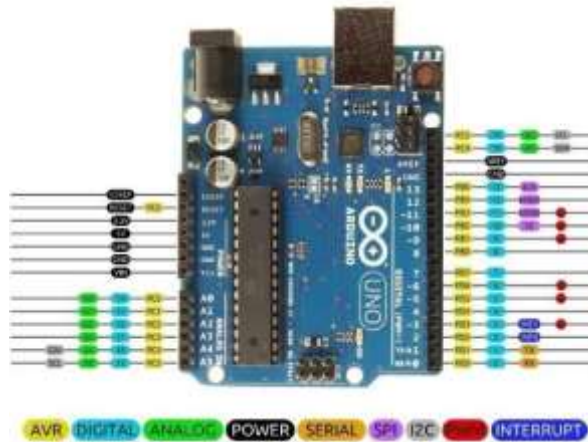


Figure 1 Pinout of Arduino Uno

Arduino is an open-source physical computing board which computes using a single microcontroller. Arduino provides connection between inputs and outputs. It modifies the output according to the inputs from source such as switching for a fan or lighting control in a room. The Arduino programming language uses an Integrated Development Environment (IDE), and a single board microcontroller. It uses C libraries to provide various features.

In our project we used Arduino UNO. It is microcontroller board based on the Microchip ATmega328P microcontroller and developed by Arduino.cc. The board has set of digital and analog pins for input/output (I/O) purpose that may be interfaced to various expansion boards and other circuits. The board has 14 digital I/O pins, 6 analog I/O pins and 6 PWM pins which are programmable with the Arduino IDE via a type B USB cable as shown in Figure 1. USB cable or a battery can power the board, though which it accepts voltages between 7 and 20 volts.

GSM Module

A GSM module is a board that is used to establish link between a mobile or a computing machine with GSM system. They use a SIM to connect their device to the network. From the view of the mobile phone network, they are essentially indistinguishable to an ordinary mobile phone, including the need for a SIM to connect themselves to the network. It operates at the frequency band of 900 MHz or 1800 MHz .



Figure 2. GSM module.

GSM Modules are one of the frequently used communication modules in embedded systems. A GSM Module is used to enable communication between a microcontroller (or a microprocessor) and the GSM Network. Here, GSM expands as Global System for Mobile Communication. It allows microcontrollers to have a wireless communication with other devices and instruments. Such wireless connectivity with microcontroller has wide range of applications like Home Security Systems, Home Automation, Disaster Management, Medical help, Track an automobile, E – Commerce and etc.

Liquid Crystal Display (LCD)



Figure 3. LCD

An electronic device that is used to display data and the message is known as LCD 16×2. It includes 16 columns and 2 rows so; it can display 32 characters in total & every character is made with 5×8 (40) Pixel Dots. 16X2 displays mainly depend on multi-segment LEDs. There are different types of displays accessible in the market with different combinations such as 8×2, 8×1, 16×1, and 10×2, however, the LCD 16×2 is broadly used in devices, DIY circuits, projects since it is cost efficient, programmable friendly & ease of access and availability

Solenoid

This 12V Cabinet Door Electric Lock Assembly Solenoid can be used for locking sell-machine, storage shelf, and etc. This hidden way of unlocking can be used for an emergency. The lock activates as the circuits disconnects, and it will unlock as the instant power-on. It is steady, strong, and energy saving and had a long lifespan. In the anti- theft and shockproof design, this lock is better than other kinds of locks. Whenever power is supplied the electro- magnet inside solenoid gets magnetized. Since to latch is made of metal it gets pulled inside thus lock opens. If the supply is stopped then simply magnetism is lost and the latch is released. It just needs Phase and ground and can be given to any pin since magnetization can be done in any direction.

DESIGN

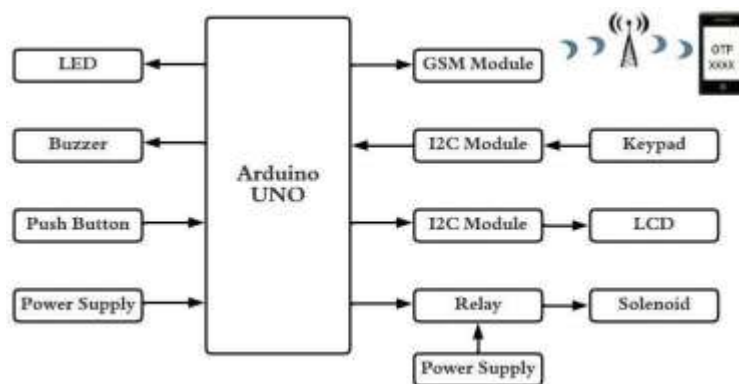


Figure 4. Block diagram of Door Lock

Based on the functionality components are divided into three categories. Input, Output and processing units. Input gets data from the user and output is used to instruct the user and also indicate

status to user. The processing unit is used process the inputs given based on the loaded algorithm and generate output. This output is delivered to user by output devices.

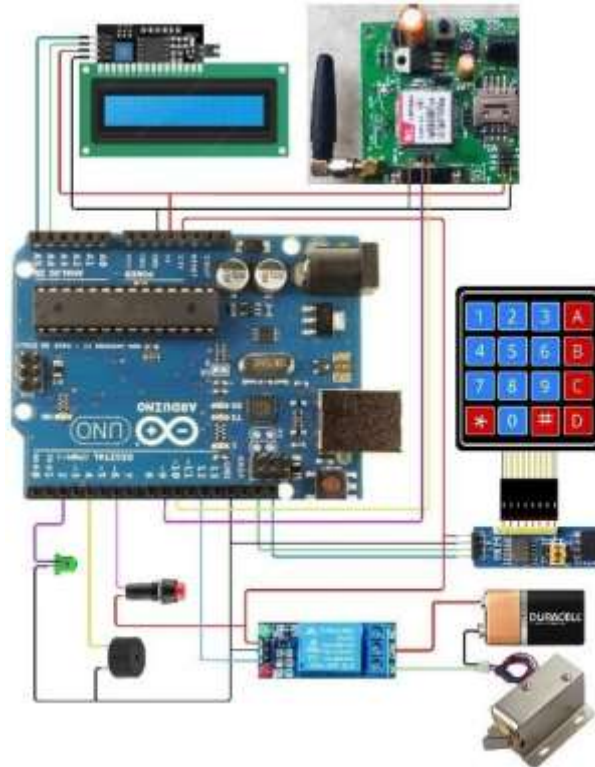


Figure 5. Circuit diagram of digital locking system

Input Unit

This unit is which commands to start the execution of a program and here button A on keypad serves the purpose of sending command as input. After this the process of unlocking starts from outside the door. Here inputs like password and OTP details entered by user are needed. So, one of the input units is keypad. To reduce number pins from 8 to 2, a serial data converter called I2C module is used. Along with that one of the other inputs in push button. This push button is used to send a signal that it is pushed. It uses power supply of 3.3V to do this function. These are the two input units. Along with this power supply is needed. Arduino needs at least 5V but it can accept 12V. So, we simply used one adaptor to power both Arduino and Solenoid.

Output Unit

The system has many output components which serves different functionality. Mainly GSM is used to interface with mobile, that is to send OTP to mobile or error notification. It needs a network card to send these SMS's. LCD is used to provide instructions to the user regarding the process. It is an important component because it is display where we can see the position of the current step. Apart from these LED is used to indicate the status of the door weather unlocked or locked. Buzzer is used to alert the security nearby whenever wrong details are entered. Command is sent to relay whenever the door needs to be unlocked. These are the output units in the system.

Processing Unit

The data from inputs is processed here to generate output. There will be a preloaded code which

is used to process data. Generally, it is the brain of the system. Here Arduino is one of the processing devices which compiles the code. It runs on an infinite loop if power is supplied. All data from input devices is given to this and this Arduino generates an output. Along with this I2C Module is used to convert parallel data into serial one. Here it consists of SDL and SCL lines. SDL transfers data and SCL is clock for data to be sent as shown in Figure 3.4. By usage of this I2C module the number of pins connected to Arduino is reduced.

WORKING

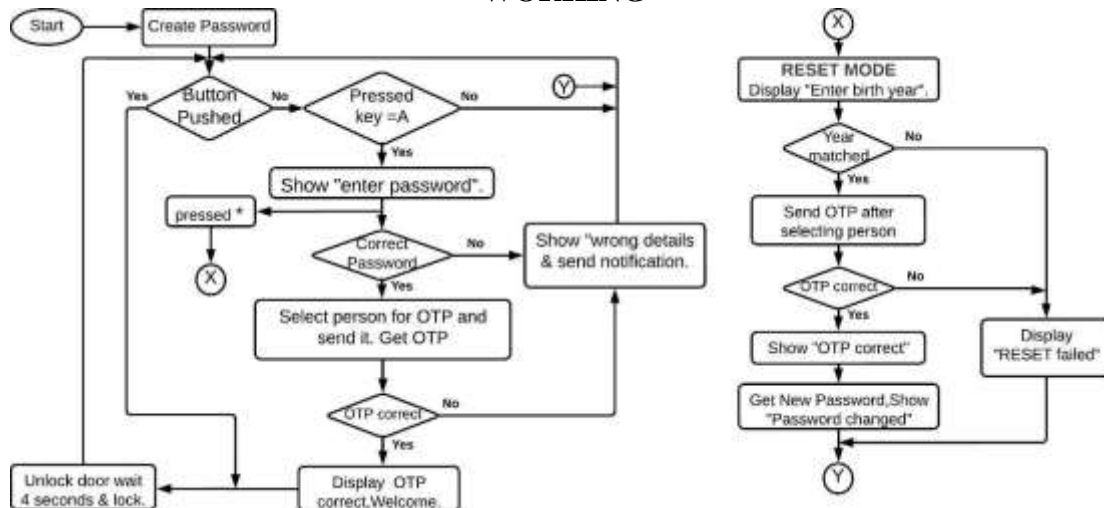


Figure 6. Work Flow of the project

Previously there were some digital locks based on GSM. Along with that there are some locks which works on password only. These are some disadvantages with this like someone might steal the mobile and then unlock the lock easily with OTP or password may be forgot. There were some other problems with this old system like mobile may be lost where OTP is received, we may forget our password, unlock door from inside and so on. So, we made sure that the issues in the old system are solved. So, the multi-factor or two factor locking system is implemented with some enhanced features which helps user to much more extent.

The option of sending OTP to multiple persons makes easy to unlock even when battery dies in one of the mobile or even the mobile is lost. To solve the issue of forgetting password, we provided feature to reset password if forgot. Reset password has a security question to make sure we can't change password directly with help of OTP only which compromises security. If any wrong character in password or OTP is entered it can be removed or in security question, this helps to make changes and not start the process from the start, Figure 7 shows the process.

To make it easy to unlock from inside, installation of a push button is done which unlocks the door with a small push. To make it easy to understand weather the door is locked or unlocked we added LED, which indicates status of door lock. To alert security guard or neighbors', buzzer which rings whenever wrong details entered while unlocking is added. All these components are connected and shown in Figure 6. Along with these features the powerconsumption is also quiet less.

RESULTS

We surveyed many smart door locking systems. We found that these locking products are expensive. Some of the implementations mentioned in the literature survey are very cost effective in implementation but do not provide multi user or multi-level functionalities. We identified these

requirements and thought to develop a system which is cost effective in implementation and having more advanced features like multiple user access and multi-level security.

The GSM Based Digital Door Lock Security System was designed and implemented successfully and it looks like Figure 8 to the user. On basis of detailed analysis and trials, we could conclude that the system was stable and can be an emerging product in field of security systems for both residential and commercial applications.



Figure 7. Front view of the project.



Figure 8. Back view of the system.

The locking system developed has overcome the following problems

- Physical is not necessary
- If one mobile gets discharged or lost, other mobiles can be used.
- Cost is comparatively less than present digital locking systems.
- Password can be reset in case forgot without anyone's help.

CONCLUSION

The design and implementation of GSM based lock system is customizable and flexible. This door locking mechanism is reasonably cost-effective than the available lock systems in the traditional market. System we designed has high accuracy as well as provides better security. Now a days all private and government organizations are very much concerned about their security. Most of the companies are interested in implementing specially designed locks for greater security mechanism but the systems which are available have very high installation cost. Because of this high cost, many small firms are not being able to afford such mechanisms. Keeping the installation cost in mind a system that is affordable to both large and small firms is developed. The main application for the proposed system is to secure the users home, working place or to keep their valuable things, documents away from intruders. Hence this project can be understood by people and future work can be done.

The "GSM Based Smart Door Locking System" is a latest successor of the older conventional door locking system. This system is very cost effective and easy to install and is designed under different modes which makes it useful. This system is considerably easy to manage, more secure from hacking and easy circuitry which concludes the purpose of this project.

FUTURE SCOPE

In future, a camera can be implemented in this system such that we can see the live feed through mobile. We can use remote unlocking method to unlock the door from any place if anyone known comes to doorstep. A rechargeable battery can be provided which can give power backup in case of

power failure. Whenever power comes back the battery can be recharged again. This can be helpful if power cuts are more in installed area. Also, battery size can be different based on the user's interest.

For further security, Biometric sensors can be used in place of password which can increase security level. But only some biometrics are efficient like retinal scanner or fingerprint.

REFERENCES

1. A. Hemalatha, G. Gandhimathi, 2019, RFID, Password and OTP based Door Lock System using 8051 Microcontroller, International Journal of Engineering Research & Technology (IJERT) CONFCALL – 2019 (Volume 7 – Issue 11),
2. M. Shanthini, G. Vidya and R. Arun, "IoT Enhanced Smart Door Locking System," 2020 Third International Conference on Smart Systems and Inventive Technology (ICSSIT), 2020, pp. 92-96, doi: 10.1109/ICSSIT48917.2020.9214288.
3. D. Aswini, R. Rohindh, K. S. Manoj Ragavendhara and C. S. Mridula, "Smart Door Locking System," 2021 International Conference on Advancements in Electrical, Electronics, Communication, Computing and Automation (ICAECA), 2021, pp. 1-5, doi: 10.1109/ICAECA52838.2021.9675590.