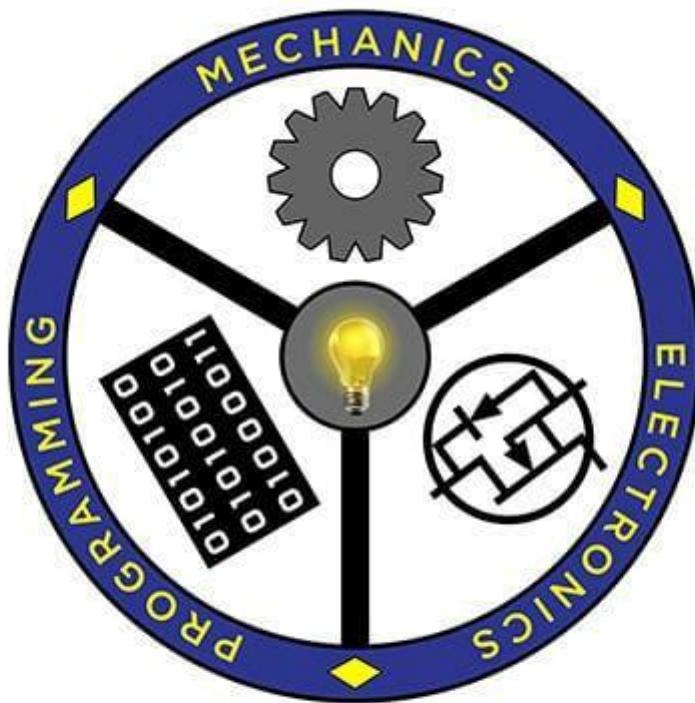


Project Report on  
Smart Locker

*Submission to THE ROBOTICS CLUB - SNIST as a part of INDUCTION'22*

TEAM NO - 11



**THE ROBOTICS CLUB**  
*Integrating Knowledge...*

**THE ROBOTICS CLUB-SNIST**  
SREENIDHI INSTITUTE OF SCIENCE AND TECHNOLOGY  
(AUTONOMOUS)  
(Affiliated to JNTU University, Hyderabad)  
Yamnampet, Ghatkesar, Hyderabad – 501301.

2022

## **CERTIFICATE**

This is the project work titled ‘Smart Locker’ by Malla Venkata Ashish, Pola Harsha, P Tejaswini, K Deeksha, Omer Syed, Mohammad Sannan Ahmed, Pundra Sudensh Reddy, K Hemanth, Sanskar Jha under the mentorship of P Sravanthi, D P Naga Ajay Kumar and is a record of the project work carried out by them during the year 2021-2022 as part of INDUCTION under the guidance and supervision of

**Mr. BHUVAN PRATAP AGARWAL**  
**&**  
**Mr. S. V. REDDY**  
**Technical head**

**Mr. Md. NIHAL ASJAD**  
**The President of**  
**THE ROBOTICS CLUB**

**Dr. A. PURUSHOTHAM**  
**Faculty Advisor**  
**Mechanical Department**

---

## **DECLARATION**

The project work reported in the present thesis titled “**SMART LOCKER**” is a record work done by Team 11 in **THE ROBOTICS CLUB** as a part of **INDUCTION-2022**.

**No part of the thesis is copied from books/ journals/ Internet and wherever the portion is taken, the same has been duly referred in the text. The report is based on the project work done entirely by TEAM 11 and not copied from any other source.**

## ACKNOWLEDGMENT

This project report is the outcome of the efforts of many people who have driven our passion to explore into implementation of **SMART LOCKER**. We have received great guidance, encouragement and support from them and have learned a lot because of their willingness to share their knowledge and experience.

Primarily, we would like to express our gratitude to our mentors, P SRAVANTHI and D P NAGA AJAY KUMAR. Their guidance has been of immense help in surmounting various hurdles along the of our goal.

We thank our technical heads '**Mr. BHUVAN PRATAP AGARWAL and Mr. S. V. REDDY**' for being with us till the end of the project completion.

We thank all the members of Steering **Steering Body, Executive Body, Technical Advisory Board, Club's Incubation and Competence Committee** of **The Robotics Club** for helping us with crucial parts of the project. We are deeply indebted to **Mr. Md. NIHAL ASJAD** - The President, **Mr. KARUMURI JAYANTH SIVA MADHAV** - The Vice President and **Mr. Gelli Kusal Venkata Sai Shravanth** - SAB Chairman and **Ms. RUSHIKA REDDY** - General Secretary **THE ROBOTICS CLUB** respectively and also every other person who spared their valuable time without any hesitation whenever we wanted.

We also thank our faculty advisor **Dr. A. Purushotham**, Professor, Mechanical Department, who encouraged us during this project by rendering his help when needed.

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**ABSTRACT**  
**THE ROBOTICS CLUB - SNIST**  
**INDUCTION'22**  
**TEAM-NO – 11**

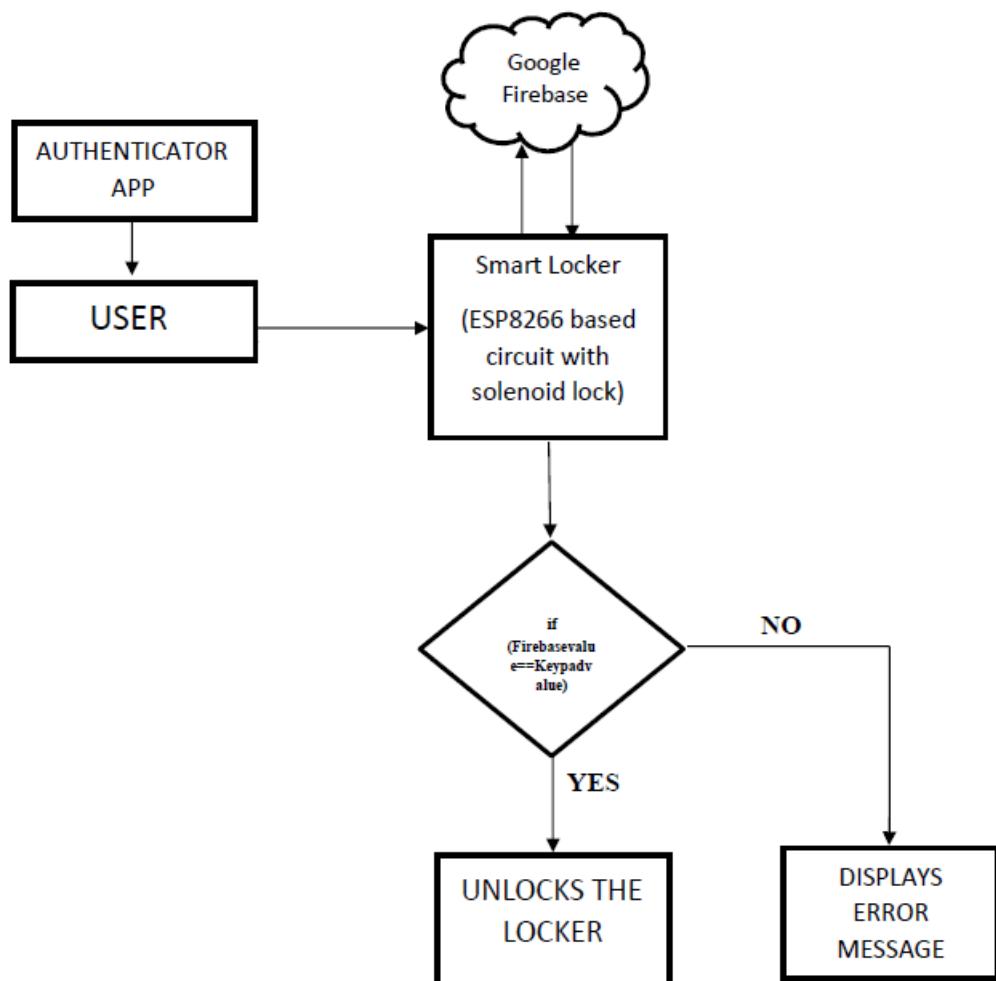
**THE PROBLEM:**

Now a days everyone is busy with their own works. It has become very difficult to monitor each and every task which goes in our daily lives. People has become so busy that they buy things for themselves through online e-commerce websites i.e., from Amazon and Flipkart. Most of them are working professional and busy with their daily schedule and as they order things they don't receive or collect their order at the time of delivery. They simply entrust the order to their neighbour's or the delivery agent takes away the parcel with him leading to delay in delivery. Due to delay in delivery the customer have reschedule the delivery date by contacting the customer care and have to wait for few more days in order to take the delivery and it leads to customer dissatisfaction.

**THE TEAMS APPROACH TO THE PROBLEM: -**

In order to solve this problem we have come up with an solution i.e. development of a Smart Locker. The main aim of Smart Locker is to prevent theft of ordered products or goods from apartments and gated communities and to ensure timely deliveries of commodities/goods. Our approach is to build a locker system which has a keypad and is connected to a google firebase for each flat in an apartment or a villa in a gated community. For every flat in an apartment or for a villa there will be few lockers according to the size of products and each locker can be accessible by the respective flat residents. Each locker is connected to google firebase for which only the residents of that particular flat can have access to their respective locker by entering the unique One Time Password generated by Authenticator at that instance.

## BLOCK DIAGRAM:



## TITLE OF THE PROJECT: - Smart Locker

What do you feel is the most innovative part of the problem?

- New OTP generated from the authenticator app is updated automatically in the firebase instantly.
- ESP8266 module communicates with the firebase and reads the OTP every second so that the whenever the user enters the OTP from keypad it cross checks with the OTP saved in firebase.

**IEEE  
FORMAT**

# Smart Locker

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<sup>6</sup>Mohammad Sannan Ahmed, <sup>7</sup> P Tejaswini, <sup>8</sup>K Deeksha, <sup>9</sup>Omer Syed, <sup>10</sup>K Hemanth, <sup>11</sup>Sanskars Jha  
1,2,3,4,5,6,7,8,9,10,11The Robotics Club-SNIST

*Sreenidhi Institute of Science and Technology*  
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**Abstract**—The main aim of Smart Locker is to prevent theft of ordered products or goods from apartments and gated communities and to ensure timely deliveries of commodities/goods. Our approach is to build a locker system which has a keypad and is connected to a google firebase for each flat in an apartment or a villa in a gated community. For every flat in an apartment or for a villa there will be few lockers according to the size of products and each locker can be accessible by the respective flat residents. Each locker is connected to google firebase for which only the residents of that particular flat can have access to their respective locker by entering the unique One Time Password generated by Authenticator at that instance.

**Index Terms**—Google Firebase, One Time Password, Authenticator

## I. CHAPTER 1

### INTRODUCTION

#### A. Problem Statement

Now a days everyone is busy with their own works. It has become very difficult to monitor each and every task which goes in our daily lives. People has become so busy that they buy things for themselves through online e-commerce websites i.e. from Amazon and Flipkart. Most of them are working professional and busy with their daily schedule and as they order things they don't receive or collect their order at the time of delivery. They simply entrust the order to their neighbors or the delivery agent takes away the parcel with him leading to delay in delivery. Due to delay in delivery the customer have reschedule the delivery date by contacting the customer care and have to wait for few more days in order to take the delivery and it leads to customer dissatisfaction.

#### B. Introduction of Project

Smart lockers are secure storage systems. We have made a locker where our orders will be stored securely. The smart locker is designed on the basis of Firebase. The owner has an app generates Random One Time Passwords whenever it is required. The generated password will be stored in the Google Firebase. Whenever the owner enters the last recently generated password the locker unlocks so that the owner can have a hassle-free delivery. This smart locker is designed in such a way that no other person can able to access the locker and the product present/parcel inside it. The keypad is the input for the locker when password matches with the latest updated password in Firebase the locker opens. The smart locker is safe and secure locker.

#### C. Literature Survey

Now a days everyone is busy with their own works. It has become very difficult to monitor each and every task which goes in our daily lives. People has become so busy that they buy things for themselves through online e-commerce websites i.e. Amazon and Flipkart. Most of them are who are working professional and busy with their daily schedule and as they order things they don't receive or collect their order at the time of delivery. They simply entrust the order to their neighbours or the delivery agent just puts it at the entrance of that particular customer's house. But there is a chance that the order might be stolen by them or due to any other reasons like any unknown persons might break into the customer's house and steal their orders. In order to solve this problem we have come up with an solution i.e. development of a Smart Locker.

## II. CHAPTER 2

### ARCHITECTURE

#### A. List Of Figures

- 1) NodeMCU ESP8266
- 2) Solenoid Lock
- 3) 16x2 Alphanumeric LCD Display
- 4) I2C Serial Interface for LCD
- 5) 4x4 Keypad
- 6) 9v Battery
- 7) Battery cap
- 8) Jumper Wires (MF, FF)
- 9) 1channel Relay Module
- 10) Vector Board (4x6)
- 11) Soldering Rod
- 12) Wire Stripper
- 13) Door Handle

#### B. Components Used

1) Node MCU, which means Node Micro Controller Unit, is a free, open-source software and hardware developer environment built. With a wi-fi module ESP8266, which is very useful while building an IoT solution. Node MCU has wi-fi/networking enabled; it has analog and eight digital pins and a few other pins. It supports serial communication protocols like SPI, I2C, UART, and more. The firmware is based on the LUA scripting language (eLua project). It has a non-os SDK for wi-fi module to support. As this is an open-source project,

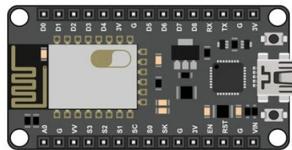


Fig. 1. Node MCU

which makes it easy and suitable for working on projects based on IoT.

2) This DC 12V Solenoid Electromagnetic Cabinet Door Lock can be used for locking sell-machine, storage shelf, file cabinet and etc. The hidden way of unlocking can be used for an emergency. The lock works as the circuits disconnects, and it will unlock as the instant power-on. It is steady, durable, and energy-saving and had a long lifespan. In the anti-theft and shockproof design, the lock is better than other kinds of locks. After connecting the wires and when the current is available, the electric lock can control the doors opening and closing.



Fig. 2. Solenoid Lock

3) 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 5x7 pixel matrix. We are using this lcd display to displaying the required message to enter the OTP.



Fig. 3. 16\*2 LCD

4) I2C Module enables 2 devices to communicate with each other in a stable, high-speed, bidirectional way and with the least I/O pins. I2C Module utilizes 2 lines to communicate, Serial Data Line (SDA) and Serial Clock Line (SCL), so that the protocol I2C uses is also called “bidirectional” protocol. What’s more special is I2C Module allows multiple devices to share the common communication lines. Thus, I2C Bus could control the communication function. I2C stands for INTER-INTEGRATED CIRCUIT.

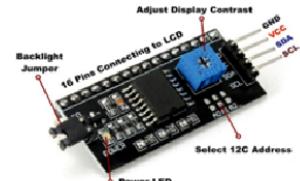


Fig. 4. I2C Module

5) A keypad is a pad of buttons set with an arrangement of digits, symbols, or alphabetical letters. Pads mostly containing numbers and are numeric keypads. Keypads are found on devices which require mainly numeric input such as calculators, television remotes, push-button telephones, vending machines, ATMs, combination locks, safes, and digital door locks.



Fig. 5. 4\*4 Keypad

6) The nine-volt battery, is an electric battery that supplies a nominal voltage of 9 Volts, actually 7.2 to 9.6 volts, depending on technology. Batteries of various sizes and capacities are manufactured; a very common size is known as PP3, introduced for early transistor radios. Today, the 9 V battery is used in everything from speakers and smoke alarms to walkie-talkies and industrial meters.



Fig. 6. 9V Battery

7) The connector is a device that joins electric circuits together. Most battery packs require more than one connector. The main battery connector is both the mechanical and electrical part that interfaces the battery to the PDA or other electronic device.



Fig. 7. Battery Cap

8) These are used to connect the components to the pins of Arduino board with the help of connecting pins.

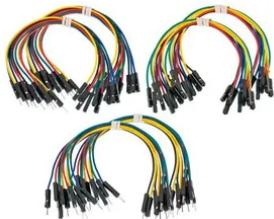


Fig. 8. Jumper Wires

9) Relay is an electromechanical device that uses an electric current to open or close the contacts of a switch. The single-channel relay module is much more than just a plain relay, it comprises of components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active or not. The single-channel relay module is much more than just a plain relay, it contains components that make switching and connection easier and act as indicators to show if the module is powered and if the relay is active. The relay uses an electric current to open or close the contacts of a switch. This is usually done using the help of a coil that attracts the contacts of a switch and pulls them together when activated, and a spring pushes them apart when the coil is not energized.



Fig. 9. 1 Channel Relay Module

10) Printed circuit board (PCB) is the board base for physically supporting and wiring the surface-mounted and socketed components in most electronic. A printed circuit board (PCB) or printed wiring board (PWB) is a laminated sandwich structure of conductive and insulating layers. PCBs

have two complementary functions. The first is to affix electronic components in designated locations on the outer layers by means of soldering. The second is to provide reliable electrical connections (and also reliable open circuits) between the component's terminals in a controlled manner often referred to as PCB design.



Fig. 10. PCB Vector Board

### C. Hardware

1) Wood is used as raw material for body of the locker.



Fig. 11. Wood

2) A soldering iron is a hand tool used to heat solder, usually from an electrical supply at high temperatures above the melting point of the metal alloy. This allows for the solder to flow between the workpieces needing to be joined.



Fig. 12. Soldering Iron Rod

3) 150-B Stripper is a tool which is used to strip the end of the wires so that we can connect one wire to another wire we can also cut thin wires with the help of this tool but this tool is mostly used to strip the ends of the wires.



Fig. 13. 150-B Wire Stripper

4) A drill is a tool used for making round holes or driving fasteners. It is fitted with a bit, either a drill or driver chuck. with hand-operated types dramatically decreasing in popularity and cordless battery-powered ones proliferating. A drilling machine, also called a drill press, is a powerful tool used to cut a round hole into or through metal, plastic, wood, or other solid materials by turning and advancing rotary drill bits into a workpiece.



Fig. 14. Drill Machine

#### D. Software

1) Arduino Integrated Development Environment (IDE)is an open-source cross platform IDE. The Syntax of this programming language is very much similar to that of C language with a little bit difference in keywords. Arduino IDE is generally used for Arduino Based Projects and in the field of robotics. We write program for different sensors and motors for them to work according to the user input. Uploading the code into the arduino is pretty much simple we can just verify the code in the text editor and with the help of a cable we can upload the code directly into the arduino with the help of Upload button present in the text editor.

2) Fusion 360 is a cloud-based 3D modeling, CAD, CAM, CAE, and PCB software platform for product design and manufacturing. Design and engineer products to ensure aesthetics, form, fit, and function. Reduce the impact of design, engineering, and PCB changes and ensure manufacturability with simulation and generative design tools. Directly edit

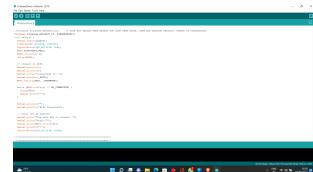


Fig. 15. Arduino IDE

existing features or model fixtures with the only truly integrated CAD + CAM software tool. Fusion 360 enables you to design effortlessly with flexible 3D CAD software. Fusion 360 enables exploration and iteration on product ideas and collaboration within distributed product development team. Fusion 360 combines organic shapes modeling, mechanical design and manufacturing in one comprehensive package.

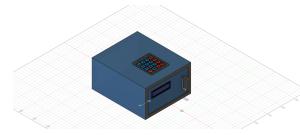


Fig. 16. Fusion 360

3) Firebase is a platform developed by Google for creating mobile and web applications. It was originally an independent company founded in 2011. In 2014, Google acquired the platform and it is now their flagship offering for app development. Firebase's first product was the Firebase Realtime Database, an API that synchronizes application data across iOS, Android, and Web devices, and stores it on Firebase's cloud. The product assists software developers in building real-time, collaborative applications.In May 2016, at Google I/O, the company's annual developer conference, Firebase introduced Firebase Analytics and announced that it was expanding its services to become a unified backend-as-a-service (BaaS) platform for mobile developers. Firebase now integrates with various other Google services, including Google Cloud Platform, AdMob, and Google Ads to offer broader products and scale for developers. Google Cloud Messaging, the Google service to send push notifications to Android devices, was superseded by a Firebase product, Firebase Cloud Messaging, which added the functionality to deliver push notifications to both iOS and web devices.

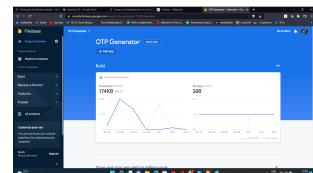


Fig. 17. Google Firebase

### III. CHAPTER 3

#### IMPLEMENTATION AND WORKING

##### A. Block Diagram

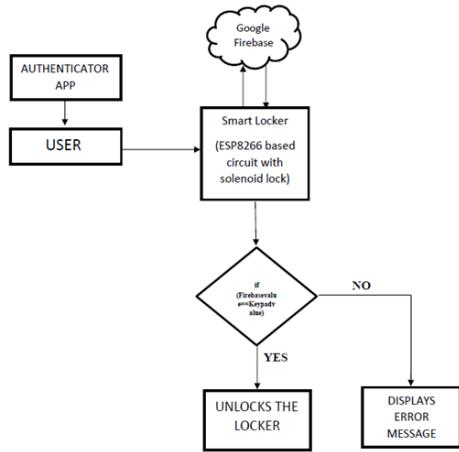


Fig. 18. Block Diagram

##### B. Circuit Diagram

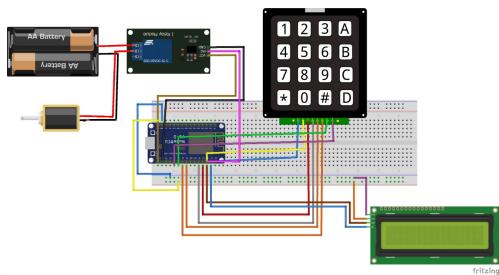


Fig. 19. Circuit Diagram

##### C. Working

The working of our Smart Locker is very simple. The user has an application which generates random One Time Password (OTP) whenever he clicks the "Generate OTP" button present in the app. At the backend this OTP gets stored in the Google Firebase which is in constant communication with ESP8266 NodeMCU which reads the OTP. Whenever the user enters the OTP displayed in the app, the lock gets unlocked since the OTP entered from the keypad is matching with the OTP stored in the Google Firebase with the help of ESP8266 NodeMCU. Here we are using a 16\*2 LCD for displaying the message on the locker for the user to enter the OTP and to inform whether the OTP entered is correct or not. A solenoid lock is used for locking mechanism which is controlled by a 1 channel relay here in this case.

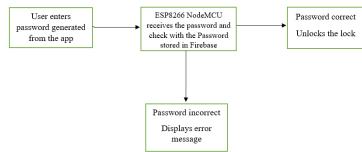


Fig. 20. Flow Chart

##### D. Flow Chart

#### IV. CHAPTER 4

#### EXPERIMENTAL RESULTS AND CONCLUSION

##### A. Results

Our locker demonstrated the mentioned working successfully. The OTP generated from the app got stored in the Google Firebase successfully and ESP8266 NodeMCU established connection with the Google Firebase and read the OTP.

##### B. Future Enhancements

Our Smart Locker might be still at prototype level but it can be upgraded with many more features like adding a camera so that the user can ensure that the parcel has been placed in the locker. Our idea can also be implemented in Apartments where a group of lockers can be setup in a single room (preferably in the ground floor) with the above mentioned technology so that the delivery boy can easily place the parcel or product of a particular customer in their respective locker.

##### C. Conclusion

Our Smart Locker has a very much potential in the market. It helps many working individuals who are just busy with their schedules and cannot make time for these things. Customer need not to worry about the delay in the delivery of the product and he can get his product on time without any fear of theft or misplace.

##### D. References

- [://github.com/Rupakpoddar/ESP8266Firebase](https://github.com/Rupakpoddar/ESP8266Firebase)
- <http://ai2.appinventor.mit.edu/>
- <https://firebase.google.com/>

## SOURCE CODE

```
#include <ESP8266Firebase.h>
#include <ESP8266WiFi.h>
#include <Keypad.h>
#include <LiquidCrystal_I2C.h>
#define FINGERPRINT
"A1:B8:E0:02:42:47:38:1D:84:1B:3C:B3:1F:6D:B8:F4:13:77:57:EF"
#define _SSID "Samsung A50" // WiFi SSID
#define _PASSWORD "ajay1604" // WiFi Password
#define PROJECT_ID "otp-generator-12592" // Firebase Project ID. Can be found in
project //settings.
Firebase firebase(PROJECT_ID, FINGERPRINT);
const byte ROWS = 4; // four rows
const byte COLS = 4; // four columns
char keys[ROWS][COLS] = {
{'1','2','3','A'},
{'4','5','6','B'},
{'7','8','9','C'},
 {'*','0','#','D'}
};byte rowPins[ROWS] = {D1, D2, D3, D4}; // rows connected to digital pins of nodemcu
byte colPins[COLS] = {D5, D6, D7, D8};
// columns connected to digital pins of nodemcu
int relayInput = D0; // the input to the relay pin
Keypad keypad= Keypad(makeKeymap(key),rowPins,colPins, ROWS, COLS);
LiquidCrystal_I2C lcd(0x27, 16, 2); // I2C // address 0x27, 16 column and 2 rows
const int len_key = 4;
char otp[len_key];
char master_key[len_key] = otp[len_key];
char attempt_key[len_key];
int z=0;

void setup() {
Serial.begin(115200);
pinMode(LED_BUILTIN, OUTPUT);
digitalWrite(LED_BUILTIN, LOW);
WiFi.mode(WIFI_STA);
WiFi.disconnect();
delay(1000);
Serial.println();
Serial.println();
Serial.print("Connecting to: ");
Serial.println(_SSID);
WiFi.begin(_SSID, _PASSWORD);

while (WiFi.status() != WL_CONNECTED) {
delay(500);
Serial.print(".");
}
}
```

```

Serial.println("");
Serial.println("WiFi Connected");

// Print the IP address
Serial.print("Use this URL to connect: ");
Serial.print("http://");
Serial.print(WiFi.localIP());
Serial.println("/");
digitalWrite(LED_BUILTIN, HIGH);
pinMode(relayInput, OUTPUT); // initialize pin //as OUTPUT
lcd.begin();
lcd.backlight();
lcd.setCursor(0,0);
lcd.print("Enter OTP: ");
}

void loop()
{
    String otp = firebase.getString("/Induction_22");
    Serial.print("Received String: ");
    Serial.println(otp);
    delay(1000);
    char key = keypad.getKey();
    lcd.setCursor(z-1,1);
    lcd.print("*");
    if (key){
        switch(key){
            case '*':
                z=0;
                break;
            case '#':
                delay(100);
                checkKEY();
                break;
            default:
                attempt_key[z]=key;
        }
        z++;
    }
}

void checkKEY()
{
    int correct=0;
    int i;
    for (i=0; i<len_key; i++) {
        if (attempt_key[i]==master_key[i]) {
            correct++;
        }
    }
}

```

```
if (correct==len_key && z==len_key){
lcd.setCursor(0,1);
lcd.print("Correct Key");
digitalWrite(relayInput, HIGH); // turn relay on
delay(5000);
digitalWrite(relayInput, LOW); // turn relay off
z=0;
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Insert Password");
}
else
{
lcd.setCursor(0,1);
lcd.print("Incorrect Key");
delay(3000);
z=0;
lcd.clear();
lcd.setCursor(0,0);
lcd.print("Insert Password");
}
for (int zz=0; zz<len_key; zz++) {
attempt_key[zz]=0;
}
}
```

## RECORD OF EXPENSES

Component	Quantity	Price
NodeMCU Esp8266	1	Rs 345.00
LCD 16*2 Green	1	Rs 185.00
I2C Module	1	Rs 97.00
Keypad 4*4	1	Rs 74.00
HI-WATT 9V Battery	1	Rs 30.00
Solenoid Lock	1	Rs 280.00
1channel Relay Module	1	Rs 60.00
Soldering Iron Rod	1	Rs 110.00
Soldering Lead	1	Rs 168.00
Soldering Paste	1	Rs 17.00
Wire Stripper	1	Rs 55.00
PCB Brown Board	4	Rs 96.00
Jumper M-M	20	Rs 53.00
Jumper F-M	20	Rs 53.00
Battery Connector	1	Rs 7.00
Door Handle	1	Rs 30.00
	Total Cost	Rs 1660.00