SIMULATION OF KEYPAD-BASED DOOR UNLOCKING SYSTEM USING TINKERCAD

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Abstract: This paper reports a simulation of keypad-based door unlocking system. The software used to perform the simulation is Tinker cad. The assembly of the system was simulated by using appropriate components on tinker cad software platform. Final simulation was tested for various conditions in order to get the proper results. An algorithm was created and appropriate coding was done using embedded C language which is available in Tinker cad simulation software. Through simulation in software an entered password will be checked and based on that, appropriate action will be taken. Motor is driven through certain angle which to imitate the opening and closing of the door in real world.

Key Words - Arduino-UNO, Keypad, Password, Security, Tinkercad

I. INTRODUCTION

Nowadays corporate security has got significant importance and automation has played a vital role in recent years. Different security systems have already reported in the literature [1-3]. Since fingerprint system is still not full-proof a camera has been introduced. While the fingerprint sensor detects the fingerprint, an image is captured by the camera and saved in the database which is reported in literature [4-7].

However, due to recent advancement in technology of Internet of Things (IoT), different security systems have been evolved over the time [8-12, 15]. Oyediran Mayowa Oyedepo [13] reported a paper on the Development of An Examination Authentication Embedded System Based on Fingerprint Approach using Arduino MEGA, fingerprint sensor and a Bluetooth module. Prof. Supriya Bhosale [14] reported a paper on Student Performance Analysis and Biometric Attendance using data redundancy, python language and machine learning. Orji.et.al. [16] has reported a Microcontroller Based Digital Door Lock Security System Using Keypad. A. Hemalatha et.al. [17] has reported on RFID, Password and OTP based Door Lock System using 8051 Microcontroller. Steffy Mathew et.al. [18] Reported a paper on Fingerprint Based Security System for ATM using fingerprint module and Arduino UNO.

Recently Alfakhri M. Murshed et.al. [19] reported on Implementation of Enhanced Finger Print based Door Locking System using microcontroller. This paper has reported the use of camera along with Arduino and fingerprint module to save the image of the incoming person in the database.

However, through this project, simulation of door unlocking system is reported by using Tinker cad software.

II. METHODOLOGY/EXPERIMENTAL
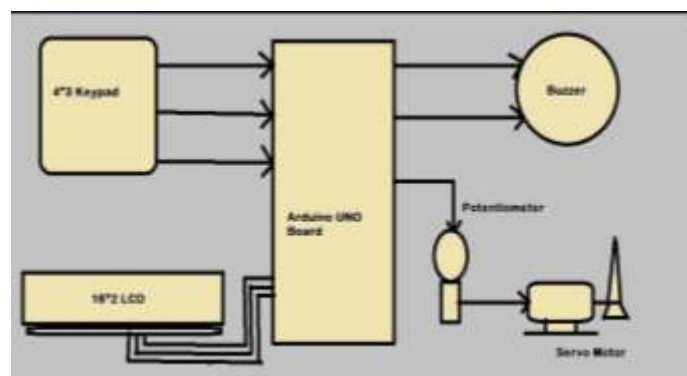
A. COMPONENTS/BLOCK DIAGRAM

Figure 1: Block diagram

Figure 1 depicts the block diagram of circuit. The password has to be entered in keypad in order to get access. A message will be displayed on the LCD screen and door will open through servo motor.

Various tools such as Arduino Uno, Keypad, Liquid Crystal Display (LCD), Servo motor, Power supply, Connecting Wires, 1K Resistors, LEDs are used as provided in tinker cad platform required for the circuit. Keypad is used to enter the password. A 16 x 2 LCD is available to display the appropriate message. A servo motor is represented as the opening and closing of the door. A piezo is used as an alarming device in the circuit.
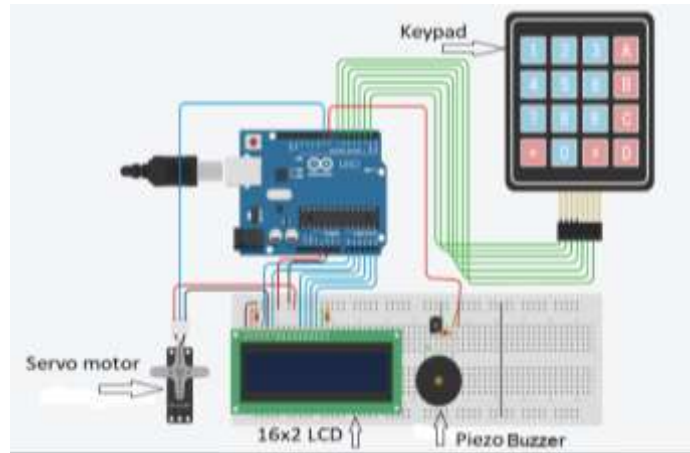
B. Circuit diagram/Design

Figure 2: Circuit diagram

Figure 2 shows the circuit diagram. A servo motor indicates the opening and closing of the door at 90 degrees. A message will be displayed on the 16x2 LCD screen for access granted or denied after password is entered in keypad. For every wrong input, a piezo is used as a buzzer for an alarm signal.

The digital input pins D1 to D7 of the Arduino are connected to the 4×3 keypad. A PWM pin of the Arduino is required to control the servo motor. Hence the PWM output pin D9 of the Arduino is connected to the servo motor. The positive wire of the buzzer is connected to the PWM output pin D10 of the Arduino while the negative wire is grounded. The 1, 3, 5, 16 pins of the 16×2 LCD are connected to ground on the Arduino while pins 2 and 15 are connected to V_{cc} (5 V). The rest of the 6 pins are connected to the analog pins A0 to A5 of the Arduino respectively.
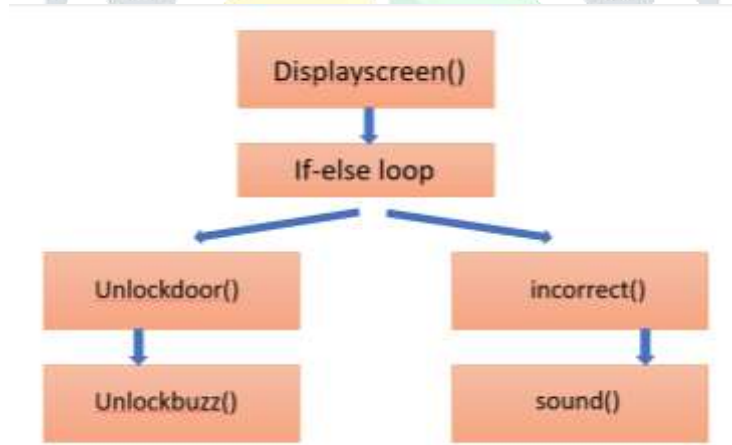
C. Algorithm/Coding

Figure 3: Block diagram of code

Figure 3 depicts the block diagram of the code. If-else statement is used for the condition of correct and incorrect input. If user enters correct password, the door starts unlocking process. A series of sound starts indicating a correct password entered and starts the timer count for 5 seconds. If the password entered is wrong a message is displayed as 'incorrect password' on the LCD screen with a high intensity sound as an alarm.

```
void incorrect()
{
delay(500);
lcd.clear();
lcd.setCursor(1,0);
lcd.print("CODE");
lcd.setCursor(6,0);
lcd.print("INCORRECT");
lcd.setCursor(15,1);
lcd.println("ENTER");
lcd.setCursor(4,1);
lcd.println("AGAIN");

lcd.setCursor(13,1);
lcd.println(" ");
Serial.println("CODE INCORRECT YOU ARE UNAUTHORIZED");
digitalWrite(redled, HIGH);
digitalWrite(buzz, HIGH);
delay(3000);
lcd.clear();
digitalWrite(redled, LOW);
digitalWrite(buzz,LOW);
displayscreen();
}
```

Figure 4: Program for incorrect password

Figure 4 represents the code for incorrect password entered. A high intensity sound as alarm will start with an 'incorrect password' message on LCD screen. After 5 wrong attempts, authorizer has to wait for 30 second in order to enter the password again.

D. Testing
Simulated system was decided to be tested for certain conditions.

Case 1: Correct password entered: The access will be granted; door will turn 90 degrees towards left and it will remain opened for 5 seconds.

Case 2: Door will lock automatically after 5 seconds by turning 90 degrees right; password has to be entered again in order to get access.

Case 3: Incorrect password entered: The buzzer will start sound as an alarming signal displaying the message on screen 'incorrect password'.

Case 4: Incorrect password entered 5 times: The buzzer will start sound as an alarming signal with high intensity and user has to wait for 30 seconds to re-enter the password.

III. RESULTS AND CONCLUSIONS
As per the planned tests the system was simulated under various cases.

Initial setup is shown in Figure 5.

Figure 6 depicts the entered password is correct; hence access is granted and door is opening by rotating 90 degrees towards left.

Figure 7 indicates the door will lock within 5 seconds.

Figure 8 represents the locking of door by rotating 90 degrees towards right.

The door is locked and password has to be entered again in order to get access as shown in Figure 9.

Access is denied as the password entered is incorrect in Figure 10.
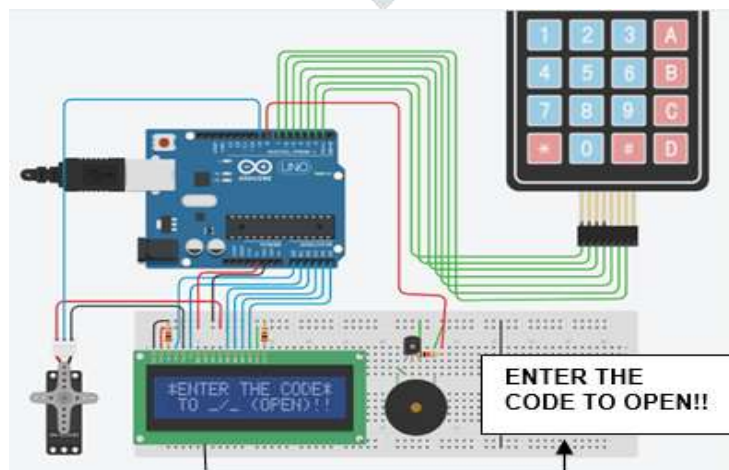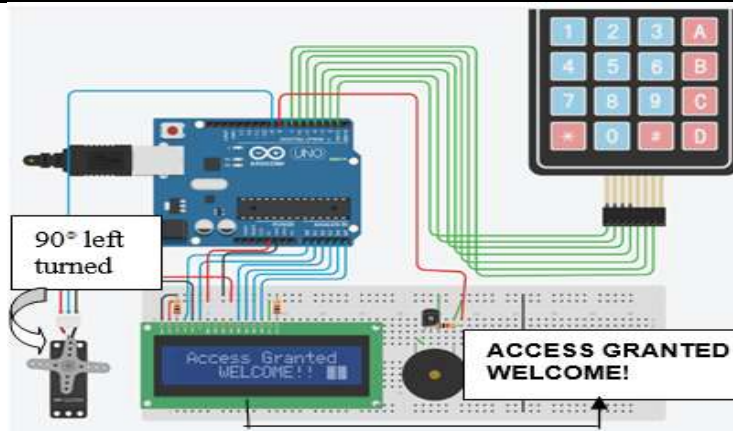

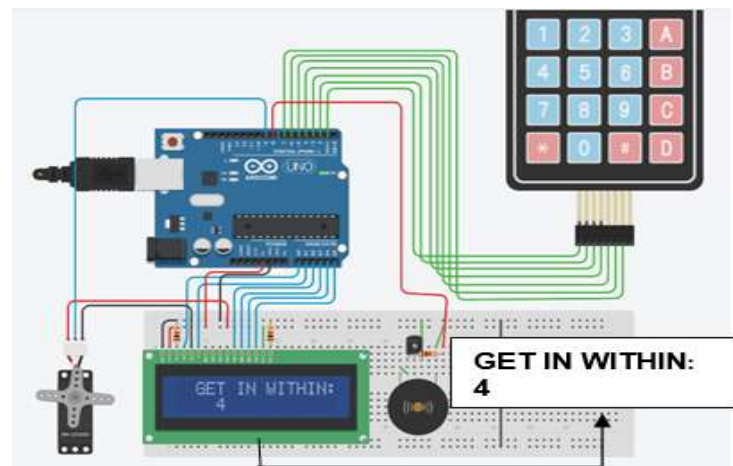Figure 5: - Enter code

Figure 6: -Access granted

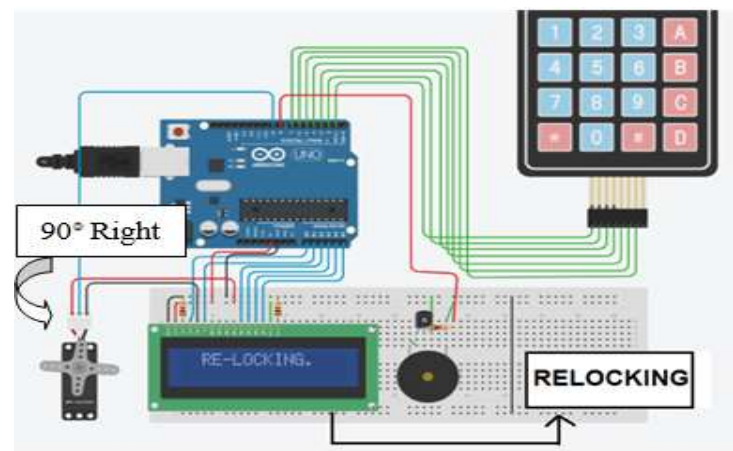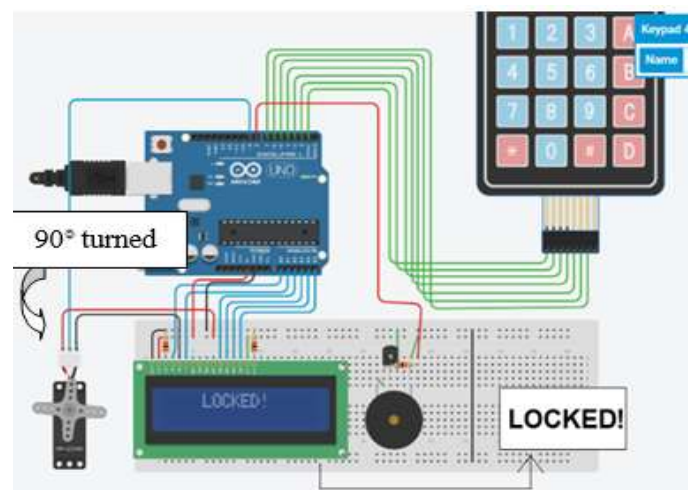Figure 7: -Time span to enter

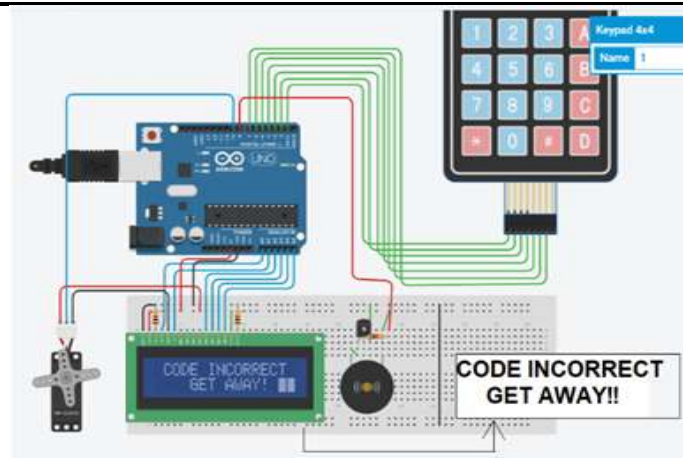Figure 8: - Relocking

Figure 9: - Locked!

Figure 10: - Incorrect password

Circuit diagram is successfully completed. When an authorized person enters the correct code, the LCD will display 'Access granted'. Unless the correct password is entered, the door will not open. Entering the incorrect password too many times will cause the alarm to go off. Suitable code is available and ready to use and interphase with Arduino and circuit.

IV. FUTURE SCOPE AND CONCLUSIONS

This is a simulation-based work so the further aim is to implement this project in real life. The simulated circuit can be optimized and can be tested to compare with actually designed circuit for the working. Simulation of keypad-based door unlocking system using Tinkercad was successfully demonstrated. Simulated system responded correctly as programmed and executed the assigned task for different test cases.

V. ACKNOWLEDGMENT

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