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An Arduino-based voice-recognition elevator for special purposes

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ABSTRACT

This paper presents the design and implementation of five floors electrical elevator system that utilizes voice recognition technology, specifically using an Arduino microcontroller, for special applications. The purpose of this project is to provide a convenient and accessible means of transportation for individuals with disabilities, specifically those who may have difficulty using traditional elevators due to physical limitations or mobility issues. The system consists of an Arduino microcontroller, a voice recognition module, a motor driver, and an elevator car with a lift mechanism. The microcontroller receives voice commands from the user and processes them to determine the desired floor. The motor driver then activates the lift mechanism to move the car to the desired floor. The system was tested and found to be reliable and efficient in transporting individuals to their desired floor. It has the potential to greatly improve the accessibility and convenience of buildings for individuals with disabilities.

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1. INTRODUCTION

An electrical elevator based on voice recognition using Arduino is a type of elevator system that utilizes an Arduino microcontroller and a voice recognition module to allow users to control the elevator using voice commands [1]. The voice recognition module is connected to the Arduino and is programmed to listen for specific voice commands, such as "go up" or "go down [2]." When the module hears one of these commands, it sends a signal to the Arduino, which then controls the motors or other hardware that moves the elevator [3].

One of the main benefits of using an electrical elevator based on voice recognition is the added convenience it provides to users. Rather than having to press buttons or use a keypad to select a floor, users can simply speak their desired destination, which can be especially useful for people with disabilities or mobility issues [4]. Another advantage of using an Arduino-based voice recognition system is the flexibility it offers. The Arduino can be programmed to recognize a wide range of voice commands and to respond appropriately, allowing users to customize the system to their specific needs [2], [5]. However, implementing an electrical elevator based on voice recognition using Arduino can be a complex project that requires a good

understanding of electrical and programming concepts. It is important to carefully plan the design and execution of the project to ensure that it is safe and reliable [6].

There are several reasons why someone might want to design an electrical elevator that uses voice recognition with an Arduino [2], [5], [7]-[9]: i) Convenience: Voice recognition allows users to operate the elevator without physically interacting with buttons or control panels, which can be more convenient and hygienic; ii) Accessibility: Voice recognition can make it easier for people with disabilities, such as those who are blind or have mobility impairments, to use the elevator; iii) Personalization: Voice recognition can allow the elevator to recognize different users and provide a more personalized experience, such as calling the elevator to a specific floor based on the user's voice command; and iv) Customization: Using an Arduino allows for more customization and flexibility in the design and functionality of the elevator. It can be programmed to perform a variety of tasks and can be easily modified or updated as needed.

There are several advantages and disadvantages of using voice recognition in an electrical elevator system that is based on Arduino [10], the advantages are;

- Improved accessibility: Voice recognition technology can make elevators more accessible for people with disabilities or mobility issues, as it allows them to use the elevator without having to physically press buttons [11]-[13].
- Increased efficiency: Voice recognition can help reduce the time it takes for the elevator to reach a destination, as users can simply speak the floor they want to go to rather than pressing a button.
- Enhanced security: Voice recognition can be used to allow only authorized personnel to access certain floors or areas of a building, providing an additional layer of security. While the diadvantages are;
- Cost: Implementing voice recognition technology in an elevator system can be expensive, as it requires the purchase and installation of specialized hardware and software.
- Limited accuracy: Voice recognition technology is not perfect, and there may be instances where it does not accurately understand or recognize a user's voice [14], [15]. This could lead to delays or frustration for users.
- Privacy concerns: Some people may be concerned about the use of voice recognition technology in elevators, as it involves the collection and processing of personal data.
- Dependence on technology: An elevator system that relies on voice recognition technology may not function properly if the technology fails or is not available [16].

2. METHOD

The block digram of the proposed system is shown in Figure 1. An analogue to digital converter (ADC) is a device that converts analogue signals into digital signals [17]. In the context of an electrical elevator, the ADC may be used to convert the analogue signals produced by sensors into a digital form that can be processed by the elevator control system.

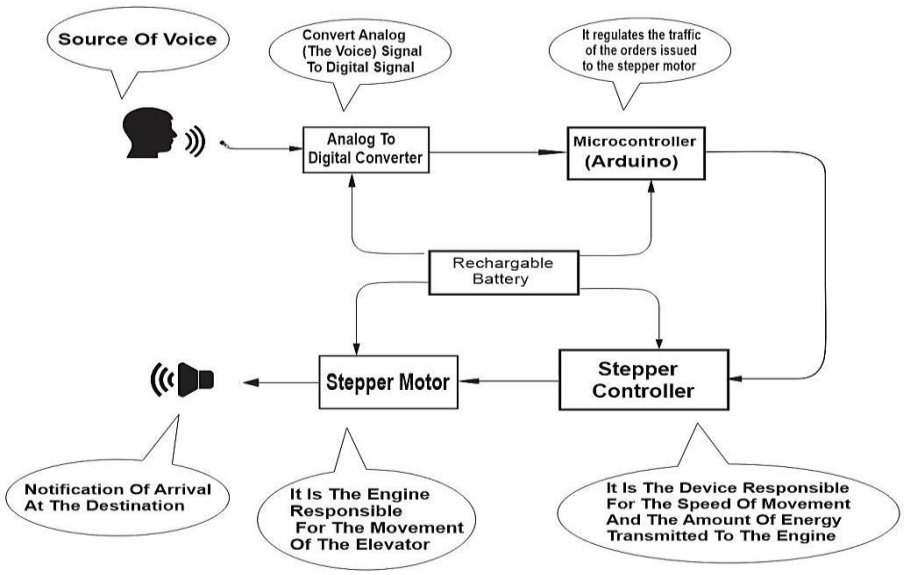


Figure 1. The block diagram of the proposed structure of an electrical elevator based on voice recognition

An Arduino microcontroller can be used to control various devices, including elevators [18]. In the context of an electrical elevator, the Arduino microcontroller may be used to process input from sensors, such as a voice recognition system, and to control the movement of the elevator based on that input [18]. A stepper controller is a device that controls the movement of a stepper motor [19], [20]. A stepper motor is a type of electric motor that can move in precise increments, or "steps," rather than continuously. In the context of an electrical elevator, the stepper controller and stepper motor may be used to move the elevator car up and down in a controlled manner [21], [22].

In summary, the ADC converts analogue signals into digital signals, the Arduino microcontroller processes input and controls the movement of the elevator, and the stepper controller and stepper motor work together to move the elevator body. The simplified flowchart of the signal flow between the ADC, Arduino microcontroller, stepper controller, and stepper motor in the proposed design is shown in Figure 2.

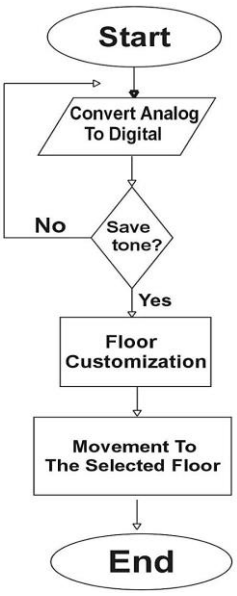


Figure 2. The simplified flowchart of the signal flow in the proposed design

- The voice recognition system receives and processes a voice command to move the elevator to a certain floor [23].
- The voice recognition system sends a digital signal to the Arduino microcontroller, indicating the desired floor [23].
- The Arduino microcontroller receives the digital signal and processes it to determine the necessary actions to move the elevator to the desired floor [24].
- If the elevator needs to move, the Arduino microcontroller sends a signal to the stepper controller, indicating the direction and distance that the elevator should move [2].
- The stepper controller receives the signal and converts it into a series of pulses that can be used to control the stepper motor.
- The stepper motor receives the pulses from the stepper controller and uses them to rotate in precise increments, moving the elevator car up or down as desired [9].
- If the elevator includes sensors, the ADC may be used to convert the analogue output of these sensors into a digital form that can be processed by the Arduino microcontroller and used to control the movement of the elevator [25].

The Arduino code for a 5-floor electrical elevator based on voice recognition using an Arduino, with explanations for each section is presented in algorithm 1.

Algorithim 1. The Arduino code for a 5-floor electrical elevator based on voice recognition

```
#include <SoftwareSerial.h> // Include the SoftwareSerial library for communication with the voice recognition module.
#include <VoiceRecognitionV3.h> // Include the VoiceRecognitionV3 library for easy use of the voice recognition module.
```

```
const int RX_PIN = 9; // Set the RX pin for the software serial connection.
const int TX_PIN = 8; // Set the TX pin for the software serial connection.
SoftwareSerial ss(RX_PIN, TX_PIN); // Create a software serial object using the RX and TX
pins.
VoiceRecognitionV3 vr(ss); // Create a VoiceRecognitionV3 object using the software serial
object.
int currentFloor = 1; // Set the current floor to 1
int targetFloor = 1; // Set the target floor to 1
void setup() {
 ss.begin(9600); // Initialize the software serial connection with a baud rate of 9600
 vr.begin(); // Initialize the VoiceRecognitionV3 object
}
void loop() {
 if (vr.available()) { // If there is a command available from the voice recognition module
 int command = vr.read(); // Read the command
 if (command == 1) { // If the command is 1
 targetFloor = 1; // Set the target floor to 1
 } else if (command == 2) { // If the command is 2
 targetFloor = 2; // Set the target floor to 2
 } else if (command == 3) { // If the command is 3
 targetFloor = 3; // Set the target floor to 3
 } else if (command == 4) { // If the command is 4
 targetFloor = 4; // Set the target floor to 4
 } else if (command == 5) { // If the command is 5
 targetFloor = 5; // Set the target floor to 5
 }
 }
 if (currentFloor < targetFloor) { // If the current floor is lower than the target floor
 // Move the elevator up one floor
 currentFloor++;
 } else if (currentFloor > targetFloor) { // If the current floor is higher than the target
floor
 // Move the elevator down one floor
 currentFloor--;
 }
 delay(1000); // Delay for 1 second between floor movements
}
```

This code uses a VoiceRecognitionV3 library to communicate with a voice recognition module via a software serial connection. The code listens for commands from the voice recognition module and sets the target floor based on the command received. The code then moves the elevator to the target floor by incrementing or decrementing the current floor variable and delaying for a short period of time between movements.

3. RESULTS AND DISCUSSION

The Figures 3-5 that follow illustrate how the planned electrical elevator with speech recognition would actually work if it were implemented using Arduino as the microcontroller. The results of the project's experiments demonstrated exceptional performance when compared to the conventional electric elevators, as it demonstrated a significant difference in the level of personal security for users. This is because the elevator only functions with particular voice prints that have been stored in the past in order to maintain user security. In addition, the concept that was offered worked out effectively with patients and other persons who have unique requirements. This project can be applied to a wide variety of settings, each of which brings its own set of advantages.

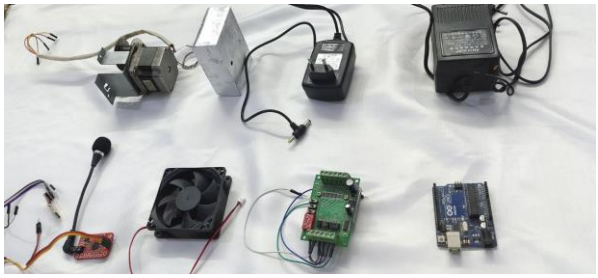
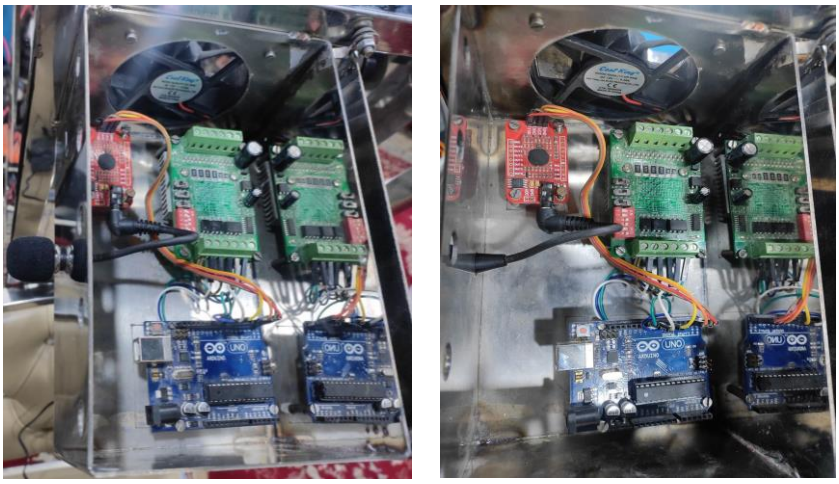


Figure 3. Components of the project



(a) (b)

Figure 4. The main components of the project after assembly (a) orginal image and (b) cropped image of the stages of assembling parts of the project

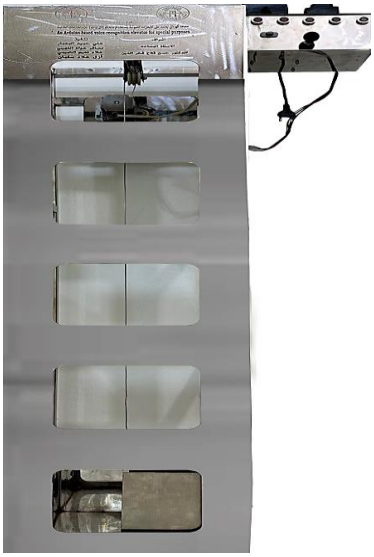


Figure 5. The external metal frame of the project

4. CONCLUSION

The Arduino microcontroller was used to develop and implement a five-floor electric elevator that operates on sound commands. The Arduino transforms sound commands into electrical signals that are transmitted between floors. The project was implemented in a practical manner, put to the test, and displayed excellent performance in a number of areas, the most crucial of which are probably the security and service aspects because the elevator only functions when it has clear instructions stored in it beforehand to protect people's safety, and because it offered excellent service to patients and people with special needs. This project can be used in a variety of settings, including residences, companies, and hospitals.

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