Controlling of Electric Elevator by using Voice Announcement, Speed Control and Mini Lift Model System

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Abstract – *The idea of this project is to develop an elevator system that accepts the destination input via external microphone, and taking the elevator to the destination accordingly. The lift would also take input for speed control, thus making it user friendly for differently abled people. This system will enable the residential and commercial places to minimize the cost spent of lifts men. The project would be primarily focusing on how inculcation of voice-based input system can effectively improve the elevator experience for differently abled and short-heighted people.*

Key Words: Voice Control, Automated Elevator, Speed Control, Disabled Friendly, Voice Input

1. INTRODUCTION

This project presents the design and construction of a voice operated lift/elevator control system. This system acts as a human-machine communication system. Speech recognition is the process of recognizing the spoken words to take the necessary actions accordingly. Users can also control the electrical devices like fan, door etc. with the help of voice recognition system. This system is extremely beneficial to those who are paralyzed, limited of stature, or severely impaired.

The elevator is extremely common for most places days. The employment of elevators is increasing in numerous applications like those square measure used in carrying product and carrying folks vertically in tall buildings like offices, searching malls, and alternative skyscrapers. With increasing technological advancement, the need of these devices is increasing day by day. Therefore, this project focuses on designing and upgrading the existing elevator infrastructure with the inculcation of voice commands. Automatic speech recognition is a method of converting a speech signal into words using a computer. Those words are used by the microcontroller to provide an acceptable instruction to all connected devices. Along with additional assistance to differently abled people, it will ensure contactless transfer of people and goods in elevator by accepting input with voice commands, thus its beneficial in the time of COVID-19 as well.

2. LITERATURE SURVEY

A. Vipul Punjabi, Ibrahim Khatik, Rajhansa Wagh, Archana Mahajan, Divya Patil, Ashwini Pawar. "Voice Operated Lift/Elevator in Emergency", November, 2018. **[1]:** Speech recognition happens to be prime focus in the project.

The speech recognition model is the system for controlling the elevator, and it is from this model that we can receive feedback for controlling the elevator. When we think about voice control, the first concept that comes to mind is Speech Recognition, which means that the machine should be able to recognize and interpret human speech as an input to the speech recognition model. Speech recognition is a technique in which a machine understands the words but not the context of the words spoken to a speech recognition module by any individual.

B. K. Srilatha1, B. Reeshma2, "Automated elevator-an attentive elevator to elevate using speech recognition", February, 2020.
[2]: The working of the Arduino microcontroller is where the proper connection is made by checking all input ports as well as the power supply connection the pins' output can be used to attach to external devices. The Arduino software can be used to run the program for the programs, and the software can operate with the C and C++ programming languages. These programs can be uploaded to Arduino microcontrollers by using them. Here we noticed that a very efficient way of providing speed control by using PWM was implemented. Pulse width modulation is a type of modulation in digital signals, using pulse width modulation, we can modify the duty cycles, effectively changing the speed of the elevator motor. The method used in this paper is reliable and variable speed can be implemented easily using this.

C. "D. Meenatchi, R. Aishwarya, `A Voice Recognizing Elevator System", December, 2016. **[3]:** Here Sphinx 4 is used for speech recognition. The recognition platform of Sphinx4 helps to add library files into dependencies of the project and there are few high-level recognition interfaces such as LiveSpeechRecognizer, StreamSpeechRecognizer, SpeechAligner and SpeechResult. For speech recognition, these interfaces are used in conjunction with the Acoustic model, Dictionary, Grammar/Language model, and Source of speech. The microphone is used as a speech source in LiveSpeechRecognizer, and the identification is done using the start and end recording featuresThe speech source for StreamSpeechRecognizer is InputStream, which can accept data from a file or a network socket. Text and audio voice are aligned with SpeechAligner. SpeechResult provides links to various aspects of the recognition result, such as the recognized utterance, a list of terms with time stamps, and the recognition lattice, among other things. Here, we notice that the java-based recognition library is accurate to a great extent and can be used offline too. But it requires substantial amount of

RAM and the initial learning curve is quite significant.

D. Haojun Qin "Elevator Drive Control system based on single Chip Microcomputer" **[4]**: This architecture employs SPWM technology, collects speed data through a photoelectric encoder, compares the provided speed curve to closed loop power, and corrects the elevator's speed in real time. Provided the speed in most cases, the elevator trajectory can be broken down into three stages: beginning, steady running, and decelerating. The repeated running and switching of the elevator's starting and stopping activities presents a threat to the motor's speed control. It is critical to have the pace if we want to ensure that the elevator is fast, secure, and comfortable. The majority of the speed of an old elevator is regulated by an integrator, and the starting and deceleration processes are controlled by timing.

2.1 Summary of Related Work

The summary of methods used in literature is given in Table 1.

Table 1 Summary of literature survey

Literature	Advantages	Disadvantages
Vipul Punjabi et al. 2018 [1]	Speech Recognition is comparatively accurate and reliable.	The microphone is located externally and needs smart phone for implementation.
K. Srilatha1, et al. 2020 [2]	Simpler implementation, easier to understand and implement. Easier to debug.	System needs to be further developed in terms of efficiency of elevator algorithm.
D. Meenatchi et al. 2016 [3]	This speech recognition system can work in offline mode too, making it slightly more reliable.	The code is not modular, so changes cannot be made in it and its difficult to add new features.
Haojun Qin [4]	This model offers beautiful insight about speed control using PWM. It provides additional safety with speed control.	Does not provide good insights about voice input and voice commands.

3. PROPOSED WORK

The aim of this project is to develop an elevator model that works smoothly on voice input like an actual elevator model would. For this purpose, it is expected to have a powerful processing system, in this case, Raspberry Pi 4 microcontroller. We aimed on having both the hardware and the software as modular as possible, to ensure that any future ideas can be inculcated into same project effectively and easily. For this purpose, we divided the code into 4 distinct parts, voice input/speech recognition, elevator algorithm, motor driver/speed control, distance formula. The usual problem with voice input-based elevator system is that it takes only one input at a time. However, this proposed elevator system takes care of that problem. With the features like PWM based speed control and voice input for multiple destination at once, this project greatly mimics the traditional elevator system.

3.1 System Architecture

The system architecture is given in Figure 1. Each block is described in this Section.

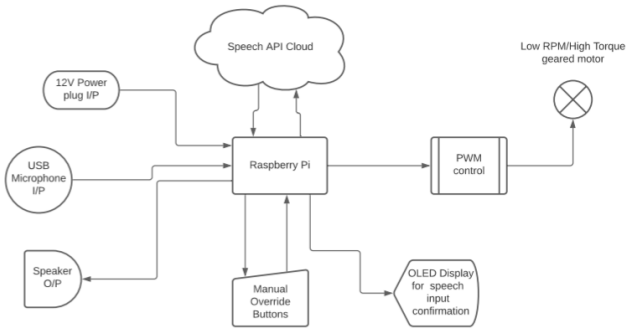

Fig. 1 Proposed system architecture

A. Speech API cloud:

For speech recognition, python text to speech is used. However, Sphinx 4 or RASA chat bot can be used too, based on the availability of internet and the requirements. One of the benefits of python text to speech and google voice recognition is that certain words can be censored and some words can be mapped to recognise a particular command, making it possible to give numerous voice commands.

B. Raspberry Pi:

Raspberry Pi 4 Model B provides great performance for this project. The performance is comparable to certain x86 PC systems. The four major parts of program are:

1. Voice input/Speech recognition
2. Elevator algorithm
3. Motor driver/speed control
4. Distance formula

Being entirely programmed in Python, the object-

oriented nature of python ensures that we can add new features to the existing model effortlessly.

C. PWM control:

The expression "pulse width modulation" (PWM) refers to a form of digital signal. Pulse width modulation is used in a wide range of applications, including complex control circuitry. The PWM is used to implement the elevator's speed control mechanism. Changing the duty cycle in PWM allows for multiple speed levels.

4. REQUIREMENT ANALYSIS

The experiment setup is carried out on a Raspberry Pi microcontroller and a wooden chassis which has the different hardware and software specifications as given in Table 4.1 and Table 4.2 respectively.

4.1 Software

Table 4.1 Software

Operating System	Linux
Programming Language	Python
Voice Assistant	Google Voice Recognition

4.2 Hardware

Table 4.2 Hardware

Processor	Quad core Cortex-A72 (ARM v8) 64-bit SoC @ 1.5GHz, 4 GB RAM variant
RAM	4GB
Microphone	2.2KΩ + 30% at 1KHz
Dual motor driver L289n	Double H Bridge L298N, Bounds: 46V and 2A
OLED	Standard 0.96 inch OLED

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