DOOR ACCESS USING VOICE RECOGNITION

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Abstract—

Generally, the life becomes difficult for disabled people to move around freely. It becomes even more difficult if it involves locked doors. This project solves problems for both abled and disabled people by using voice recognition to control the lock of the door. It also provides better security than any other locks provided with the doors. Various biometric scanners including fingerprint, iris scanner, facial recognition have the same footprint and provide security till only some extent and can be bypassed with some effort. This voice recognition uses a special password only known to the user which can be anything to the user's liking and it is difficult to bypass, thus providing better security. The setbacks of other biometric can be solved using voice recognition. The use of voice-based bio metrics is more practical especially for disabled people and is way easier and quicker. This study makes use of voice and speech-based algorithms to interpret and implement them in granting door access. There are two phases in this project – voice command phase and speech recognition phase. The command is given through the Bluetooth device and the speech is recognized and sent to the micro controller. If the command is approved by the controller, the door is opened and granted access. The main goal of the project is to lock and unlock the door using a mobile phone and controlling the door through speech recognition.

Keywords— Voice Recognition, Biometrics, Voice command, Bluetooth module, Micro controller, PCB board, embedded system, Bluetooth device.

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I. INTRODUCTION

The aim of the project is to build a system that locks or unlocks the door with the help of a voice command to simplify the task of disabled people and make their properties and lives secure. The main focus is to adopt natural language processing algorithms into voice recognition system. We give speech commands to the Bluetooth mobile application and control the door (close/open). We have taken the help of a Bluetooth module which is a wireless technology that is used to send and receive signals from devices like smartphones over a small distance. The controller of the whole project is a PIC microcontroller. The voice commands are fed on this microcontroller. This microcontroller will OPEN/CLOSE the door through L293D motor driver based on the received commands. Here DC motor works as door for opening/closing.

II. LITERATURE REVIEW

The restriction of entry to a place is possible with the use of a system known as an access control system. When someone does not have the required identification, such as a key, key card, fingerprint, voice password, RFID card, security token, or currency, a lock on a door can be employed as a physical barrier to keep them out. Computers were created later, and thanks to advancements in technology, they now provide access control through computer software and applications.

A. History of accessing door through voice.

Beginning in the 1950s, voice recognition was only possible with single-speaker systems that had vocabulary of about ten words. For single-speaker digit identification, three Bell Laboratories researchers named Stephen Balashek, R. Biddulph, and K.H. Davis created Audrey, an autonomous digit recognizer. Each utterance contained the spectral peaks of the human vocal tract's sound spectrum (formants). Five years of voice recognition were financed in 1971 by the DARPA as part of its speech research program. They incorrectly assumed that speech understanding would be a major factor in increasing speech recognition, but this was not the case. BBN, IBM, Carnegie Mellon, and Stanford Research Institute were among the organizations that took part in this endeavor.

In the 1990s, the first effective voice recognition systems were released. The first products were a recognizer from Kurzweil Applied Intelligence that was introduced in 1987 and Dragon Dictate, which was released in 1990. In 1992, AT&T introduced a speech recognition software where calls were handled without any human interference. Laurence Rabiner and other Bell Laboratories employees created the technology. Speech recognition business Lernout & Hauspie, located in Belgium, bought a number of firms, which includes Kurzweil Applied Intelligence and Dragon Systems in 2000. In 2001, the L&H speech technology was shut down due to an accounting issue. L&H's voice recognition technology was purchased by ScanSoft, which later changed its name to Nuance.

A deep learning technique known as Long Short-Term Memory (LSTM), which is a concept in Neural Networks which was first created by Sepp Hochreiter and Jürgen Schmidthuber in 1997, and has taken over many elements of voice recognition. With Connectionist Temporal Classification (CTC) trained LSTM, Google voice recognition saw a huge performance jump of 49% and is being accessed by a lot amount of smartphone users.

B. Applications of Voice Recognition

i. People with disabilities can use voice recognition to ease their lives by automating some of the processes.
ii. Voice commands in car infotainment systems can be used to provide some of the functions like calling, changing the volume and controlling some other aspects of the car.
iii. In smartphones, the entire device can be controlled by the desired person making it easier to use.
iv. Automatic opening and closing of doors can be initiated by the voice of the user.

C. Innovations in Door Access systems

The fundamental purpose of accessing system for door is providing people the access to the door. Compared to the conventional methods, these systems are an improvement. Many biometric technologies are being added to the door for restricting unauthorized access. The following biometric technologies are some of those now included into door access:

i. Voice

The capacity of the system to recognize human speech, understand it, and respond appropriately is termed voice recognition. The system initially has to experience the enrollment step, where the user's speech is captured and is taken as input, where several analyses of the voice is done where properties of the voice are taken and analyzed.

ii. Fingerprint

Security systems employ fingerprint scans as biometric identification. They are employed in security applications as well as unlocking doors, computers, and mobile phones. Initial step for using fingerprint is registering and scanning device into the door and it is to register the user's fingerprint by analyzing and storing it using a scanner. The person would have to touch the scanner device in order to unlock the system, and the computer would recognize the person's distinctive features to allow access.

iii. Face Scan

A biometric AI-based domain called face or facial recognition can recognize a person by analyzing properties and characteristics in their facial form and texture. Selected facial characteristics from a particular scan are compared to faces in a database to determine how it functions. Moreover, facial recognition has two processes. At the first step, the individual's distinctive facial features would be recorded in the system. If a match is observed for a face by referring the faces in the database, the system decides whether to allow or deny entry depending on the accuracy.

iv. Iris scanner

Iris Scanner is a method of identifying iris of the user. The approach makes use of the analysis that is done on one or both the irises where each of the iris has different properties. Iris technology captures photographs of the delicate, finely detailed structures of the iris that are not visible through a normal camera. It uses technology which contains infrared rays or infrared light.

v. Palm Scanner

A biometric identifier called hand geometry uses a user's hand shape to grant access. Hand scanner takes multiple-dimensional measurements of the user's hand and analyses and stores them in a file preferably database. It is one of the most widely used biometric methods that is digitized. Although not being seen as being as differentiating as other biometric figures, it continues to be the technique of choice of biometric implementation where the security needed is high.

D. Voice Recognition stages

The phases in voice recognition system are:
i. Registering – In this phase the password of the user is registered so that the command is only known to the user.
ii. Verification – In this phase using the password given by the user is used and the input from the user is taken to verify the password in real time.

III. EXISTING WORK

The lock on the door acts as a barrier and only allows a certain person with authorized access to enter the door. Without proper identification, the door access system does not allow a person to enter. Technology has advanced with the evolution of computers, the granting access for the door can be controlled via the software embedded in the hardware(door). The most secure method now a days in use is voice recognition, which works by recognizing the speaker and decoding human speech. Voice recognition and speech recognition are the two aspects for a perfect door access system. Voice recognition is the process of identifying a person according to the characteristics of that person's voice. Speech recognition is the text that converts speech of a person into text.

Generally, till now there were 2 phases in the system. One is the voice recognition system and the other one is the matching and retrieving the voice from the database. Our current system is equipped with additional security features where two factor authentication is added by adding a Bluetooth device for the door to open. To further improve security, a password in the form of text has been added which is only known by the user.

1. ANFIS system for door access system to build security

This research described the many tools used to safeguard secure buildings from unwanted entry, including PIN pads, keys), identification cards, cryptographic techniques, and dual control processes. A desirable and comparatively unobtrusive way to increase the security for granting access through the door is voice recognition, which is the ability to identify a speaker by listening to their voice. According to the survey and the report by some researchers, it is difficult to duplicate the voice of a human being. Because of these advantages, the study report discussed creating a voice-recognizable door that can be controlled using voice for increasing security. With the prototyped system, a registered user just has to give his voice into the microphone connected to the device to gain access. After then, the prototyped system will determine whether the voice is true or false and it will choose based on the user's identification, or it may indicate a lack of confidence and request further details. Additionally, models of authorized people based on their speech were developed

using an intelligent system method. The prototyped system uses Fuzzy Inference Systems, namely ANFIS, to distinguish between authorized and illegitimate users.

2. Implementing security using Voice recognition in biometric systems

The implementation of this project is to use MATLAB software to create and create a voice recognition system that could recognize a user's voice. The input voice is then converted into a waveform and is transformed into a visual format. There are several options for visually conducting the speech for a voice recognition system, including MFCC or Mel-Frequency Cepstrum Coefficients. The MFCC is used to compare input voice from the voices stored in the database. The user is asked to speak so that the voice is analyzed in the training phase. Users train the system by repeating their password and uttering the password into the system. MATLAB was used to identify and identify the voice. According to the results from the testing, the system identified the voice and decided whether to grant access and reject access if the voice is not found or unauthorized. Depending on the correctness and truthfulness of the system is contingent upon the training of the system by the user.

3. Constructing an automated system based on real time analysis

The project discussed the integration of technology into houses to respond to occupant requests and orders in order to ease the living situation at home. The purpose of this project is to use software which is embedded in the hardware and the system is used to recognize the voice, using them to transition between the proper tasks. An 8051-microcontroller kit, relays, and a voice recognition system were all used in the design. The system was initially in a standby condition awaiting voice input from the user. The voice recognition module examined an input as soon as it was discovered. The voice recognition system delivers the appropriate digital portrayals to the microcontroller if it recognizes a recognized command. The data stored in the database is looked through for the match of the input voice to determine whether the voice is accepted or rejected. A display is placed to show the statuses for the state of the recognition. The main purpose of this project is to construct a reliable hardware prototype to help with voice recognition-based home device control.

4. Door control using Bluetooth bases android smart phone

The phrase "smart home" is determined where a house works smartly by combining its numerous smart home systems. In this study, the Android mobile device is used for opening a door. Opening a door automatically without any human interference is possible is possible with Bluetooth. The control system is linked to a Windows OS Computer which most people use. In order to make the method simpler and more effective to employ, this research utilized Bluetooth on a smartphone. This study examined the usage of Bluetooth in Android mobile phones to automate door unlocking. During the research phase, a Bluetooth-based Android smartphone-based door access automatic system was designed and prototyped. After describing the construction of the hardware and software, it was explained how to innovate and make a Bluetooth-based smartphone application for locking and unlocking doors. The door-lock system combines an Arduino as a microcontroller as the controller and data processing hub, a smart phone as the task master, and a solenoid as the door lock output.

We have tried to compare our work with other voice recognition door access systems. Most of the studies revolve around the enhancement of the infrastructure and the accuracy of the system rather than building the security. Even the few existing systems that focused on security are unable to create and provide better safety and security mechanisms due to aspects like key duplication. Our project mainly focuses on the security of the system and uses two factor authentication with the help of Bluetooth and mobile devices.

IV. SOFTWARRE REQUIREMENTS

1. Express PCB – for designing circuit
A certain software named Express PCB is used to create PCB boards and embed the software. It is incredibly simple to apply and utilize.
A desirable and comparatively unobtrusive way to grant access for the door is speaker verification or speech recognition, the ability to identify a speaker by listening to their voice. Because of these advantages, it is better to create an access system for the door using this type of biometric.

2. PIC C compiler - for compilation part
PIC C compiler is a p software used to write code and program the system using the C programming language. The machine source code is first compiled, and then it is transformed into hex code that is then loaded into the microcontroller for

further processing. Code written in C is also supported by the PIC compiler.

It's crucial that you are familiar with the embedded C programming language, which is used with microcontrollers. We also refer to it as PIC C because we'll be using the PIC Compiler. There are different compilers for the PCB, PCM, and PCH. For 12-bit, 14-bit, and 16-bit PIC microcontroller opcodes, respectively, use PCB, PCM, and PCH. All three compilers are covered in this reference handbook due of their many commonalities. There are indications of features and restrictions that only apply to particular microcontrollers. These compilers were created expressly to cater to the PIC microcontroller's particular requirements. This enables software designers to create applications more quickly and in higher-level, more readable languages.

PIC A typical C program and C are very similar. If you are familiar with assembly, developing a C program is not difficult. We'll have a main function in PIC where you can define all the work that's specific to your application. When using embedded C, there isn't an operating system present. You must therefore ensure that your program or primary file never exits. Simple while (1) or for (;;) loops, which run indefinitely, can be used to do this.

If the right header is not used for the coding part, the registers cannot be accessed. The following header is used to access registers in the controller. #include <16F877A.h>

3. **Coding Language** - C

4. **Google Speech services** – Google speech service is a software that is used to recognize the speech of the user. In this case it is implemented for recognizing the password set by the user.

 V. HARDWARE REQUIRMENTS
1. PIC Microcontroller
The PIC16C72/72A and PIC16F872 devices are upward compatible with the 8-bit, CMOS FLASH-based PIC16F72 microcontroller. It has a 200 nanosecond instruction execution time, self-programming, an ICD, two comparators, two capture or compare or PWM functions, a synchronous serial port that can be set up as either a 3-wire SPI or 2-wire I2C bus, a USART, and a parallel slave port.
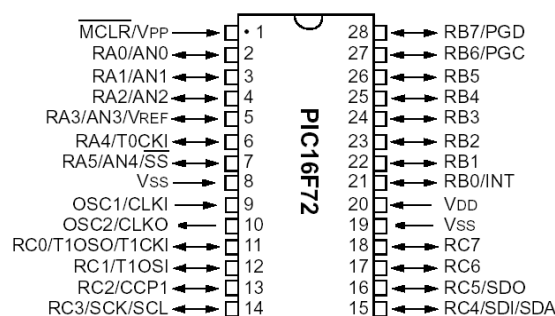
2. Bluetooth module
The Bluetooth module HC-05 is a master and slave module. The initial setting for the Bluetooth module is "slave". The same Bluetooth module named "slave" cannot be used to perform actions like adding another Bluetooth requests, but it can accept any incoming requests. Only the module named "master" can add or initiate a connection. To set up a connection between MCU and GPS, serial port can be used by replacing.
It auto connects to the last device by default and permits pairing device to connect.

3. Mobile Phone
The mobile phone is used to Give voice input via the microphone present in the phone. The speech is recognized by the google speech services and the command is received by the Bluetooth device on the system.

VI. METHODOLOGY
The amalgamation of software and hardware is an embedded system which performs a specific task given by the user. In this case to grant and give access to the door. Main devices used in the embedded systems are microprocessors and micro controllers.

Since they merely accept input, process it, and output, microprocessors are frequently referred to as general-purpose processors. A microcontroller, on the other hand, allow the input data to be inputted and also enhance it, connects it to various devices, controls it, and ultimately produces the output.

The project Door Access using voice recognition uses 16F72 microcontroller which is used to control the door via Bluetooth using speech command by using smart phone. The Microcontroller is used to send commands whether to grant access through the door or not using the conditions given which are embedded in it. The term embedded systems is an isolated minicomputer that stays on a system to perform certain task.

This is the proposed system's construction, along with a description of each component. Contrary to other biometric identification methods like fingerprint scans, speech recognition still has to go through a lengthy training process in order to stabilize the system. Reading in various terms from many people helps stabilize the system and improve system performance. Project initiation, planning, execution, monitoring and control, and project closing are the five project management phases that have been separated into this research. The type of job required makes the split necessary.

The planning, carrying out, monitoring, and controlling processes for a project include the following:
1. Project Planning: During the planning stage, effects and blueprint of the planned solution were generated. A wide range of topics including access control systems, speech recognition, biometrics and artificial intelligence, were studied by using websites, articles, and material found on the internet.
2. Project Execution: Voice recognition software and Microcontroller were both employed in this project. In the research's software and hardware sections, voice recognition techniques and the Microcontroller were both utilized. The LED indication switch, control of granting or rejecting users and other aspects were all operated using Microcontroller.
3. Monitoring and control: Several tests were run after the execution to make sure the door access control system can function properly. The 2 stages training and the testing are the two phases of the speech recognition exam. Speech was input through the microphone throughout the training phase. Using a voice recognition algorithm, the characteristics of the inputted speech were retrieved and saved in the database. Speech was entered using the microphone throughout the testing phase. Voice recognition techniques were used to extract the speech's characteristics. During the training phase, the new features were
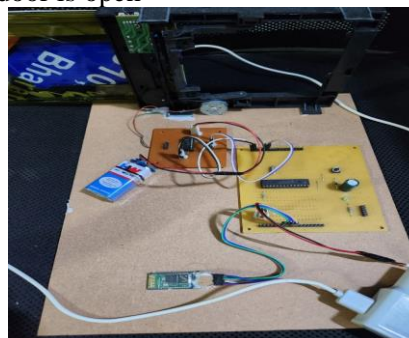
compared to the data that had previously been placed in the database.
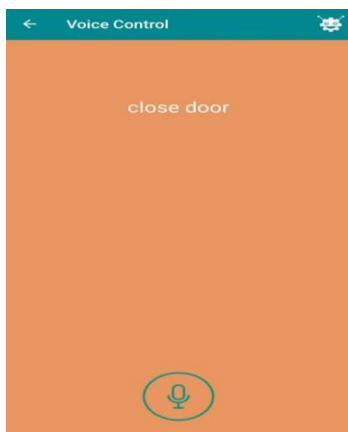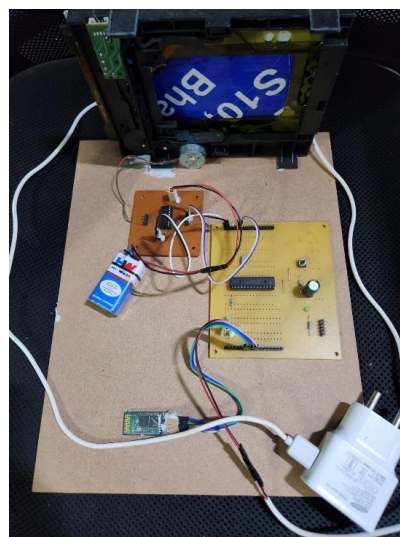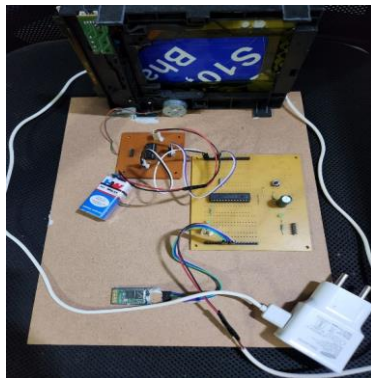
VII. IMPLEMENTATION
1. Software Module – For the software there must be an android phone where it must run android OS greater than version 8.0 which should include 2GB of internal memory and minimum #GB of RAM.
2. The below picture depicts the user interface to control the door. The speech is inputted into the microphone of the mobile phone after clicking on the microphone icon. Microphone permission should be given.
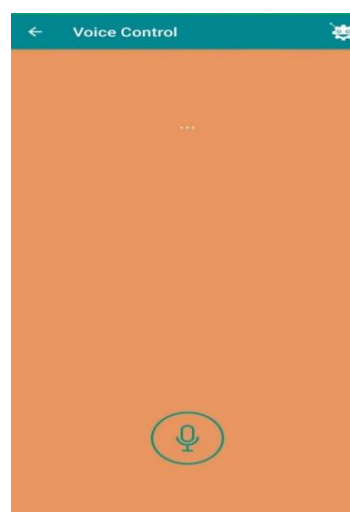

When door is open –

When door is closed –

4. The circuit diagram –

Using either simple pictures of the component elements or internationally recognized symbols, the circuit design illustrates the pictorial depiction of the connected system circuit. An Android smartphone is used to send input signals to the mobile app. Text is extracted from voice using speech-to-text algorithms. The server receives the extracted text and processes it there. Initially the server sends the signal to the Arduino which transfers the signal to unlock the door if the text matches the predetermined unlock phrase. The magnetic lock is powered by the relay module.

3. Hardware Module –

The main parts contain an Arduino microcontroller, a relay module, Bluetooth module, and a motor-controlled door.
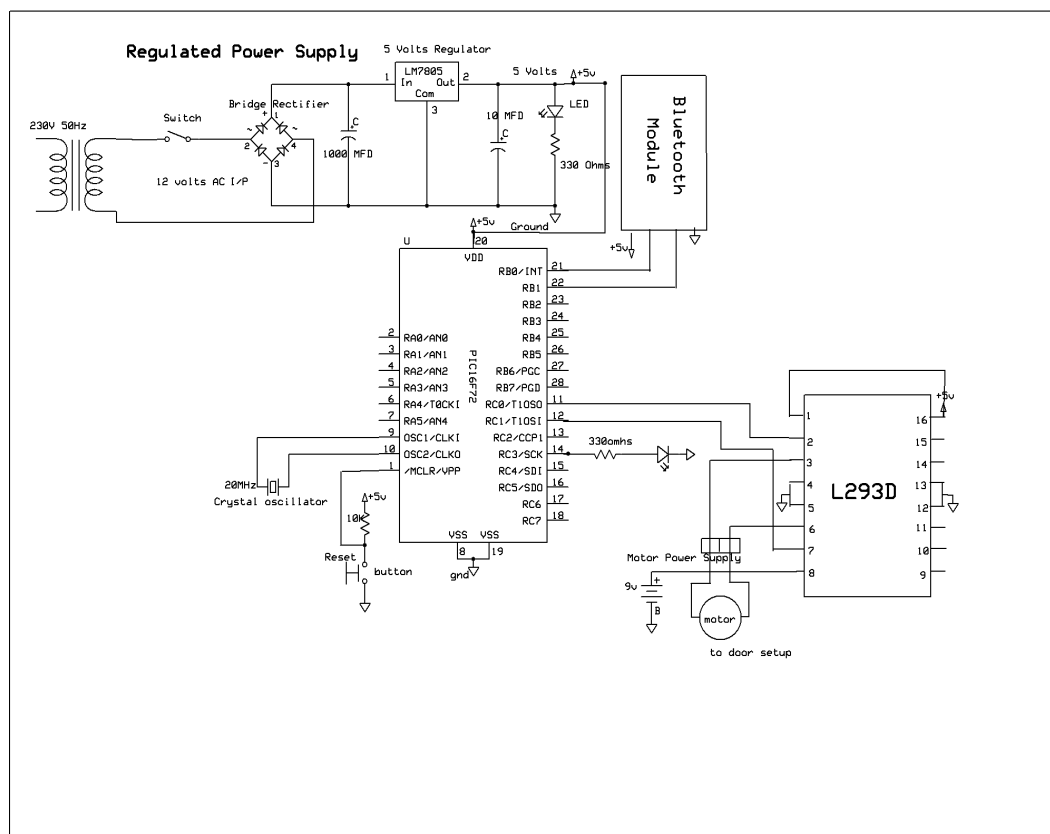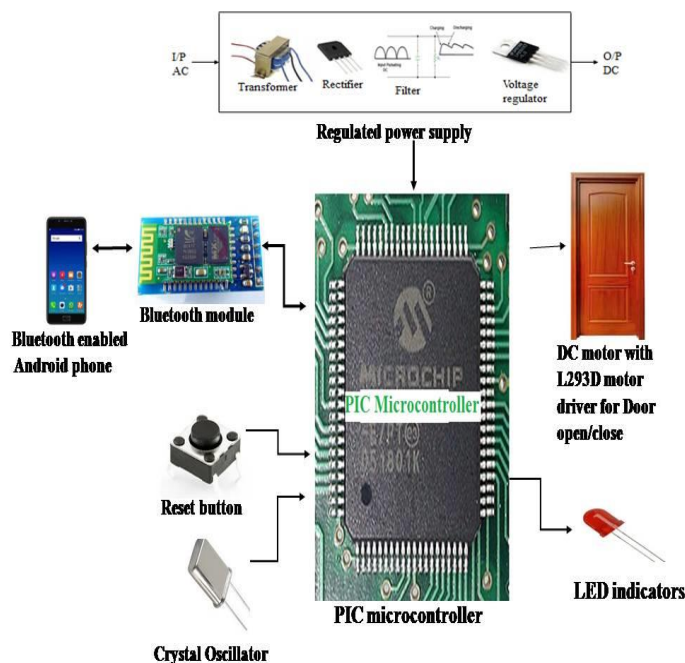
The project "Door Access using Voice Recognition" was designed a voice command-based door controlling system which is operated wirelessly through smart phone via Bluetooth. The receiver receives the signal from the phone and sends to the Microcontroller which send commands to open or close the door. A phone is used as a remote for controlling the door to be locked or unlocked.

5. DC Motor
The energy should be converted from electrical to mechanical which is done by the DC motor. The DC motor contains 2 parts: the rotating armature and the fixed field coils. Figure depicts a photograph of a standard DC motor.

The DC motor, and rotor are shown in the image above. Wire coils are twisted around a spinning centre with an extended shaft to create the armature. Another thing to observe is that each wire coil has its extremities terminated at one end. The brushes make electrical contact with the

commutator, often referred to as the termination points, to transmit electrical current to its rotating component.
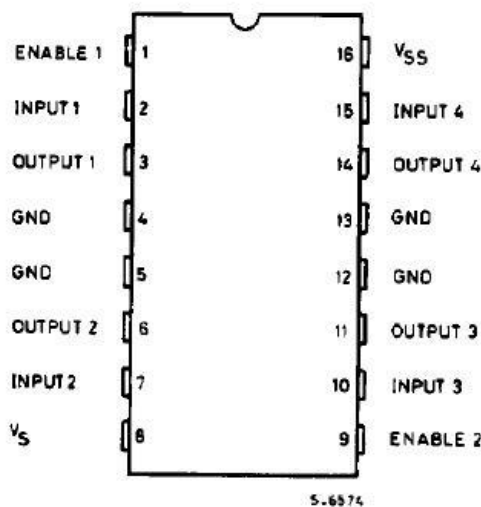
VIII. CONCLUSION
This project mainly focuses on providing easy and feasible lives for elderly and disabled for accessing doors as using the voice to lock and unlock the door is easier. It also discusses how to use speech recognition as a biometric authentication method to fix problems with existing biometric authentication methods.

According to the reviewed literature, there are several approaches or algorithms that can be used to increase the security of door systems, but they might not be able to make it simpler way of

accessing doors for people with disabilities or make any security improvements It was designed with features that integrate with all of the hardware components utilized. The placement and arrangement of each module has been carefully thought out, allowing the unit to operate as efficiently as possible. Second, using cutting-edge ICs, the project has been successfully carried out with the aid of developing technology.

1. Advantages
i. No keys are required that can be stolen or lost.
ii. Keyless entry which will be easier for entering, especially for elderly and disabled people.
iii. Minimum effort required to close and open the door.
iv. Doors are automatically opened and closed. Security is improved.

2. Disadvantages
i. The Bluetooth range can only be supported for a certain distance.

IX. FUTURE SCOPE
There can still be some improvements be made in order to make it better:
1. The system can be improved by implementing it through IOT technology.
2. Security cameras can be added to the system where for every lock and unlock of the door, a picture is sent to the email of the registered user.
3. Alerts can be sent for unauthorized attempts to unlock the door.
4. With voice recognition, another biometric security feature like fingerprint or a pin can be added as a backup in case the voice recognition does not work,
5. Support for native language can be added so that it can reach wide range of people.

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