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An Investigative Study of Voice Functioned Smart Door Lock System

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A B S T R A C T

This article discusses how speech recognition can improve security for persons and property while making door systems more accessible to people with impairments. Facial recognition, fingerprint scanning, and iris scanning are examples of popular biometric technologies. Based on features and qualities used to identify various people for the safety and security of their lives and property, these biometric identifiers are distinctive and one-of-a-kind. Sadly, these biometrics are vulnerable to hacking. A pin or password can be cracked, a person's finger can be severed to perform a fingerprint scan, an eyeball can be removed to perform an iris scan, and a person's photo can be used to perform facial recognition. With the help of speech recognition biometrics technology, these obstacles can be reduced.Technology for voice biometrics is more precise, swifter, more practical. In order to give individuals a quick way to open their doors and simultaneously protect their safety and security, this research study intends to design a door access control system that makes use of voice recognition algorithms. The testing phase and the training phase are the two phases that make up the system. The attributes of a speech are extracted and stored in a database during the training phase. Using voice recognition algorithms and vocal models, the intents from a person's address would be derived during the testing phase. A user is given access if a match is detected.

Keywords: Speech recognition, door locking system, Arduino, PIR Sensor, Bluetooth module , LCD sensor,Electronic Magnetic locks (Maglock)

1. Introduction

Security issues are becoming more prevalent among people today. The security of everything has become increasingly important in recent years as security has become a crucial concern on a global scale nowadays. This work attempts to replicate the thorough literature review on the numerous gate and door security systems required for domains including home, business, and vehicle security, where the risk of intrusion is rising everyday. Recently, research has been conducted on several door lock security systems, including conventional security systems that give indicators via an alarm.

Some door lock security systems now use microcontrollers, GSM, GPS, numerous sensors, software like MATLAB and PROTEUS, biometrics like facial recognition and iris scanning, RFID, Smart Cards, and passwords, among other contemporary technological advancements. Every system has benefits and drawbacks.

The majority of the time, SMS is utilised as a form of communication to speed up message delivery, make the system more reliable and cost-effective. Security has grown to be a major issue, thus security monitoring systems need to be up to date. The authors of certain studies have provided embedded and Zigbee-based door lock security monitoring systems. In some cases, the lock is secured by an automatic password, making it difficult for hackers to break into. Additionally, advanced security solutions based on wireless technologies, embedded systems, and the Android platform are available. Various Door lock security have undergone numerous changes recently, and more changes will take place in the years to come. Our lives and our possessions are protected by security. For the purpose of avoiding illicit handling, it is essential to ensure both the safety of individuals and their valuables. Therefore, it's essential to concentrate primarily on door lock or gate security to prevent more issues in monitored areas. Because mechanical locks are so easily broken, crimes and robberies still occur with them. It is therefore important to create a new lock that cannot be easily damaged. As a result, numerous authors provide various types of digital door locks, including automated password-based and software-based ones that are frequently used in homes and workplaces. Ordinary, electronically driven locks, digital codes, and biometrics technologies like fingerprint technology are used to prevent unwanted entry into buildings through the main doors.

Some solely use thumbprints as their basis. The use of palmtop recognition systems, face recognition systems, face detection systems, voice recognition systems, wireless sensors, PIR sensors, RFID techniques, intelligent cameras, and many other technologies has made it possible for people to secure their homes or places of business from a distance. As a result, even when people are away from home, they need not worry about home security. Doors prohibit people from entering. They are not just made of wood, but also of metals.The security industries are going through a diversity like never before. Therefore, it is necessary to check the veracity of the systems that are now in use, and research should be done to develop more dependable and sound systems that function intelligently and with minimal effort. The main thing is to offer greater security. Therefore, we have suggested the voice-based door-locking system using Arduino with the notion of most elevated security and safety in mind.

2. Proposed Methodology

Our system helps build an economy and a low-budget voice based lock. The first step is to create a program using Arduino IDE and upload it into a microcontroller. In this case, it is Arduino Nano. This program establishes a communication link between the nano board and a smartphone via Bluetooth. This communication link helps the microcontroller execute the commands sent by the smartphone.

Construction of the proposed system with an explanation of the various components. Unlike other biometric means of authentication, such as fingerprint scan, voice recognition is still required to pass through lots of training phases to attain stabilization of the system.

- Project Planning: Simulation and schematics of the intended solution were developed during the project planning stage.
- Project Execution: Arduino and voice recognition algorithms were used in this project. Voice recognition algorithms were used in the software section, while Arduino was used in the hardware section of research.
- Monitoring and control: Various tests were carried out post-execution to ensure that the door access control system could perform satisfactorily. Various factors are considered when choosing a microcontroller for a particular purpose. These include

  1. The number of digital inputs and analog inputs the system concerned requires; is a factor that helps to determine the minimum number of inputs and outputs (I/O) that the chosen microcontroller must have and the extent of the need for an internal analog to digital converter module.
  2. The size of program memory storage required
  3. The magnitude of clock frequency; is a factor that determines the execution rate of tasks by the microcontroller 4. The number of interrupts and timer circuits required.

3. Hardware accomplishment and working

Once the door locking system is initialized, if the PIR motion sensor detects human movement, it displays the message Welcome. After 10 seconds of delay, it shows the following message "speak" Then that voice is recorded by the voice recognition module. It compares the recorded voice with the reference voice, then, if matched, it will give a valid command operated through the microcontroller, i.e., Arduino. Then access is granted, and it displays the message "access granted. " If not matched, then it shows a pass key message. We have to enter a passkey. If the passkey is checked, it will be granted through the display. If the access key is not matched, then the system denies the access.

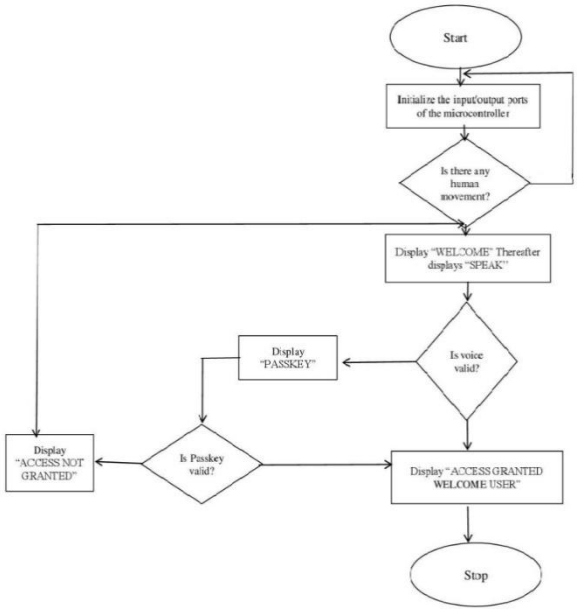

Fig. 1 –Flow Chart

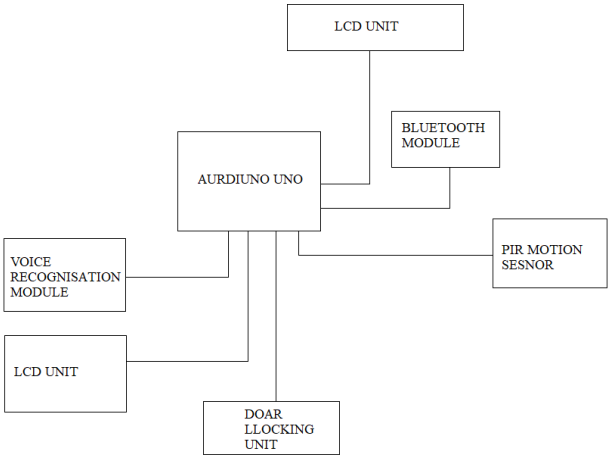

Fig. 2–Block Diagram

4. Technology Applied

4.1. Arduino UNO

The Arduino Uno can be powered via the USB connection or with an external power supply. The power source is selected automatically. External (non-USB) power can come either from an AC-to-DC adapter (wall-wart) or battery. The adapter can be connected by plugging 2.1mm centre-positive plug into the board's power jack. Leads from a battery can be inserted in the Gnd and Vin pin headers of the POWER connector. The board can operate on an external supply of 6 to 20 volts. If supplied with less than 7V, however, the 5V pin may supply less than five volts and the board may be unstable. If using more than 12V, the voltage regulator may overheat and damage the board. The recommended range is 7 to 12 volts.

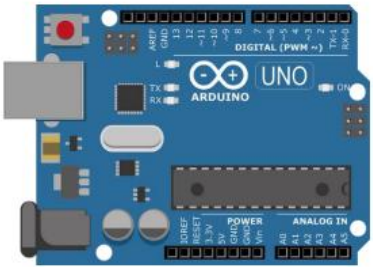

Fig. 3 - Arduino UNO

4.2. Electronic Magnetic locks (Maglock)

An electronic, magnetic lock, also known as a maglock, is a locking device that consists of an electromagnet and an armature plate that securely prevents a door from opening without proper access credentials. Electric locking devices can either be "fail safe" or "fail secure." A fail-secure locking device remains locked when power is lost. Fail-safe locking devices are unlocked when power is lost. Direct-pull electromagnetic locks are, by default, fail-safe. Maglocks can be paired with switches and/or credential tools to release the lock remotely to grant access.

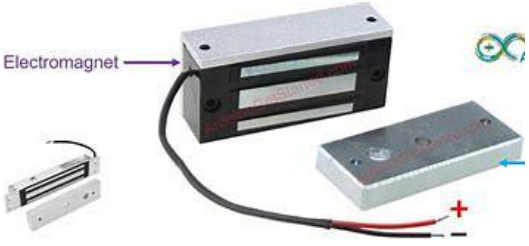

Fig. 4- Maglock

4.3. Bluetooth Module

The HC-05 Bluetooth module used in this project is a simple-to-use Bluetooth SPP (serial port protocol) module that allows for seamless wireless serial connection setup. In this project, the HC-05 Bluetooth module functions as a wireless bridge between the microcontroller and the mobile phone app, allowing serial communication between the two.

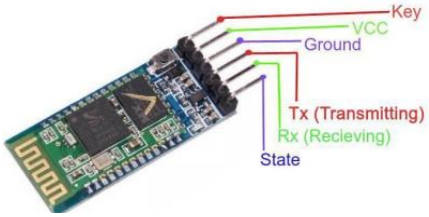

Fig. 5-Bluetooth Module

4.4. Voice Recognition Module V3

Speak (Voice) Recognition Module V3 compatible with Arduino is a compact and easy-control speaking recognition board. Speak (Voice) Recognition Module V3 product is a speaker- dependent voice recognition module. It supports up to 80 voice commands in all. Max 7 voice commands could work at the same time.

4.5. LCD sensor

You can easily interface a liquid crystal display (LCD) with an Arduino to provide a user interface. Liquid crystal displays (LCDs) are a commonly used to display data in devices such as calculators, microwave ovens, and many other electronic devices.

5. Advantages

- Security: This study aims to overcome the shortcomings of traditional door access control systems in safeguarding the safety of people and property. One restriction is that the existing system cannot offer the best security because of various system attacks, such as key duplication. It is also thought that it would act as a springboard for the creation of more advanced voice recognition systems, which would be intended to increase security and simplify life.
- Simple to use: The speech recognition system is incredibly helpful for persons who are blind or have other disabilities.
- Easy to use technology: Voice biometrics is more accurate, quicker, and more practical.

6. Application

Based on their functions, voice recognition apps typically fall into the following categories:

- In-car systems: You can use voice commands to start phone calls, choose radio stations, or play music from a smartphone, MP3 player, or flash drive with music on it.
- Military: Speech recognition is used to manage flight displays, radio frequencies, autopilot systems, steer point coordinates, and weapon release settings on high-performance fighter aircraft.
- Telephony: For predefined or customised speech commands, speech recognition is frequently utilised as part of a mobile phone's user interface.

Education: Proper pronunciation can be taught through speech recognition. Students who are blind can communicate using technology and then hear the computer repeat what they said. They don't need to look at the keyboard and screen to use a computer; they may only use their voice to give commands.

- People with disabilities (handicapped): Speech recognition helps these individuals with daily tasks.

7. Application

The paper's main objective was to develop an Arduino Uno and Bluetooth module-based home security system. As a result, whether a person is at home or away, it helps them feel secure. The coding for this project was done using the Arduino IDE platform, which is based on Arduino. Overall costs are modest, and operation is simple. In an endeavour to improve energy management and achieve complete home automation to assure comfort, security, and privacy, even our homes will evolve into intelligent homes that are constantly in communication with the grid.

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