

GROUP 17

**COLLEGE OF
ENGINEERING & COMPUTER SCIENCE**



Senior Design I

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Proposal Document

SECURITY HAND FREE ENTRY SYSTEM

I. Objective:

In recent years the problem of home land security has attracted increasing attention and resources. The search for solutions that can guarantee greater independence and a better quality of security has begun to develop easily available state-of-the-art technology. Intelligent control systems, most called smart homes, smart environment systems, intelligent buildings, or intelligent homes can now be planned and would go far towards simplifying the interaction between difference technologies. A great number of benefits would stem from the implementation of such systems: greater safety, autonomy and self-esteem, and consequently, better relationships with others.

The proposed project is to utilize Radio Frequency Identification (RFID) and Voice Recognition technology to create a Security Hand Free Entry System. This project is motivated by the many times when people are hurriedly entering or leaving their residence as they are carrying groceries or boxes which may occupy the use of both hands. With the completion of this project, one will be able to easily enter a home or office even with both hands preoccupied. RFID Technology utilizing a 125 KHz proximity key will allow the user to unlock a lock within two feet (basic) from the door they are trying to open. The users will be able to walk up to the door with their key in their pocket and unlock the door without having to physically touch the key. The proximity key would replace manual keys, swipe cards. The proximity key design will work in combination with voice recognition to ensure a higher level of personal security when unlocking the door. A user spends a few moments enrolling his or her voice in an application (creating a voice profile). Under normal operating conditions when the proximity key is within range, the user will be prompted by the application to speak a predetermined phrase of which will be compared to the voice profile on file. If there's a match, the user is accepted, and the door automatically unlocks. The door will remain unlocked for a pre-programmed period of time, and will return to the locked state at the end of the complete process.

Voice recognition is one of the most widely used technological advances of our times. The technology has made a large progression to make it practical for commercial consumer use, such as, allowing those with disabilities the freedom to communicate with others. In this project, voice recognition will be manipulated to utilize the capabilities and functionalities of the technology. We plans to achieve this by combining the voice recognition technology with the 125 KHz proximity card access control system.

The system has three main components: the Proximity Card Reader system, the Voice Recognition System, and the Electric Door Lock System. We will use the proximity card reader system, Voice Recognition System, and combine it with an electric door locking system to make up a fully integrated access control system. In this modern time, maintaining personal security should be considered of the utmost importance. What if we lose the card key, what if someone recorded our voice? With this proposed solution it will take more effort for an adversary to obtain the card key and the voice at the same time.

The aim of the design team was to gain an in depth understanding of electronic door lock, speech recognition, and proximity card reader system integrates with microcontroller in the design and implementation of the Security Hand Free Entry System.

Our primary goal is to design an affordable device for the conveniences. If this can be achieved, many other features can be added to our design. The Security Hand Free Entry System should be easy to use, dependable and very accurate. Because of our time constraint, it will be a challenge to add many features to our design.

II. Specification

Benefits

- Unlocking a door hands free
- Convenience
- Home security
- Key will read through non-metallic coatings of dirt, dust, etc.
- Ability to Recode the Data on the Key

List of Features

- Voice Recognition
- Maximum up to 6 ft range
- Alarm System
- Automatically locks the door
- Ease of Use
- Convenience

1 Proximity Card Reader System:

1.1 Card Reader

Proximity card reader is ideal for installations incorporating parking control and long read range application.

The Reader is used to activate the passive tags with RF energy and extract information from these tags. They contain a transmitter, receiver, and digital control module that interface with the Host Computer. The reader interfaces with its antenna via an interface chip. If a tag is sensed by the antenna, the reader decodes the data and passes it to the microcontroller which is programmed to lock or unlock the door.

1.1.1 Feature:

1.1.1.1 Interfaced:

Interfaces with all parity bit, clock and data, RS-232, RS-422 and RS-485 protocol access control system

1.1.1.2 Audiovisual Indication:

When a proximity card is presented to the reader the red LED flashes green and the beeper sounds. The multicolor LED and beeper can also be controlled individually by the host system.

1.1.2 Read Range:

Up to 6' depending what kind of card/tag to use.

1.1.3 Power Supply

Configurable 12 or 24 VDC
Linear power supplies

1.1.4 Current Requirement:

DC current at 12v: Avg. 200mA, Peak 700mA

DC current at 24v: Avg. 260mA, Peak 1.2A

1.1.5 Transmit Frequency: 125 kHz

1.2 Card Reader Converter

The converter integrates all standard based reader technologies into other applications. The Converters has multiple used:

- It translate all data output to USB, RS-232, RS-485 or TTL
- Provides the computer/terminal/PLC interface when using ID badges for more than door access.

1.2.1 Feature:

1.2.1.1 Platform independent:

Supports any operating system with USB, RS-232 or RS-485 support

1.2.1.2 Compatibility:

Compatible with any converter comes with configurable flash memory to support any card format.

1.2.1.3 Configuration Software:

- Number of parity bits to strip
- Set the ID bit Count
- Fixing the decimal character data length
- Define a card gone character
- Define decimal or hex output

1.2.2 Relay:

Normally open and normally closed

1.2.3 LED:

Two-state LED

1.2.4 Power Supply and Interface

- Normal input: 4-6V DC supplied
- USB model: supplied via USB cable
- RS-232/485 model: supplied via terminal block or DC Jack

1.3 Card:

For the purposed of the project, we plan to use Proximity Card with read range up to 24". The shorter of the reader range, it will reduce the cost of project.

The Proximity tag is a passive tag which means it will sends a signal to the reader only when it is in range of the reader. It consists of an antenna circuit and a silicon

device. The reader induces a small electric current when it is in range. It also sends a signal to the Reader. Our reader will have anti-collision system so multiple keys can be used in the same area. When the key is not within a design range the door will automatically lock.

2 Voice Recognition

The speech recognition system utilizes differences in the frequency content of speech to determine which word is spoken by the user.

2.1 Feature:

- The speech recognition processor must be able to recognize at least 3 commands. The commands that the speech recognition processor will recognize are:
 - ✓ Open
 - ✓ Closed
 - ✓ Specified command
- Speaker dependent
- External RAM support
- Manual and CPU modes available.
- Microphone support

2.2 Applications:

Toys
Home Automation
Telephone assistance systems
Voice recognition security
Speech to speech translation

2.3 Power supply:

Input Voltage: 9 to 15 V DC Use a commonly available 12V 500ma DC Adapter
Output Data: 8 bits at 5V
5v power supply

3 Door Lock

The Electric Door Lock System consists of a series of resistors, an amplifier, and a relay. This system is capable of taking the output of the microcontroller and amplifying it enough to allow the electronic lock to open when the proximity card is in range. The electronic door lock need between 9-14VDC to power it up.

4 Interacting the Microcontroller with Reader, Door Lock and Voice

The Microcontroller had to be interconnected with all three of the other main components of our schematic for our design to work.

- Ultra Lower Power

- Operating speed: up to 25 MHz
- Flash Memory Program: 0.5KB to 256KB
- Pinout: compatible to other 28-pin or 40-pin, 48-pin.

4.1 Proximity Card Reader System

The Reader is used in the system to detect different tags that were in range of the antenna. For our project, we needed to interface the Reader with our main microcontroller so it can output a high to our Electric Door Lock System when a tag is within the range. The Card Reader System consisted of a reader, a converter, an antenna, and several tags. We need to program the microcontroller to sense the correct tag, when it was in range and output a high and output a low when the tag was not in range

4.2 Voice Recognition

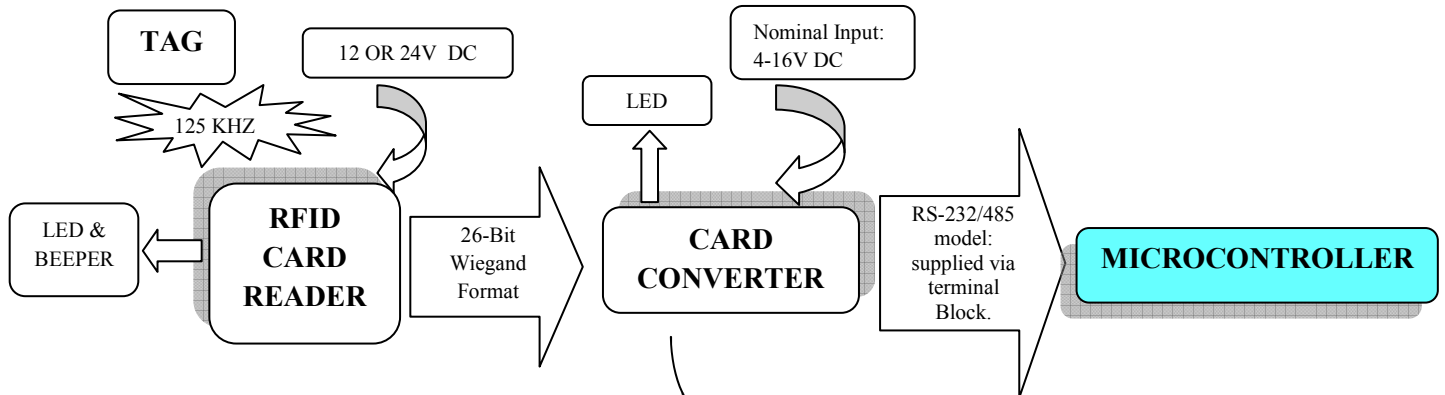
The speech recognition system utilizes differences in the frequency content of speech to determine which word is spoken by the user. A single filter was used to pick out a segment of speech which has frequency content for both 'open' and 'close', 'specified command'. Then, we will distinguish between the commands. A microphone is used to take voice input. The analog output of the DSP chipset was then fed through an amplifier and into the microcontroller.

4.3 Door Lock

The microcontroller outputs a high into the Electronic Door Lock System when the correct tag is within range of the reader. The system consists of an OR-gate whose input is coming from the microcontroller and its output goes to an amplifier. The amplifier that we used had the option of using an external resistance that controlled the gain. The output of the pick fed into a coil of the relay that drove the Electronic lock that we used.

III. Block Diagram

Card Reader System Block Diagram To be acquired – Anh Nguyen



If the tag ID is as below,
 Bit 25 0
 1 0110 1001 1000 0100 0110 1011 1
 The illustration of data process will be like this:

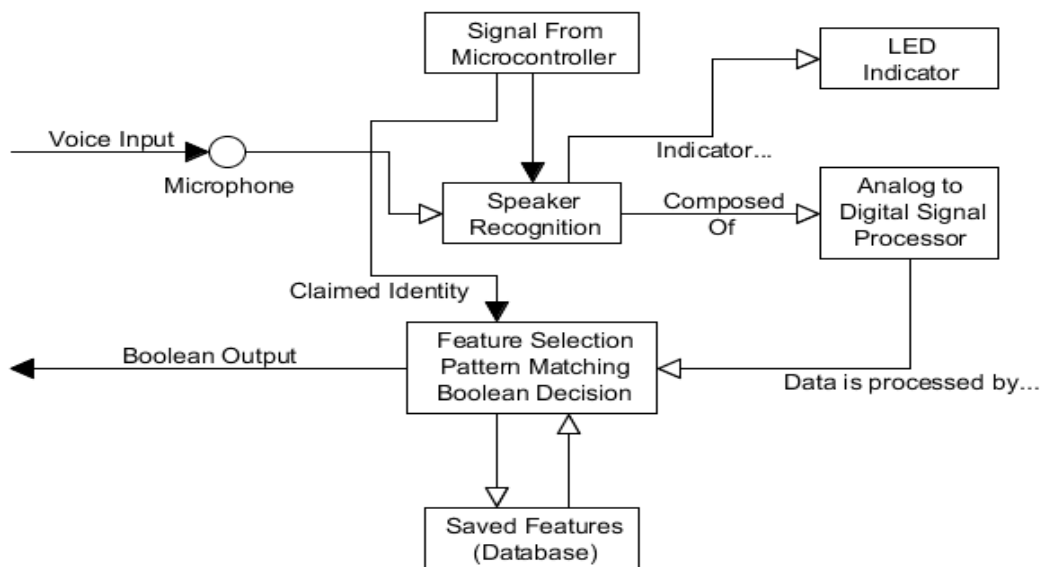
- Data [0] = 0...0000 0001
- Data [1] = 0...0000 0001
- Data [2] = 0...0000 0001
- Data [3] = 0...0000 0000
- Data [4] = 0...0000 0001
- Data [5] = 0...0000 0000
- Data [6] = 0...0000 0001
- Data [7] = 0...0000 0001
- Data [8] = 0...0000 0000

.....
 Data [25] = 0...0000 00001

"Standard" 26-Bit Wiegand Format



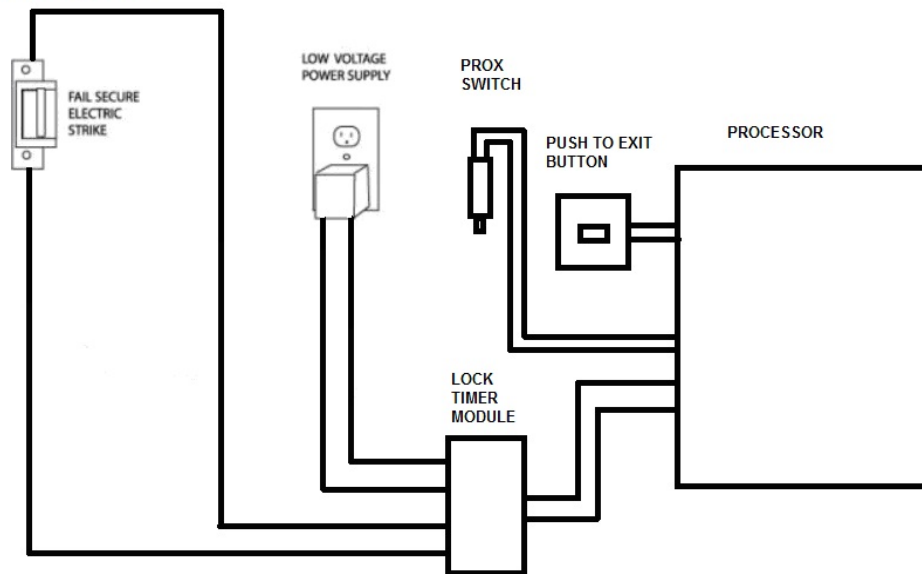
Voice Recognition Block Diagram Research – Jordan Acedera:



The speech verification system will be run on its own microcontroller. Hereafter, “main microcontroller” refers to the main microcontroller unit performing the RFID and panic mode functions, whereas the “speech microcontroller” refers to the speech verification system. The speech verification system will wait for two pieces of data from the main microcontroller. The first is the enable signal which will “inform” the system that the main microcontroller is waiting on the verification data (a one or zero). The second piece of data is the claimed identification of the user, based on the RFID obtained by the microcontroller. The user can then physically activate the microphone by depressing a button for the full duration of the voice input, or the voice input can be detected automatically and trimmed to eliminate silences at the beginning and ending of the input (to be determined). The voice input will be converted from analog to digital signal immediately and inputted into a digital signal processor. The processor will perform feature selection and pattern matching against a known database of user-inputted passwords. The processor will then make a decision (based on a predetermined threshold) if the user is verified and output that back to the microcontroller.

Electronic Door Lock System To Be Acquired – John E. Van Sickle:

Electric Strike System



Upon signal from processor denoting prompt to open door, timer will be initiated allowing electric latch to release for specified amount of time.

Timer will count down utilizing 12 volts at 500 milliamp power supply to maintain open door condition for this specified time.

Card Converter mounted atop door will provide feedback to processor to give feedback of door open/closed state.

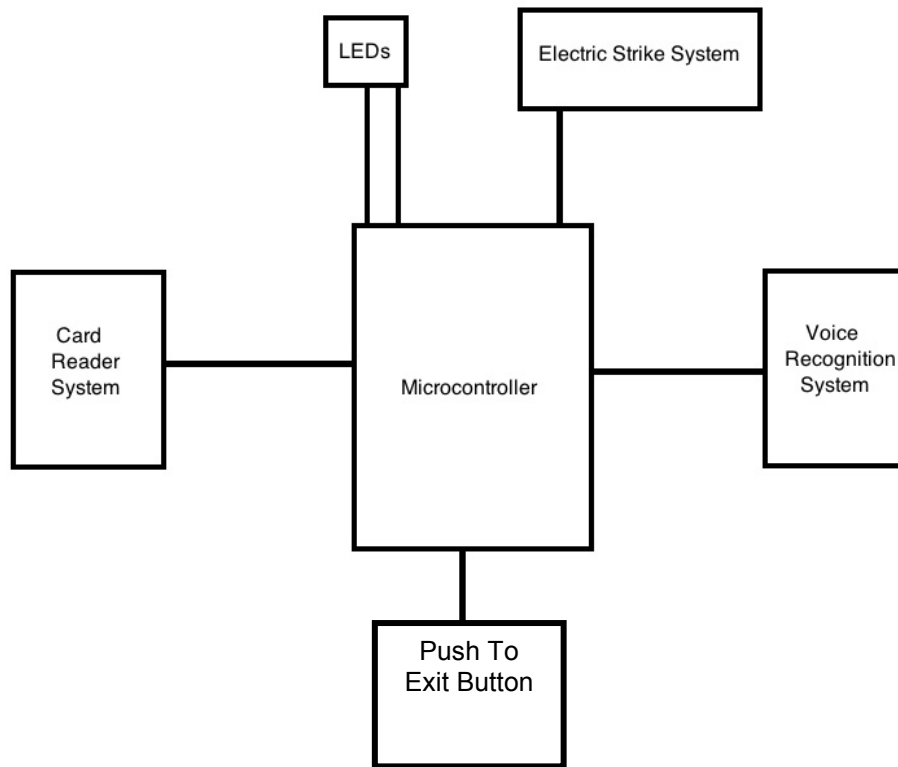
System is fail secure – it will lock in the event of a loss of power condition.

This provides secured door in event of power loss.

Push to exit switch on interior of door will allow exit of personnel via processor.

It is assumed that a one way crash bar exit door will be provided in a room that this system is utilized (in accordance with life safety code); additionally, UPS to be provided at processor location to allow this door to be used as a secondary means of egress.

Microcontroller Block Diagram Research – Christopher Splading:

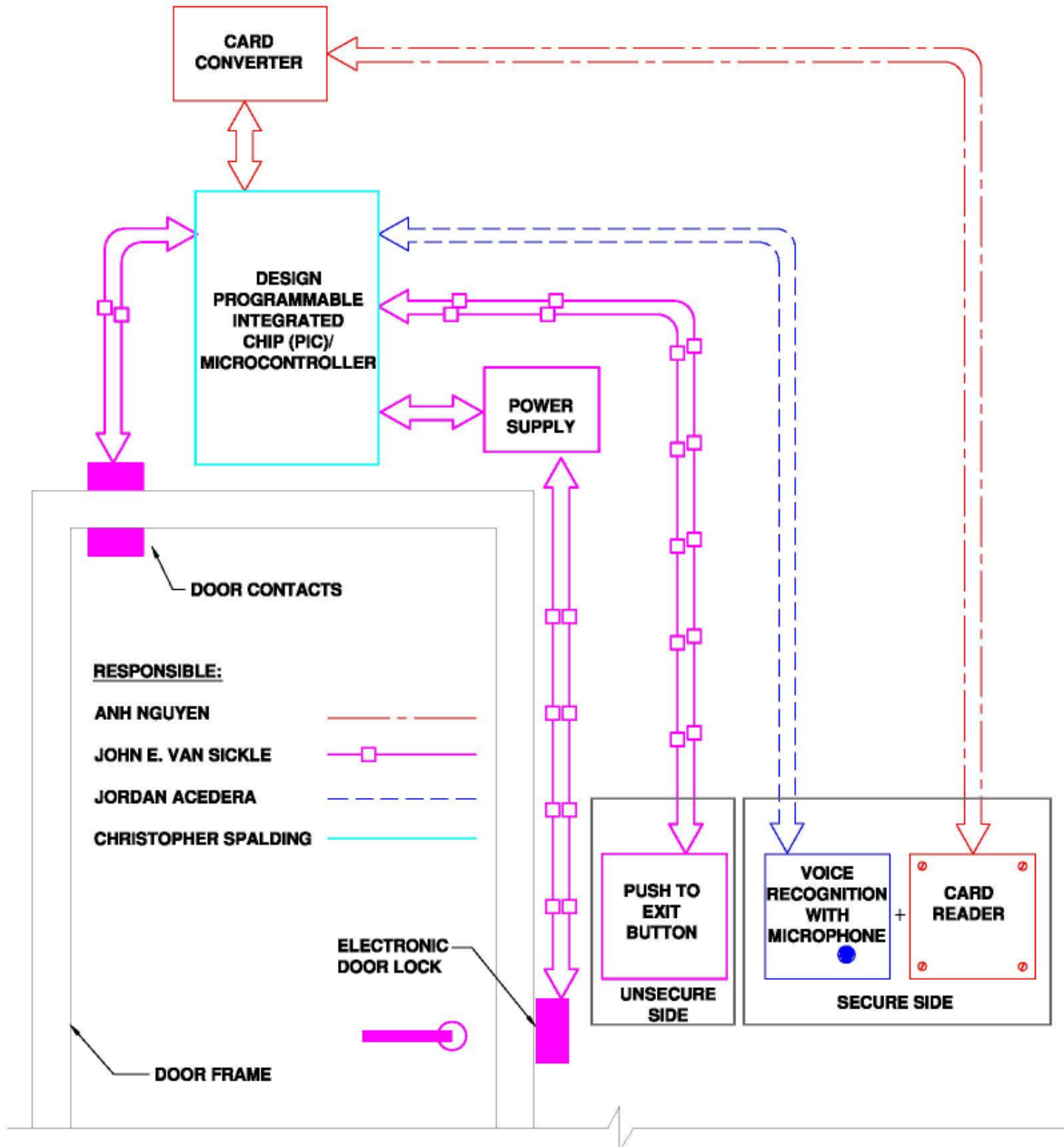


The microcontroller will initially wait for a signal from the card reader system indicating that the RF tag is in range. The microcontroller will then check to make sure the code on the tag matches the preprogrammed code for opening the door. If the codes match, a signal will be sent to light the red LED indicating the correct tag is in range, but the door remains locked. The LED will remain lit until the tag is no longer in range or until a positive voice match has been made. The processor will then wait for a signal from the voice recognition system indicating that a positive match has been made. Upon receiving this signal, the microcontroller will extinguish the red LED, light up the green LED, and send a signal to the locking mechanism to unlock and open the door.

The system will also contain a release button located inside the house. When this button is pushed, the microcontroller will behave as if the correct tag is in range and a positive voice match has been made.

After the door is shut, the system will return to the standby phase as it waits for the tag to come back in range.

Security Hand Free Entry System:



SECURITY HAND FREE ENTRY SYSTEM CONFIGURATION