



SECURITY HANDS FREE ENTRY SYSTEM

“SHES”

GROUP 17



Who is SHES?



Presented by:

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- Advisor: Dr. Samuel Richie
- Mentor: Sean P. Wicks – HDR Inc.
- Sponsor: Workforce Central Florida
- Sponsor: Michael E. McCoy - Stanley Security Solutions, Inc.
- Sponsor: Emma Battaglia - HID Global Corporations.

What is SHES?



- Two-pronged security system for hands-free entry into secured environment
- Easily integrates with existing residential and business security systems
- Brought about by need to improve homeland security

Goals and Objectives



- Implement a system that utilizes both identification card and voice recognition securities
- Easily adaptable to various building systems
- Offers hands-free, keyless entry into a facility with added convenience and security
- The Security Hands-Free Entry System should be easy to use and robust
- Thorough integration of software and hardware disciplines

Motivation



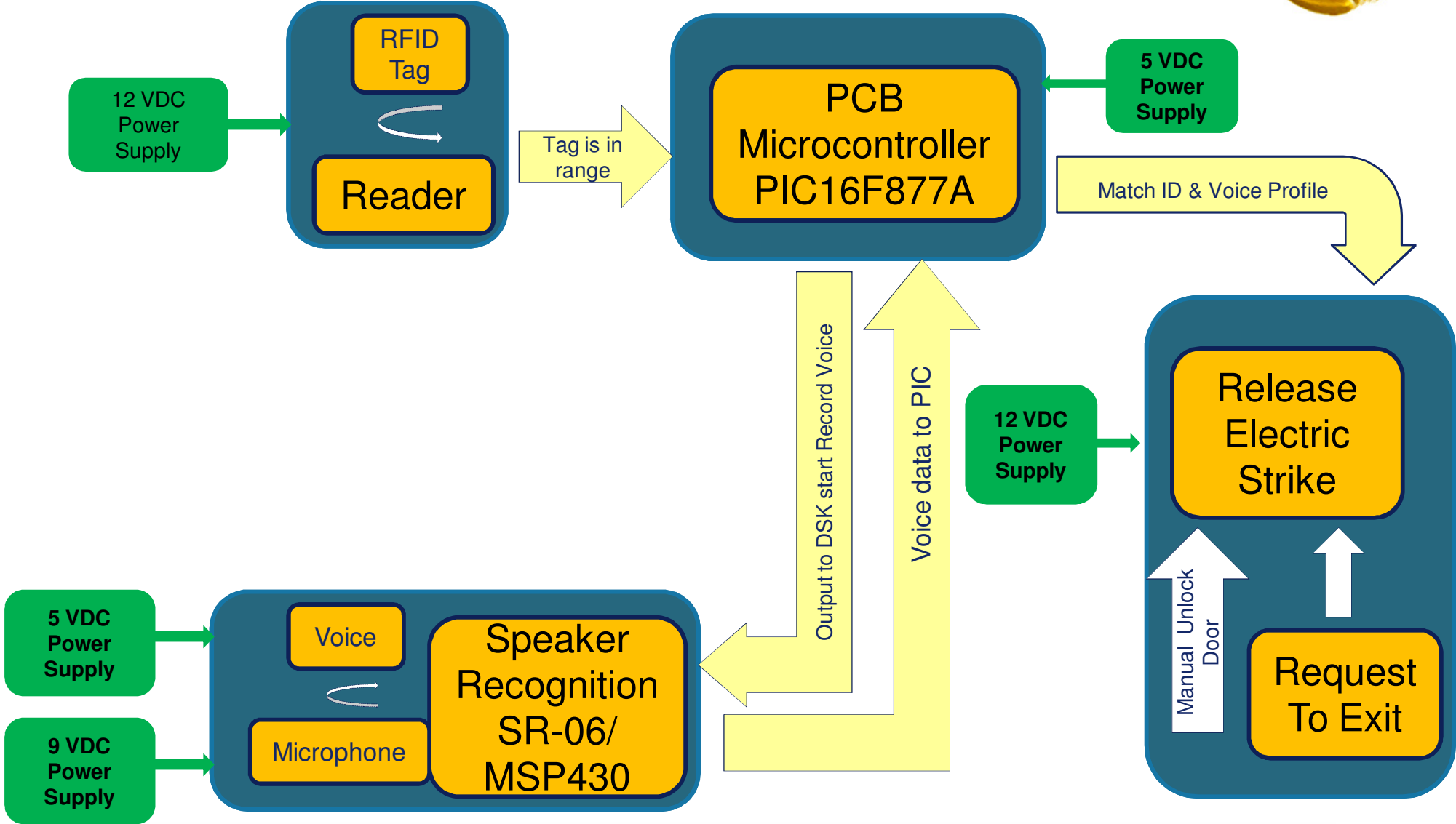
- This project is motivated by the many times when people are hurriedly entering or leaving their residence as they are carrying groceries or boxes which may occupy the use of both hands.
- The product created offers a hands-free entry system that offers protection and can be used in any home or office
- Maintaining personal security should be of the utmost importance. With this proposed solution it will require more effort to obtain the card key and the voice at the same time.

Specifications



- Standard 12V, 9V and 5V power supply units
- Full functionality for 4 user profiles, expandable
- 18 inch range RFID card
- Utilizes C-Programming within Peripheral Interface Controller (PIC) to integrate 3 independently-functioning subsystems

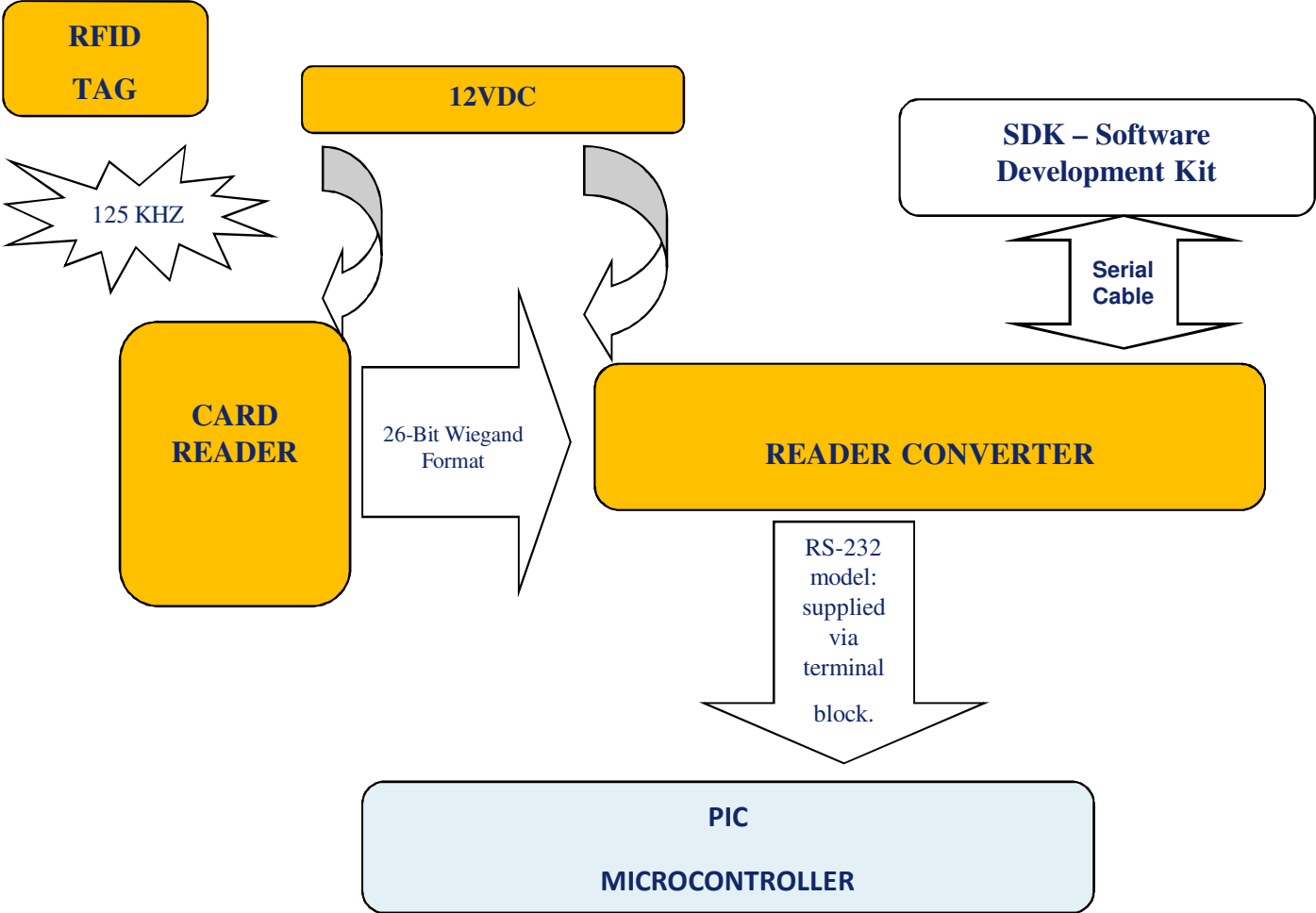
SHES Block Diagram





Card Access System

Block Diagram – Card Access System



Comparison



Reader	Thinline II	MaxiProx	Long Range Reader
Base Part Number	5395	5375	620 Core Module ASR-620XX
Dimension	4.7"x3.0"x.68"	12.0"x12.0"x1.0"	11.2"x11.2"x1.8
Power Supply	5-16VDC	12VDC or 24VDC	12/24VDC
Current Requirement	35mA	200/700 mA @12VDC 260 mA/1.2A @24VDC	1.0A/750 mA
Termination	Pigtall	Terminal Strip	Terminal Strip
Output Formats	Wiegand and Clock and Data	Wiegand, Clock and Data, RS-232, RS-422 and RS-485	Wiegand, ABA Track II
Read Range	Up to 5.5"	Up to 8'	Up to 26"
Tamper	No	Switch	No

Comparison



Card	ProxCard II	iCLASS Prox	FlexCard
Base Part Number	1326	202X/212X; 203X/213X	FPCRD
Read Range			
Thinline II	Up to 5.5"	Up to 5.0"	N/A
MaxiProx	Up to 29.0"	Up to 20.0"	N/A
Long Range Reader			Up to 25"
Memory Size/ Application Area	N/A	2k bits with two applications areas, 16k/2 + 16k/1, 16k/16 + 16k/1	N/A
HID Proximity 125kHz	Yes	Yes	Yes
Contact Smart Chip Module Embeddable	No	Optional	Optional
Wiegand Strip	No	No	No
Magnetic Stripe	No	Optional	No
Printable	Yes	Yes	Yes
Slot Punch	Vertical (standard)	Vertical Optional	Vertical
Visual Security Options	N/A	Yes	Yes
Cost Each	\$2	\$9.19	\$4.25

Reader System Specifications



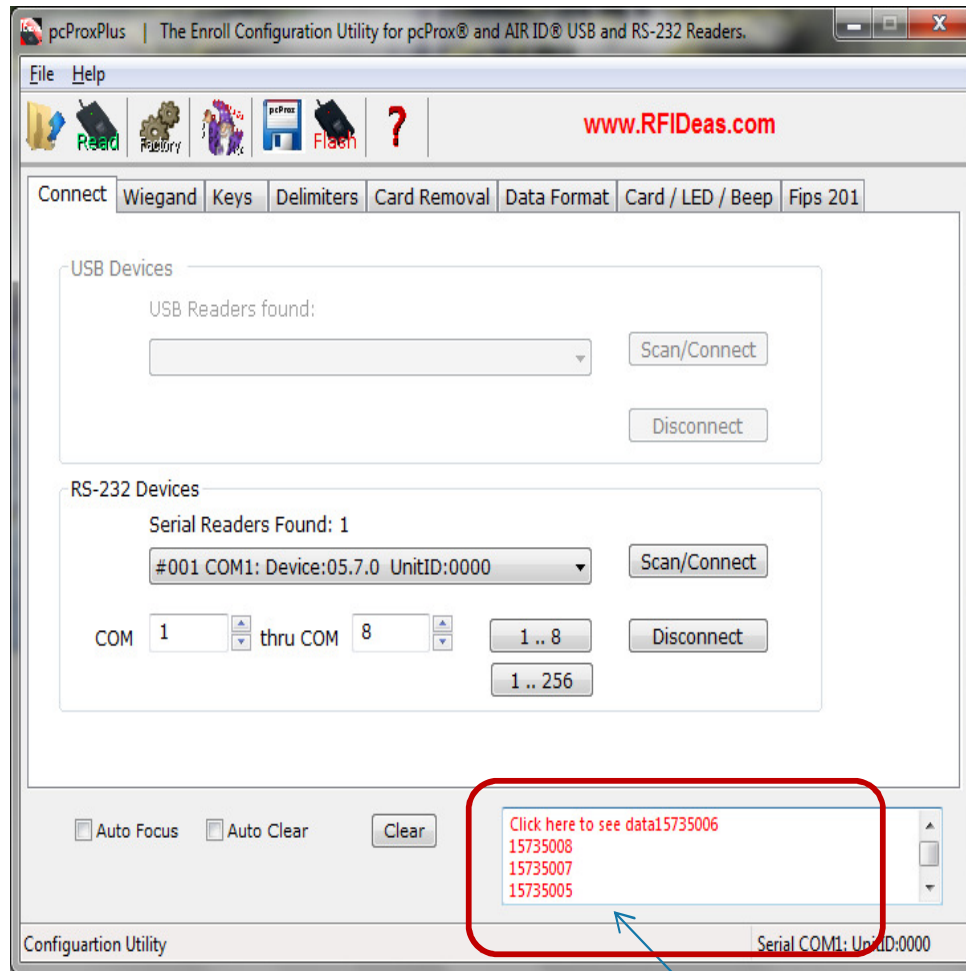
- Prox Card II:
 - a passive RFID
 - carries a set of 26 bit Wiegand number

- MaxiProx 5375 Reader:
 - 125 kHz Long Range reader with maximum 8' range
 - Tamper switch
 - Active the passive card with RF energy
 - Extract information from card, transfer card ID to converter

- A Reader Converter OEM-W2RS232-V3 :
 - Recognize the data and accept or reject card
 - Decode Wiegand format to ASCII string
 - RS-232 communications parameters: 9600 baud, N no parity, 8 data bits, 1 stop bit, no hardware flow control

- 12VDC Power Supply

Converter Interface



- Configure the reader
- Read card data
- Convert data to ASCII code
- Transfer code to PIC

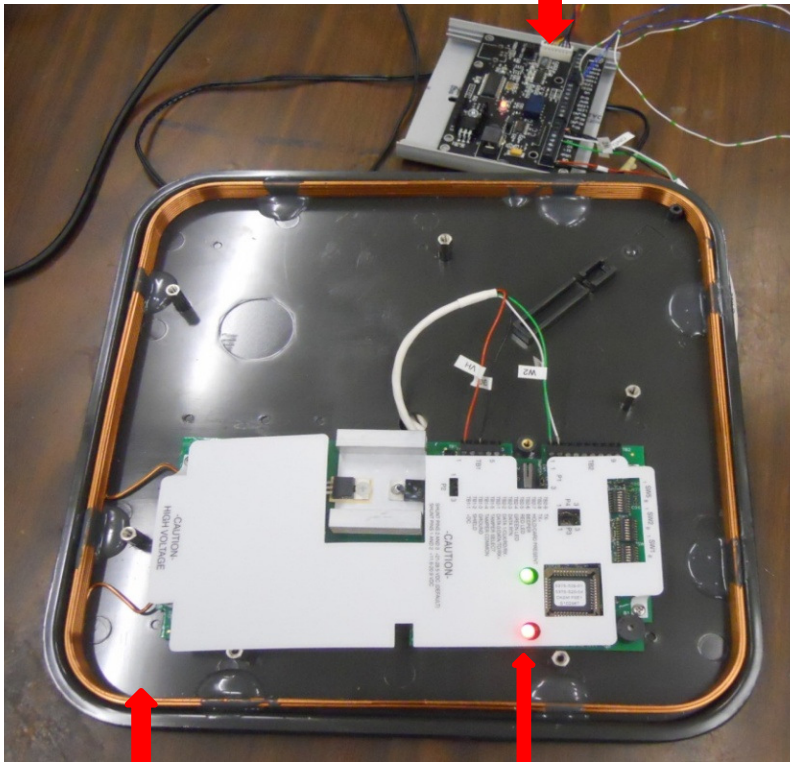
Card Data



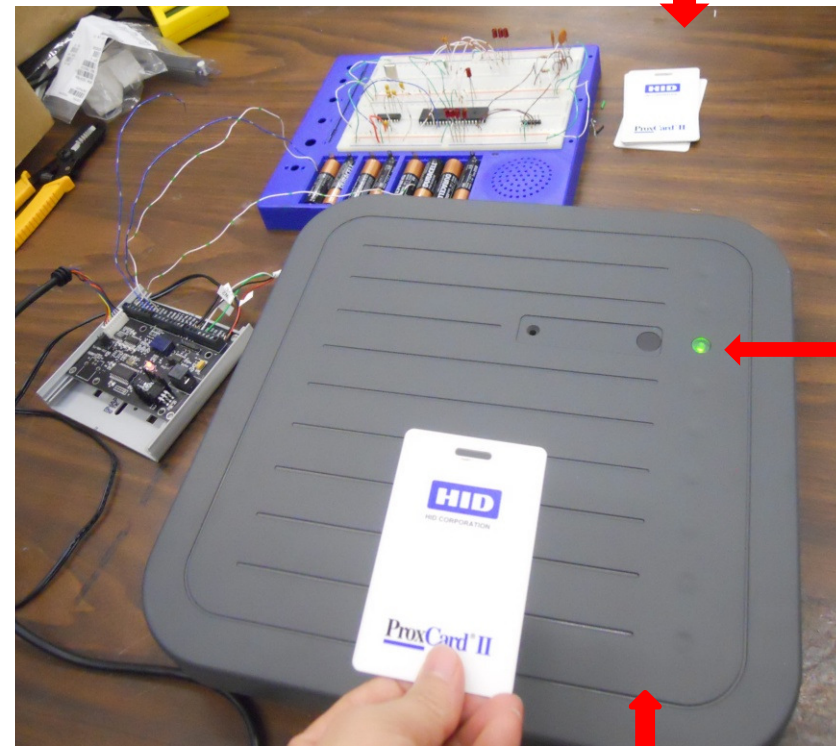
Card Access System Prototype

Reader Converter Board OEM-
W2RS232-V3 2.5"x4.2"x0.975"

Card :2.125"x3.370" x .030"



Interior MaxiProx 5375 Reader LED



LED
11.8" x 11.8" x 1"
MaxiProx 5375 Reader



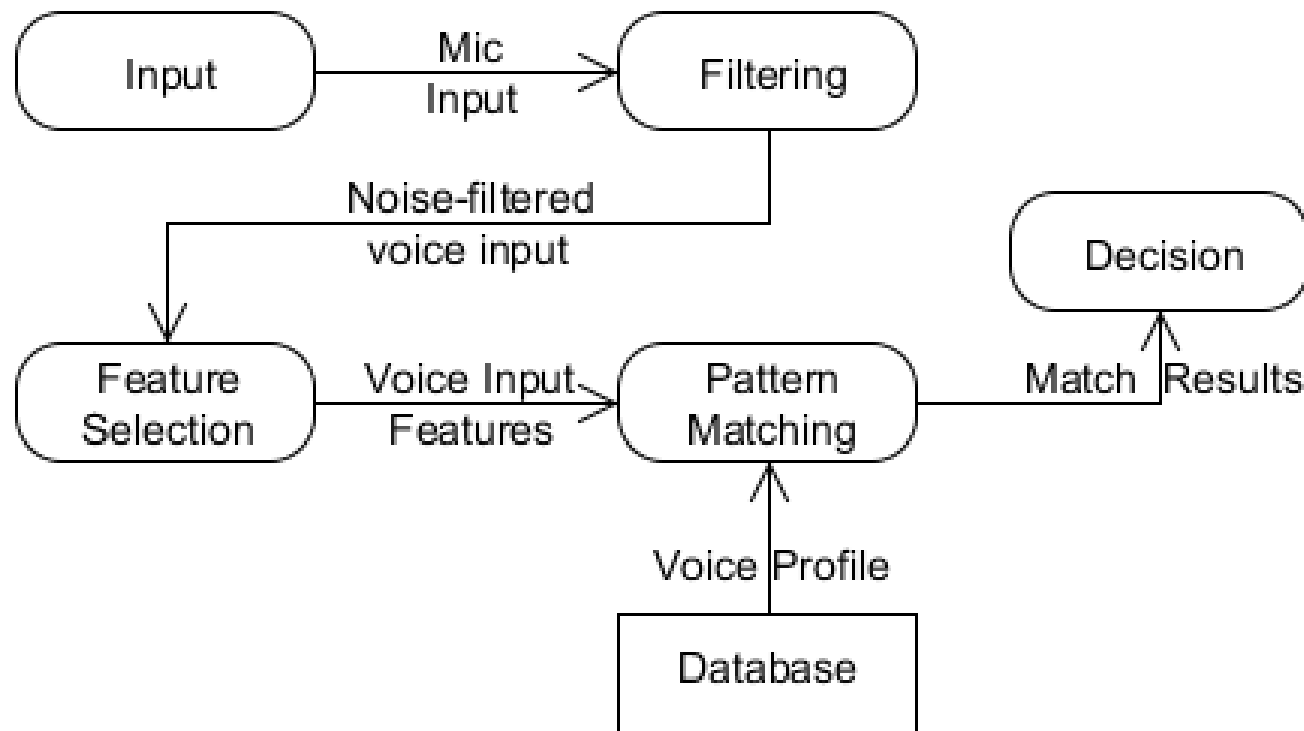
Speaker Recognition System

Introduction to Speech Processing



- **Speaker Recognition** vs Speech Recognition
- **Verification** vs Identification
- **Text-Dependent** vs Text-Independent

Block Diagram – Speaker Recognition



Speaker Recognition Requirement



- Process input voice data in the real time
- Store voice profile data for multiple users
- Accuracy in verification

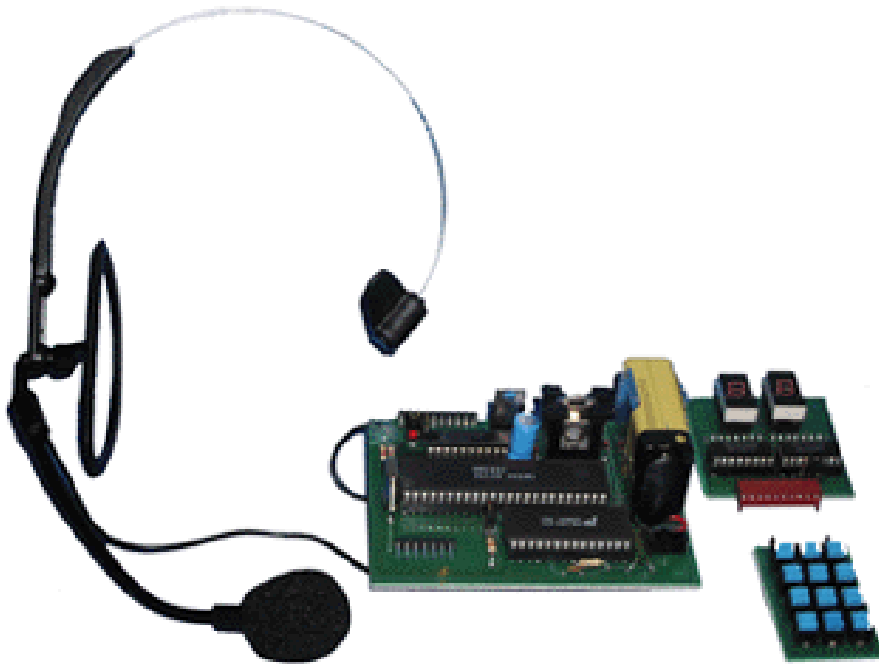
Comparison and Considerations



<u>Device Name</u>	MSP430G2553 MCU EVM	TMS320VC5510A DSP	SI SR-06
Max Operating Frequency	16 MHz	200 MHz	3.58 MHz
RAM	512 B	320 KB (expandable +NVRAM)	64 KB (external)
ROM	16 KB	32 KB	N/A
IO Pins Available	14	13 (software set)	8 (output only)
Price (USD)	4.30	395.01	114.95

- Motivation for selecting MSP430 derived from previous [DIY project](#)
- MSP430 cannot perform feature selection or pattern matching
- Previous experience with DSP proves that it is fairly difficult to program and set up
- Selected combination of SI SR-06 and MSP430G2553 MCU EVM

SR-06 Specifications



SI SR-06

- 9V battery-powered
- 8-pin binary output to 2-digit LCD 7-seg. display w/ driver
- 4x3 pushbutton array (0-9 w/ train and clear buttons)
- LCD Display and pushbutton array are detachable
- Standard 3.5 mm microphone jack
- Can store up to 40 unique passphrases
- Can store up to 1.92 seconds per passphrase

MSP430G2553 Specifications



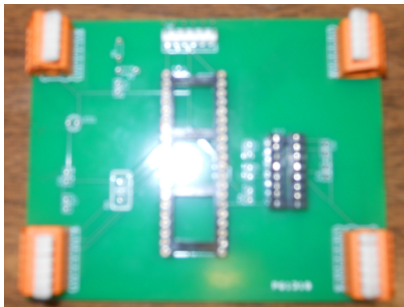
MSP430 Launchpad

- 14-/20-pin DIP (N) socket
- Built-in flash emulation for debugging and programming
- 2 programmable LEDs
- 1 power LED
- 1 programmable button
- 1 reset button
- USB connection to interface with PC

Voice Recognition System



PCB PIC

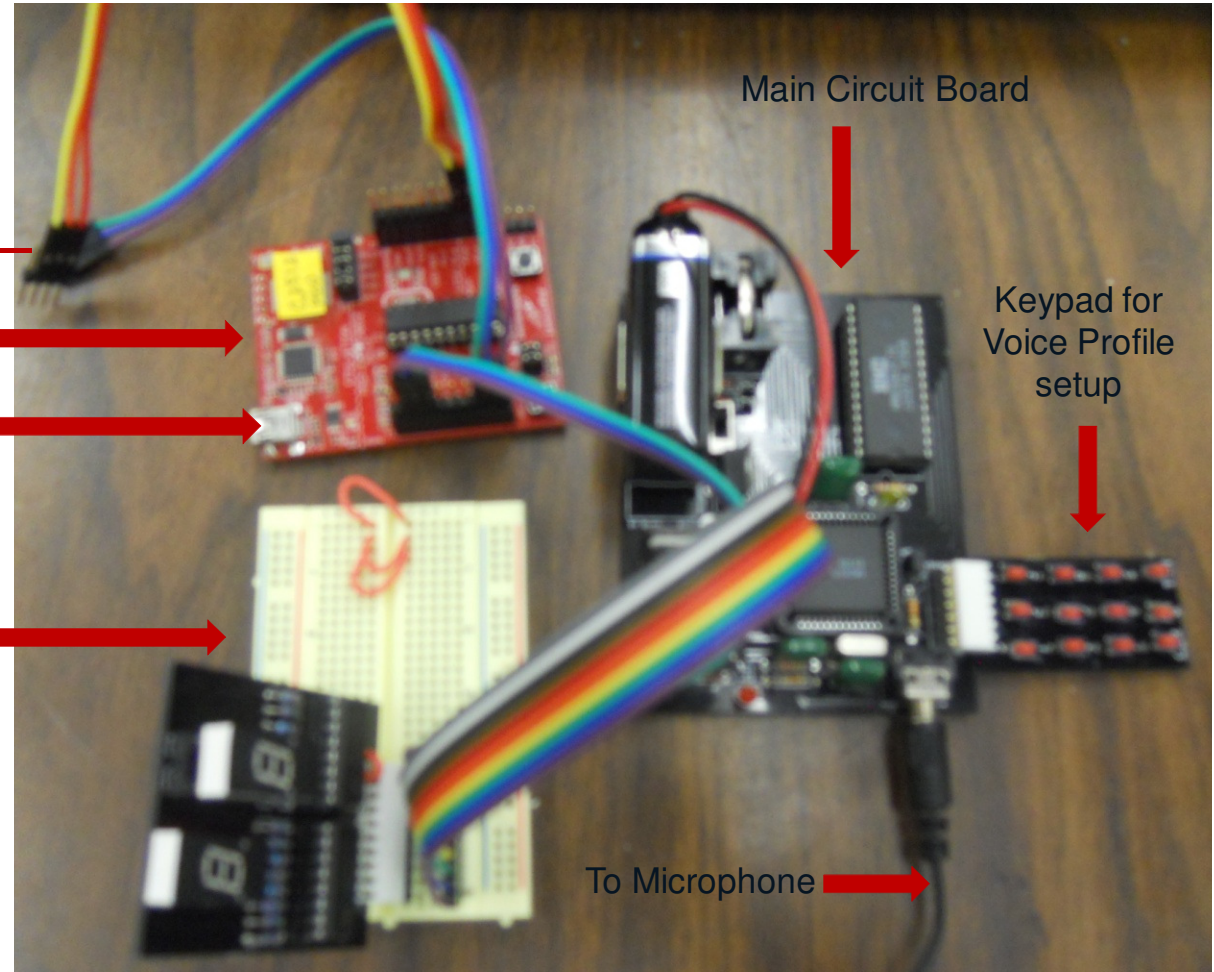


3 Input
3 Output

MSP430

USB to PC for
programming
matching ID

Display Board
for voice profile
setup



Main Circuit Board

Keypad for
Voice Profile
setup

To Microphone

SPEAKER RECOGNITION

Basic Operation

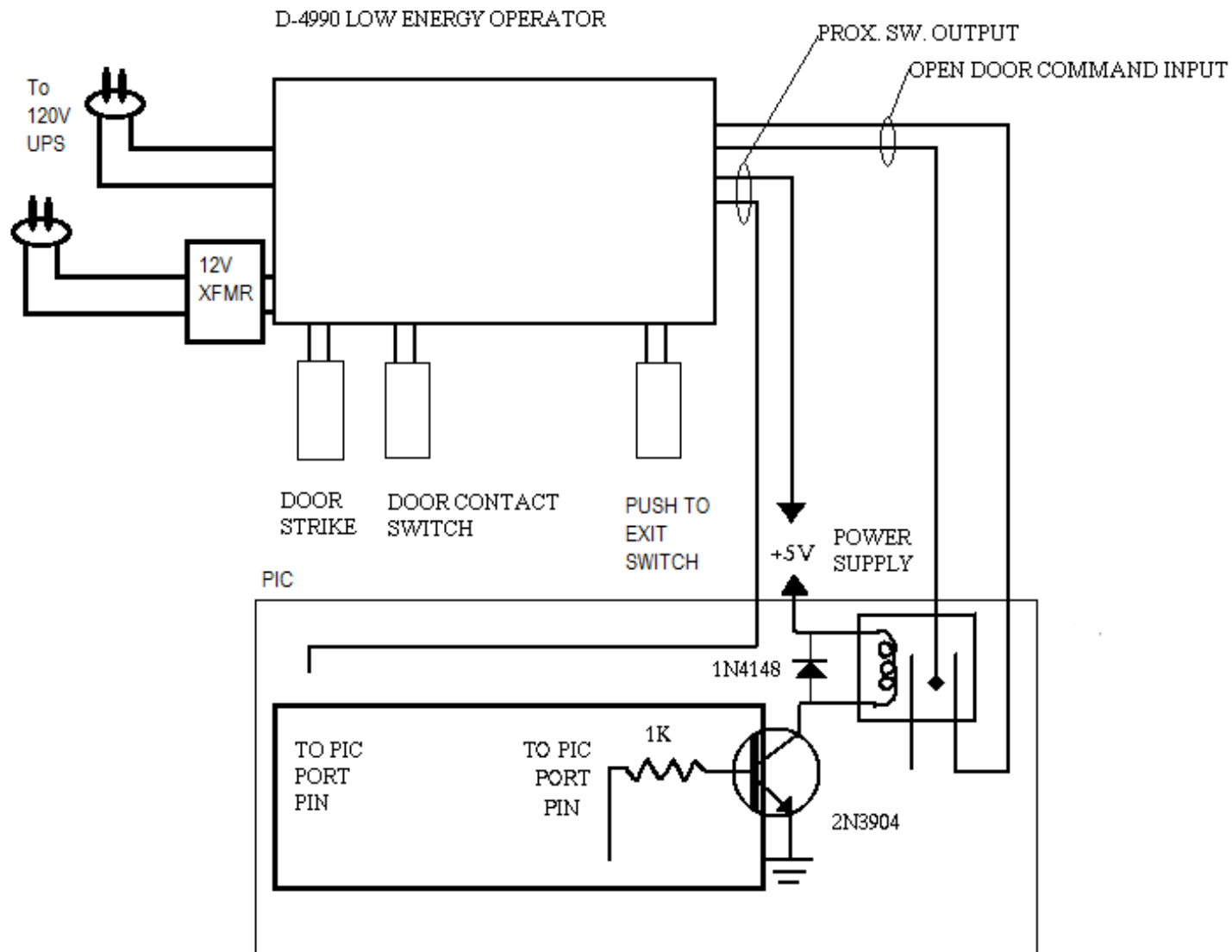


- Using ID from PIC, retrieve voice profile data
- Record voice using microphone
- Select features and perform pattern matching
- Output match result to PIC



Electronic Door Lock

Block Diagram – Electronic Door Lock



Electronic Door System Functions



- Dependent or independent operation
- From the system, ability to open the door without having to insert a key or turn a knob
- Without integrated system, can manual open or closed the door by pushing a button.

Comparison



Type of Security	Manufacturer / Part Number	Cost	Concern	Voltage	Image
Electric Strike	Hes / 5000 Series Heavy Duty Electric Strike Body	\$80.00	Breakaway Static strength 1,500 lbs. Dynamic strength 70 ft-lbs.	12/24V 450mA/ 225mA	
Magnetic Lock	Seco-larm / E-941SA- Electromagnetic Lock	\$85.00	Security - Loss of Power 1200 lbs Holding Force	12/24V 500mA/ 250mA	
Electric Lock (Pin Type)	Von Duprin / 050535 EL Solenoid Plunger	\$164.00	Safety - Loss of Power	24V 500mA	

Electronic Door System Specification



- Electric Strike:
 - 12 VDC @ 0.5A
 - Fail Secure
- Door Position Switch:
 - Normally Open Magnetic Contact
 - Recessed Mounted – Concealed
- Request to Exit Switch:
 - N.O. Contacts
 - Clearly marked EXIT device
- Door Assembly
 - 3' wide half door construction
 - Relay Circuit to PIC
- The D-4990 Low Energy Operator
 - 115 VAC \pm 15% 60Hz
 - Built-in Controller

Door System Prototype



SECURE SIDE (EXTERIOR)



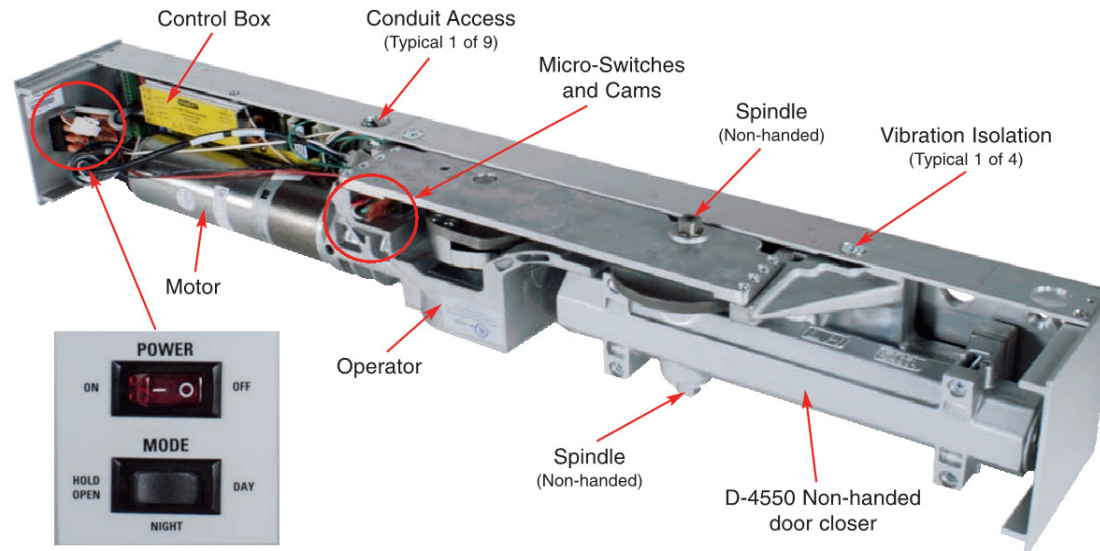
UNSECURE SIDE (INTERIOR)



OPENING VIEW



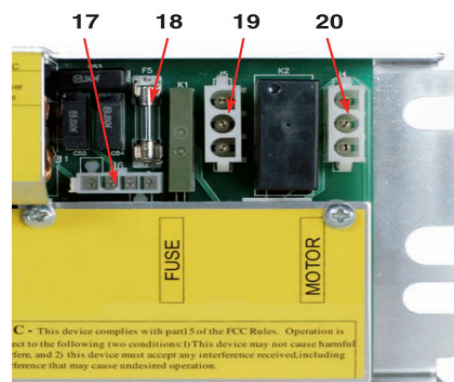
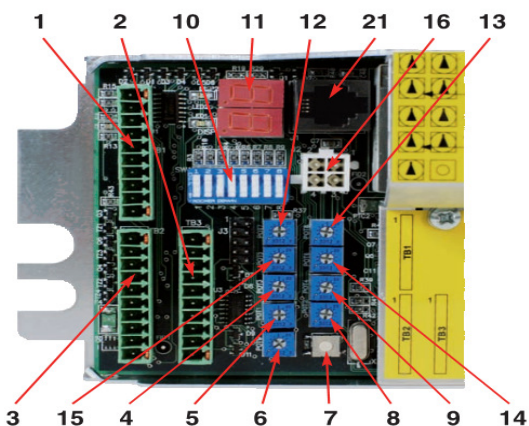
D-4990 LOWER ENERGY OPERATOR



Close up of switch face (shown on opposite side)



Controller



Switch Setting

SETTING	ON	OFF
1. Electric strike logic	fail secure	fail safe
2. Electric strike	enabled	disabled
3. PUSH side/PULL side	PULL side	PUSH side
4. PUSH and GO	enabled	disabled
5. Power close	enabled	disabled
6. N/A		
7. N/A		
8. N/A		

1. TB-1
2. TB-3
3. TB-2
4. Pot #3 not used
5. Pot #1 Hold open time 0-28 seconds. Must be a minimum of 5 seconds after door fully open
6. Pot #9 Vestibule time delay
7. Self test button
8. Pot #2 Full open position adjustment
9. Pot #4 Stall force
10. DIP switches (See chart above)
11. Digital readout
12. Pot #7 opening torque, only needs changed for use on heavier doors
13. Pot #8 not used
14. Pot #6 open sweep speed
15. Pot #5 open check speed
16. Encoder plug input
17. AC power in
18. Fuse
19. N/A
20. Motor socket
21. N/A



PIC Microcontroller

Comparison

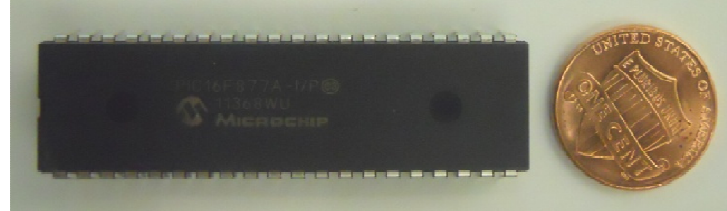


Microcontroller	Pin Count	Advantages	Disadvantages
TI MSP430G2231	14 (10 I/O)	<ul style="list-style-type: none">- Free support- Free software- Ample documentation	<ul style="list-style-type: none">- Limited I/O pins- No support for RS232 communication
Atmel AVR ATmega8	28 (23 I/O)	<ul style="list-style-type: none">- Active community of users- Supports RS232 communication	<ul style="list-style-type: none">- Concern regarding number of I/O pins
Microchip PIC16F877A	40 (33 I/O)	<ul style="list-style-type: none">- Ample I/O- Supports RS232 communication- Free software	<ul style="list-style-type: none">- More features than needed

PIC16F877A Specifications



- Operating Speed: DC – 20 MHz clock input
- Up to 8K x 14 words of Flash Program Memory
- Up to 368 x 8 bytes of Data Memory (RAM)
- Up to 256 x 8 bytes of EEPROM Data Memory
- Wide operating voltage range (2.0V to 5.5V)
- I/O Ports:
 - A (6 pins)
 - B (8 pins)
 - C (8 pins)
 - D (8 pins)
 - E (3 pins)

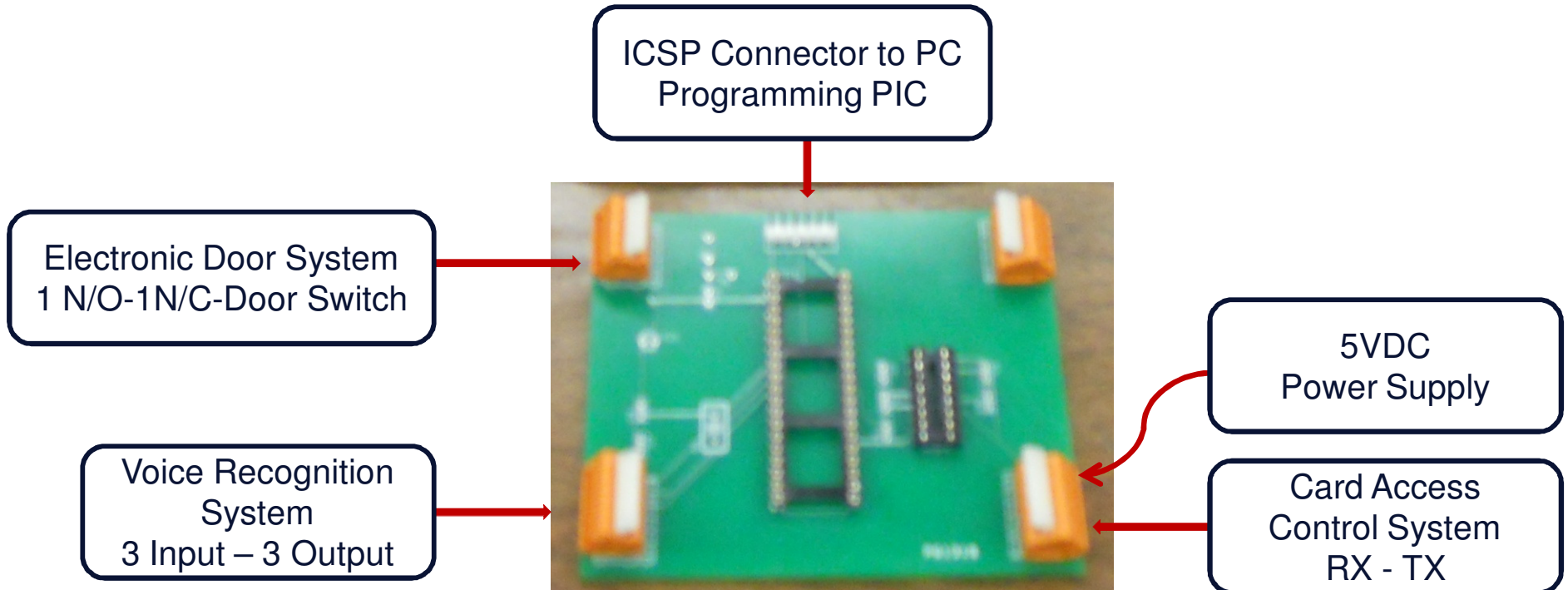


PIC16F877A Project Functions



- The PIC is the “brain” of the project
- PIC will serve as the driving force for the Reader, Speaker Recognition and Electronic door
- Programming
 - `configure();`
 - `waitForCard();`
 - `waitForVoice();`
 - `operateDoor();`
- Read the incoming data and decide what to do
 - Incoming data from Reader System
 - Incoming data from Speaker Recognition
- Output
 - To initialize the Speaker Recognition
 - Release the door relay

PCB Connections





Administrative

Project Schedule



SCHEDULE-SD2

Date	Anh Nguyen	Jordan Acedera	Christopher Spalding	John E. Van Sickle
01/15/2012	Review Introduction/ Cost Analysis and Block Diagram Description	Review Verifications, Testing Procedures, Block Diagram	Review: Introduction/Block Diagram Description	Review: Introduction/Block Diagram Description
01/16/2012	Order RFID Reader System,	Order Speaker Recognition	Order PIC Microcontroller	Order Electric Door Lock
02/16/2012	WCF/Mentor Meeting	WCF/Mentor Meeting	WCF/Mentor Meeting	WCF/Mentor Meeting
02/28/2012	CDR Presentation	CDR Presentation	CDR Presentation	CDR Presentation
03/13/2012	Midterm Projection Demonstration	Midterm Projection Demonstration	Midterm Projection Demonstration	Midterm Projection Demonstration
03/26/2012	WCF/Mentor Meeting	WCF/Mentor Meeting	WCF/Mentor Meeting	WCF/Mentor Meeting
04/05/2012	WCF/Mentor Meeting	WCF/Mentor Meeting	WCF/Mentor Meeting	WCF/Mentor Meeting
04/12/2012	Final Presentation	Final Presentation	Final Presentation	Final Presentation
04/18/2012	Finished SD2 Paper	Finished SD2 Paper	Finished SD2 Paper	Finished SD2 Paper

Project Budget



Parts	Quantity	Unit Price	Price
Card reader			
Long Range Reader	1	450.00	450.00
Tag	4	15.00	60.00
Power Supply	1	25.00	25.00
Reader Converter	1	181.70	181.70
Miscellaneous	1	100	100
Sub Total			816.70
Door Hardware			
Magnetic contact/prox switch	1	Free	Free
Electrified Hinge	1	201.08	Free Rent
Push to exit switch -	1	15	15
Low Energy Operator D4990	1	3899	Free Rent
Electric Strike	1	55	55
Door Assembly	Assy	340	340
Power/Cable	1	20	20
Miscellaneous	1	298.35	298.35
Sub Total			\$728.35

Parts	Quantity	Unit Price	Price
Microcontroller			
Programable Circuit Board	1	39.60	39.60
PIC16F877A	2	24.00	48.00
PCB Assembly	1	200.00	200.00
Sub Total			287.60
Voice Recognition			
TMS320VC5510 DSP Starter Kit	1	395.00	395.01
SoftBaugh ES449 Demo Board	1	199.00	199.00
MSP430 LaunchPad	1	4.30	4.30
SR-06	1	1	115.00
Miscellaneous	1	1	485.00
Sub Total			1198.30
Total			\$3030.95

Successes and Improvements



■ Successes

- Integrate system all together
- Differentiate between voice profile almost 75% of the time
- Differentiate between each RFID card

■ Improvements

- Long range microphone
- More accurate speech processing
- Increase the number of user
- Combine door relay on PCB



Question ?