Voice Recognition Project
Team #3

ECE 411 Practicum

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Overview of Problem

- Adolescents want to secure small items in their home but can not find anywhere to do so.
- Must be secure enough for small keepsakes, diaries, etc.
- Not a high security system.
- Must be secure and trendy.

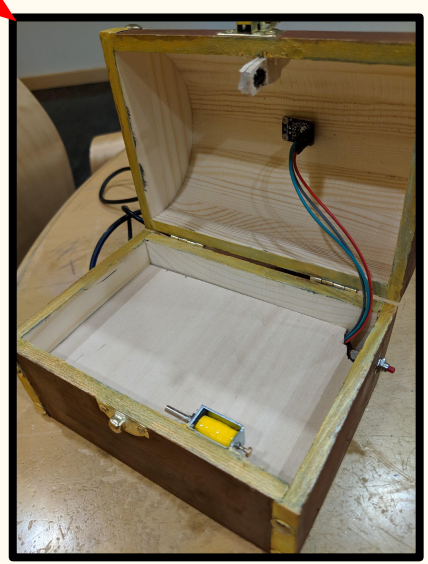
Project Choice Decision Matrix

	Option 1 - Voice Activated Lock Box	Option 2 - Theremin Lock	Option 3 - Ocarina Lock	Option 4 - Rhythm Lock
Doability (Hardware)	8	7	8	4
Doability (Software)	5	5	7	6
Affordability	8	6	6	5
Interest	9	5	8	5
Prior Experience	7	5	6	4
Sum	**37**	**28**	**35**	**24**
Rank	**1**	**3**	**2**	**4**
Status	Chosen	No	No	No

Concept of Operation - Voice Activated Lockbox

1. Locked state: Solenoid keeps lid closed.
2. User input: Password spoken into microphone
3. Device output: Solenoid retracts and box is open
4. User input: Close box, press reset switch, solenoid engages lock.

User Input: “Shore”



Level 0 Block Diagram

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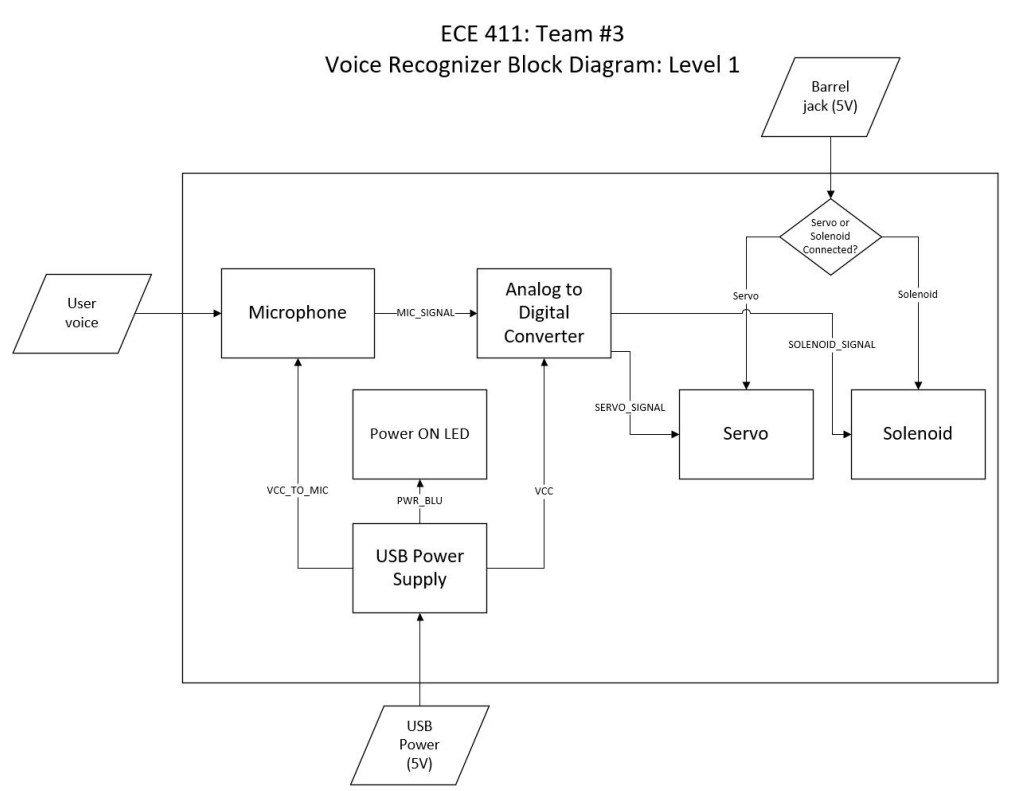
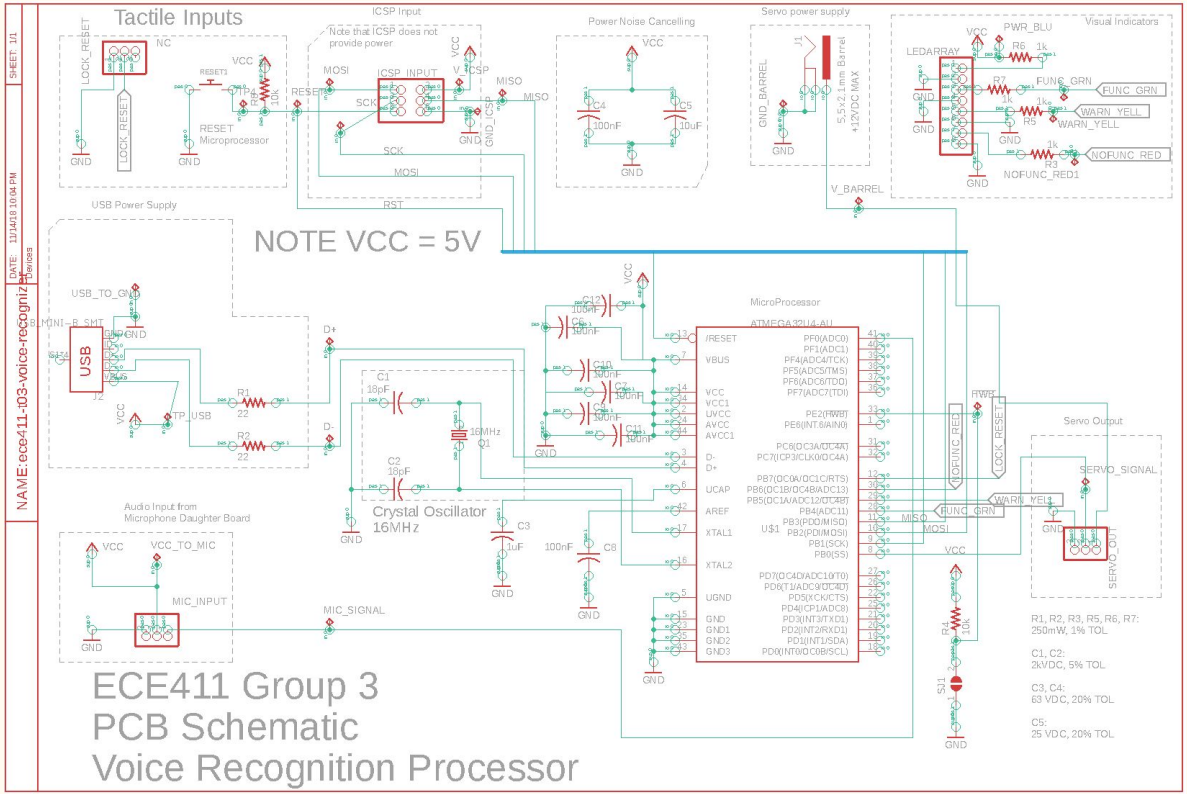
Voice Recognizer Block Diagram: Level 0

Module	Password proteched lock box
Inputs	User voice USB power (5V) Servo power/solenoid power (5V wall wart)
Outputs	LED activation: blue power LED indicates that product is powered. Servo activation: servo motor activates to rotate arm and allow box to be open unimpeded. **-OR-** Solenoid activation: solenoid plunger slides into solenoid body.
Functionality	Allows user to place keepsakes in locked box. Box unlocks when correct passphrase is spoken.

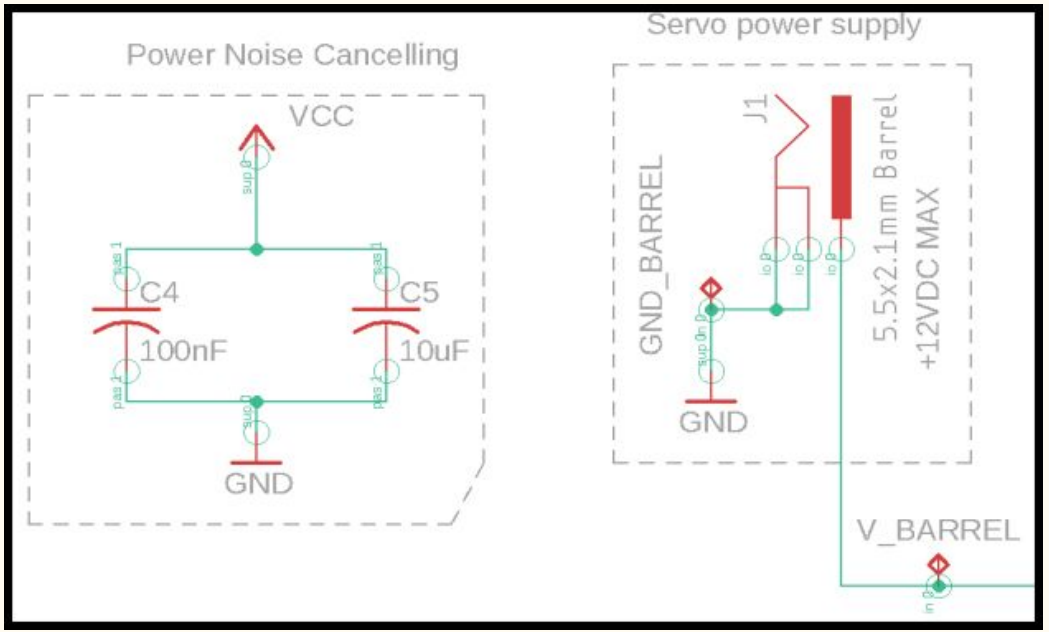
Level 1 Block Diagram

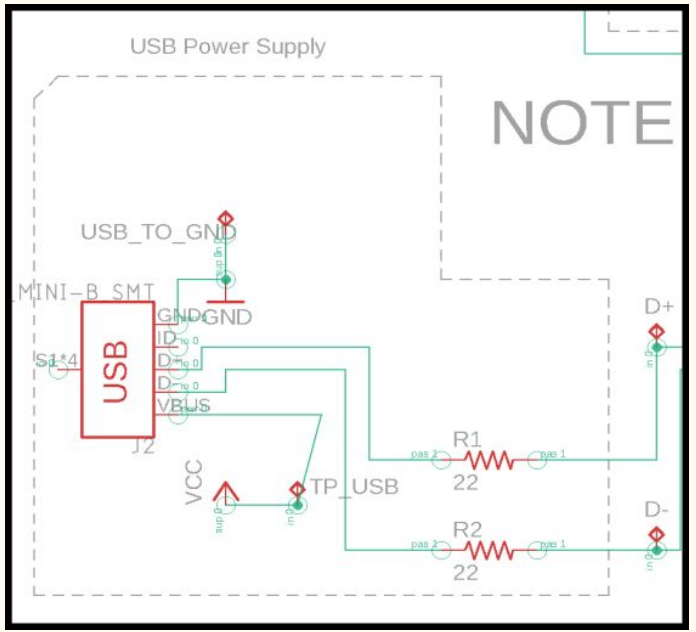


Overview of Schematic - Full Picture

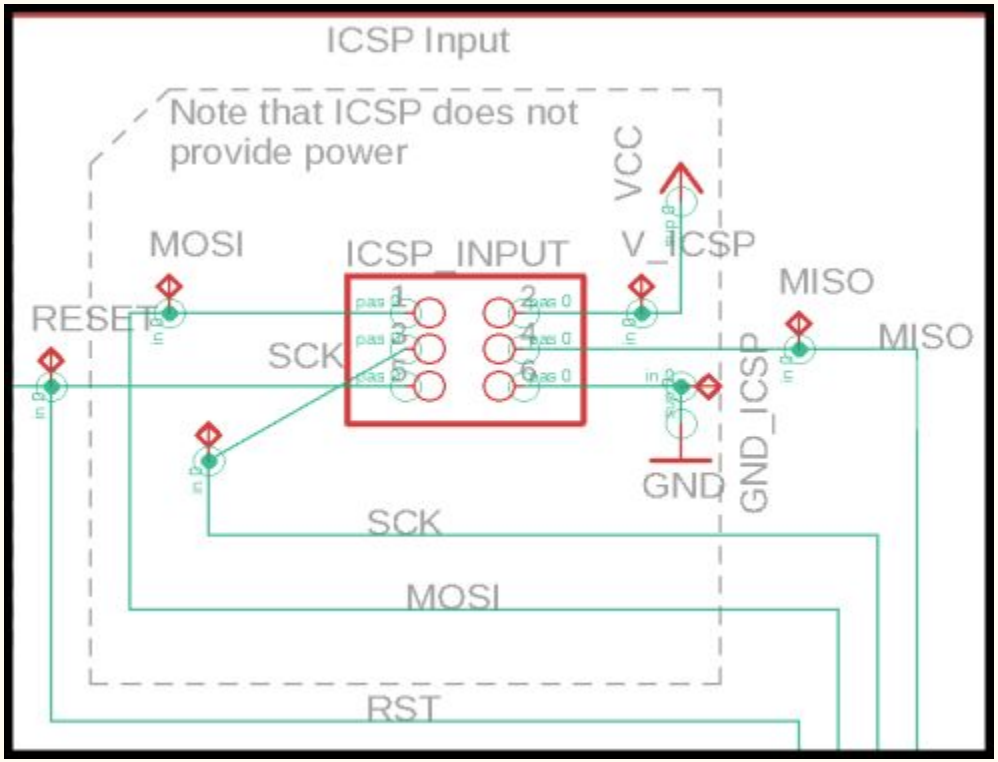


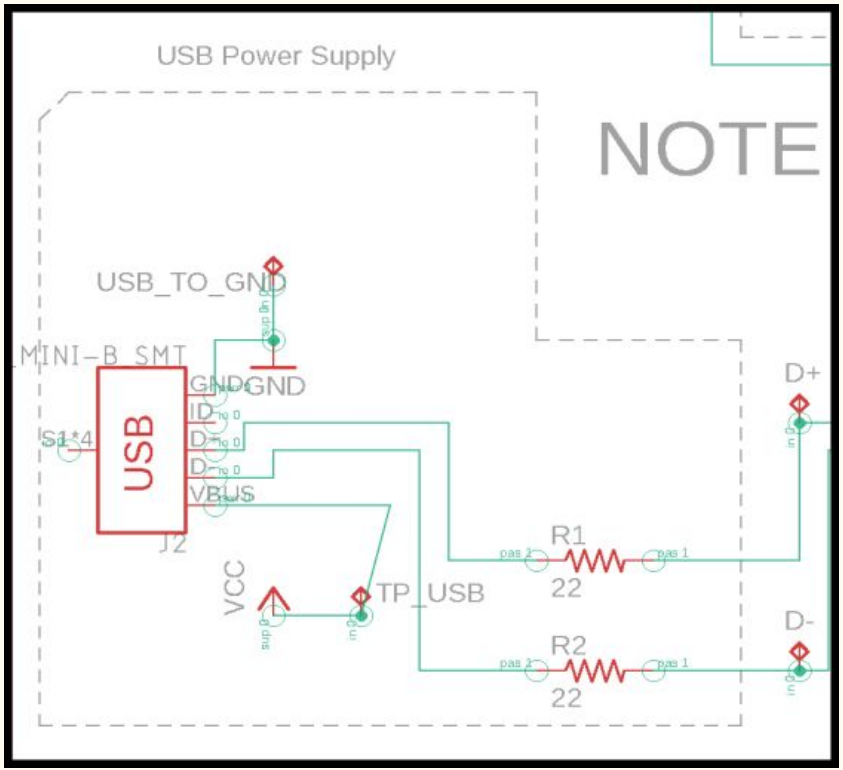
Overview of Schematic - Power



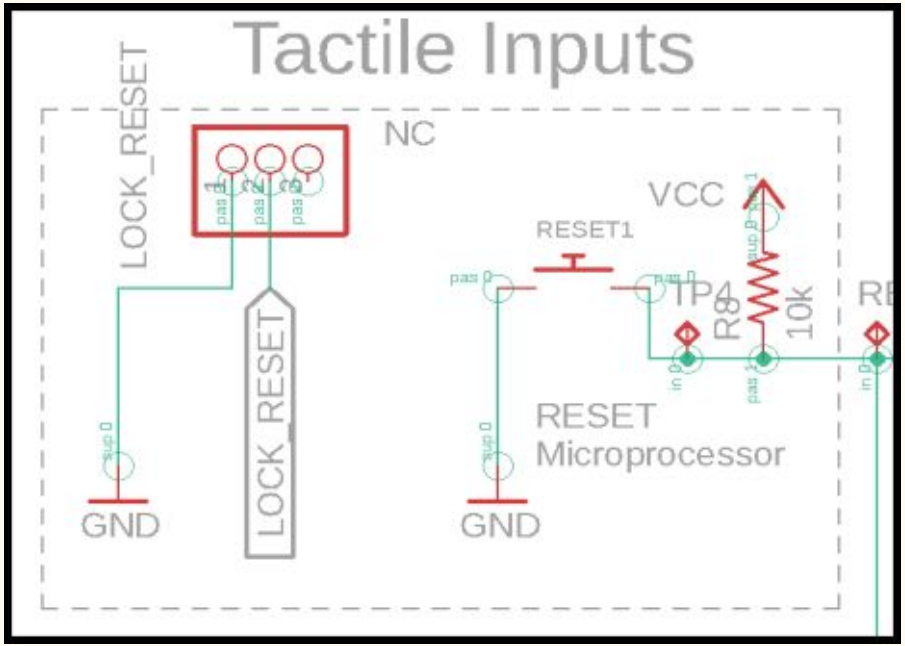


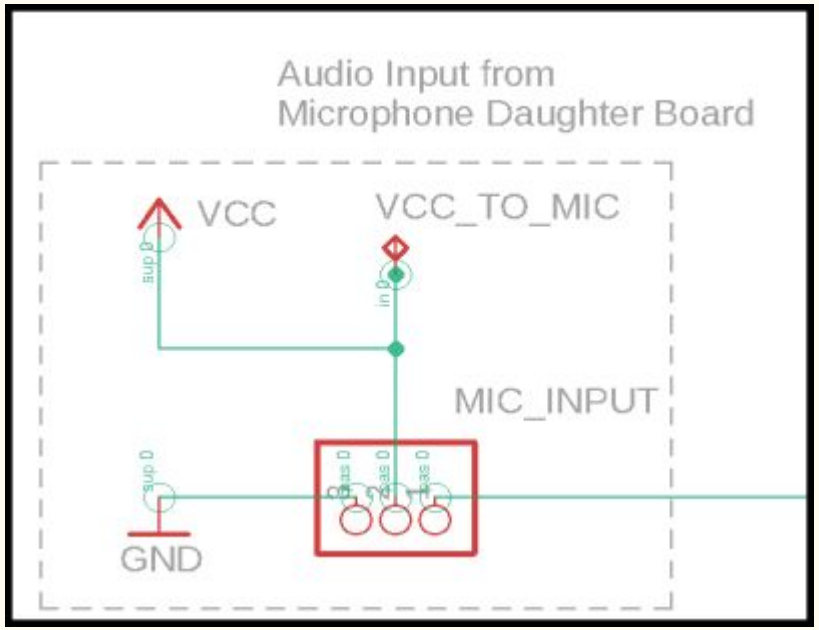
Overview of Schematic - Programming Interface



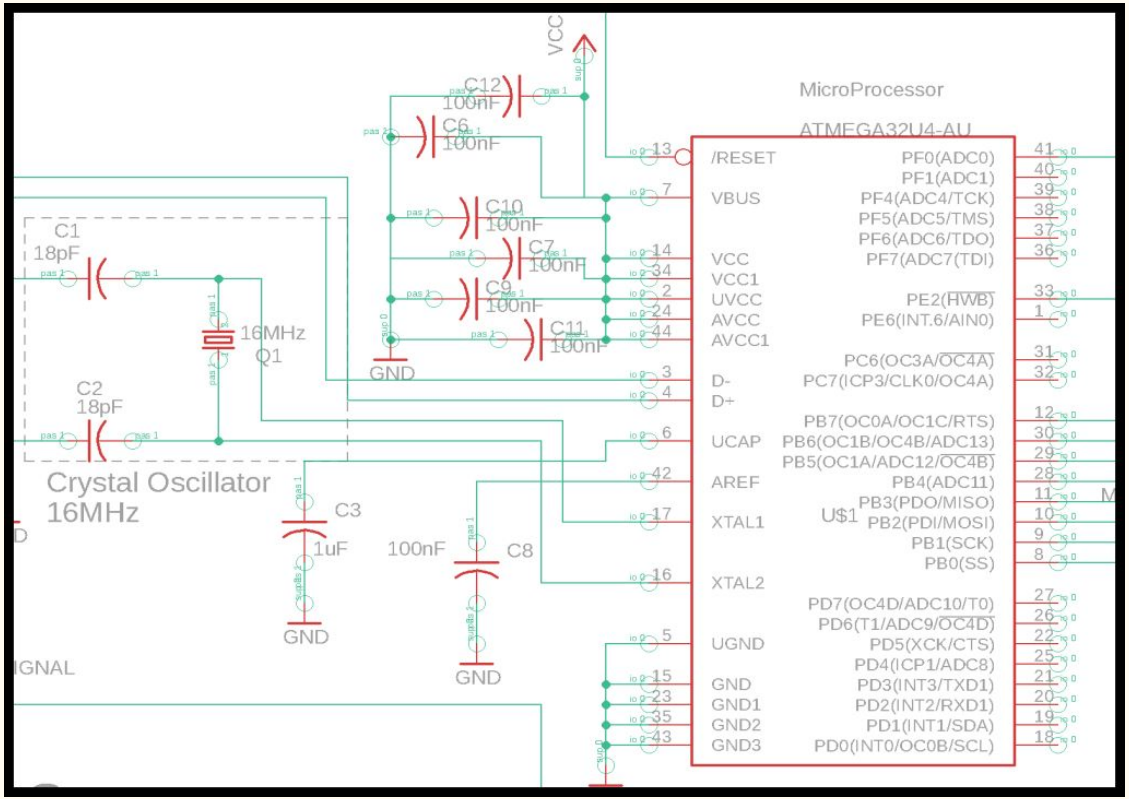


Overview of Schematic - Inputs

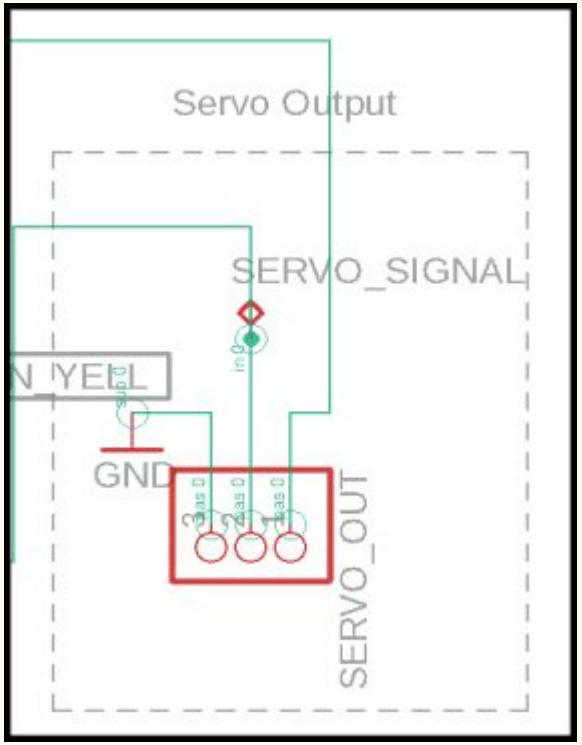


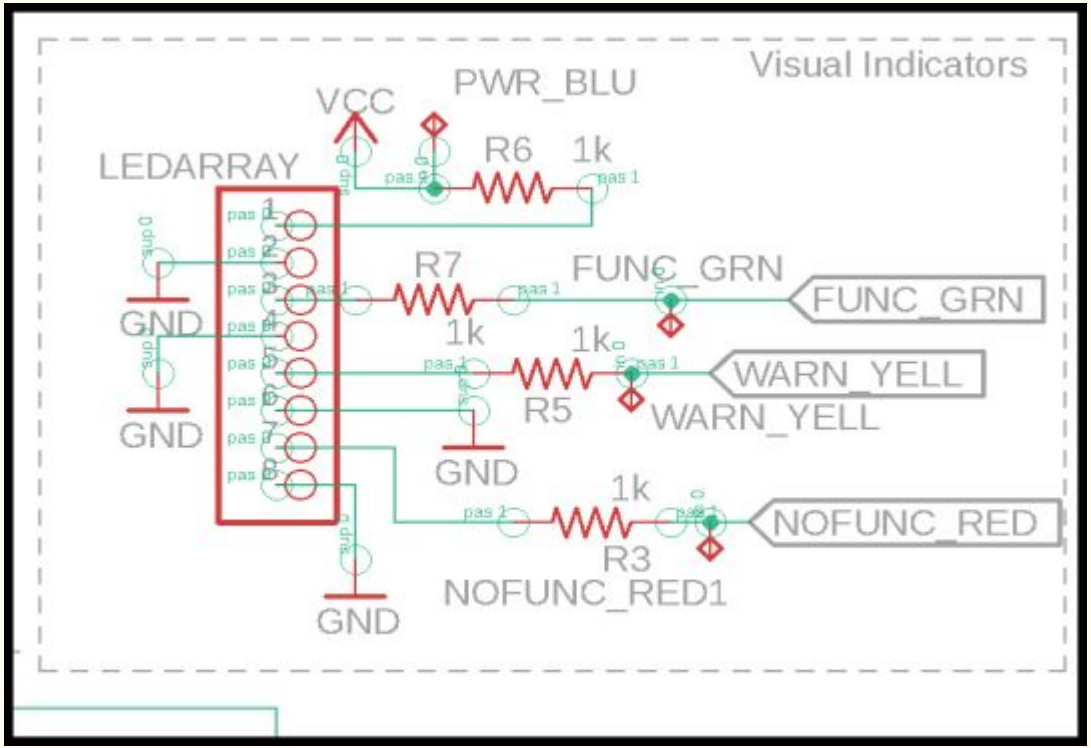


Overview of Schematic - Processor

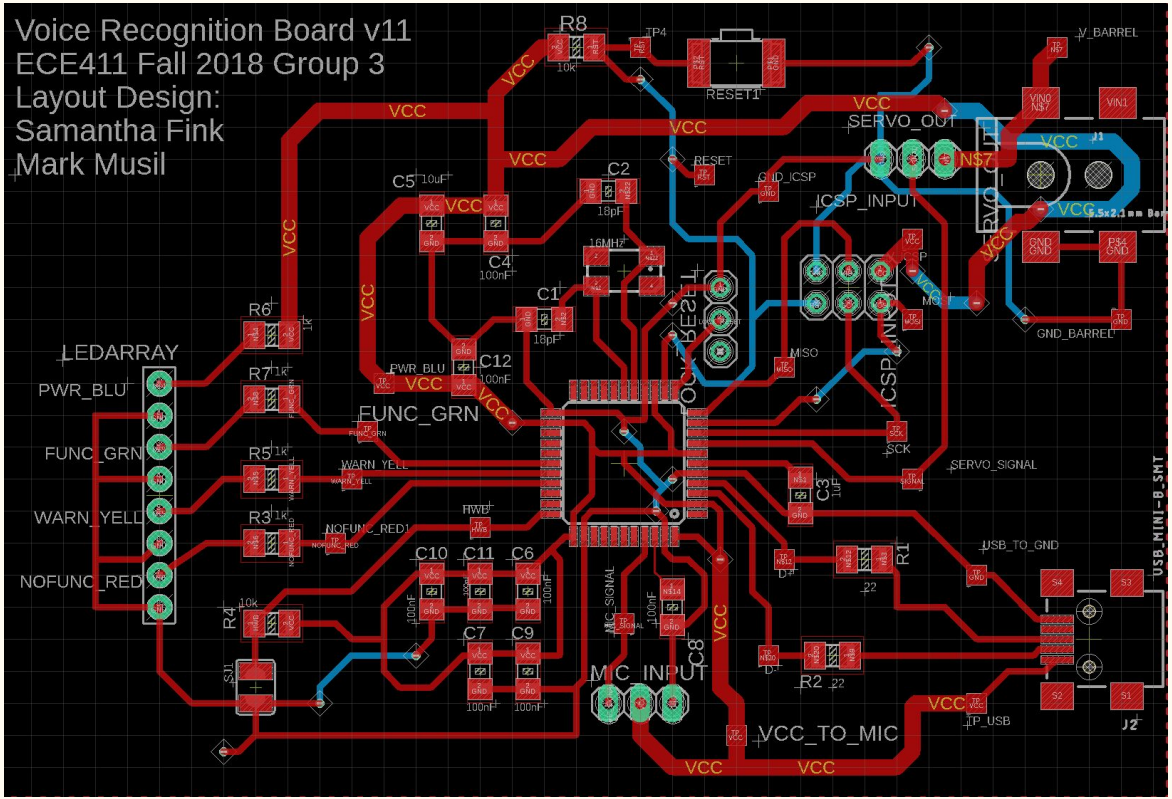


Overview of Schematic - Outputs

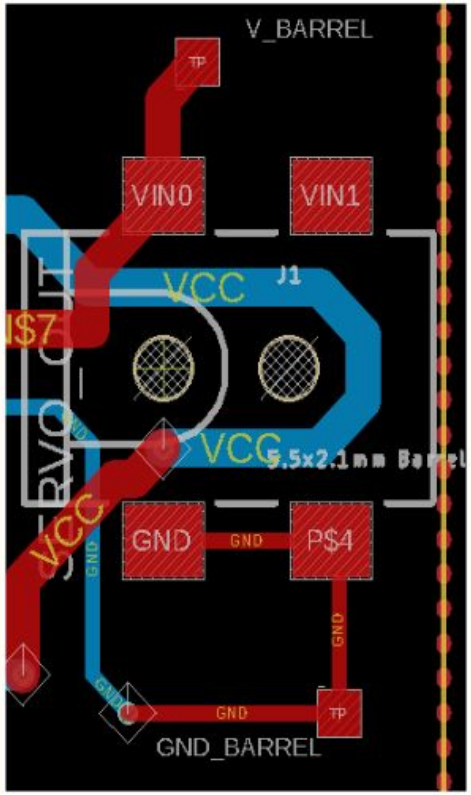


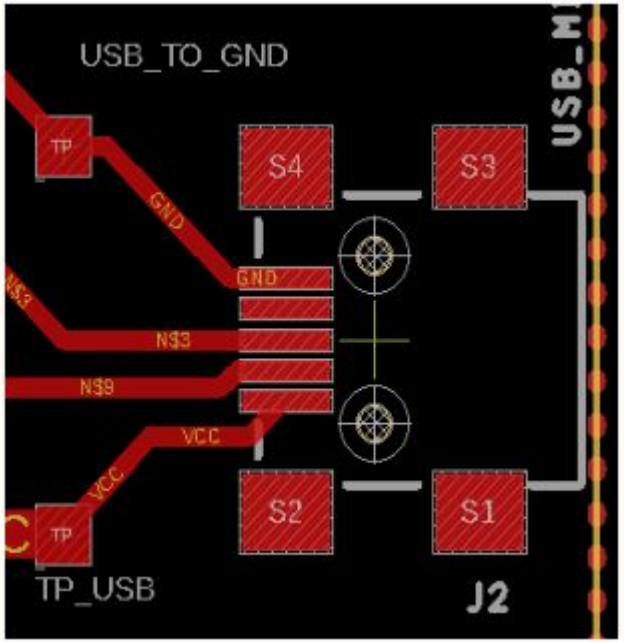


Overview of Layout - Full Picture

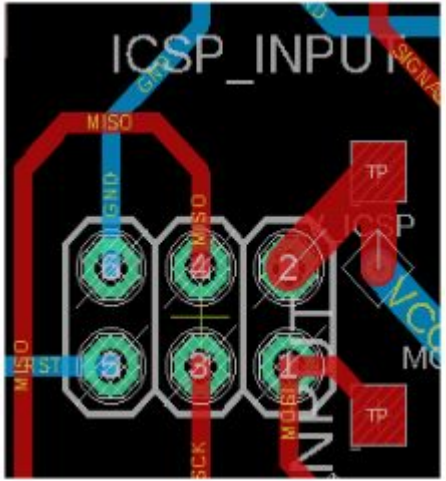


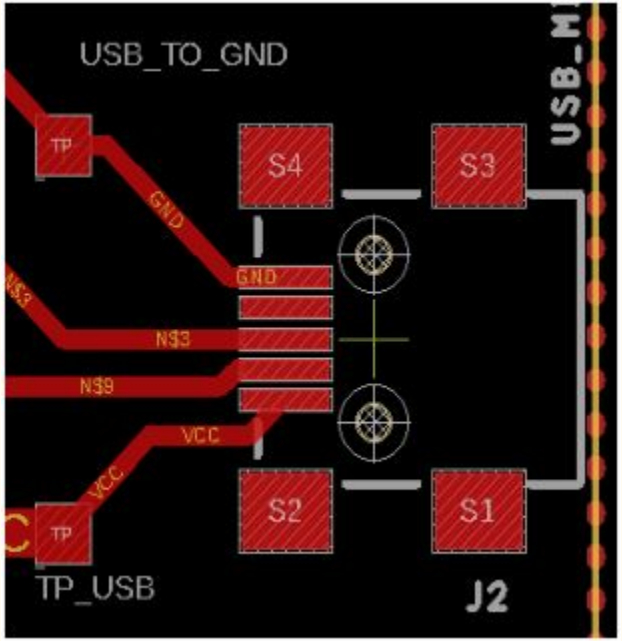
Overview of Layout - Power



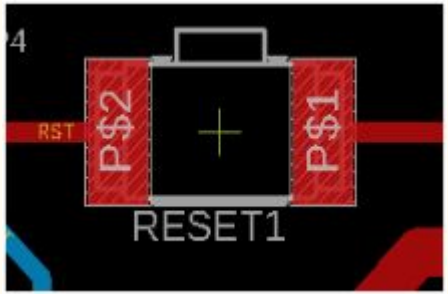


Overview of Schematic - Programming Interface

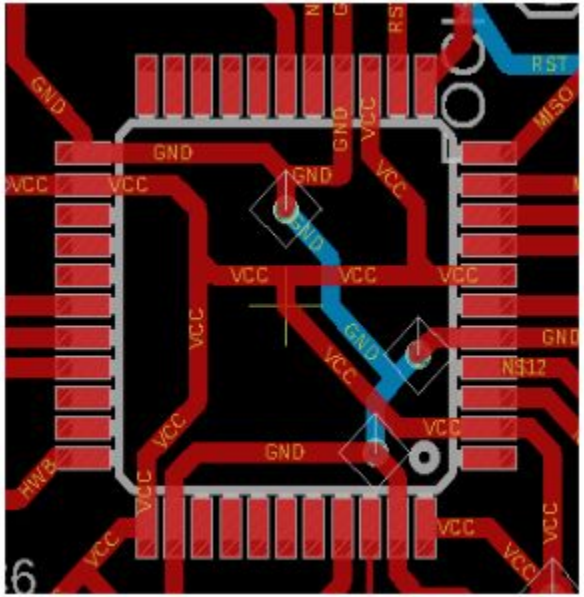




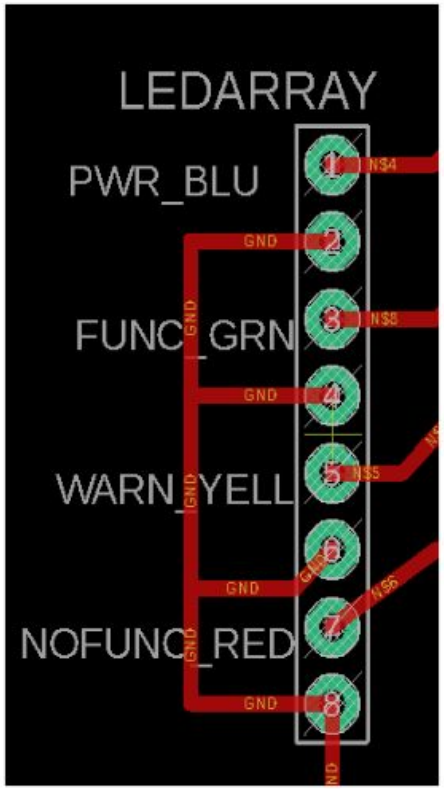
Overview of Schematic - Inputs



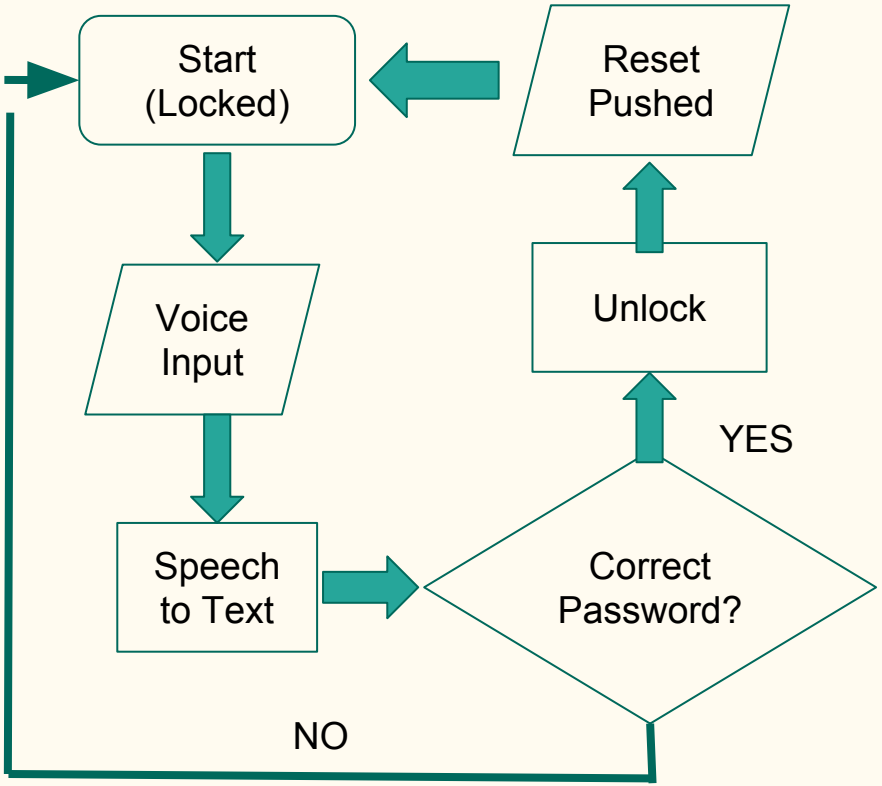
Overview of Schematic - Processor



Overview of Schematic - Outputs



Functionality Flowchart



IP Used

- CAD
  - EagleCAD was used for the schematic and layout design
- Firmware
  - An open source library called “µSpeech” (written by Arjo Chakravarty) is used to analyze the phonemes from the user input.

Bill of Materials

PCB Version: 1.0
BOM Version: 1.0
P/DNP = Place/ Do not place component
Comments: All components are SMD unless otherwise noted

Qty	Value	Parts	P/DNP	Mfg	Mfg Part #	Device Description	Distributor	Dist. Part #	Price per unit	Ext. Price
1	PWR-GRN	LED1	P	EPL-PSU	Unknown	Through hole Green LED	EPL	n/a	0.25	0.25
1	FUNC_ORNG	LED2	P	EPL-PSU	Unknown	Through hole Orange LED	EPL	n/a	0.25	0.25
1	NOFUNC_RED	LED3	P	EPL-PSU	Unknown	Through hole Red LED	EPL	n/a	0.25	0.25
1	WARN_YELL	LED4	P	EPL-PSU	Unknown	Through hole Yellow LED	EPL	n/a	0.25	0.25
2	MIC_ON, RESET1	Buttons	P	Panasonic	667-EVQ-Q2K01W	Tactile button 6mm square	Mouser	667-EVQ-Q2K01W	0.3	0.6
8	100nF	C4, C6, C8, C12	P	Murata	GRM31C5C2A104JA01L	100nF 100VDC 5% 1206 Capacitor	Mouser	81-GRM31C5C2A104JA1L	0.71	5.68
2	10k	R4, R8	P	Welwyn	WIN-T1206LF-03-1002-B	10k 1% 250mW 1206 resistor	Mouser	66-WINT1206LF031002B	0.59	1.18
1	10uF	C5, C7	P	Murrata	GCJ31CC71E106MA15L	10uF 25VDC 20% 1206 Capacitor	Mouser	81-GCJ31CC71E106MA5L	0.94	0.94
1	16MHz	Q1	P	NDK	NX3225SA-16.000000MHZ-T1	16MHz Surface Mount 10ppm	Mouser	344-NX3225SA16MHZT1	0.92	0.92
2	18pF	C1, C2	P	Murata	GRM31A7U3D180JW31D	18pF 2kVDC 5% 1206 Capacitor	Mouser	GRM31A7U3D180JW1D	0.74	1.48
4	1k	R3, R5, R6, R7	P	KOA Speer	RN73H2BTTD1001F100	1k 1% 250mW 1206 resistor	Mouser	660-RN73H2BT1001F100	0.44	1.76
1	1uF	C3	P	KEMET	C1206X105M3RACTU	1uF 25VDC 20% 1206 Capacitor	Mouser	80-C1206X105M3R	1.36	1.36
2	22	R1, R2	P	Welwyn	WCR1206-22RFI	22 1% 250mW 1206 resistor	Mouser	756-WCR1206-22RFI	0.1	0.2
1	5.5x2.1mm Barrel	J1	P	Adam Tech.	Unknown	Barrel Jack Female 5.5mm jack, 2.1mm center pole diameter	Sparkfun	PRT-12748	1.5	1.5
1	ATMEGA32U4-AU	U$1	P	Microchip	ATMEGA32U4-AU	ATMEGA32U4-AU	Mouser	556-ATMEGA32U4-AU	4.12	4.12
1	USB-A	X1	P	CUI	UJ2-AH-1-SMT-TR	USB-A	Mouser	490-UJ2-AH-1-SMT-TR	1.28	1.28
1	DC Wall Wart	N/A	DNP	NLPOWER-CN	SFE-5V2AD	DC Wall wart 5.5mmx2.1mm 5v, 2A	Sparkfun	TOL-12889	5.95	5.95
1	USB-A Cable 2 pack	N/a	DNP	DTOL	Unknown	USB-A Male to Male 4ft cable	Amazon	link	8.2	8.2
1	120 Pack cables	N/A	DNP	Elegoo	Unknown	MI to MI, Fm to MI, Fm to Fm Connectors	Amazon	link	6.98	6.98
1	Misc Connectors EP	N/A	DNP	EPL-PSU	Unknown	Miscellaneous Headers from EPL Store	EPL	n/a	3	3
1	PCB	N/A	DNP	Oshpark	Unknown	Printed Circuit Board	Oshpark	n/a	11.45	11.45
								Total Cost One Board		**57.6**

Version Changes: Initial BOM

Test Plan #1: Initial Power Up of Practicum Project

Objective: to test if board is powered up. The board should be connected to the board and the solenoid should be in the locking position.

Test Procedure: Plug USB connector to laptop to see if blue light is on. If light is on board is powered up.

If light does not turn on:

- Probe the board and check connections.
- Run simple test code (LED blink) to determine if coding issue.

Test Plan #2: Prototype System (Arduino Uno)

Objective: To test the phoneme recognition. When microphone is powered, solenoid should activate when user speaks password (“shore”) into microphone.

Test procedure: Make sure blue light is on. Say the specified word.

If solenoid is not activated:

- Try repeating the word
- Modify the phoneme sum and other indicators.
- Use debugger that is provided in the arduino uno to figure out why it is not unlocking.

Gantt Chart

Task ID	Work Breakdown Structure	Planned Start	Planned Finish	Actual Start	Actual Finish	Workload (Hours) (Plan | Actual)		Progress	2018/11/26
1	Solder board together	2018/11/21	2018/11/27	2018/11/24	2018/11/28	6	6	100.0%	
2	Troubleshoot Hardware	2018/11/27	2018/11/28	2018/11/29	2018/11/29	16	18	100.0%	
3	Install software	2018/11/28	2018/11/29	2018/11/29	2018/11/30	16	22	100.0%	
4	Recalibrate code	2018/11/30	2018/12/01	2018/12/01	2018/12/04	16	18	100.0%	
5	Build enclosure	2018/12/01	2018/12/01	2018/12/04	2018/12/04	4	5	100.0%	
6	Final touches	2018/12/02	2018/12/02	2018/12/05	2018/12/06	8	8	95.0%	

What is left to do?

- Increasing the **accuracy** of the phoneme recognition.
    - This can be done by using a different microphone or a faster processor.
- Reinforcing **mechanical strength** of the lock and chest.
- **Catering aesthetic** to the target market's preferences.

What have we learned as a team?

- We learned how to communicate and **split up work** accordingly.
- It is critical to **record all purchases** so that individuals are reimbursed fairly
- Success and failure should come in **equal amounts** for the best team cohesion

What have we learned individually?

- Amanda:
- Mark: Test points should be at every node for ease of debugging.
- Rawan:
- Sam: how to use EAGLE (for schematics and PCB routing), new soldering techniques.

The End
Questions?

Link to GitHub