



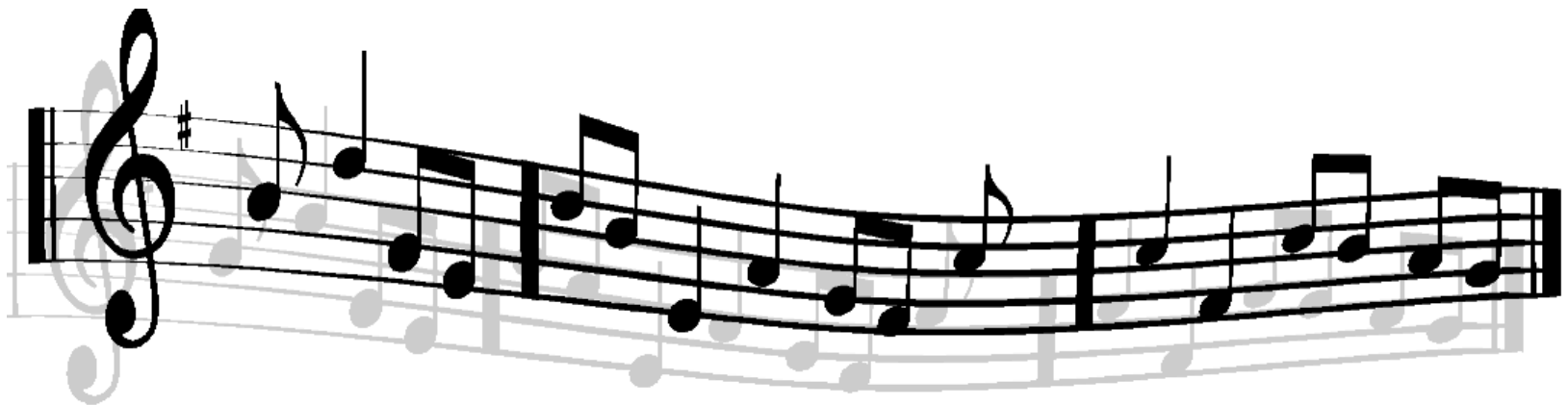
Ukulele Instrument Tutor

ECE 445: Senior Design Presentation

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Presentation Overview

1. Introduction
2. Objective
3. Overview
4. Functional Tests
5. Successes and Challenges
6. Additional Tests
7. Future work

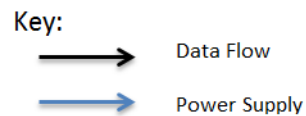
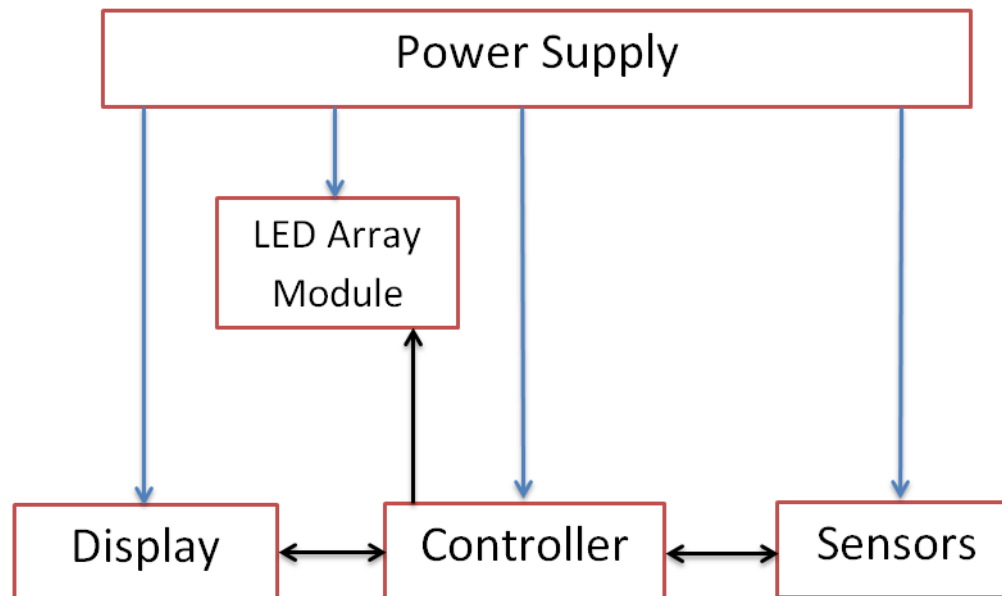


Introduction

- Motivation
 - Doesn't exist in market
- Objectives
 - Main function
 - Requirements
- Benefits
- Features



System Overview (Hardware)

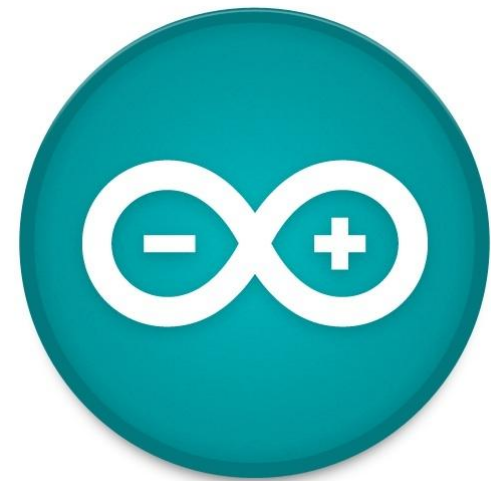


System Overview

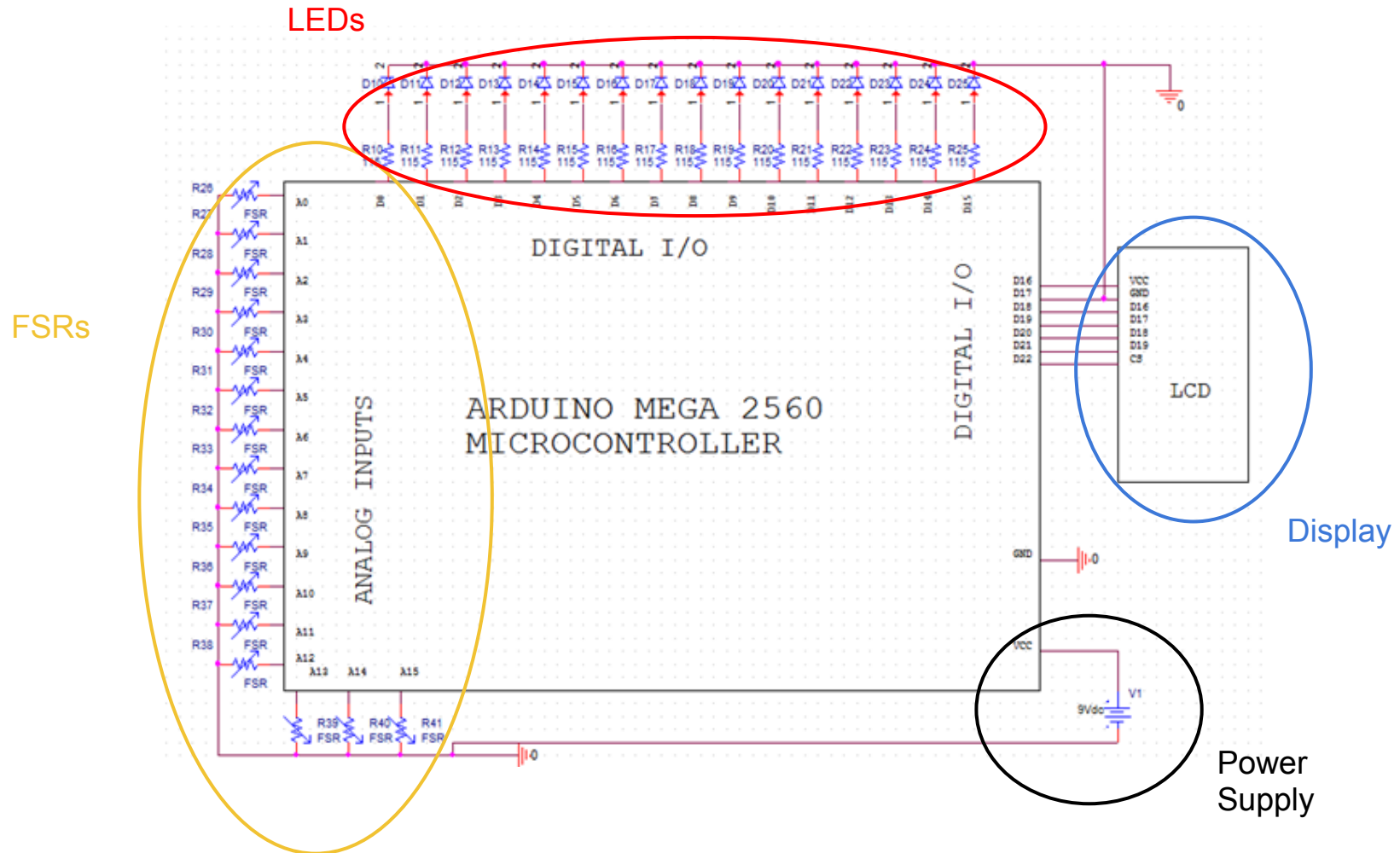
(Software)

- Arduino

- Note display and detection
- Menu navigation
- Notes, Chords, and Song selection
- Display notes, chords on LCD
- Song storage



Components

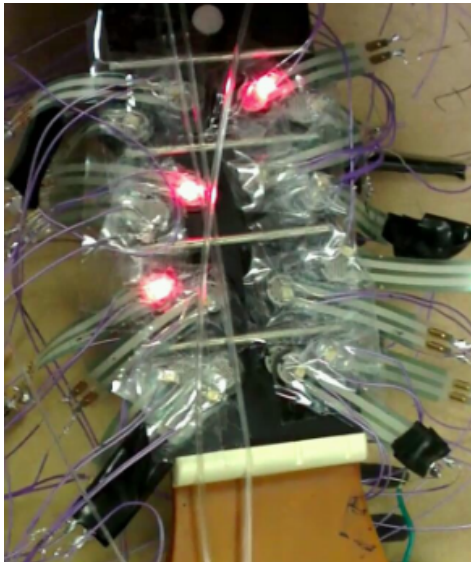


Microcontroller

- Arduino Mega 2560
 - Features: 54 Digital I/Os, 16 Analog Inputs, 4kB EEPROM memory, 256 kb flash memory
 - Flash memory will store the ukulele tutor program
 - FSRs use analog pins (ADC)
 - The LEDs,LCD use digital pins



LED Array



- Light intensity varies with current.
- 16 surface mount LEDs.
- LED sequential logic.

Display

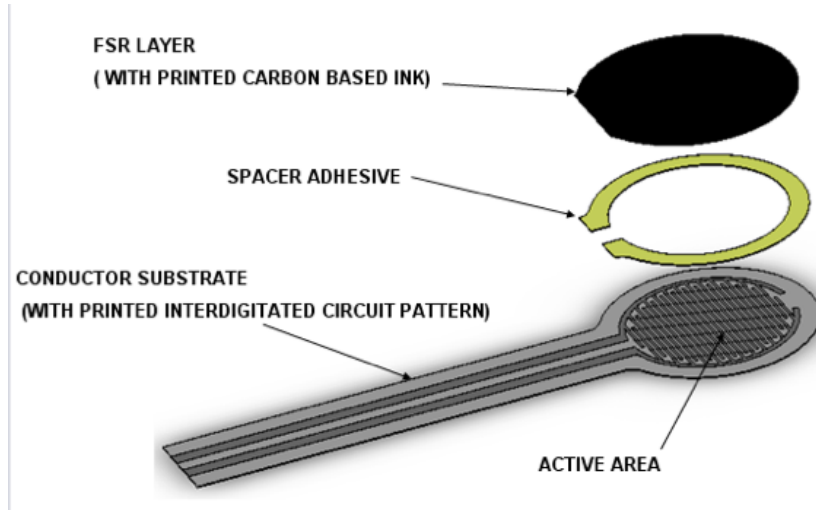


- SainSmart 16x2 LCD Keypad module
- 6 buttons
- `lcd.print`, `lcd.setCursor`, `lcd.clear`

User Interface



Force Sensitive Resistor (FSR)



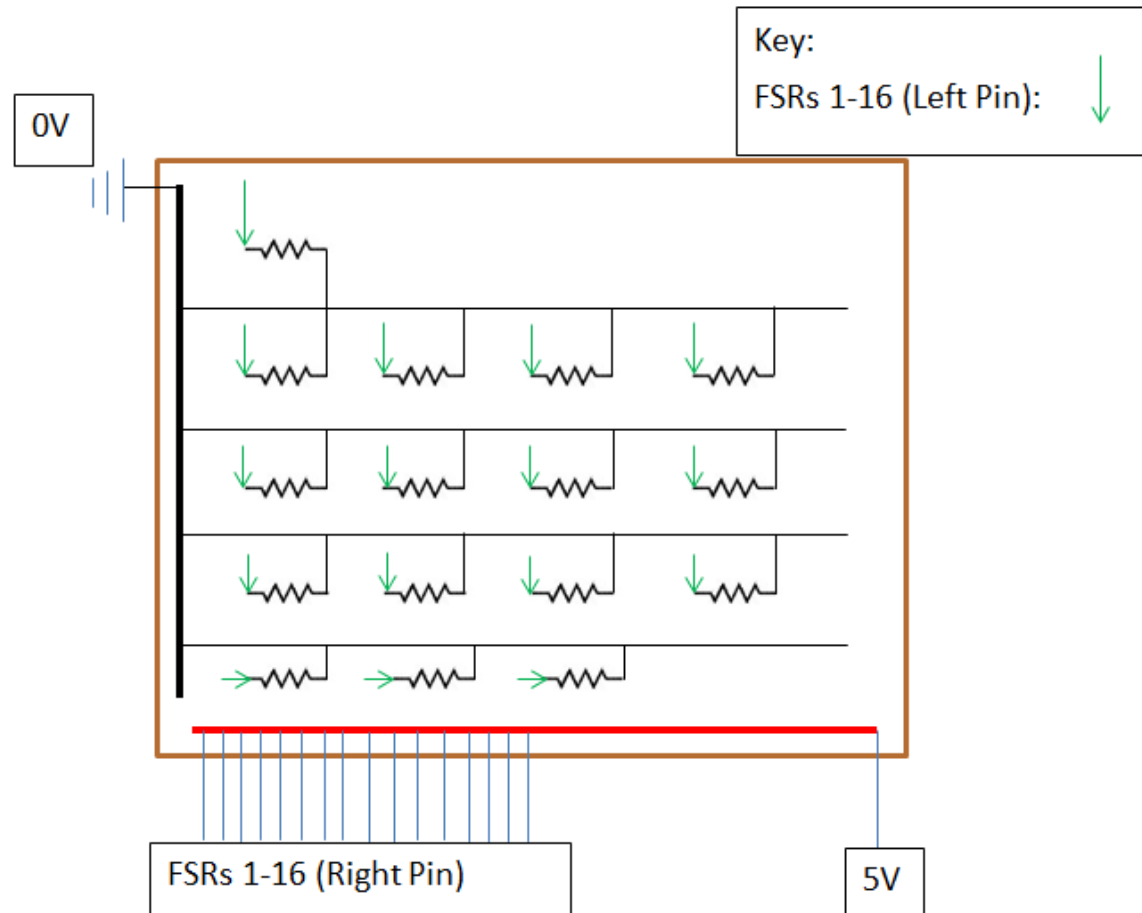
- Resistive vs Capacitive
- FSR composition
- `analogRead()`
- Placed at each location of fretboard

	A	A#/Bb	B	C	C#/Db
1 st String	A				
2 nd String	E	F	F#/Gb	G	G#/Ab
3 rd String	C	C#/Db	D	D#/Eb	E
4 th String	G	G#/Ab	A	A#/Bb	B

Sample Code

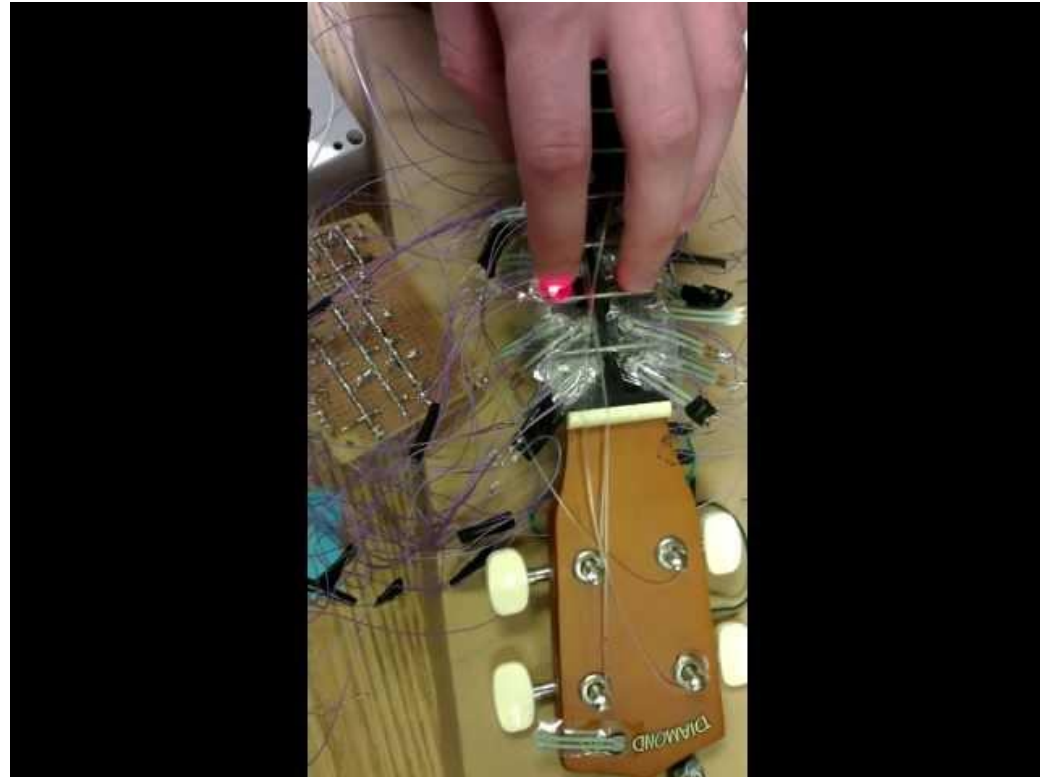
```
case 5:{  
    //Dmajor = 5, 6, 7  
  
    do{  
        do{  
            do{  
                digitalWrite(ledPin5, HIGH); //turns LED on  
                digitalWrite(ledPin6, HIGH); //turns LED on  
                digitalWrite(ledPin7, HIGH); //turns LED on  
                fsrValue5 = analogRead(fsrPin5); //reads FSR  
                fsrValue6 = analogRead(fsrPin6); //reads FSR  
                fsrValue7 = analogRead(fsrPin7); //reads FSR  
                if (fsrValue5 >= 200){  
                    if (fsrValue6 >= 200){  
                        if (fsrValue7 >= 200){  
                            digitalWrite(ledPin5, LOW); //turns LED off  
                            digitalWrite(ledPin6, LOW); //turns LED off  
                            digitalWrite(ledPin7, LOW); //turns LED off  
                        }  
                    }  
                }  
            }  
        }  
    }while (fsrValue5 < 200);  
    }while (fsrValue6 < 200);  
    }while (fsrValue7 < 200);  
}  
break;
```

Vector Board Design



Final Tests & Verifications

- LCD Menu navigation
- Using buttons to go through songs, chords, notes.
- Proper display of notes, chords, songs.
- Continuity Tests (components on vector board, FSRs, LEDs)



Success and Challenges

- FSR calibration
- Damaged components
- Acquiring data from the FSRs
- Code functionality and debugging
- Mechanical issues (broken components, adhesives, soldering, component positioning on ukulele)

Conclusion & Future Development

- Overall System
 - Performs as designed
- Future Development
 - More sensors, more accuracy (FSRs)
 - Better placement of components on ukulele
 - Larger Song Library
 - Record songs and create games
 - Interface with PC (upload midi files, get FSR data, etc.)



Thank You!

- Professor Singer
- Ryan May
- Lydia Majure
- Skot Wiedmann





Questions?