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

- FSRs
- LEDs
- Display
- Power Supply
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
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

Key:
FSRs 1-16 (Left Pin):

FSRs 1-16 (Right Pin)

0V

5V
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
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Questions?