#### Spring 2019 - Capstone Design Project Team D7

## PianoMan

**Design Review Presentation** 

#### Team D7



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A Contraction

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Lizzy Thrasher

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Vanessa Hwang



Surbhi Inani

# **APPLICATION AREA**

A self-learning tool for Piano players.

Reads sheet music of song, then lights up LED system using a teaching module for that song.



#### SOLUTION APPROACH

- Taking ideal scans of sheet music
  Lighting up LED MATRICES BAR set above the keyboard at appropriate times in a game-like teaching module
- Keeping track of what keys the user pressed and calculating a performance score for improvement



#### **BLOCK DIAGRAM**



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#### **IMPLEMENTATION PLAN - OMR**

- ⊗ **Borrowing/Buying**: Electronic Piano Keyboard (61 keys)
- Downloading: PDF to JPG python library, openCV python library, Sheet Music PDFs
- ◎ **Designing and Developing**: Full OMR software using these two libraries

### **IMPLEMENTATION PLAN - HARDWARE**

- Buying: Raspberry Pi 3 B+ model, Four 16x32 LED Matrices, Power Supplies for both, M-M and F-F Jumper Cables
- Assembling: Daisy-Chaining 4 LED matrices and wiring the first's Hub 75 Input pins to the GPIO Pins of Raspberry Pi
- ◎ **Downloading**: Henner Zeller's LED Matrix Controller Library
- Designing and Developing: C++ program in Raspberry Pi to receive file from OMR program output and lighting up the notes at the correct times with a game-like effect to teach the song

#### **IMPLEMENTATION PLAN - PERFORMANCE SCORE**

- Buying: MIDI cable that connects to the piano keyboard and sends user input midi files to the computer
- $\otimes$  Assembling: Keyboard  $\rightarrow$  MIDI  $\rightarrow$  Raspberry Pi configuration for interpreting keys the player pressed evaluating performance score
- Designing and Developing: Python code for parsing MIDI file's User Input to evaluate performance and generate score that will be pushed to the Raspberry Pi over Wifi to be displayed by LED Matrix

#### METRICS AND VALIDATION

Test for Optical Music Recognition (OMR)
 Data:

Ideal scans of sheet music from MuseScore (<u>https://musescore.com</u>)

#### Test:

- Use SoundSlice (<u>https://www.soundslice.com</u>) to convert OMR's output MusicXML to PDF
- 2. Check the difference between original PDF and converted PDF / played MIDI file

#### METRICS AND VALIDATION

- Test for Raspberry Pi LED Matrices
  Data: MusicXML from MuseScore (<u>https://musescore.com</u>)
   Test:
  - 1. Test if the microcontroller can successfully transfer data to LEDs

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2. LEDs light up correctly according to the design requirements

### METRICS AND VALIDATION

⊗ Test for Scoring system

**Data:** MusicXML from MuseScore (<u>https://musescore.com</u>) **Test:** 

 Test if the scoring system correctly calculates the performance score of the input MIDI file 11

- 2. LED matrix correctly displays the performance score
- User testing
  Data: Classmates
  Test:

1. Let them learn basic songs from MuseScore and collect feedback

#### PROJECT MANAGEMENT

TASK NUMBER	TASK TITLE	TASK	WEEK 4	WEE	K5 WEEK6	WEEK 7	WEEK 8	WEEK 9	WEEK 10	WEEK 11	WEEK 12	WEEK 13	WEEK 14	WEEK 15
			MTW	R F M T W	R F M T W R	FMTWR	FMTWR	FMTWR	FMTWRF	M T W R F	FMTWRF	M T W R	FMTWRFM	T W R F
1	Project Conception and Planning													and the second designed of the
1.1	Abstract Report	Team D7												
1.2	Project Proposal Presentation	Team D7												
1.3	Design Review Presentation	Team D7												
1.4	Planning and Research	Team D7												
1.5	Final Presentation	Team D7												
1.6	Demo	Team D7												
2	Optical Music Recognition (OMR)													
2.1	Test OpenCV for functionality	Lizzy												
2.2	Create Data Structure for Sheet Music	Lizzy												
2.3	Find and Remove Staff Lines	Lizzy												
2.4	Find Connected Music components	Lizzy												
2.5	Perform Basic template matching on easy notes	Lizzy				and the second second								
2.6	Find note heads for any component	Lizzy												
2.7	Evaluate Duration for connected components	Lizzy												
2.8	Evaluate Pitch for all note heads	Lizzy												
2.9	Integration Testing	Lizzy												
3	Transition of Data + Performance Score													
3.1	Setup Scripts to send data to RPi through Wifi	Vanessa												
3.2	Research into MusicXML file	Vanessa												
3.3	Convert OMR data structure to MusicXML file	Vanessa												
3.4	Parse MusicXML file to get keys and duration	Vanessa												
3.5	Receive and read User Input as MIDI file	Vanessa												
3.6	Evaluate perfromance - MIDI and MusicXML files	Vanessa												
3.7	Send performance score to RPi automatically	Vanessa												
3.8	Integration Testing	Vanessa				and and and and			and the local pairs and	and the last day in				
4	Hardware and LED Matrix Software													
4.1	Research of LED Devices	Surbhi												
4.2	Order Parts and one LED Matrix to test functionality	Surbhi												
4.3	Setup Raspberry Pi with new OS in SD card	Surbhi												
4.4	Run Demos of LED Matrix Library on assembled system	Surbhi												
4.5	Write own sample demos for LED matrix	Surbhi												
4.6	Parse MusicXML file to get keys and duration and setup LED Matrix Data structures	Surbhi												
4.7	Daisy Chain 4 LED Matrices to work together when assembled	Surbhi												
4.8	Integration Testing	Surbhi												