

EE2026 Project Report

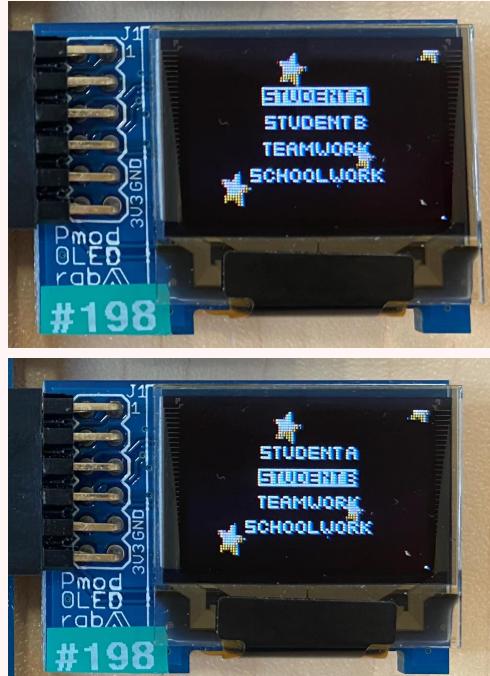
Lab session: Thursday A.M.

Team No.: S1_11

Student A: Yuan Xinrui (A0222679W)

Student B: Chen Zihan (A0240951J)

Part 1. User guide to project improvements

Feature Name	Feature Description	Image Illustration
Team Main Menu	<p>btnU: selecting box up btnD: selecting box down btnC: go into selected feature</p> <p>SW[15] = 1: back to menu after going into any function</p>	
Student A: Yuan Xinrui Piano Notes On Keyboard	<p>SW[14] = 1: show the display of an electronic piano keyboard.</p> <p>SW[12:1] controls the 12 keys on the piano keyboard.</p> <p>OLED display White key after pressing will become orange. The name of the natural notes (C-D-E-F-G-A-B) will show below.</p>	<p>Start</p> 

	<p>Black key (originally red in colour) after pressing will become pink. The name of these half notes (Db-Eb-Gb-Ab-Bb) will show below.</p> <p>LED display When only one key is being pressed, the LEDs will shine accordingly. When it is a natural note (white key), the number of LEDs turned on follows the numerical naming of the notes. Half notes (black key) are represented by a blinking LED.</p> <p>7-segment display When only one natural note (white key) is being played. The numeric name (1-2-3-4-5-6-7) will show on the 7-segment display.</p>	<p>Play E and Gb</p> <p>Playing Ab</p> <p>Playing A (6)</p> <p>Start</p>
Student A: Yuan Xinrui E-Piano - All about Chords	<p>SW[13] = 1: show the display of an electronic piano with the logo e-Piano.</p> <p>SW[12:1] controls the 12 keys on the piano keyboard. Some specific combinations will make up piano chords.</p> <p>Chords supported by this improvement:</p>	

Chord	Note1	Note2	Note3
C	C	E	G
Cm	C	Eb	G
D	D	Gb	A
Dm	D	F	A
E	E	Ab	B
Em	E	G	B

In switch combination:

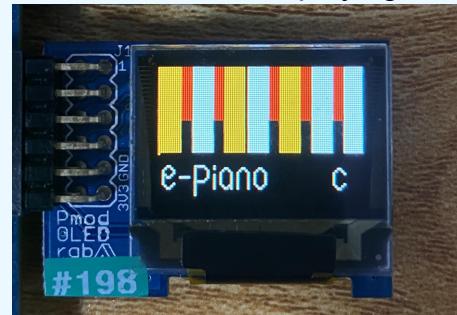
Chord	Note1	Note2	Note3
C	12	8	5
Cm	12	9	5
D	10	6	3
Dm	10	7	3
E	8	4	1
Em	8	5	1

There are two modes under this improvement.

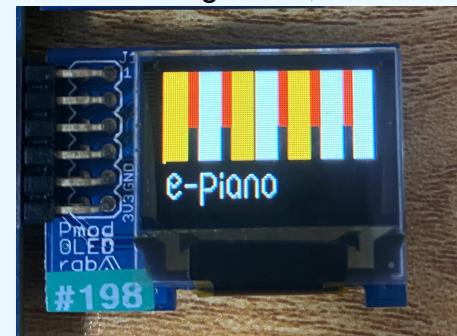
1. Demonstration mode:
 $SW[0] = 1$ (LED[0] : on).
 Name of the chord appears when the correct notes are played.

2. Test your learning mode:
 $SW[0] = 0$ (LED[0] : off).
 Name of the chord does not show immediately. You can produce a sound loud enough to check your answer.

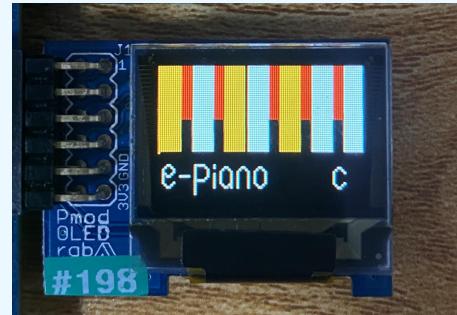
In demonstration mode, playing chord C

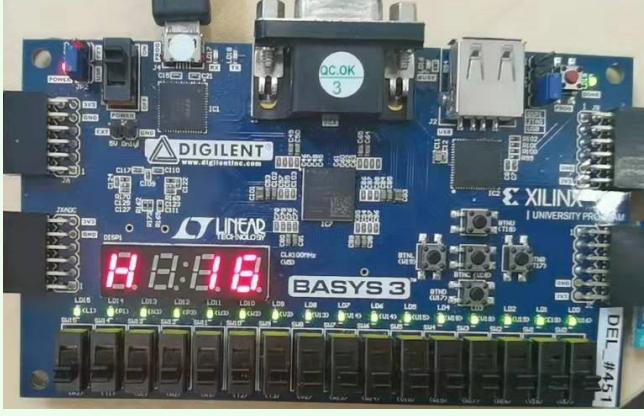
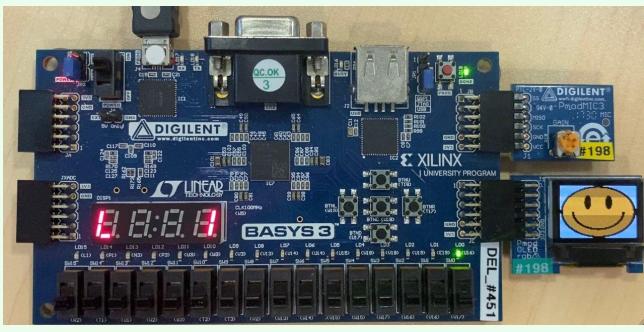


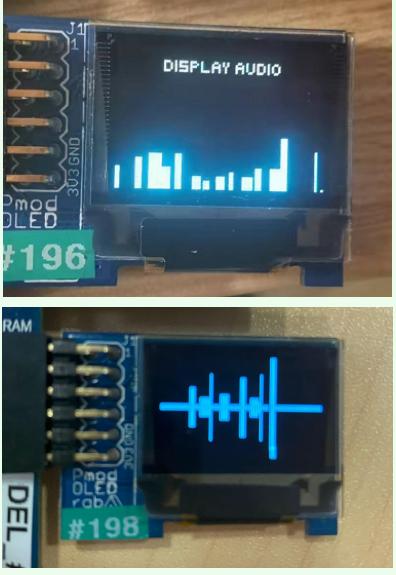
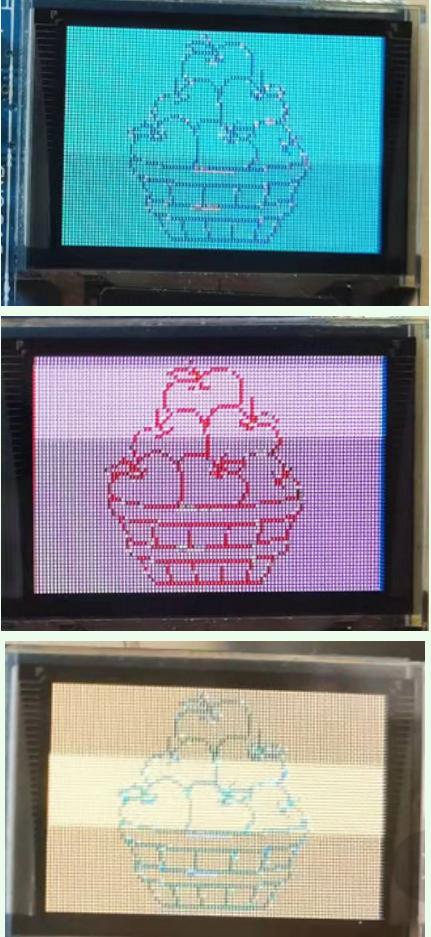
Under testing mode, Chord C

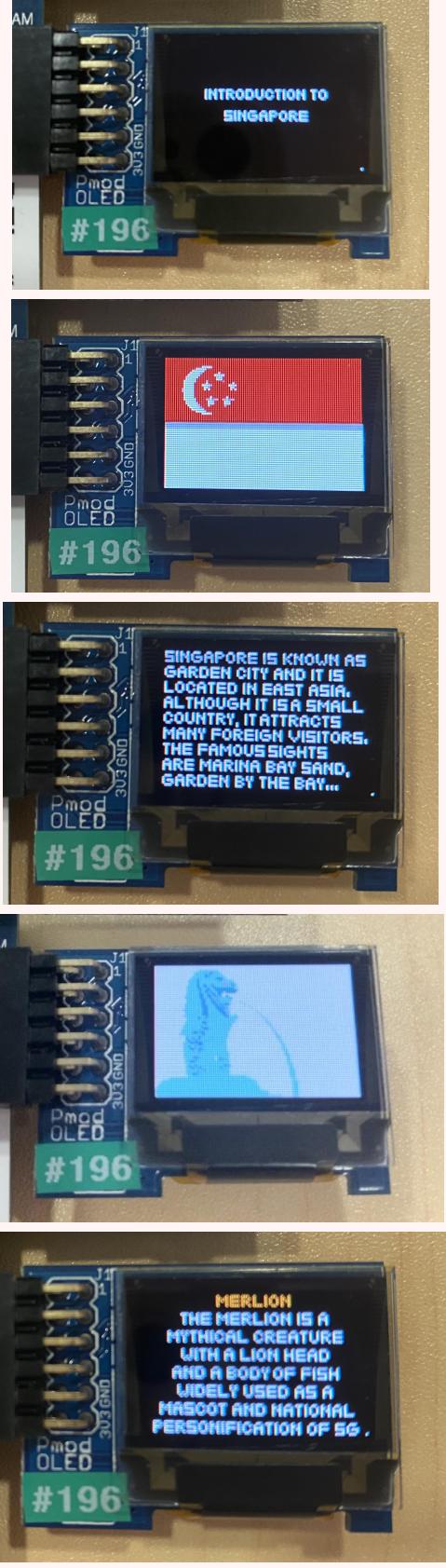


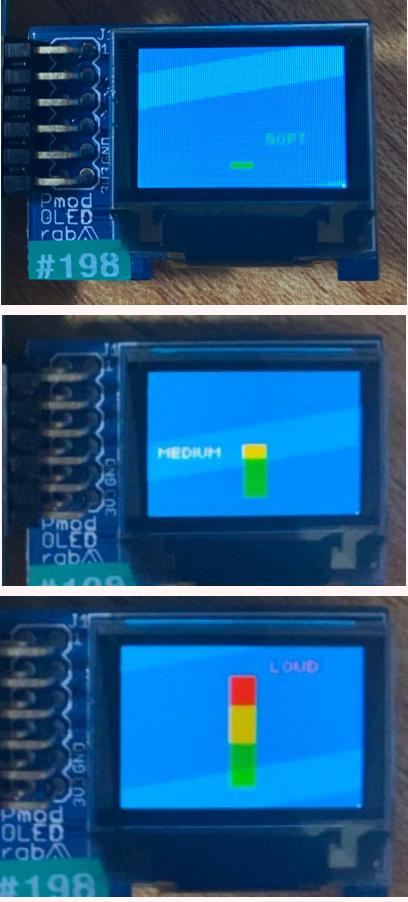
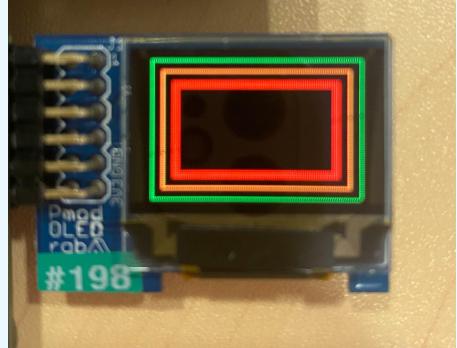
When a loud sound is produced

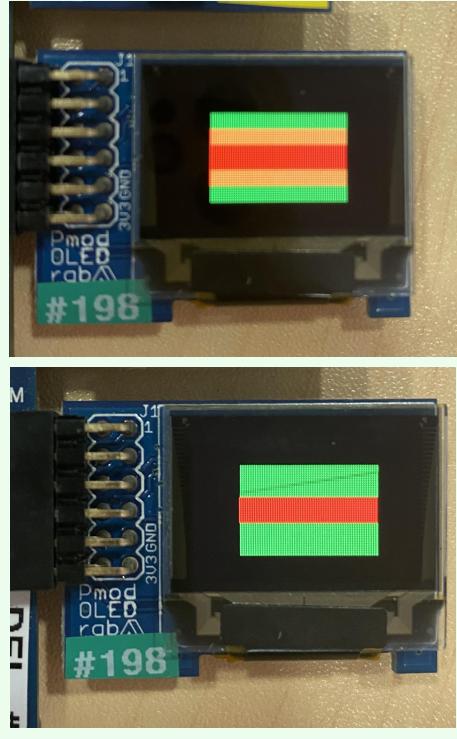
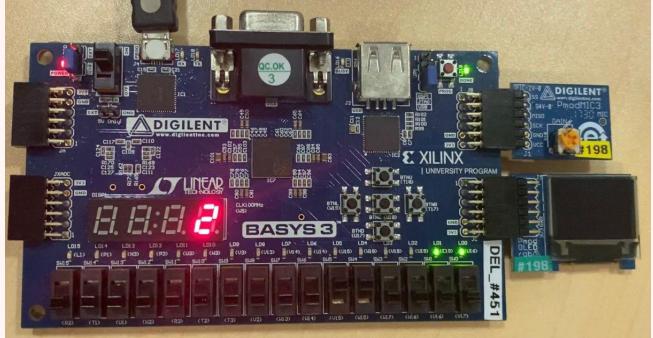
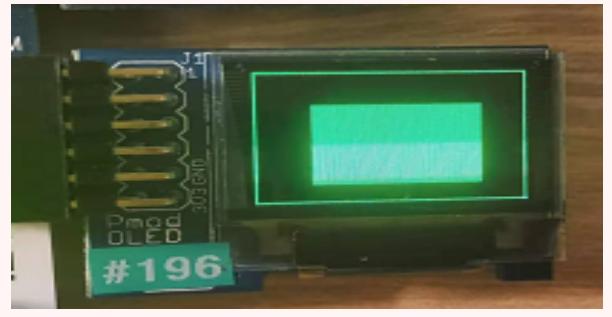


<p>Student B: Chen Zihan</p> <p>Audio Indicator</p>	<p>SW[0] =1: 7-segment and 16 leds display peak value which detected every 0.2s</p> <p>SW[0]=0: 7-segment and 16 leds display decoded mic-in value</p> <p>When volume range is From 0 - 5, display L, From 6-11, display M, From 12-16, display H</p>	
<p>Student B: Chen Zihan</p> <p>Loud Noise Reminder</p>	<p>Default OLED display: a smiley face will be shown when peak value <5. Otherwise, a shush emoji will appear.</p> <p>SW[14] = 1: pause the change. Either a smiley face or shush emoji will freeze and remain on OLED.</p>	 

<p>Student B: Chen Zihan</p> <p>Sound Wave Display</p>	<p>This improvement displays the volume bar based on the decoded mic-in value in the past few seconds. The bar keeps changing color and the title “DISPLAY AUDIO” keeps blinking unless SW[14]=1.</p> <p>SW[1] = 1 :volume bar is positioned at the bottom</p> <p>SW[2] = 1: volume bar is positioned in the center</p> <p>SW[14] = 1: freeze the display</p>	
<p>Student B: Chen Zihan</p> <p>Image Colour Editor</p>	<p>SW[3] = 1: trigger the function</p> <p>btnR, btnL: change colors</p> <p>Default: switching from white to yellow</p> <p>SW[6]: switching from white to blue</p> <p>SW[7]: switching from white to red</p>	

<p>Team</p> <p>Digital Guidebook to Singapore</p>	<p>This section starts with an introduction to Singapore. It will display an image of the national flag and a short description of Singapore, followed by imagery and text information of 3 places of attractions in Singapore.</p> <p>Functions to try out:</p> <p>btnL(btnR): flip the page to the previous/next</p> <p>SW[2:1]: change the speed of text display</p> <ul style="list-style-type: none"> • Default: text comes out 1 line per 2s • SW[2] =1: increase the display speed to 1 line per 1s. • SW[1] =1: display all the text immediately 	
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Team Volume Indicator	<p>SW[0]= 1: trigger the function</p> <p>There will be a volume bar changing its height according to the loudness of the sound input.</p> <p>SW[5:7] controls the background colour.</p> <ul style="list-style-type: none"> • Default: peach colour • SW[5] = 1: marine blue • SW[6:5] = 11: violet • SW[7:5] = 111: maroon 	
Student A: Yuan Xinrui OLED task A	<p>SW[1] = 1 Display 3 borders</p> <p>SW[1] = 0 Hide 3 borders</p>	

Student B: Chen Zihan OLED task B	SW[3:2] both 1 Display bars of 3 colours SW[3] = 0 Hide the orange bar	
Team Task AVI	SW[4] = 1 Turn on the LED display SW[5] = 1 Turn on the 7-segment display SW[0] = 1 The OLED display will show different pattern based on the volume level (0-5)	 

Part 2. Feedbacks

What we like about the project is the high level of freedom given to us. We can develop the feature we would like to include for our project, which is a freedom that is not commonly found in other programming modules that we have learnt before.

What we do not like about the project is that we have gotten much emotional damage when we were trying to combine our parts and generate one single working bitstream.

One way that might help this project assignment to improve is that the lectures or lab sessions can cover more about the 12 bit parallel *mic_in* sample data we get from the PmodMIC3. Even though helping us decode the audio inputs saved us a lot of trouble, knowing more about the PmodMIC3 will still benefit the project.

Part 3. References

- [1] nvbinh15, 2022. *FPGA-Project-EE2026/characters.ipynb at main · nvbinh15/FPGA-Project-EE2026*. [online] GitHub. Available at: <https://github.com/nvbinh15/FPGA-Project-EE2026/blob/main/Python_helpers/characters.ipynb> [Accessed 5 April 2022].
- [2] uosjapuelks, 2022. *digital-design/game_mix.v at master · uosjapuelks/digital-design*. [online] GitHub. Available at: <https://github.com/uosjapuelks/digital-design/blob/master/Digital%20Design%20Project/Wk8.srcts/sources_1/new/game_mix.v> [Accessed 5 April 2022].
- [3] Yi, M. and Jiang, W., 2022. *GitHub - Hurtfulcheese/EE2026-FPGA-Sound-display: NUS EE2026 final project: Sound Display and digital piano. An FPGA project written by NUS Electrical Engineering Undergraduates Yi Ming and Jiang Weixi*. [online] GitHub. Available at: <<https://github.com/Hurtfulcheese/EE2026-FPGA-Sound-display>> [Accessed 5 April 2022].