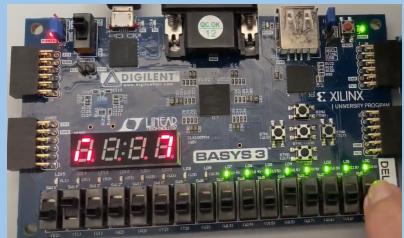
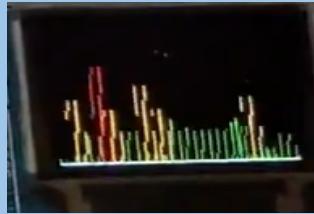
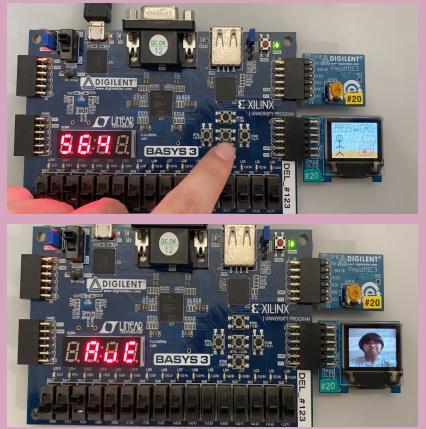
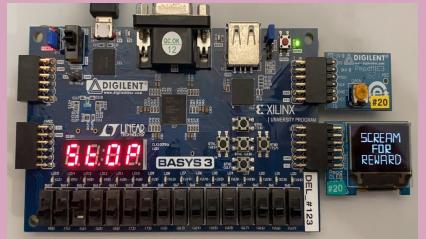
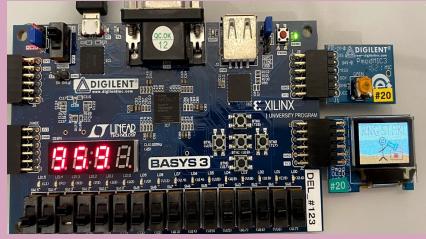


Feature	Mark for	Input Devices	Feature Description	Images/Photos
Real Time Audio Volume Indicator (Basic and Improved)	Jared	SW0, SW1, SW2, SW3, Mic	<b>BASIC</b> <ul style="list-style-type: none"> <li>• SW0 toggles between read in peak or mic_in rebased to 16 bits;</li> <li>• SW0 off: 12-bit peak value with default sampling per 0.2s shown on 16 LEDs, SW0 on: 12-bit mic_in shown on 16 LEDs. 7-segment display shows a value between 0 and 15</li> <li>• SW2 to on/off LMH 7-seg display</li> </ul> <b>IMPROVED</b> <ul style="list-style-type: none"> <li>• SW1 displays FREEZE animation on 7-seg, also freezes LED</li> <li>• SW3 activates new volume indicator mode, DEAF SOFT OKAY LOUD AAAA</li> </ul>	
Audio Wave Visualizer	Jared	SW1, SW4, SW5, SW14, Mic	<ul style="list-style-type: none"> <li>• SW14 to activate audio wave visualiser subsystem</li> <li>• SW4 toggles between 2 types of audio waves             <ul style="list-style-type: none"> <li>◦ When SW4 on: shows all louder audio values above 2000 only</li> <li>◦ When SW4 off: shows all audio values centered around a middle value</li> </ul> </li> <li>• SW1 on: freeze waveforms, SW1 off: continuously updates wave</li> <li>• SW5 toggles colour scheme between Red, Yellow, Green or Cyan, Magenta, Orange</li> </ul>	
Graphical visualisations and configurations	Avellin	SW6, SW7, SW8, SW9, SW10, SW15, btnL, btnR	<ul style="list-style-type: none"> <li>• SW15 to activate volume bar subsystem</li> <li>• All functionalities from Real Time Audio Volume Indicator (Basic and Improved) apply</li> <li>• SW6 to turn on border width of 1 pixel, SW7 to turn on border width of 3 pixels (if both SW6 and SW7 are on, SW6 takes priority)</li> <li>• SW8 to turn off volume bar</li> <li>• SW9 to change volume bar to alternate colour scheme 1</li> <li>• SW10 to change volume bar to alternate colour scheme 2</li> <li>• btnL and btnR to shift volume bar to the left and right respectively by 10 pixels, without going out of the screen</li> </ul>	
Menu Screen for Arcade game	Avellin	btnU, btnD, btnR, SW13	<ul style="list-style-type: none"> <li>• SW13 to turn on menu screen and start game</li> <li>• btnU to navigate up the options</li> <li>• btnD to navigate down the options</li> <li>• btnR to select option for game             <ul style="list-style-type: none"> <li>◦ Hammer leads to RNG game</li> <li>◦ Key leads to morse code interpreter game</li> <li>◦ FPGA leads to microphone scream game</li> </ul> </li> </ul>	

Drawing and generation of Images for Arcade game	Avellin	Block RAM	<p>Images Drawn:</p> <ul style="list-style-type: none"> <li>• Hammer + Random Number Generator (RNG) Game</li> <li>• Key + Password Game</li> <li>• FPGA + Microphone scream</li> <li>• You Win</li> <li>• You Lose</li> <li>• Jared's face</li> <li>• Avellin's face</li> </ul>	
Arcade Game 1: Morse Code Interpreter	Team	btnL, btnU, btnD, btnC	<ul style="list-style-type: none"> <li>• btnL to go back to main menu, btnU to reset to starting state of game</li> <li>• Each number from 0 to 9 can be expressed as a series of 5 dots and/or dashes</li> <li>• btnD denotes dot, btnC denotes dash</li> <li>• User will input any combination of 20 dots/dashes</li> <li>• As each series of 5 is computed, the corresponding morse code number is flashed on the screen</li> <li>• After all 4 numbers are keyed in: <ul style="list-style-type: none"> <li>◦ If '2026', 7-seg shows HELO, OLED shows YOU WIN</li> <li>◦ If '2660', 7-seg shows JARED animation from Left to Right, OLED shows Jared's face</li> <li>◦ If '5646', 7-seg shows AVELLIN animation from Right to Left, OLED shows Avellin's face</li> <li>◦ Else for all other combinations, 7-seg shows FAIL, OLED shows YOU LOSE</li> </ul> </li> </ul>	
Arcade Game 2: Microphone Scream	Team	btnL, btnU, Mic	<ul style="list-style-type: none"> <li>• btnL to go back to main menu, btnU to reset to starting state of game</li> <li>• To restart game after user wins or loses, press btnU twice</li> <li>• 7-seg display shows RDY 3 2 1 GO STOP</li> <li>• At GO command, user is to make some noise or shout for help. After 2 seconds, STOP is displayed</li> <li>• User's score based on volume is then computed and a value from 0 to 99 is displayed</li> <li>• If score is <math>\geq 80</math>, user wins; PASS displayed on 7-seg, YOU WIN shown on OLED</li> <li>• Else if score <math>&lt; 80</math>, user loses; FAIL displayed on 7-seg, YOU LOSE shown on OLED</li> </ul>	
Arcade Game 3: Random Number Generator (RNG) Jackpot Machine	Team	btnL, btnU, btnC	<ul style="list-style-type: none"> <li>• btnL to go back to main menu, btnU to reset to starting state of game</li> <li>• To restart game after user wins or loses, press btnU twice</li> <li>• Number will cycle randomly from 0 to 9</li> <li>• btnC to lock in present choice, move on to next number</li> <li>• Next number only displays when previous number is locked in</li> <li>• When all 4 numbers filled, sum of 4 numbers is then computed</li> <li>• If number is <math>\geq 25</math>, user wins; PASS displayed on 7-seg, YOU WIN shown on OLED</li> <li>• Else if number <math>&lt; 25</math>, user loses; FAIL displayed on 7-seg, YOU LOSE shown on OLED</li> </ul>	

### Feedback:

We felt that the project was sufficiently open-ended to give us room for creativity and exploration of the various features we wanted to implement. However, especially since we were completely new to Verilog at the beginning, we felt that the complexity, scale and technicality of the project was too much of a jump in difficulty from the graded lab assignments (which was already quite a huge jump from the lab exercises themselves). As such, it was very challenging and time-consuming to implement all the features in such a short time period. Perhaps more time can be devoted to making the learning curve of the labs and project gentler and more progressive. In particular, we think more time and focus could have been given to teach structural modelling better, especially for Lab 3, 4 and the project.

### References:

NIL

### APPENDIX A: MORSE CODE

Numbers for morse code. Dot: 0, Dash: 1

Key in from left to right

ZERO 11111

ONE 11110

TWO 11100

THREE 11000

FOUR 10000

FIVE 00000

SIX 00001

SEVEN 00011

EIGHT 00111

NINE 01111