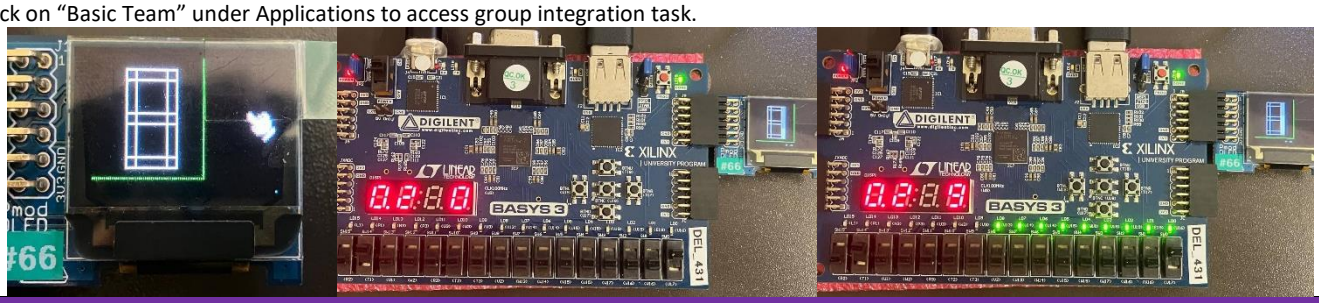
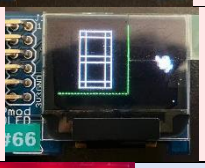
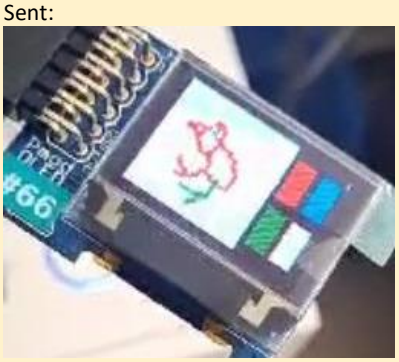
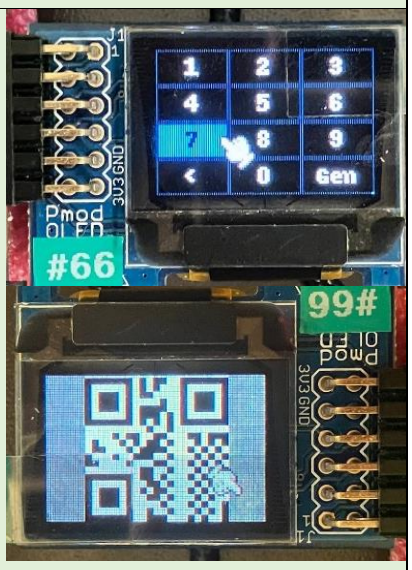
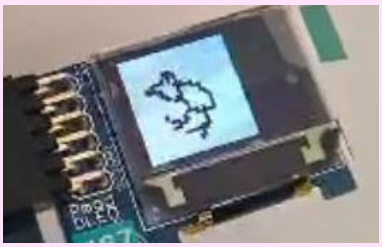
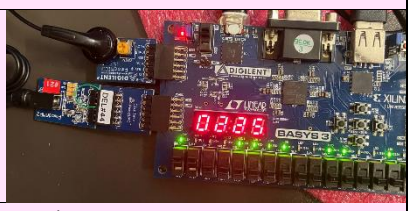
Group Task (Section 4.E)

Click on "Basic Team" under Applications to access group integration task.



Personal and Team Improvements

Improv. Name	Improvement Description	Images/Photos
Student A: Zheng Hong "Scrolling Main Menu"	**Main menu GUI interface** that can access all the different applications with **scrolling functionality** - Press **btnU** to scroll up and **btnD** to scroll down smoothly across the screen - Use **mouse** to move cursor position, entry with mouse hovered on top of it will be highlighted - **Left click with the mouse** to enter the application - Press **btnL** to return to the main menu from any application	
"Custom Cursor"	- **Custom image of white gloved pointing hand** that moves together with mouse position.	
Student B: Dylan Chia "Number Pad"	- A **10-digit (0-9) GUI number pad** that can be manipulated using the **mouse** cursor and **left click** to select input digit - Backspace button (less than sign <) to delete incorrect digits - Number display on **7 segment display**	
Student C: Ming Chun "Paint Canvas" "Paint Canvas Receiver"	- **64 x 64 Canvas (32 x 32 upscaled to 64 x 64) with paint option** interfacing mouse, selection from three colors + an eraser, similar usage as Microsoft Paint. - Allows for detection of holding down of mouse to ensure pixels are generated as the mouse moves along - Ability to clear canvas with button C - Used in team improvement by communicating and transmitting pixel data across devices. Receiver side can visually see the pixel information flowing in. - Options for grayscale and colour transmission. Paint app controls: -**Mouse left click** on sidebars colour to select drawing colour -**BtnC** to clear canvas -Toggle **sw0** on to achieve faster data transmission speed (ensure receiver has this on too) -Toggle **sw14** on to use colour transmission (over grayscale) -On **sw15** to start audio transmission (once transmission starts, it will continue for entire image, so can off once audio starts playing)	Paint app:  Sent:  (See team component for received image)

"Jukebox"	**- Jukebox**: produce varying audio frequencies based on user inputs. **Switches** were used to toggle the user input, which allows for the user to create music at their fingertips. - Used to produce varying frequencies for testing, calibration and transmission of frequency-shift-keying (FSK) modulated digital signal for the information transfer. Use **sw15** to start audio playing, **sw[3:0]** to control sound frequencies creating music of varying pitch
Student D: Jing Yang "Frequency detector"	**<u>Zero-crossing based frequency detector</u>** with - variable user-defined values of decimation and sampling period - Debouncing of detector for accurate frequency detection; ± 1 decimal under sufficiently low decimation - Incorporated into team-improvement as frequency thresholding method for FSK demodulation of digital signal
"QR Code"	**<u>(Failed) prototype of a Version 1 21 x 21 QR code generator.</u>** 4-digit number input (received via numpad) encoded into Version 1 QR code (via numeric encoding), with 1-M error correction level and a standardized $i + j \% 2 == 0$ bitmask. -> USE **NUMPAD** to select 4-digit number, number will be displayed on 7-seg display. Click GEN to view created QR code, and btnC to return to NUMPAD. -> Step 1: Numeric Encoding of 16-digit hexadecimal into 128-bit encoded data message. -> Step 2: Error codeword generation using (16,10)- Reed Solomon (BCH) encoder. -> Step 3: Module placement into matrix of: Data blocks, Error blocks, finder patterns, format information, timing patterns and dark module on the screen with the chosen bitmask. NOTE: End-product was not functional by the time of submission, for two potential reasons. (1) Chosen error-correction level of 1-M might have been too poor. (2) Choice of bitmask may not be compatible with image processing algorithms on phone devices.
	
Team "Communication and information transmission"	Audio-based asynchronous FSK-modulated information communication system with error-correction capabilities. Applications derive from this system. - Option to transmit at both 20 and **50 data bps**. Hence, able to transmit **64 x 64 grayscale image** (upscaled from 32 x 32) in UNDER 54 SECS. **-** Option to transmit up-to-4-digit numbers UNDER 200MS. **Robust and Consistent:** - Ternary-bit signal to transmit start, 0 and 1 bits, for transmission with predefined asynchronous clock, - FSK modulation of signal with well-calibrated thresholds to lower possibility of accidental activation by ambient noise. - 4-bit codewords encoded with (7,4) hamming code to achieve higher Packet Success Rate (PSR).
	 (See paint component for transmitted image)
Helper app "Audio cal(ibraton)"	- App to test transmission capabilities and tune positioning of earphone - Visual representation with **LEDs** of sent message, progress of message sending and received message - **7 segment** display of current detected sound frequency using zero-crossing algorithm
	
"Audio Receiver" controls	- Toggle **sw15** on to use image receiver mode (off will be numpad receiver) - Toggle **sw10** on to use grayscale colour transmission (off for colour transmission) - Toggle **sw0** on to achieve faster data transmission speed (ensure sender has this on too) - On **sw14** to start audio receiving (off ONLY when image has been fully transmitted)