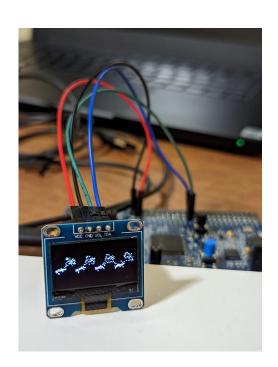
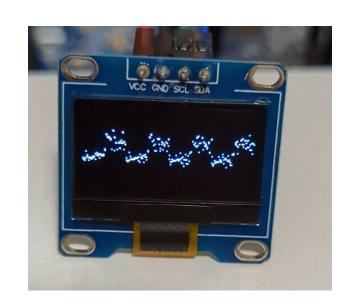
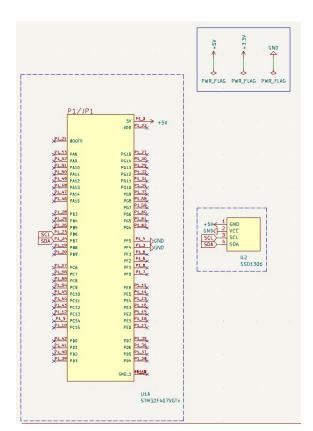
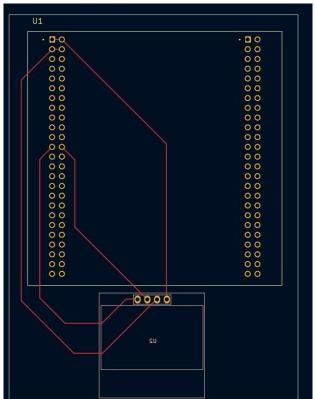
Audio Visualizer Using STM32

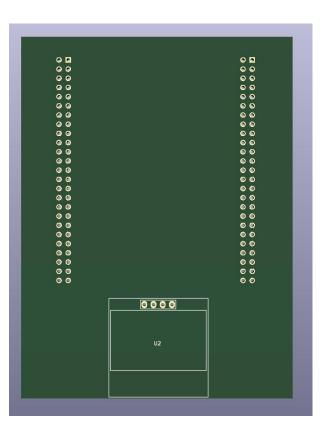




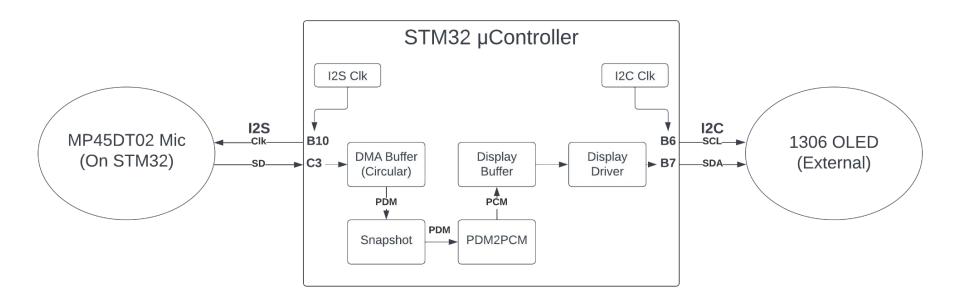
Schematics and PCB Layout







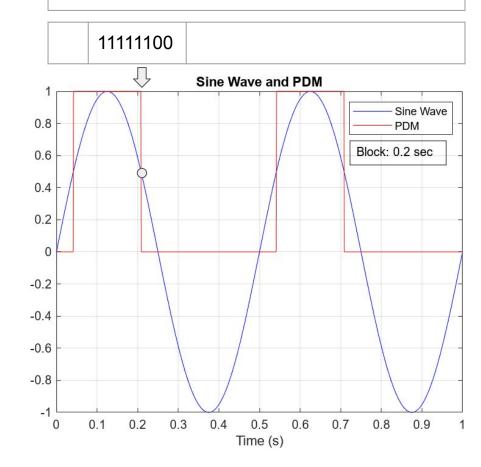
Block Diagram



Data Processing

 The microphone sends data in the PULSE DATA MODULATION (PDM) format

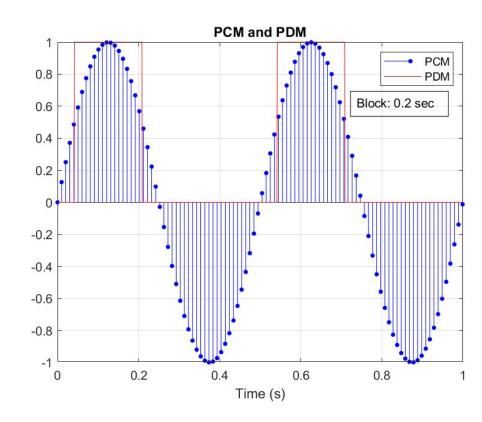
- PDM is a continuous binary signal
- It is read in blocks
- Then count the number of 1s in the block
 - If the entire block is 1s that is the max amplitude
 - If 1s makeup half than the amplitude is 0
 - If the block is 0s that is minimum amplitude



Data Processing 2

- The PDM signal is converted to Pulse Code Modulation (PCM)
 - This is just amplitude vs time (discrete)

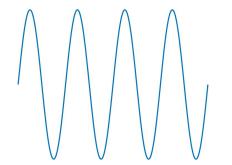
- The signal is converted using the built in PDM2PCM library for the STM32
- The library reads the 1s from each block to find the amplitude
- A high pass filter is then used to remove any DC offset from the mic
 - A constant signal (theoretically) has a frequency of 0



Data Processing 3

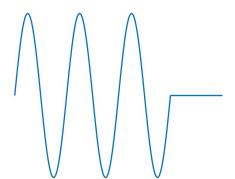
- The PCM data is added to a display buffer
- The display buffer is shifted forwards by the length of the data being added.
- The data is inserted at the end of the wave

Initial Buffer

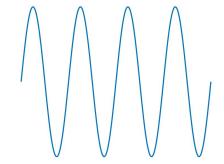




New Data

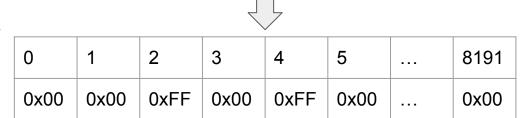


New Buffer



Output

- Communication to the 1306 OLED is handled by a driver*
- The driver has a 1-d Array for writing to the OLED
 - o Off is 0x00. On is 0xFF
- The driver takes the position (x,y) of the pixel to change and maps it to this array
- Updating the screen involves writing the array to specific chunks of the memory
- For each chunk a series of setup commands are issued and then the memory is written



 <sup>(0,0)
 (0,1)
 (0,2)
 (0,3)
 (0,4)
 (0,5)
 ...
 127,63</sup> Off
 Off
 On
 Off
 Off
 Off

^{*} from https://github.com/4ilo/ssd1306-stm32HAL

End

