

Final Project Proposal

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Overview

Our final project is called the Digital Trombone. The Digital Trombone will output a sound frequency (a note) depending upon the input from an ultrasonic sensor. The Digital Trombone will have a 4x4 keypad connected that will serve as muting and octave control. For example, the Digital Trombone will output no sound when no button is pressed. When a button is pressed, the Digital Trombone will output the note corresponding to that octave number pressed.

Inputs

- Distance from ultrasonic sensor.
 - Using a UART interface, the ultrasonic sensor will continually send data to the microcontroller. This could include an upright flat object mounted to a 3D printed rail which the user can move to choose the discrete value.
- Button presses from the Keypad.
 - Several buttons on the Keypad will be configured to control the octave output from our buzzer.
- Volume changes using a potentiometer.
 - As the user changes the resistance of the potentiometer, the volume of the buzzer will increase or decrease.

Outputs

- Sound from buzzer.
 - The buzzer will be configured in one of two ways, to both provide discrete values for different notes and continually changing the frequency for smooth transitions. The buzzer's behavior would mimic that of a trombone.

Parts and Materials

- Potentiometer
- Nucleo-64 STM32L476 Board
- 4x4 Keypad
- 3D Printed Rail
- PiezoBuzzer
- Taidacent Ultrasonic Sensor

Challenges

There are a few noteworthy challenges foreseen in the design of the Digital Trombone. Firstly, the input from the ultrasonic sensor may need to be discretized in specific bins. This is needed if the output of the sensor has too much noise that a steady location of the Trombone produces a fluctuating sound frequency.

Secondly, delays of calculation, timing, and sampling will need to be mitigated enough that playing the Digital Trombone feels responsive. A concern is that the conversion from the output of the ultrasonic sensor to the proper output frequency will take long enough that the user will feel a delay.

Block Diagram

