Project Title: Theremin Sound Game

Members:

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Project Abstract:
The Theremin Sound Game brings your musical skills to the test without even touching an instrument! Play different notes with a theremin by moving your hands back and forth in front of the sensor, and try to match the notes of the song displayed on the screen display. Get a high score and match the pitch of the notes, using the tuner to get the notes as close as possible! Watch the lights on the LED matrix board light up as they change colors and make a show based on the notes!

Detailed Project Idea:

1. Overall Description of Project Idea:
   The project's aim is to emulate a sound game which will utilize a theremin as well as LEDs and a TFT LCD color display. The game's win scenario is achieved by playing the theremin and accurately matching the notes of the song that the game displays on the screen. The LEDs will change colors depending on the notes of the song that is being played to create good vibes.
2. Initial Project Design Using Multiple Arduinos:
   One Arduino will be used to create the theremin. The second Arduino will be used to handle the actual game mechanics. The game will have a number of pre-recorded songs and display the notes that the player needs to produce. It will keep track of how off pitch the notes are and display a score at the end of the song. The screen of this Arduino will also show a color-coded tuner that displays how far off pitch the player is from the real note. A third Arduino will control the LED lights display that changes based on the pitches coming from the theremin when the game is not running. When the game is running, it will display colors based on the note of the song.
3. Communication Between Arduinos:
   For communication between Arduinos, serial communication will be used. It will send data back and forth between the Arduinos, such as pitch frequency and colors

for the LEDs and screen. The Theremin Arduino will send the pitch frequencies to the LEDs Arduino so that it knows which colors to change the LEDs to. The pitch frequencies will also be sent to the Game Arduino so that it can check the notes being played with the ones of the song.

4. Expected Inputs/Outputs:
   An input would be proximity sensors, used to create the theremin. It will sense where the players hands are in order to produce certain notes on the theremin. Another input is the touchscreen that will be used to control the game, such as selecting a song. Potentiometers also act as inputs to change the brightness of the screen and the volume of the notes playing. Outputs would be the changing LED lights, and the screen that the game will run on. It will display the notes to play, the score at the end of the song, and the color-coded tuner based on the accuracy of pitch.
5. Original Work:
   This project combines the LED lights with a theremin to create a multi-sensory musical experience. It also runs a game based on playing the theremin accurately to match notes of a song.

Timeline:

Week of	Goal
October 14	Start working on creating a theremin, start ordering components
October 21	Code theremin pitch logic and setup input/output
October 28	Hook up LEDs, code LED display color code logic
November 4	Setup LCD (16x2) screen for game mechanics, figure out any hardware issues that come up
November 11	Code game mechanics to utilize theremin and LEDs, as well as audio logic
November 18	Debug any errors/software issues relating to any of the Arduinos
November 25	**Design Presentation**
December 2	**Project Demonstration**

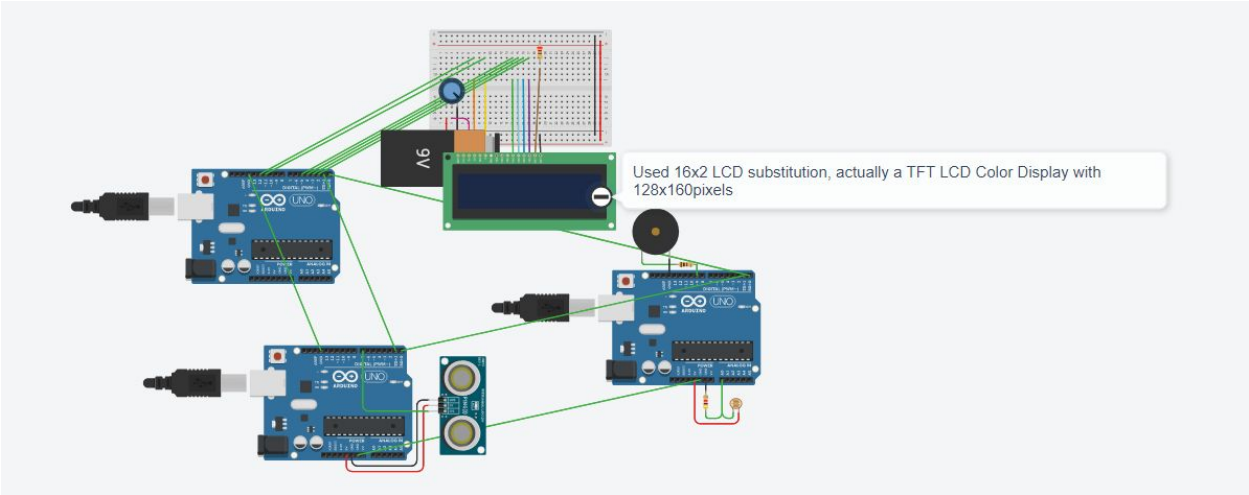
Materials:

- Color TFT LCD Display x1
- Audio Integrated Chip/3-16V Piezo Buzzer
- Open Theremin Arduino Shield x1
- Arduino UNO/Genuino UNO x3
- Capacitor (temperature stable)
- Digital Potentiometer x2
- 9V Battery Power Supply x3
- Soldering iron x1
- Jumper wires
- Resistors
- Distance-sensor x1
- Breadboard x1

References:

- How to make a theremin using an Arduino reference -- https://create.arduino.cc/projecthub/gaudi/real-theremin-using-open-theremin-shield-for-arduino-4a2619
- Second reference on how to make an arduino and wire things up -- https://learn.adafruit.com/adafruit-arduino-lesson-10-making-sounds/overview
- How to use a TFT LCD Display -- https://howtomechatronics.com/tutorials/arduino/arduino-tft-lcd-touch-screen-tutorial/
- Programming LED Matrix Board Reference -- https://create.arduino.cc/projecthub/SAnwandter1/programming-8x8-led-matrix-23475a

Diagrams:



Code Sketches:

Theremin/Buzzer Arduino:
Theremin distance sensor input pin variable initialized
Serial variables initialized for receiving and sending data
setup()
{
    Serial initialized
    pitch variables initialized
    input mode for distance sensor set
    Output mode for buzzer set
}
loop()
{
    record pitch variable as scale of computed number from distance sensor value
    Sends pitch variable to play on buzzer as some tone
    receives data from other two arduinos through serial
    processes data
    gets data from other arduino which is the song notes, sees if pitch is in a really close range to the pitch variable recorded by the distance sensor
    if it is, sends a "good" signal back to the game arduino to update score
    if it isn't, it's just off pitch, and it gets sent to the led/buzzer arduino to display how off the tone is with lights
}

LED Matrix Board Arduino:
LED Matrix board pin variables initialized
Serial communication variables initialized
setup()
{
    Serial initialized
    Rgb color leds initialized
    Led matrix board output mode set
}
loop()

```
{
    receive data from theremin arduino and game arduino
        if (game has not started, just theremin data)
        {
            process data and store theremin pitch into a specific range of values to assign
            to a specific color on the hue chart of led colors
            corresponding color is displayed on the led matrix board
        }

        else
        {
            game has started, leds will take the input from the game arduino song notes
            leds on matrix board will "react", change color based on notes of song
            corresponding color of pitch from theremin is also displayed
        }
}
```

LCD Game Menu Arduino

```
initialize game mechanic note array, songs
initialize TFT LCD screen variables
setup()
{
        TFT screen setup
        Serial initialized

}
loop()
{
        receive data from theremin board and led board
        draw pixels on screen display for game menu
        if statements for menu touch screen choice
        if (game is running, song is on)
        {
                display tuner with color code range from green to red, like hot/cold to
                show in one section of screen
        }
        sends data of options selected on screen (whether menu,song,cancel,etc...) to
        theremin and led matrix board
}
```