CS/EE 120B Custom Laboratory Project Report

Pick that Lock!

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Introduction

My project is a game called “Pick that Lock!” It is an audio cue based game where the player must reach a specific distance to an ultrasonic sensor, use audio cues that are based on how close they are to the correct distance, to finally then use a remote control to confirm whether or not they were correct. In creating this project there were some limitations that resulted in some desired features being left out. The biggest challenge was that due to my use of an ultrasonic sensor and how I coded my state machine, the addition of a remote control was made inconsistent. To be more specific, every button on the remote control emits its own frequency to be read and decoded, yet during the coding process any given button fails to hold a singular decoded message. This made assigning different remote buttons to different functions, such as level selection and differing lock confirmations, impossible. Therefore I had to merely accept any button press and a general confirmation within my game. This is the only real hiccup of a complexity that resulted in project aspects not being as I desired.

Complexities

Remote control - Implemented with limitation

For user interaction within the game. During the process of confirming any given lock, when the user is ready to confirm any given distance they must press any button on the remote control.

Ultrasonic sensor - Successfully Implemented

Used for lockpicking within the game. The user must place their hand next to the sensor, with the correct distance apart being some randomized. They may freely explore which distance is correct and must hold it during confirmation.

Buzzer - Successfully Implemented

Gives the audio cue when the user gets closer and closer to the correct distance for the ultrasonic sensor when lockpicking. When the user successfully lockpicks the lock three times, a “victory” buzz will play for a few seconds.

User Guide

The user starts the game with 3 different means of interaction. They have a singular reset button on the breadboard, they have the ultrasonic sensor to approach, and a remote control for lock confirmation.

The user must use their hand and place it near the ultrasonic sensor, within arms reach. They must then explore within that distance and rely on audio cues given by a passive buzzer, until they reach a high pitch and frequency buzz, denoting that they have discovered the correct lock tumble location. Using the remote control while maintaining this distance, they must then press any button to confirm, or in other words, pick those locks.

Upon successful confirmation they must repeat this process 2 more times, with the distance being randomized. If they have confirmed a lock with an incorrect distance, they lose, as denoted by the LCD, and must hit the reset button to start over. Upon picking all 3 locks a victory buzz will play and the LCD will display that they have “picked that lock.” They can hit the reset button as normal, or during any time, to reset the game.

During this time the LCD will display how many levels they have won, “picked” with a numerical score.

Hardware Components

Elegoo UNO R3 Controller
LCD1602 Module

IR Receiver Module
Remote Control

Ultrasonic Sensor
Passive Buzzer

Button to perform a total reset

Resistors as necessary

Microcontroller Pins:

5V pin is used to power the breadboard
GND pin acts as the ground for the breadboard

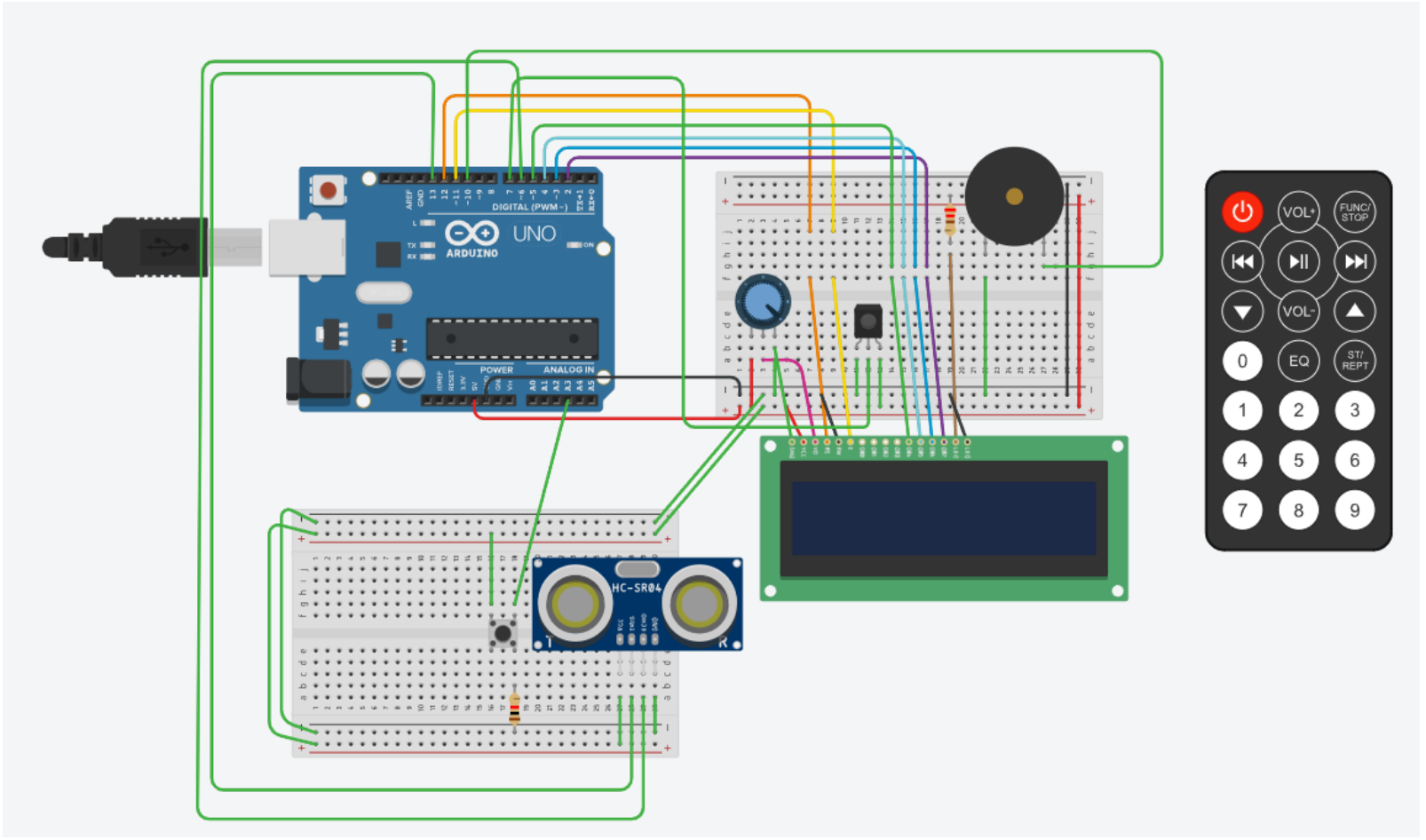
Digital PWM pin 13 is used for the Ultrasonic Sensor Trigger
Digital PWM pin 12 is used for the LCD1602 display RS pin
Digital PWM pin 11 is used for the LCD1602 display E pin
Digital PWM pin 10 is used for the Passive Buzzer
Digital PWM pin 9 is used for the LCD1602 display RS pin
Digital PWM pin 8 is used for the LCD1602 display E pin
Digital PWM pin 7 is used for the IR Receiver Module
Digital PWM pin 6 is used for the Ultrasonic Sensor Echo
Digital PWM pin 5 is used for the LCD1602 display D4 pin
Digital PWM pin 4 is used for the LCD1602 display D5 pin
Digital PWM pin 3 is used for the LCD1602 display D6 pin
Digital PWM pin 2 is used for the LCD1602 display D7 pin

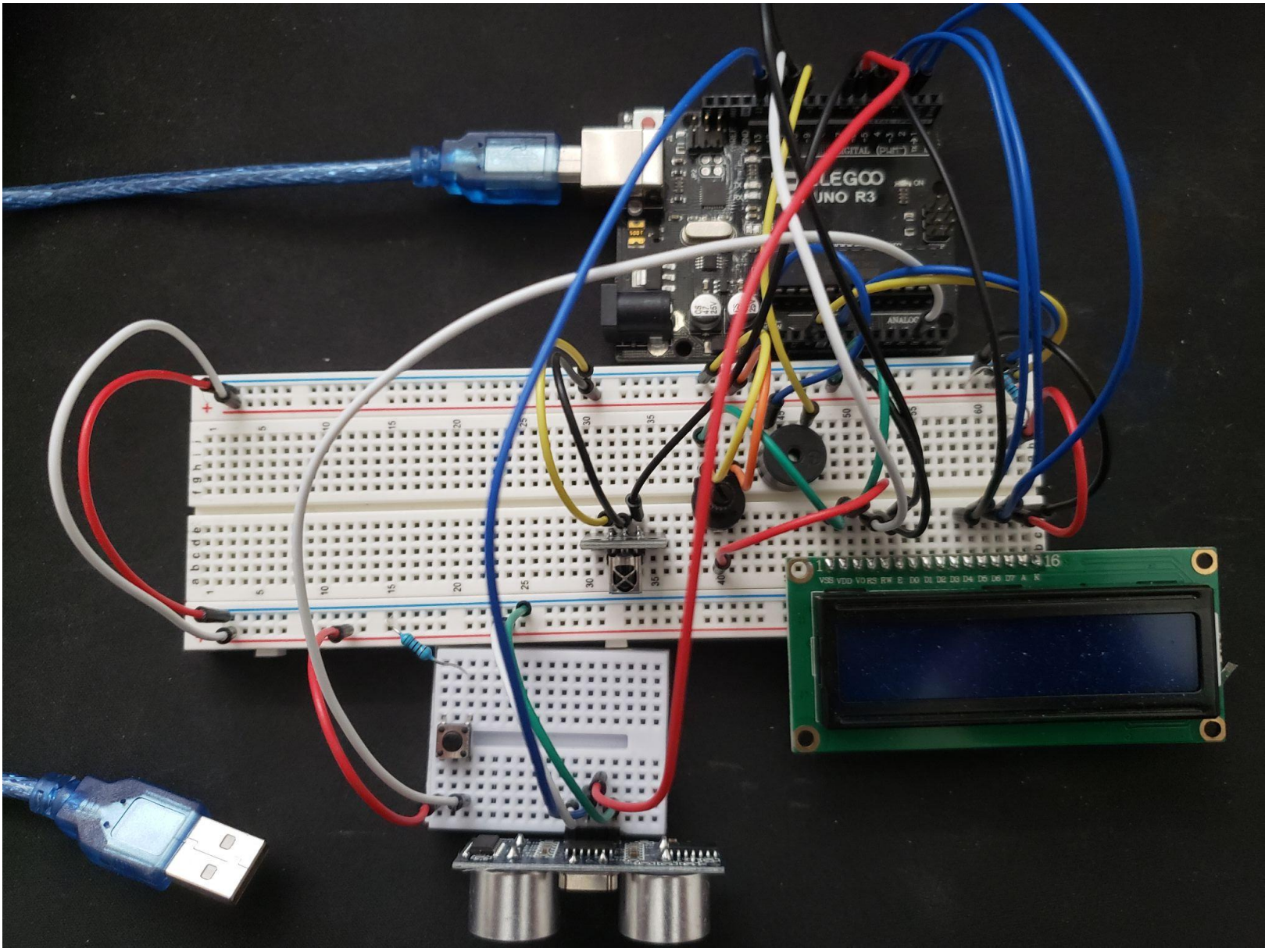
Analog Input A3 is used for the Reset Button

Software Libraries Used

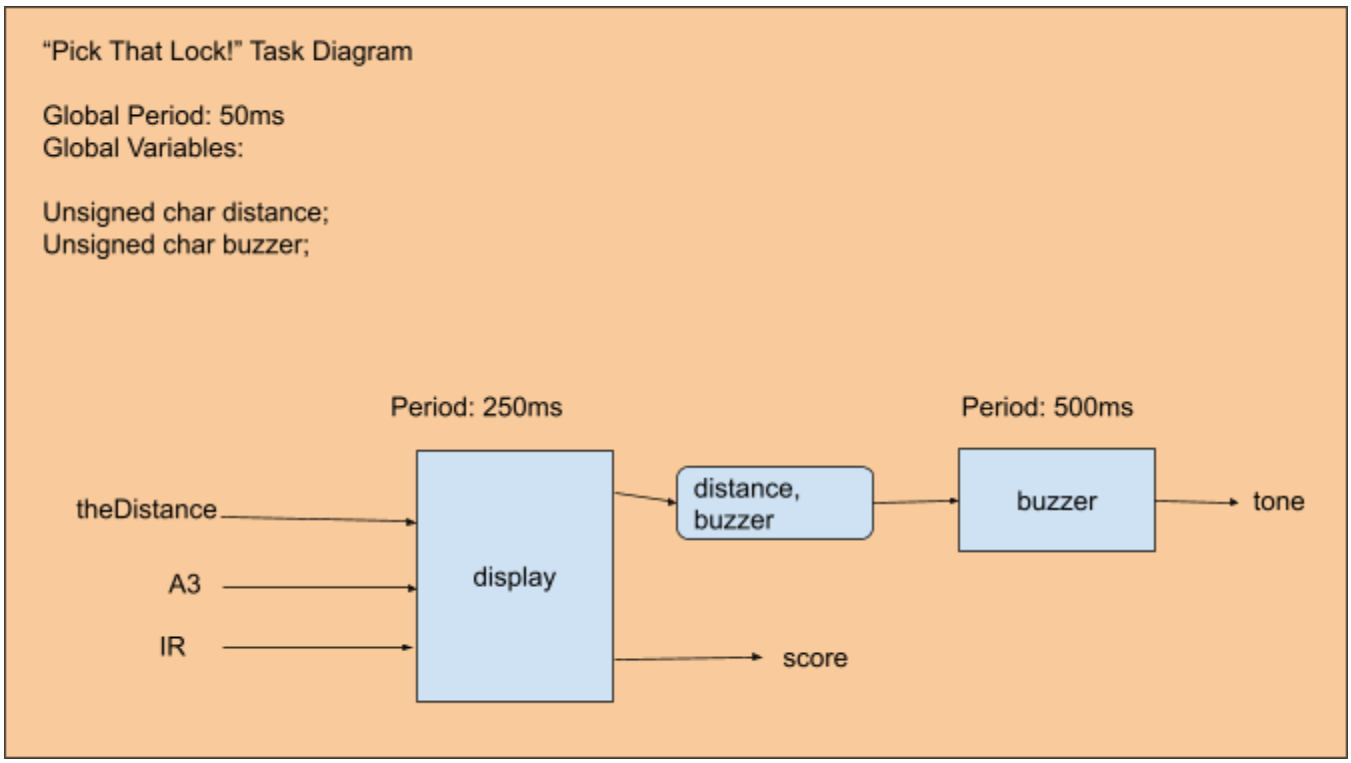
IRremote Version 3.5.2
This library was installed to make use of the remote control, where when a button is pressed I was able to receive the button press as data, allowing me to recognize the press as a manner of input to confirm locks.

Wiring Diagram


DIGITAL (PWM~)
UNO
ARDUINO
POWER
ANALOG IN
HC-SR04
VOL+
FUNC/
STOP
VOL-
EQ
ST/
REPT
0
1
2
3
4
5
6
7
8
9


LEGOO
UNO R3
VSS VDD VO RS RW E D0 D1 D2 D3 D4 D5 D6 D7 A K

Task Diagram



theDistance is dynamically calculated from the ultrasonic sensor.
A3 is the reset button
IR is the infrared receiver for the remote control
Score gets outputted onto the LCD1602 display

Distance and buzzer is calculated and set within the **display** task and is sent to the **buzzer** task.

Tone is the audio output from the passive buzzer calls within the **buzzer**.

SynchSM Diagrams

This is the link to my display task synchSM. Apologies but the image was too big to make the text readable in pdf format. This is the next best solution. Anyone with the link can open up the image.

https://drive.google.com/file/d/1Ur2l9Df8He6WlzDQkN1owsySWINZM1fK/view?usp=sharing

synchSM for Buzzer Task