

Hand-Eye Coordination Game

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Functionality:

The following features have been implemented in the final game:

- Both Game mode and Test mode have been implemented according to the brief.
- During Test Mode, the ultrasonic sensor can sense objects up to 20cm away.
- The ultrasonic sensor can accurately distinguish between four distinct regions, each of which is 4cm wide.
- A slide switch has been implemented that can be used to switch between game mode and test mode.
- A seed based pseudo-random number generator has been implemented for game mode.
- The current region (Test mode), random number (Play mode), and final score (End of play mode) can be displayed accurately on a pair BCD seven segment displays.
- Three LED's to communicate the score.
- During game mode, a timer has been implemented to allow the player 4 seconds to find the correct region.
- During test mode, the same timer as used above is used to delay between displaying the regions.
- The final score (positive and negative) displayed on the seven segment displays once the game has ended. Moreover, scores above 10 can also accurately be displayed on the seven segment displays.

Discussion of circuit and implementation

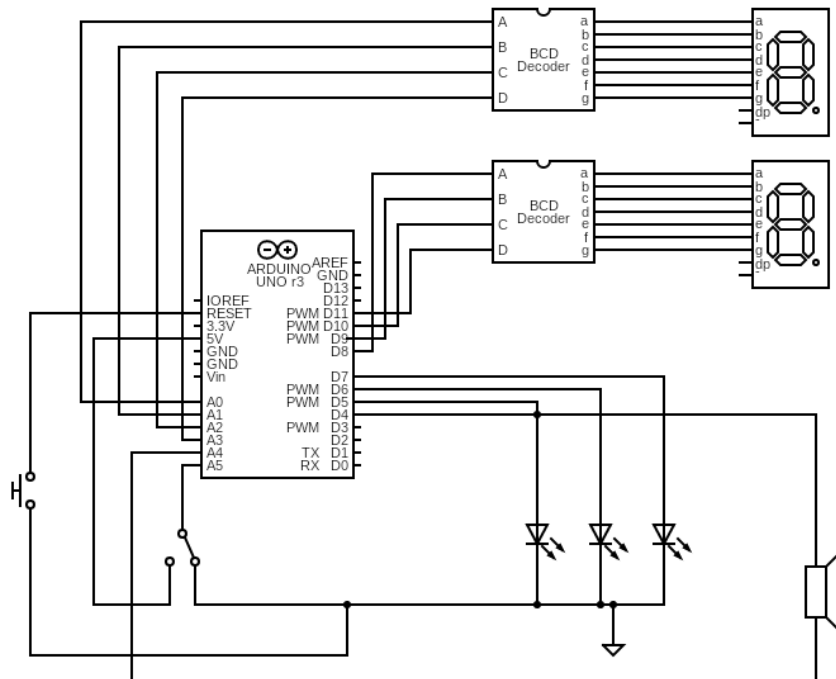
The main component of the entire game is an Atmega328p microprocessor that interfaces with the rest of game through an Arduino development board. In addition, the seven segment displays interface with the Arduino through BCD decoders. The push button is connected directly to the reset pin in order to reset the game. The pin change interrupt handler has been written in such a way to distinguish between rising edge and falling edge inputs. This is so that when a pulse is generated after timer 1's overflow interrupt is called, timer0 can sample the pulse coming from the echo pin in order to determine distance. The distance is calculated by resetting the value stored in timer0 when the echo pin sends a high, and then storing and processing the value in timer0 when the echo sends a low.

The table below describes what each interface component of the microcontroller was assigned to.

| Interface | Responsibility |
|--------------|---|
| Port-B (0-3) | The seven segment display that outputs units |
| Port-C (0-3) | The seven segment display that outputs tens |
| Port-C (4) | Outputting a pulse to trigger the ultrasonic sensor. |
| Port-C (5) | Receiving input from the slide switch, in order to determine the game mode. |

| | |
|----------------------|---|
| Port-D (4) [PCINT20] | Receives the output of the echo from the ultrasonic sensor. This triggers a pin change interrupt upon receipt. |
| Port-D (5) | Outputs to the red LED |
| Port-D (6) | Outputs to the orange LED |
| Port-D (7) | Outputs to the green LED |
| Timer0 | This timer is pre-scaled to its maximum value in order to count as slow as possible. This is so that it can keep track of the duration of the pulse returned by the echo. This value is used in distance calculation. |
| Timer1 | This timer is pre-scaled to its maximum value in order to count as slow as possible. This is so that when the timer overflows, it can serve as the delay between each pulse generation. |

Circuit Schematic



Circuit Diagram

