

THE HANDY
Rival

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Design Summary

Our device is an arcade game that allows an individual to play rock, paper, scissors against a robotic hand. When the user puts on the glove, movement is detected and the displays turn on (Fig. 1). Blinking LED lights prompt the user to select either the “Best of Three Rounds” or the “Best of Nine Rounds” button (Fig. 2). After a button is pushed, the LEDs stop blinking and the game begins.

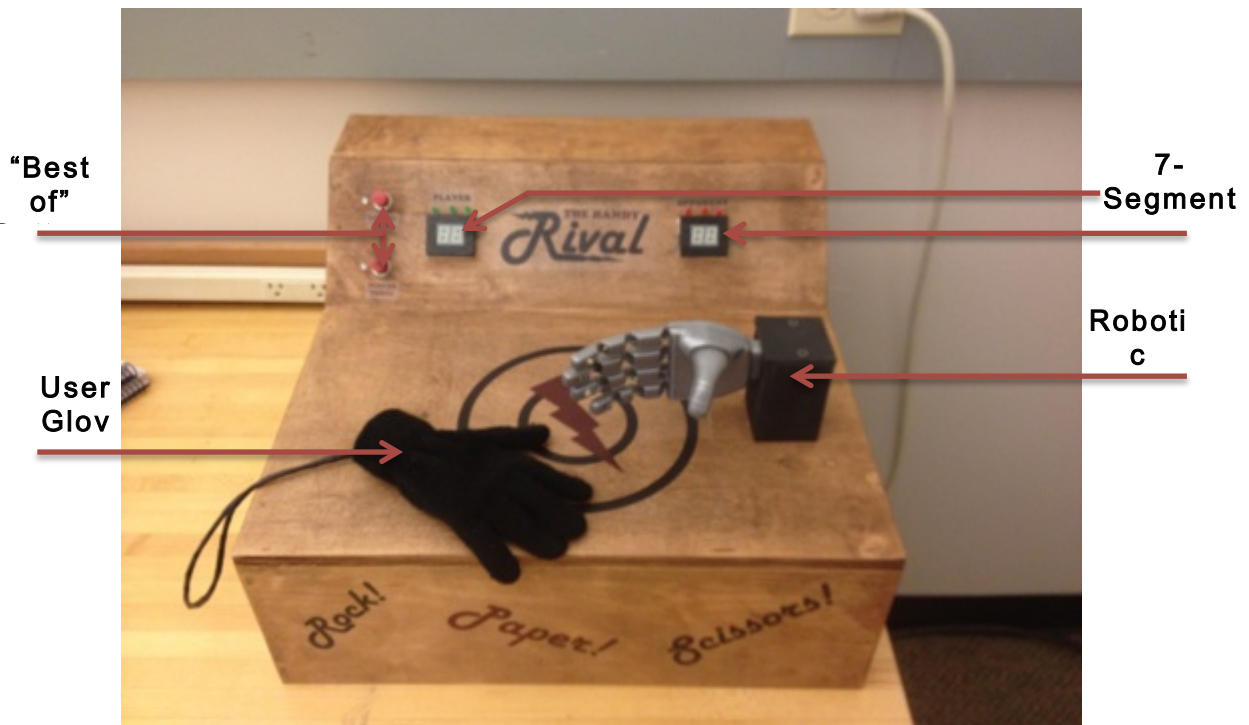


Figure 1: Front view showing the main user interface

There are four beeps to synchronize the user with the timing of the “rock... paper... scissors... shoot.” On the fourth beep or the “shoot,” the user and the robotic hand show their selection by use of the familiar rock, paper, or scissors hand signal. If the user wins the victory sound plays and one point is added to the “Player” score on a 7-segment display (Fig. 2). If the user loses, the defeat sound plays and a point is added to the “Rival” score on a separate 7-segment display. In the event of a tie, a neutral beep sounds, no points are awarded, and the round is replayed.

If either opponent scores two points in a three round tournament, or five points in a nine round tournament, the game is over. A final tune will play and the LED's around the "Best of" buttons begin to blink again prompting the user to begin a new game. If there is no motion for 30 seconds while it is waiting for a button to be pushed, the displays and LEDs will turn off until there is motion (Fig.2).

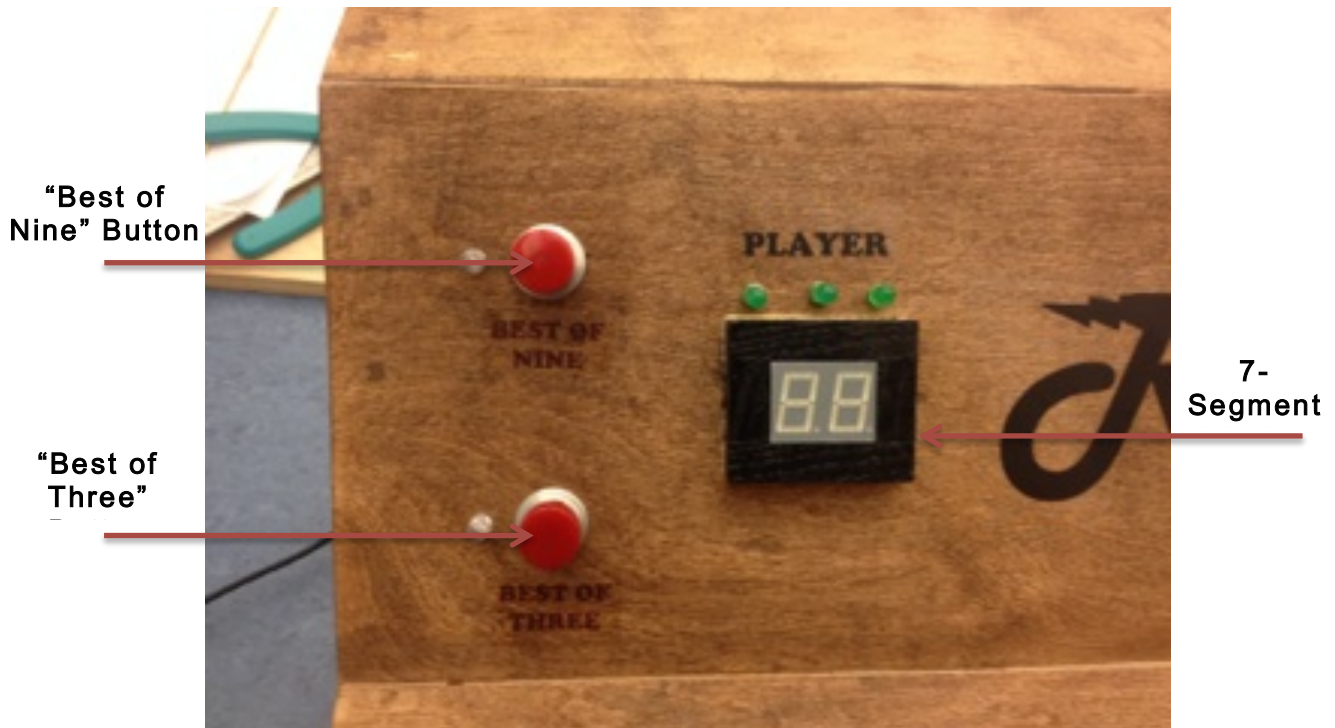


Figure 2: Displays and LEDs off after 10 seconds of inactivity.

System Details:

When the PIR sensor below the user's glove is activated by motion, the 7-segment displays turn on. Blinking LEDs cue the user to press a normally open push button to determine the number of rounds in the game. Once the user inputs the number of desired game length is selected, the game begins. The PIC microcontroller produces four beeps using the "SOUND" command in PICbasic to indicate the timing of the "rock, paper, scissors...shoot." Sound is amplified using a transistor and plays through a speaker mounted to the top of the enclosure (Fig.3).

The robotic hand moves according to a selection randomly assigned to it by the "motor 1" microcontroller. Magnetic reed switches in the glove collect the user's input and the "main" microcontroller compares it to the random input of the robot to determine who won the round (Fig.3). The PICbasic code for the microcontrollers can be found in the appendix with the code for the remaining PICs.

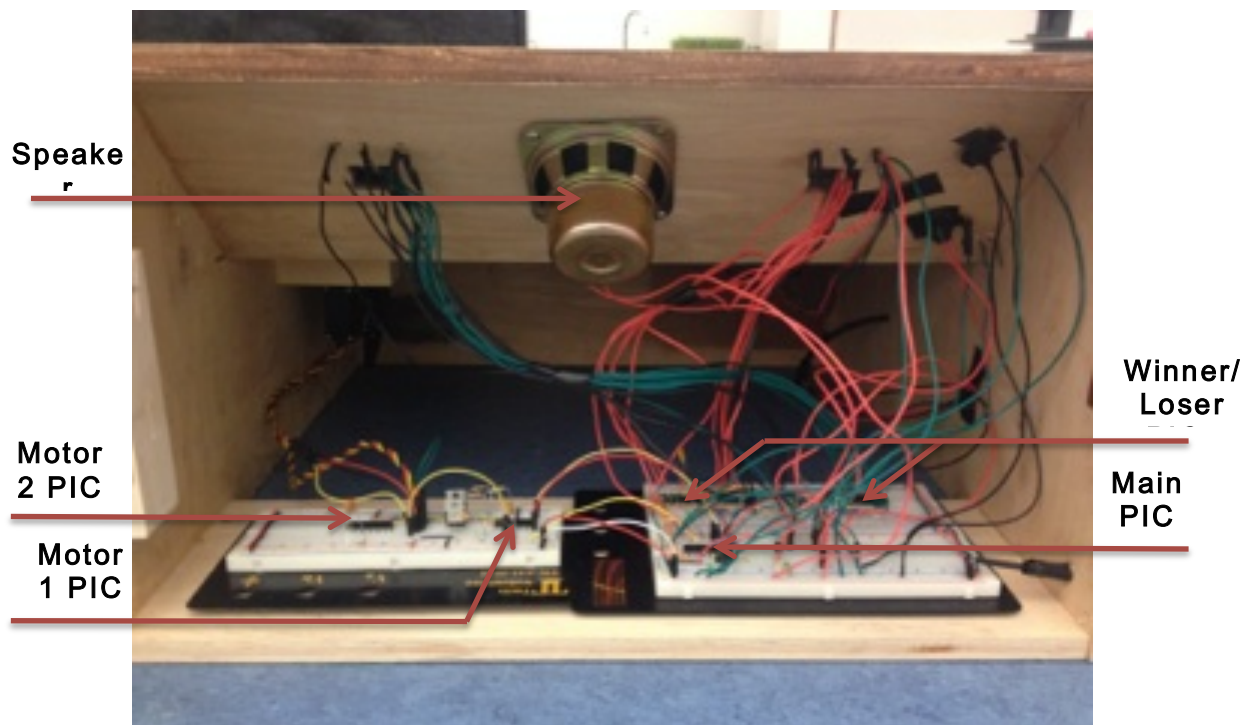


Figure 3: Internal Layout

The user glove contains two magnetic reed switches and two sets of magnets. One sensor is toward the base of the middle finger to detect a fist, and a second sensor is between the middle and pointer finger to distinguish between paper and scissors. The user's hand positions in Figure 4 will send high signals to the "main" microcontroller to indicate the appropriate input.

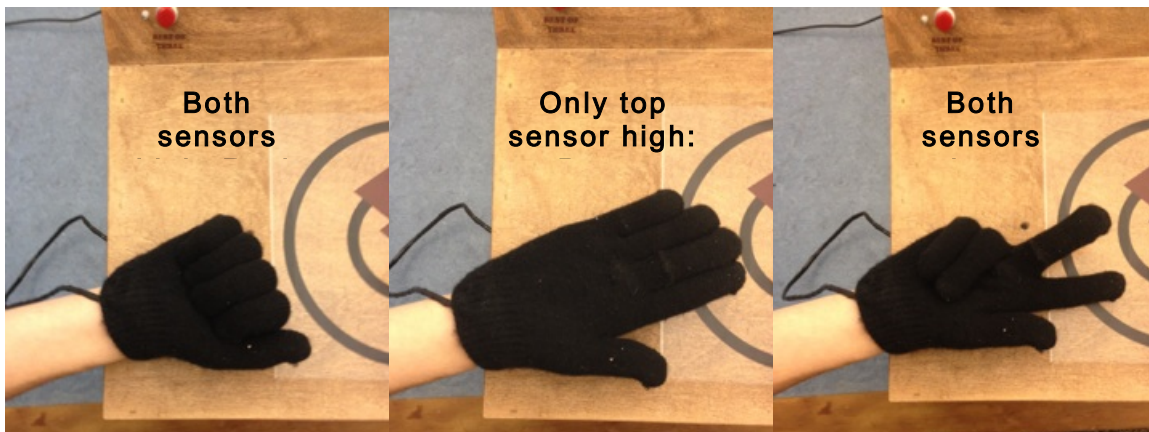


Figure 4: User Inputs

The robotic hand displays outputs through the use of two servo motors mounted directly below it inside of the enclosure. Fishing line connects the top two fingers to motor 1 and the bottom two fingers attach to motor 2. The hand begins in a rock position. When the "motor 1" PIC sends an output, the two motors activate according to the positions in Figure 5. The motors then turn the opposite direction and return the hand to the rock position.



Motor 1	Motor 2	Position
Move	Move	Paper
Move	Stay	Scissors
Stay	Stay	Rock

Figure 5: Motor Outputs

The “main” microcontroller receives the inputs from the user and “motor 1” and uses logic to determine the winner of the round. The “winner” or “loser” PIC receive an input that adds a point to the previous score, displays the new score on the 7-segment display and blinks LEDs to indicate which player won the round (Fig. 3). When either score reaches the majority of the rounds in the tournament, the “winner” or “loser” PIC sends a signal to the “main” PIC that the game is over. The microcontroller outputs a “game over” sound and the 7-segment displays return to zero. The “main” microcontroller returns to its opening loop of blinking the “Best of” LEDs and waiting for a user to choose a number of rounds. If the PIR sensor does not detect any motion for 10 seconds, all displays and LEDs turn off.

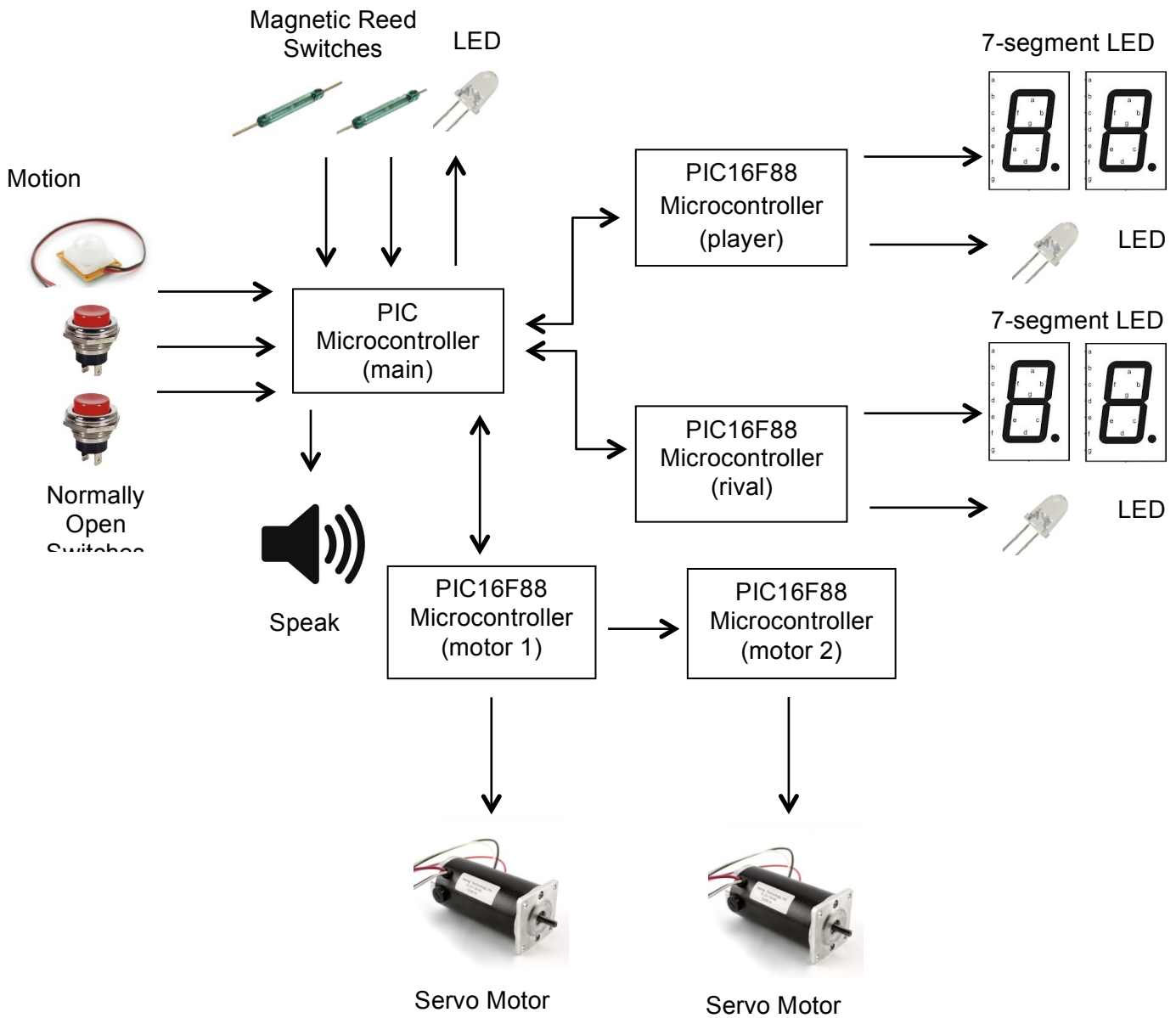


Figure 6: Functional Diagram

Partial Parts List:

Part Name	Model Number	Source	Quantity	Price
Servo Motor	6KG-WPHLNA0252	Hobby Town	2	\$35.50
PIR Sensor	2760347	Radioshack	1	\$10.00
Reed Switch	COM-10601	Spark Fun	2	\$1.95
Power source	ETAOU61JBE	Recycled	1	\$0
Speaker	N/A	Recycled	1	\$0
Plastic Hand	833-12	Amazon	1	\$12.27

Allied Electronics Similar Parts List:

Part Name	Allied Stock Number	Quantity	Price
Servo Motor	70050414	2	\$95.90
PIR Sensor	70372366	1	\$9.60
Reed Switch	70168917	2	\$3.49
Power source	70213306	1	\$17.02
Speaker	70115728	1	\$2.24
Plastic Hand	n/a	1	n/a

Pictures:

