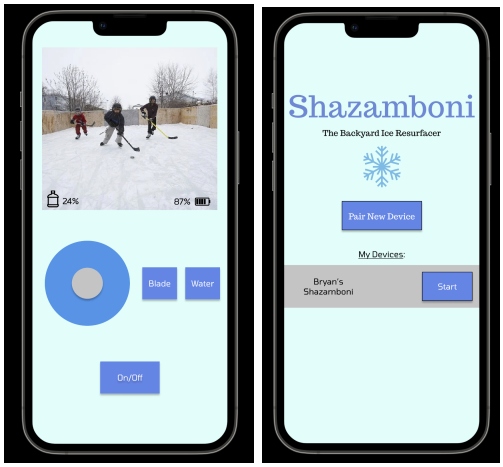
Boston University
Electrical & Computer Engineering
EC464 Capstone Senior Design Project

Second Prototype Testing Plan

Shazamboni



by

Team #10
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Team Members

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March 3, 2022

Required Materials:

Hardware:

- Raspberry Pi 4 (with 64GB SanDisk SDHC card)
- Raspberry Pi 2
- HC-SR04 Ultrasonic Sensor
- SunFounder Smart Video Car Kit V2.0
- 470 and 330 ohm resistors
- 18650 Rechargeable batteries
- DC 12V 300RPM Gear Motor
- L298N Motor Driver Controller
- Arducam 5MP Camera for Raspberry Pi, 1080P HD OV5647 Camera Module V1 for Pi 4, Raspberry Pi 3, 3B+, and Other A/B Series

Software:

- Python Scripts
- Motion Sensor Detection
- Remote Control (Base Code)
- Motor Controller and Motion Sensor Detection
- Camera Interfacing
- Ad-Hoc Connection

Set Up:

There will be four tests conducted – the first testing the ultrasonic sensor integration with the motors, the second testing ad-hoc connection and live-stream, the third testing socket motor control communication and the four testing the joystick control on the ShazApp.

The first test will be set up into two parts: hardware and software. The hardware includes a L298N motor controller connected to the Raspberry Pi 4 and two DC gear motors. The Raspberry Pi 4 also features connections to an ultrasonic sensor, again featuring the 330 Ohm and 470 Ohm resistors on a breadboard configuration. We will connect the Pi 4 to two 18650 batteries and the power socket for the purposes of this test. The ultrasonic sensor will be connected to 4 pins on the Raspberry Pi: VCC, GRND, TRIG, and ECHO. Each DC motor is connected to the L298N motor controller using three pins: ENABLE, and two INPUTS. The software will consist of testing forwards, backwards, stopping and starting motions, as well as detection of objects with the ultrasonic sensor. The python script that will be used can be found in our Github named *robot.py*

The second test will test the websockets of our additional raspberry pi paired via an ad-hoc connection. We will disconnect the primary raspberry pi 4 from the internet for the purposes of this portion of this test.

The third test will check the ad-hoc controls via the python script *controller.py* on our Macbook air.

Finally, the fourth test will send joystick distance and degrees values from our ShazApp to a socket running on our Macbook air, again.

Pre-testing Setup Procedure:

1. Ultrasonic Sensor and Motor Controller:

1. Connect Raspberry Pi 4 to monitor, power, internet, keyboard, and mouse
2. Run the python script *robot.py* for ultrasonic sensor work.
3. Run the python *manual_control.py* script for the forward and backward controls.

2. Sunfounder Webcam and Ad Hoc Network:

1. Connect webcam to Raspberry Pi 4 and power
2. Start motion library

3. Socket Motor Control

1. On Raspberry Pi, start *controller.py*

4. ShazApp Socket Communication:

1. Start socket server on computer by running *nc -lvp 1234*
2. Start mobile app on second computer and update IP address in code
3. Move joystick and see JSON packet.

Testing Procedure:

1. Ultrasonic Sensor and Motor Controller:

1. Use the commands on the script to control the motors (r-run s-stop f-forward b-backward l-low m-medium h-high e-exit)
2. Place an object in front of the ultrasonic sensor and move it closer and further .
3. Check to see if the motors stop working when an object is placed close to the ultrasonic sensor.

2. Sunfounder Webcam and Ad-Hoc Network:

1. Connect to the Ad-Hoc WiFi network (IBSS-RPi)
2. Visit http://raspberrypi.local:8081 to view livestream

3. Socket Motor Control

1. Run sender.py on Raspberry Pi to make motors move.

4. ShazApp Socket Communication:

1. Start socket server on Yanni's computer
2. Run android emulator on Bryan's computer and open ShazApp, click on start to view control page
3. Move around joystick

Measurable Criteria:

1. Ultrasonic Sensor and Motor Controller:

I. Should detect distances larger than 7 cm.
II. Motor should stop when objects presented less than 7 cm.
III. Motor should continue when objects detected are greater than 7 cm.
IV. Motor should move when the command line -r runs.
V. Motor should change speed when the command line -h or -l runs.
VI. Motor should reverse direction when on the command line ? runs.

2. Sunfounder Webcam:

I. Able to connect to ad-hoc WiFi network
II. Able to see a live stream from remote device

3. Socket Motor Control:

I. Motor should move in three directions.

4. ShazApp Socket Communication:

I. Should see JSON packets from Bryan's computer to Yanni's computer

Score Sheet

1. Motor Controller and Ultrasonic Sensor:

Description	**Did it work? (y/n)**
The motor can move forward.	
The motor can move backward.	
The motor stops if it detects an object at a distance of 7 cm.	
The motor continues if the sensor does not detect an object.	

2. Webcam and Ad-Hoc:

Description	**Did it work? (y/n)**
The Raspberry Pi interfaces with another device through WiFi	
The motor can move forward based on the signal sent.	
The motor can move backward based on the signal sent.	
The Webcam streams footage.	

3. ShazApp Motor Control:

Description	**Did it work? (y/n)**
The motors can move in one direction on the signal sent.	
The motors can move a second direction based on the signal sent.	
The motors can move a third direction based on the signal sent.	

4. ShazApp Motor Control:

Description	**Did it work? (y/n)**
JSON packets are streamed from one computer to another	

Hardware Pinout

Pi4 Pin #	Usage/Description
26	Trigger/ Sends a sound wave for detection for sensor
19	Echo/Receives the sound wave back for sensor
2	Power/5V for sensor
6	GND/ The end of the loop for sensor
24	Motor controller input 1 for motor 1 (right)
23	Motor controller input 2 for motor 1
25	motor controller enable A for motor 1
26	Motor controller input 3 for motor 2 (left)
27	Motor controller input 4 for motor 2
28 (19)	motor controller enable B for motor 2