Testing Plan

3D printed handle

1. What do you test?

We will be testing the durability and the connections of the umbrella handle.

2. How do you test it?

By designing it using the stress analysis tool within inventor. In addition, printing it out and dropping it and using the handle in a more rigorous way than the intended use to insure the integrity of it.

3. Which data to be collected, from which ‘locations’, and how collected?

After going through the tests we will analyze the integrity of the handles to determine if there are any fractures or breakage anywhere on it and why it might have broken the way it did.

4. How are raw data processed?

By analyzing the areas that broke.

5. Determine characteristics to be used to present results

Pictures and figures showing where and where the handle broke.

6. Evaluate project success

Did the handle break? Where did it break? What was done to it to make it break? Would it break the same way from normal everyday use? If so what needs to be done to fix it?

7.How long the experiment will be tested on.

Each handle will be experimented within two days but if revisions are needed then it could take two to three weeks to finish a design that passes the testing. The first testing will begin the 3rd week of the semester and will go into the 4th week if more revisions are needed. The 5th week is also set aside for testing in case unforeseen issues occur during the first two weeks.

3D modeling— Ferrule

1. What do you test?

 Ferrule needs to be tested on its durability and overheating situation.

2. How do you test it?

1)Assemble the Pi and Battery.

2)Measure the peak temperature that both components create.

3)Applying same temperature environment to the ferrule.

4)Check the ferrule’s shape and comparing with the original dimension.

5)This process may test on the extreme case like in the room temperature 90o.

3. Which data to be collected, from which ‘locations’, and how collected?

Peak temperature will be collected by the temperature sensor DHT22.

4. How are raw data processed?

 The test will process 10 mins with 3 times testing. Record the temperature for each min.

5. Determine characteristics to be used to present results

Temperature Vs. Time.

6. Evaluate project success --- a set of questions to be answered based on the above-mentioned graphs

Does the Ferrule keep the original shape? Ferrule melted when overheat? Is inner area temperature reaching the warning range for battery and Pi?

7. How long the experiment will be tested on.

This experiment will be placed on the 5th week. When the pi and battery are ready to use and 3D model has been built. The first 2 week will use for 3D modeling and printing.

Control system

1. What do you test?

 Testing the pi zero and the python code. Checking to see if things turn on and off at the correct time.

2. How do you test it?

 Running the code to make sure there are no errors. Then going back and changing or reworking lines to make the code better. Making sure the sensors and electronics are not failing even if the code is correct.

3. Which data to be collected, from which ‘locations’, and how collected?

 The DHT11 is used to collect both temperature and humidity. Data can be obtained from pinging the sensors every three seconds.

4. How is raw data processed?

 Using python’s native error reporting as well as visually with the motors and pumps. Anything that happens can be seen on the command line or physically.

5. Determine characteristics to be used to present results

 The easiest way to present results is to physically showing the electronics turning on and running

6. Evaluate project success

 If the electronics turn on and off at the correct times. The code is being used to try and keep temperature and humidity within an acceptable range. If the electronics are on and off when inside or outside the range, then the code is working successfully.

7.How long the experiment will be tested on.

 This experiment will be tested on for any where from 1 to 2 weeks. The thing that will take the most time is changing timings within the code. It will not take long to get the code running properly however making sure its running optimally is what will take the longest time.

Solar Panels

1. What do you test?

Testing voltage output of all solar panels together.

2. How do you test it?

Connecting all five solar panels in parallel. On a sunny day, a multimeter will be used to measure voltage output as well as consistency of voltage output.

3. Which data to be collected, from which ‘locations’, and how collected?

The voltage output will be a manual measurement by the multimeter. The output will first be monitored for 10 minutes in the sun to check for the consistency of the output. Another test will take an output reading every hour from sunrise to sunset.

4. How are raw data processed?

During the test for consistency, a graph of voltage output will be plotted vs time for the 10-minute period. The test for the effect of sun intensity throughout the day will consist of several manual measurements throughout the day. There will be a voltage measurement for each hour of sunlight.

5. Determine characteristics to be used to present results

voltage output plotted vs time. Two separate graphs, one short term and one long term.

6. Evaluate project success

What percentage of the time during the 10 minutes was the output voltage supplying enough voltage? Which hours of the day are optimal for solar panel usage?

7.How long the experiment will be tested on.

Two weeks or less, depending on how many sunny days there are

Cooling System:

1. What will you test:

The humidifier temperature change and the humidity change of the immediate area.

2. How do you test it?

The temperature and humidity change will be measured in a stationary configuration as well as a moving scenario.

Steps:

1). Attach the humidifier at a fixed distance on a rod and facing it so the humidifier exhausts the air downwards.

2). Attach the temperature and measure sensor, DHT11, at a fixed location a foot from the fixed position of the humidifier.

3). Turn on the humidifier as well as the sensor and record the output temperature and humidity sensor for 30 minutes.

4). The environment would be preferably be tested in different temperature and humidity ranges. This can be done different ranges: high temperature with low humidity(less than 20%), high temperature with average humidity(greater than 20% and less than 75%), and high temperature with high humidity(greater than 75%).

* 1. High temperature will be considered as greater than 90 ℉.

3. Which data to be collected, from which ‘locations’, and how collected?

The data collected will be from the humidifier and its effects on the immediate area. The data will be collected with a DHT11 temperature and humidity sensor.

4. How are raw data processed?

The temperature and humidity will be measured by the DHT11 and will be recorded by raspberry pi 3. The recorded data will be saved as a csv file to be analyzed in excel.

5. Determine characteristics to be used to present results:

The temperature and humidity will be plotted against time at various environments. The change in temperature will be observed to determine that it will decrease as the humidity increases.

6. Evaluate project success:

A successful evaluation would be achieved if the temperature in the immediate area decreases by 10 degrees. The humidity should be increased to a value below 80% humidity in order to maintain a comfortable environment for the user.

7.How long the experiment will be tested on.

The testing will be tested during a week to obtain a variety of different temperature and humidity ranges. This testing will be completed during our first testing week and should be done by the start of the second week.

Water pump test:

1. What do you test?

The power consumption, how much water can be lifted per minute, and compatibility with h-bridge and Raspberry Pi. Also, test if the pump is compatible with water in different temperatures.

2. How do you test it?

Run the water pump at a certain voltage (5V, 500mA) and record its condition while operating. Calculate its power consumption. Also simulates the condition when it works in the umbrella, test how much water can it deliver for a certain lift range (70cm). After that, change the water temperature using ice and test if the water pump is working.

3. Which data to be collected, from which ‘locations’, and how collected?

The power consumption of the water pump calculated using voltage and current on the water pump. Also record the amount of water that is delivered. This number is got from the water tank. Also record the condition of the water pump when it is working in different conditions.

4. How are raw data processed?

The power consumption data can be used to calculate the battery life and further design the power distribution of the whole system. And the flow rate is used to calculate the work and halt period of the pump to match with the humidifiers. The temperature data will provide a working temperature range for the water pump.

5. Determine characteristics to be used to present results

Power consumption plot and water flow rate are the main characteristics of the water pump. Temperature VS working condition plot is also wanted.

6. Evaluate project success

Whether the pump work within the voltage level and current level that a raspberry pi can provide (5V, 1A), while delivering water at a rate the humidifier need. And the water pump should work without malfunction for at least 10 minutes. Also, if the water pump can work properly within 32 F to 100F, the test is a success.

7.How long the experiment will be tested on.

Estimated to be 3 hours.

Fan test:

1. What do you test?

The power consumption, and compatibility with h-bridge and Raspberry Pi of the fan motor.

2. How do you test it?

Run the fan motor at several voltage (3-5V) with the fan blades equipped on it and record its condition while operating. Calculate its power consumption.

3. Which data to be collected, from which ‘locations’, and how collected?

The power consumption of the fan motor calculated using voltage and current on it.

4. How are raw data processed?

Voltage and current measured are used to calculate power consumption, and it will contribute to the total power consumption and battery life estimation.

5. Determine characteristics to be used to present results

The wind level that it can provide is related to the power that the fan consumes. Power consumption VS wind level is the characteristic that we need for the fan.

6. Evaluate project success

If the fan can provide wind at different levels of voltage, it counts a success of the test.

7.How long the experiment will be tested on.

Estimated to be 2 hours.