Team Name: Bugs Life

From: Austin Monette, Zachary Schreiner, Donovan Simmons

Date: April 4, 2023

Subject: Testing Plan

Identifier:

Team: The project we are working on is for the USGS Grand Canyon river guides. This project includes a UV black light connected to a battery source to collect insects at night while on the Colorado River to collect data for their studies. The data they collect helps them understand what is affecting the environment and the changes with the Colorado River. The project for our team is to find a way to get rid of using AA batteries as they only last 4 hours. They want a system that will last 15 hours on one charge. The project we build for them will eliminate battery waste and their time with changing the batteries out every 4 hours. Our solution is to incorporate solar with a better battery source to maximize their time with running the light. So far the light with our system ran for 23 hours on a single charge.

Team Members:

Austin Monette: Electrical Engineering Major

Donovan Simmons: Computer Engineering Major

Zachary Schreiner: Electrical Engineering Major

Introduction:

The objective of the USGS smart lamp project is to minimize battery waste, and come up with a solution to run the lamp for 15 hours without charging, or replacing the batteries. With many comparison matrices, we found the perfect batteries, charge controller, and solar panels to achieve the goal of reaching a minimum of 15 hours of run time with the light before needing a charge. Our project is to remain as simple as possible while still achieving the minimum of 15 hours of running the lights. The basics of our smart lamp project are that we have two 6 volt batteries wired in series connected to a 12 volt charge controller that is then buck converted to 5 volts to power the lamp. When the solar panel is plugged in, the batteries are getting charged with the MPPT charge controller.

The main parts that need to be tested with our project are how long the batteries will last on a single charge while running the light; how long the solar panel will take to fully charge the batteries; and how long it will take to charge the batteries with the wall charger. For testing how long the batteries will last running the light on a single charge, we ran the light for multiple hours on different nights until the batteries would not run the light any more. For testing the solar panel charging the batteries we will see how much of a charge setting the solar out for different lengths of time and calculate what time will be needed to fully charge the batteries straight from solar. Lastly we will charge the batteries from the wall charger and time how long it takes to charge the batteries from being dead to fully charged. This way we can tell the people operating the system how long the batteries take to charge from the wall charger and gives them an idea on when to charge the system before their next expedition.

Testing/Approach:

Functionality Testing:

1. The functionality testing of the solar-powered lamp will ensure that all the functions and features of the device work correctly. This includes testing the lamp's power output, brightness levels, and temperature, among other things.

Battery Life Testing:

2. The solar-powered lamp's battery life testing involves assessing how long the device can run on a single charge. It's also essential to test how the device behaves when the battery is low, such as how long it takes to recharge the battery and whether it can be charged through solar power when there is not enough sunlight. Additionally, how long charging takes when plugged into a wall outlet.

Solar Panel Efficiency Testing:

3. The solar panel efficiency testing will evaluate how well the solar panel of the lamp can generate and store energy from the sun. This testing can involve evaluating the charging speed of the device under various sunlight conditions and checking how much energy is generated and stored by the panel.

Durability Testing:

4. The durability testing of the solar-powered lamp is critical to ensure that the device can withstand harsh environmental conditions such as the conditions in the Grand Canyon. This testing may involve exposing the lamp to different weather conditions, such as rain,

heat, and humidity, and assessing whether the device is still functional after being exposed to these conditions.

User Experience Testing:

5. User experience testing of the solar-powered lamp involves assessing the device's ease of use and its overall user interface design. This includes evaluating the device's control mechanisms, such as the switches, and ensuring that the device is accessible and easy to use for all.

Regulatory Testing:

6. Regulatory testing involves ensuring that the solar-powered lamp complies with all other components in the ammunition can. This includes testing the device's MPPT Controller, buck converter, batteries, and the black light ensuring that it does not interfere with other electronic devices, and ensuring that it is safe for use.

By following these testing approaches, it is possible to ensure that the solar-powered lamp operates efficiently, is reliable, and delivers a positive user experience.

Testing Matrices:

Tester:

Test case:	Battery life		Date:		
			Time:		
Setup:					
Test:	voltage:	Expected output over time:	Obtained output:	Pass	Fail
1					
2					
3					
4					

Overall test result:		

Tester:

Test case:	Charge time from wall		Date:		
			Time:		
Setup:					
Test:	Time charging:	Expected voltage to fully charge:	Obtained voltage after charging:	Pass	Fail
1					
2					
3					
4					

Overall test result:		

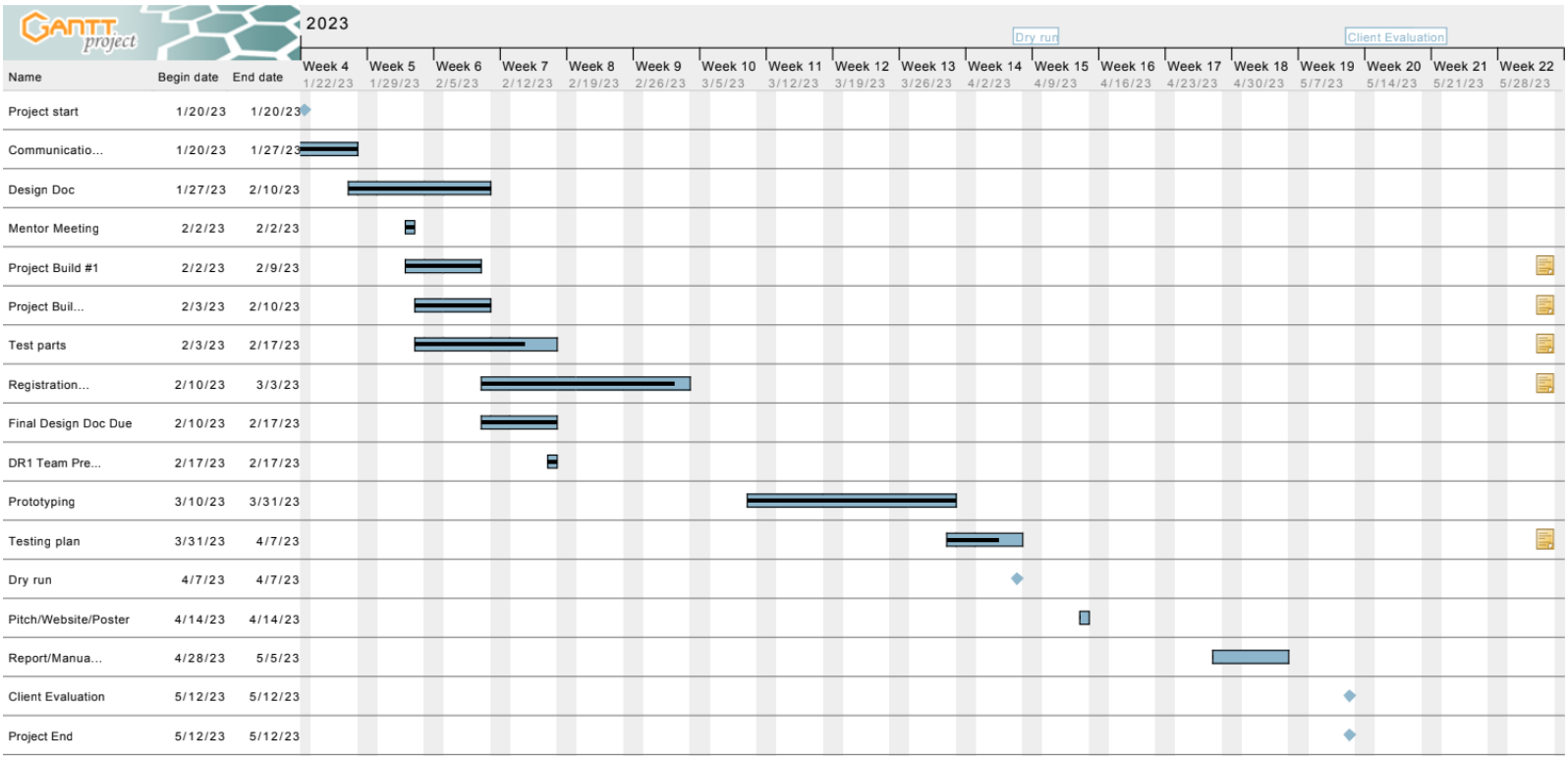
Tester:

Test case:	Charge time with solar		Date:		
			Time:		
Setup:					
Test:	Voltage from sun:	Expected voltage over time in sun:	Obtained voltage from solar:	Pass	Fail
1					
2					
3					
4					

Overall test result:		

Schedule:

Gantt chart:



As shown in the gantt chart above we had a start date to test our parts starting on February 3rd. We were ahead on our build and were able to start testing certain parts in the month of February. There is still more testing to be done and we will test again once we build USGS another smart lamp set up. The end date of our testing parts section will be the middle of April to ensure that everything is tested and ready before any due dates with the complete project.

Tasks:

Tasks

Name	Begin date	End date
Project start	1/20/23	1/20/23
Communications Memo	1/20/23	1/27/23
Design Doc	1/27/23	2/10/23
Mentor Meeting	2/2/23	2/2/23
Project Build #1	2/2/23	2/9/23
install thermometer with switch. COMPLETE *2- DC female ports for light and solar panel. COMPLETE* *connect the two 6v batteries in series. COMPLETE* *connect light, solar, and batteries to charge controller. COMPLETE*		
Project Build Continued	2/3/23	2/10/23
just need to wire parts together and test prototype. *3/8/23 in the middle of testing*		
Test parts	2/3/23	2/17/23
testing how long it takes to fully charge from dead		
Registration for UGrad	2/10/23	3/3/23
Need to upload poster and power point		
Final Design Doc Due	2/10/23	2/17/23
DR1 Team Presentation	2/17/23	2/17/23
Prototyping	3/10/23	3/31/23
Testing plan	3/31/23	4/7/23
Light ran for 23 hours on a single charge. *Testing charge times now*		
Dry run	4/7/23	4/7/23
Pitch/Website/Poster	4/14/23	4/14/23
Report/Manual/Reflection	4/28/23	5/5/23
Client Evaluation	5/12/23	5/12/23
Project End	5/12/23	5/12/23

Risks and Contingencies:

For our project we have a few different possible risks for our project. One of the major risks for our project is getting damage from the elements. Our project will be deployed in the grand canyon for most of its lifetime. It will be stored on a boat for trips in the grand canyon. This is a problem because our project has electrical components inside it and they can not get wet or be exposed to the elements. Our contingency for this is weatherproofing every possible entrance. This includes the lamp plugin, the usb chargers, and the opening of the top. With all these weather proofed with silicon we are confident that our product is weather resistant. It is not fully weatherproof because we can not guarantee that if our device gets dropped in the river that it will stay safe or if the lid is left open, the weather will not destroy it. That is why we are saying it is weather resistant and not weather proof.

Another risk in our project is our solar panel. Our solar panel is susceptible to damages from almost anything. It is not a flexible or bendable panel like some solar panels are, however ours does not. We are currently researching flexible solar panels to get rid of this issue. We also have careful handling instructions on how to use and store the solar panel to make sure that it is not broken.

Next, another risk we have in our project is the lamp we are using. The lamp we are using is an incandescent light which makes it very vulnerable to breaks. Unlike LED lights incandescent lights are much more fragile because of the glass and wires used in the design. LED lights do not produce heat in the way that incandescents do, because of this incandescent lights get very hot and when the temperature outside is hot they heat up much more and have a possibility to break. Where the leds use semiconductor materials to produce the light which does not emit close to any heat. The heat is not the only problem, our lamp is also fragile because it is

made out of glass. If the lamp is dropped then it will break, so we added instructions to be very careful with the lamp when the guides set it up on the canyon floor.

Finally, we have a few risks in our project but we are aware of these issues and made it instructions, we are confident that the project will be successful and the risks will not happen if our instructions are followed. In this paper we are making tests to make sure our project can survive the conditions it will be put in. When we are done with testing and updating our product will run properly when it is deployed!