

Solar water filtration system



“Saving one life at a time using a solar powered water filtration system”

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Group 24

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2. Motivation and Project Description

The World Health Organization estimates that 3.575 million people die from water-related diseases every year. That means somewhere around the world, every ten seconds, a human being dies. The water death related diseases include the following: polio, cholera, typhoid, and the one that is causing more than five hundred deaths, diarrhea. Sometimes, we do not see how fortunate we are until we get to travel outside the country and see how much we take the little things for granted. Going to a third world country and seeing their living conditions are unfortunately a reality we had to face: they need our help. It is a global catastrophe because it not only affects adults, but it also affects children and newborn babies. Most of the families living in these conditions can barely afford to buy food and having access to safe water is very difficult and sometimes non-existent. Unfortunately, contaminated water also affects urban areas, big or small cities where people with very low income cannot have access to clean and healthy water.

Our goal is to make a difference in somebody's life and to provide clean and healthy water by designing a water filtration system using solar panels in order for everyone to have access to safe and healthy water no matter where they are and most importantly, water that is not contaminated. The function of our project is to generate power from solar panels that will go through a filtration system. We will also include a manual pumping system so in case anything was to fail in the system we will still be able to make purified water by using a manual pumping system. Our project will mostly contain the following components: a UV barrel, a UV choke AC, a UV lamp for sterilization, X clamp, I connectors with three both side push fit, push fitting lock, elbows for the fitting, a piece of tube, double sided tape, a piece of plywood, nut with bolts and a battery. The impure water intake will come in to the sediment filter system then from there, it will go to the carbon filter where it will reach its final destination, the UV barrel, that will sterilize the water. The pure water will then go through the pump and then will expel through the output tubing. We will also include a lithium polymer battery that can take over charges and it can run for about six hours without the sun on just the pump and about three and a half hours for the UV.

We hope to also help decrease the number of deaths that keeps increasing due to unsanitary water consumption and no water filtration systems that is easily accessible to them. One of the most important parts of our project is not only to make the water filtration easy to use but also to make it portable, lightweight so they can carry it wherever there is water nearby. Designing is one of many aspects of the project but also making it safe and easy to use so not only adults can use it but also children can learn how to use it on their own so when their parents are not around, they can use it independently without any assistance. Once a household understand how the water filtration system works, they will then have the opportunity to teach and show how the apparatus to their neighbors. The learning process will go from one household

to another and we will be able to help hundreds, if not thousands or millions of people to get healthy and safe water.

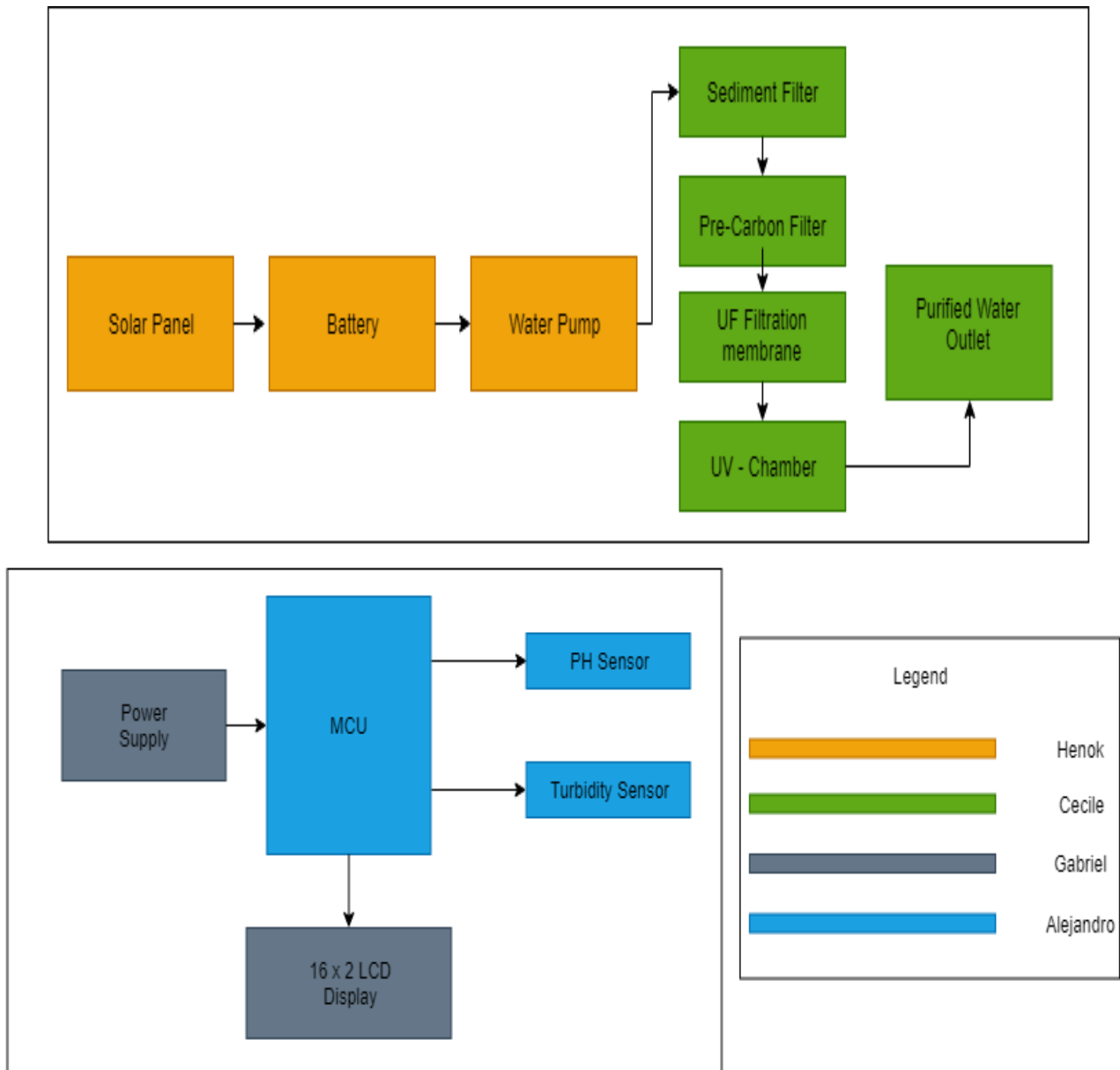
Most designs regarding water filtration that we have found are not portable. The size of the whole apparatus usually takes more than one person to carry it and most of them require few people to install it and set it up properly. Since it is portable, we also want to make it lightweight. Most water filtration systems are heavy, mainly because the solar panels are mostly large in size, but they also take a lot of space. Our solar panels will be very light, and they will also have removable magnets that will be attached to a portable case. Inside the case, we will have our battery, generator and our multiple filters to give crystal clear and safe water. We also want to minimize the cost of our project and make it affordable. Most water filtration systems are expensive, not portable and require multiple people to set it up. Building this project is not only exciting, because we get to build something from scratch, see the final result and test it to see if it works properly. But most importantly, we get to make a difference in people's lives. They can finally have access to clear and purified water using our filtration system with solar panels and better their quality of lives, a day at a time.

3. Specifications

- Solar powered and battery integrated.
- Use multiple layers of filters in order to remove all harmful substances in the water.
- Portable size and weight for easy handling.
- Waterproof casing.
- Easy to use and simple setup.
- Water quality check using PH and turbidity sensor.
- Microcontroller unit with LCD display for turbidity and PH values.

The motivation for our project is making a difference in underserved communities by providing simple yet sustainable water filtration mechanism. However, most of the time these communities lack technical personnel to deal with system failure and routine maintenance. Or they are not easily accessible due to transportation, political or financial challenges. And often, on system outages they go back to drinking unsafe water. So, our goal is to integrate some remote sensing procedure to ease this burden and make the maintenance of the system as easy as possible. Second challenge is harnessing power to run the system in areas where solar energy is not applicable. The plan is to use a backup battery and/or some hand cranking mechanism to maintain continuity of the system during these times.

4. Project Block Diagram



As we can see from the block diagram, the power station which will generate power from our solar panels will power all our electrical needs, such as the water pump, any kind of sensors and microcontrollers, and the UV chamber which will be used to kill harmful bacteria and viruses to make the water extra safe to drink.

The impure water is first fed to the sediment filter to remove fine particles such as slit, dirt and dust. Then the water from sediment filter is fed to the carbon filter which removes excess chlorine, bad odor and harmful chemicals. The water from carbon filter is then feed to the

Ultrafiltration membrane which removes harmful bacteria and make the water safe to drink. And finally, the output water from the UF membrane is fed to the UV chamber to kill any remaining bacteria, protozoa and viruses making the output water safer to drink.

5. Estimated project budget and financing.

So far, we haven't acquired a sponsor yet. But the estimated cost of the project will be close to \$500. Summary of component prices is listed in the following table.

Component Description	Quantity	Unit price (\$)	Total price (\$)
Sediment filter	1	12.96	12.96
Carbon filter	1	45	45
UF membrane	1	31.50	31.50
UV barrel/ bowl 8"	1	30	30
UV lamp 11 watt	1	8.99	8.99
UV choke	1	11	11
Teflon tape	1	9.80	9.80
Elbow (1 side push fit & 1 side threaded)	6	11	66
I-connector	3	4.59	13.77
Push fitting locks	12	2.90	34.8
C - Clamps	4	2.9	12
X – Clamps (1 side large and 1 side small)	1	3.99	3.99
1" Nut bolt	4	0.38	1.52
10 feet RO filter pipe	1	9.29	
Double sided tape 2-3" piece of ½" water tube (pipe)	1	4.79	4.79
23 x 15 cm piece of plywood	1	2.79	2.79
Case	1	16.73	16.73
Solar panel	1	100-150	100-150
PCB printing	2	15	30
Battery Backup	1	25	25

6. Milestones

Senior Design I Milestones		
Week No.	Date	Objective
4	September 16	Begin research, elaborate project idea and create plan
6	September 30	Begin writing document
10	October 28	60-page draft complete
11	November 4	Adjust document and keep writing remaining of the pages
12	November 11	At least 100 pages complete
14	November 25	Finish document and print final paper

Senior Design II Milestones		
Week No.	Date	Objective
1	January 6	Buy and order parts
2	January 13	Start programming and testing parts
4	January 27	Build project
7	February 17	Test project
12	March 23	Prepare for presentation
14	April 6	Finish preparations and be ready for final presentation

