Solar Powered Water Filtration System

ECE 445 - Project Proposal

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Introduction

Title

This project was chosen because we currently do not have a cheap and efficient method of cleaning contaminated water. Currently, developing countries lack access to clean water. With a solar powered water filtration system that is able to self-sustain itself, this would be a great way to help get clean water to the developing countries.

Objectives

Goal:

The goal of this project is to provide a cheap and effective way of cleaning water in third world countries.

Functions:

- Solar panels provide power
- Fans provide airflow
- Battery provides energy storage
- DC-to-AC inverter allow the reactor to run properly
- Reactor produces the ozone

Benefits:

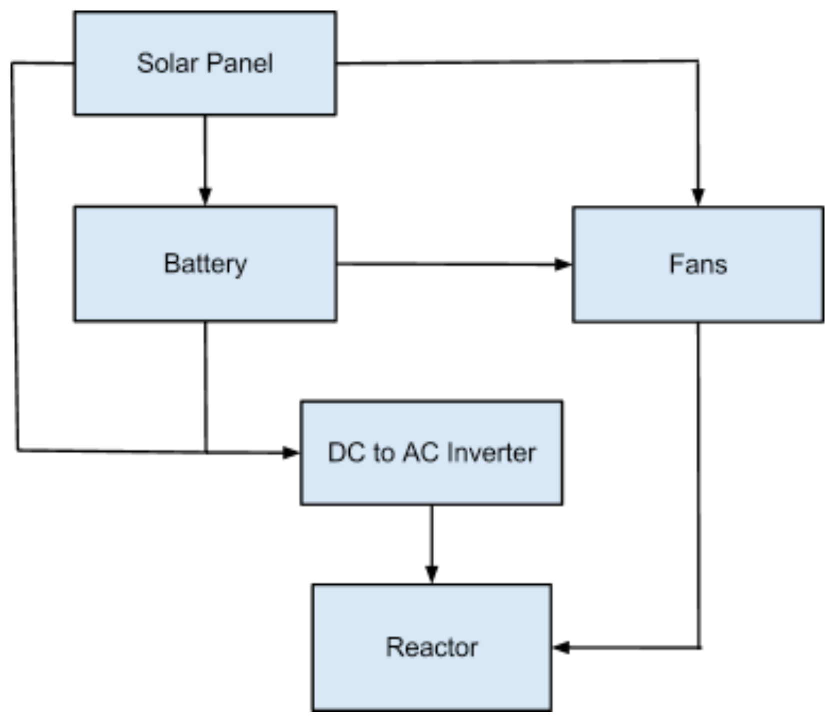
- Clean water, free of deadly bacteria
- Reduce negative drinking water statistics
- Compact and cost effective alternative to existing systems

Features:

- Solar powered
- Compact - small dimensions
- Cheap materials
- Self-sustained

Design

Block Diagram:



Block Description:

Solar Panel - The solar panel will provide the main source of power. In order to maximize the amount of power that we can get out of the solar panels, we will be designing the geometry of the container so the panels will be effectively utilized. Since the reactor is small in size, the solar panel configuration will most likely dictate the size of the system. We will try to design the solar panel layout so that it is low profile but highly efficient.

Battery - The battery will be storing power from the solar panel for later use. For example, the battery will provide power to the system during the night and rain storms, when solar power is insufficient. Also, it will provide stability to the DC-to-AC inverter since a battery is a more stable source of power than a solar panel. In addition, it will provide power to the fans in order for the system to continually operate.

Fan - The fan will provide the airflow through the reactor for the creation of ozone. The fan will contribute to the efficiency of the system based on several factors: size, power consumption, and the number of fans used.

DC-to-AC Inverter - The reactor depends on AC supply; therefore, we need to convert the solar panel's DC output, in order for the system to operate. The circuit itself will use a 555 timer to be the low frequency oscillator and then use a transformer to produce the required output for our AC output.

Reactor - The reactor will receive airflow from the fans so that it will have a source of oxygen to produce the ozone. Then it will receive input from the solar panel DC-to-AC inverter and take the airflow from the fan to create the ozone needed to clean the water. The reactor contributes to the compact size of the system and the cost.

Block Level Requirements and Verifications

Requirements:

Solar Panel: The solar panel outputs a sufficient amount of power to operate the reactor.

Battery: The battery provides the stability to the system. Also, it provides power to the system when the solar panel is not being utilized.

Fan: The fan provides enough air flow through the reactor to purify a set amount of water, within a reasonable time frame.

DC-to-AC Inverter: Efficiently converts output from solar panel to AC for use in the reactor while remaining compact and inexpensive.

Reactor: Produces a sufficient amount of ozone and cleans the water efficiently and effectively.

Verificaiton and Test:

Solar Panel:
Verification **-** If the solar panel can provide the required voltage and current needed at 12 Volts and 1.7 Amps then the solar panel is functioning properly.

Test - monitor the voltage and current output, which can be used to calculate power. If the power is sufficient, then the solar panel passes the test.

Battery:
Verification - If the battery can provide the required voltage and current needed at 12 Volts and 1.7 Amps when the solar power is not in usage, then the battery is funcitoning properly.

Test - monitor the voltage and current output, which can be used to calculate power. If the power is sufficient, then the battery passes the test.

Fan:
Verificaiton - If the fan is moving and providing air flow then it is working.

Test - Check that there is airflow through the system. Check if the fan rotor is functioning.

DC-to-AC Inverter:
Verification - If the DC-to-AC inverter converts the DC power from the solar panel to AC power for the reactor, then it is working properly.

Test - Scope, voltmeter, ammeter to measure values and confirm correct conversion.

Reactor:
Verification - If the unclean water is cleaned, then we can conclude that the reactor is working properly by outputting ozone.

Test - monitor output from reactor and state of the water.

Tolerance Analysis:

DC-to-AC Inverter:

Tolerance Analysis - This is the main component that is driving the reactor. Because the reactor requires AC and the solar panel and battery outputs in DC, that means that the converter is essential to the overall functionality of the design. If the DC-to-AC inverter is not functioning correctly that would mean that the reactor will not produce ozone, defeating the purpose of the device. So by running the solar panel through the DC-to-AC inverter, we will monitor the output. If it is to what we desire than it is functioning the way it should be. The reactor requires 10 Watts of power. We have decided that it will run effectively and safely with a +/- 5%, so our range would be 9.5 Watts to 10.5 Watts from the solar panel.

Cost and Schedule

Labor:

Name	**Hourly Rate (HR)**	**Total Hours Invested (THI)**	**Total Cost = HR * THI**
Matthew DuBois	$30.00	160	$4800
Eric Liu	$30.00	160	$4800
Albert Lo	$30.00	160	$4800
Total		480	$14400

Parts:

Part	**Total**
Solar Panel	$70
Fan	$20
Resistors	$2
Capacitors	$2
555 timer	$6
Transformers	$10
Inductor	$12
Total	$122

Schedule:

Date	Objective	Partner
9/23	Design Review Sign Up	Eric Liu
9/29	Finish DC-AC inverter design	Albert Lo
9/29	Design Encasement	Eric Liu
9/29	Order Parts	Matthew DuBois
9/30	Finish Design Review Prep	Group Effort
10/6	Assemble System	Group Effort
10/21	Individual Progress Reports	Individual
11/4	Practice Mock Up Demo	All
12/2	Practice Demo	All
12/9	Reports Finished	Individual