Hybrid Wind and Solar Generation System

Project Plan

May1621

Advisor:
Venktaramana Ajjarapu

Team Members:
Dylan Hird
Jeremy Helgeson
Xiangpeng Yang

Table of Contents

Planning

Requirements Specification

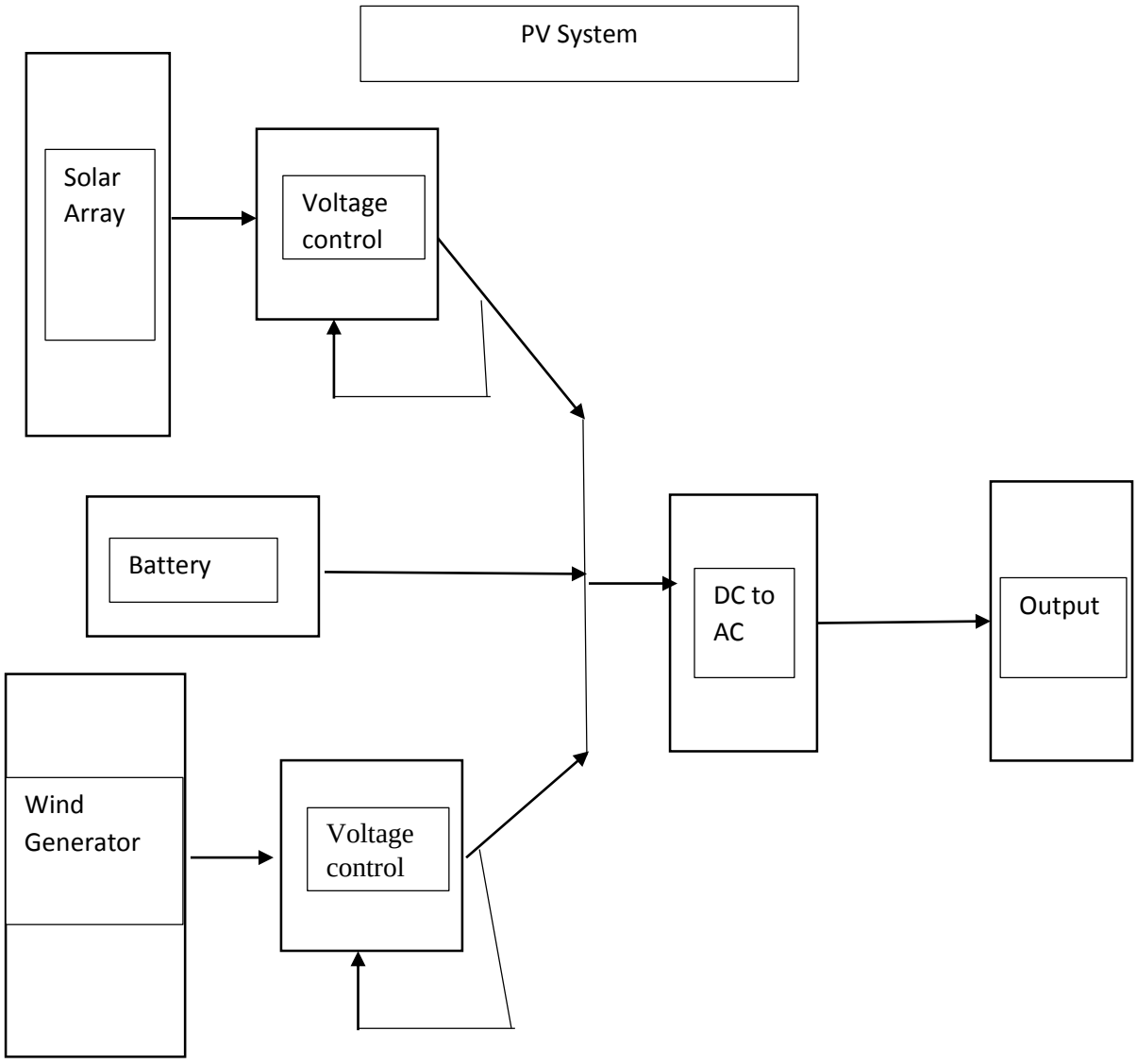
Problem/needed statement

Our system is not a new idea and has been implemented by other companies, but for our project we needed to create our own hybrid standalone system. Because there was a group before us we needed to improve upon existing designs and add our own input to the system to create a fully functioning system.

For this we first needed the knowledge of the workings of the two individual systems that we were presented. This includes learning how a PV cell and wind turbine generates electricity that can be used. We also needed the knowledge of each aspect and step in the generation system.

After this we need to create a plan in order to create the working system and improve on what has already been done. The final deliverables will be a combined system but will also have improvements on each individual system

Block Diagram



System Description

Solar

We plan on doing more work on the PV system in this semester because less needs to be done for it, but improvements can be made. For our solar, we have a PV array that is a connected to regulator that keeps the output of the PV cells at a certain voltage and current in order to transfer maximum power into our system (MPPT). This is also connected to a battery that will provide the current when the solar system cannot provide enough.

Next the system is connected to an Inverter that converts the DC voltage to a 120V, 60 Hz AC output. This is so that we can simulate our output voltage as if it was ready to be connected to a grid. We also have a load connected across the output of the inverter to simulate the use of different appliances and component.

Wind

Because this system is not yet ready we will have to spend more time on trying to get the system to work before we can combine the two. Our Wind system cannot be actually hooked up to a wind generator, due to issues, so we have to simulate this using a motor to run the wind generator.

Because the wind system does not keep a constant voltage we have to use a rectifier to transform the voltage into a DC voltage to be able to work with it. We then use a DC-DC boost converter to take this voltage and make sure that it is at the right voltage to input into the inverter.

Operating environment

The actual environment that this system will be running on is not comparable to what we will be working on in the lab. If we create a whole system we might be able to run the system in an actual comparable system. What we would like to have the Hybrid system running in is a remote location that is hard to access any other form of power. This would allow power generation in many different conditions and allow access to electricity for those who might not be able too.

Specific regions might have little influence on the design structure of the system, but for the most part the system will be set up in the same way. For instance a high temperature regions we might change from a higher voltage system to a higher current.

User interface description

In the lab while working on the project we will want to have as many aspects of the systems being monitored. This is ideal to allow us to observe how the system is working and be able to confirm that it is working properly.

In the final design which will be designed for commercial use, we expect to be able to have very little interface for which the user can control. We do not want there to be a lot of ways for the user to break the system or damage any part. We will how ever want to include switches that allow for battery charging, by turning off the load, and possibly a switch to turn off the wind generation system in conditions where wind is too fast to handle.

In addition we will also want to be able to have the consumer monitor the output of the system. This will include implementing a few sensors that read voltages and currents at different parts of both systems. We will also need to be able to read the battery voltage so that we can make sure the battery never becomes fully depleted.

Functional Requirements

Every aspect of this system should be implemented in some way or another. We might not be able to build the final design in the specifications that we have planned out, but the system will be working using the parts we have.

Nonfunctional requirements

A fully commercially ready product is not possible for us with our budget. We can provide the specifications and details to create the system but not implement. We will also not be able to implement stress tests for many parts of the system. These stress tests may be theoretical and not actually achieved in the laboratory, due to weather and other conditions.

Market

We are designing this product for remote locations and third world countries that do not have access to power. Because this can change the product in a few ways we will mostly focus on the third world countries in Africa to be able to design better. We have to take into consideration exactly how much power is needed and how much this power can vary by. Because this can change we cannot know for sure and will have to include constraints on our system.

Project plan

Work breakdown structure

For each system we have divided the work into each semester with the second having more implementation. The first semester we will be working with the PV system and improving that, and then the second semester we will be working with the Wind generation system and the system as a whole.

During both semesters we will also be doing the required documents for our advisor and our professor, which will also need to be taken into account.

Resource Requirements

Because a lot of the components that are needed for this project are currently available we will not need very much. As of currently the only possibly needed parts are a new Wind generation motor, because the last group could not get the one to work, and more sensors to be able to read each value in the system. Another thing that might be useful is different loads to attach to our complete system for tests. This could include.

- Motor- below total rating
- Different wattage light bulbs
- Inductive loads
- Other household appliances

Because we have 300 dollars to spend, we should not have any problem with money.

Project schedule

Week	Project work	Class work
1		Choose project
2		Meet with advisor
3	Acquire information	
4	Understanding PV cells	
5		
6	Power point on PV	Project plan 1
7		
8	Understanding of system	
9	Power flow equations	Design Doc 1
10		
11	Implementation ideas	Project plan 2
12	Real world applications	492 meetings
13	New design	
14		
15	Ready work for next semester	Design doc 2, project plan 3
16		Final presentation

Risks

When working with high amperage systems there is always a risk. Every time we are in the lab we must work as a group of at least two. This was a requirement set to us by our advisor. We also run the risk of accidentally breaking the equipment that we are using. Because

we were not properly trained on everything that we are using we will have to spend more time learning about each component.