Capstone

Second Generation Bike Station

Electrical Emphasis

Puneet Dhillon, (Peet), Alex Devine, Rashed Alharbi

10/9/2013

Overview

- Introduction
- Problem Statement
- Flowchart Of System
- Required Research
- FPGA's VS. Embedded Systems
- Potential Output on a Bike
- What We Need For The Generator
- Homemade Generators VS. Purchased Generators
- How The Generator Will Work
- General Chargers
- References

Introduction

- Our Client is Marilla Lamb has a bachelor in Environmental Engineering and she is getting her masters in Mechanical Engineering. She would like us to design a bicycle powered charging station which will power laptops and other, small AC devices drawing up to as much as 60 watts.

Problem Statement

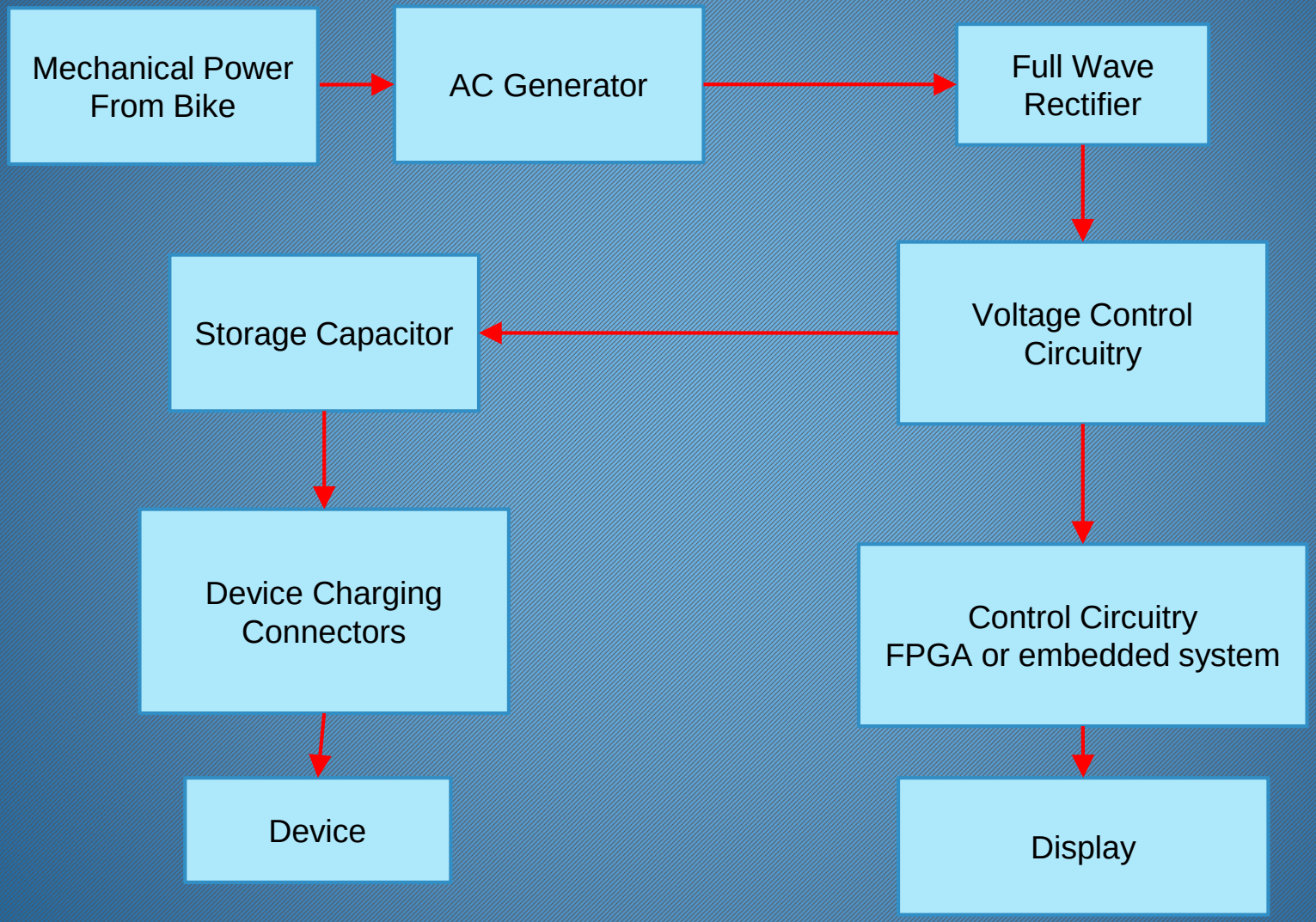
- The charging station must be able to be moved easily around campus to be used in various buildings and at different events.

- The bicycle charging station must be built within the budget of $1,600 provided by Green Fund.

Problem Statement Cont.

- Interactive display
- Power generated
- Power used
- Total power generated over the lifetime of the charging station
- Total number of users
- Carbon offset

Flowchart Of System



Required Research

- Current “off the shelf” solutions
- Potential output of a person on a bike
- Power requirements of possible devices
  - Common mobile phones
  - Tablets
  - Laptops

Required Research Cont.

- Available premade generators
  - Advantages of custom made vs store bought
- FPGA vs embedded control system
  - Speed
  - Power requirements
  - Display properties

FPGA's VS. Embedded Systems

- FPGA's are much faster than microprocessors due to their parallel processing power.

- As for display, FPGA's seem to have very good graphics properties. The idea of using which Chip is still being decided.

FPGA's VS. Embedded Systems Cont.

- The power requirements are about the same, however FPGA's have to implement more logic in order to compute the necessary algorithms. As where Microprocessors can compute high precision floating point calculations.

Potential Output On a Bike

- Usually a general charging bike can power up to 60-100W when connected to a load, which is usually a 12V battery depending upon the user.

- Now in order to power multiple devices, the power will be generated in parallel so that there is not significant loss in power.

What We Need For The Generator

- In order for our particular design of the generator to work, we **at least** must have the following:
  - A coil
  - At least one magnet
  - An armature
  - Leads

Homemade Generators VS. Purchased Generators

- A purchased Generator can range from $135 to $1000.

- A homemade generator will be easy to make, and the cost could range from $35 to $100. The homemade generator seems most suitable.

Homemade VS. Purchased Cont.

- Since our budget is $1600, this option does not seem suitable. Other than the budget, a premade generator may not be compatible with our design in terms of how much power is used and placing of the generator within the system itself

How The Generator Will Work

- A general idea of how DC generators work:
  - A coil wrapped around an armature (in our case about 5000 to 6000 turns of coil)
  - A magnet that is perpendicular to the coil that is either spinning or accelerating in a motion that creates a magnetic field

General Chargers

Sources	Voltage	Current	Power
PC USB	5 volts	0.5 amps	2.5 Watts
iPhone Charger	5 volts	1.0 amps	5 Watts
iPad Charger	5.1 volts	2.1 amps	10 watts

https://discussions.apple.com/docs/DOC-3511

Conclusion

- Design Of System
- How will we define the problem
- What is necessary complete this task
- What chip design we will use
- How much power will be generated
- Generator requirements
- Homemade Generator instead of Premade
- How will it work
- Universal chargers

Questions?

References

- www.ehow.com
- discussions.apple.com
- www.windstreampower.com
- www.econvergence.net
- www.latticesemi.com