UCF Senior Design 1

Department of Electrical and Computer Engineering

Multi Source Powered Bike

Group 32

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Narrative Description

Statement of Motivation

- A way of charging a phone portably with only a bike at your disposal
- A method of charging devices for Doordash riders, hikers, etc

The project serves as a way of charging a phone or device with only a bike, which could be useful for hikers, Doordash riders, and commuters, just to name a few. It would harness energy from the rotation of the wheels and a solar panel attachment. Since it is more likely for bikers to be outdoors during the day, it makes sense to integrate solar panels. This allows for efficiency in harnessing more power in a shorter amount of time, while also making use of a renewable energy source.
Having two sources of energy charging a storage battery instead of directly charging a phone will eliminate the need of having to bike at high speeds for extended periods of time, since charging directly to the phone requires certain speeds to enable stable charging. It would also help bikers in metropolitan cities where they deal with constant stop-and-go traffic. More traffic means fewer full rotations of the tires, and this will harness less energy versus at constant higher speeds. Solar panels can be added to contribute to charging the battery and make up for traveling at those lower speeds.
When riding a bike and using a map application, the location services from the app are constantly sending signals between satellites trying to pinpoint your location which drains your battery a lot faster than other simple functions would. Being in a place with a weak signal will drain your battery life even quicker due to the longer period of time required to send signals and pin locations. To avoid the battery life from being completely depleted, we can harness the energy from the rotational movement of the wheels along with solar energy to a battery. This will allow bikers in remote places and in the city to charge their phone no matter how fast or slow they peddle.

Function of the Project

The bike will integrate two sources of energy, solar and mechanical, to charge a battery which can then be used to charge small devices. By using only renewable energy, the project will be inherently eco-friendly. Because the device is meant to be attached to a bike, it must be portable as well. Since our intended audience are people like hikers and commuters, the project should be easy to use and understand so that the average layperson can operate it. It should also be able to withstand some weather associated with using a bike outside, some rain or temperature changes. To achieve this, most of the components will likely be housed within a lidded basket attached to the bike. Except for the two energy sources which will have to be outside the basket

to function; the solar panels likely attached on top of the basket lid and the mechanical bike generator attached to some part of the wheel.
After some investigation, similar products were found to identify features. The Pedalcell uses a fork-mounted rim generator with maximum power output of 15-20W and a smart power hub, built using a super capacitor instead of a battery, that includes two USB-C ports, one outputting 3W max and one 12W max. The use of the supercapacitor makes the device able to withstand a much larger range of temperatures and can deliver energy much faster when compared to a battery. On the other hand a battery can hold more power for much longer periods of time.
Other similar products include various dynamo generators with either a rim mounted wheel or a part that would be agitated by the spokes as the bike tire spins.
Other features of the project include a headlight and taillight that will be powered by the same battery as the phone or small device. This will improve the safety of users while biking at night especially. The lights can be automatic, detecting ambient brightness with a photoresistor, or manually operated so the user can choose when to turn lights on. A digital display will be able to display various statistics including the voltage being generated, velocity of the bike, ambient temperature, the time, and charge remaining on the battery. The digital display will have at least three modes that can be selected: off mode to prevent draining the battery when it is not in use, and modes that will display various sensor readings split into categories.

Requirements Specifications for the Project

Battery	3.7 V 5000-10000 mAh Small, ~6.5 oz / 0.4 lb battery
Solar panel	15.5% efficient 5.5V peak power 170mA at peak power
Bike power generator	12 V 6 W
Water resistant	IP34
Head and tail lights	200 lumen/2.2 W LED
Digital display	LCD1602 display

Table 1

Project Block Diagrams

RC - Orange
EC - Green
DM - Purple
MV - Blue

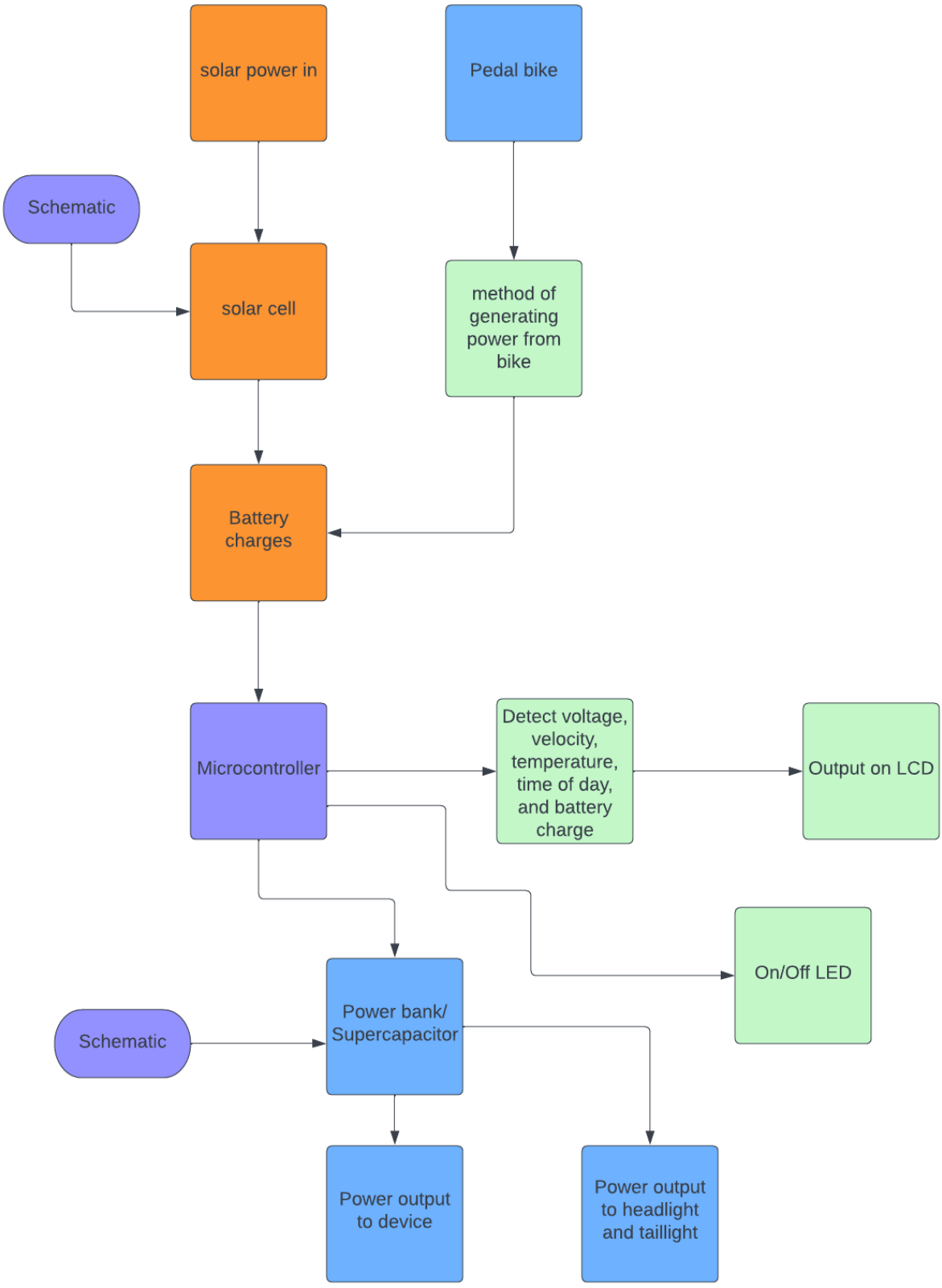
solar power in
Pedal bike
Schematic
solar cell
method of generating power from bike
Battery charges
Microcontroller
Detect voltage, velocity, temperature, time of day, and battery charge
Output on LCD
On/Off LED
Schematic
Power bank/ Supercapacitor
Power output to device
Power output to headlight and taillight

Figure 1

Estimated Project Budget and Financing

Component	**Price**
Bike	$200
Digital Display	~$10
Microcontroller	~$30
Portable charger / power bank	~$30
Solar panel	~$25
Basket	~$5
PCB Parts	~$30 - $100
LED Lights	~$5
Total	**$135-205**

Initial Project Milestone for Both Semesters

- Senior Design 1:
    - Project Idea Discussion
    - Divide and Conquer Part 1 (due 9/16/22)
        - First Draft - 10 pages max
        - Initial idea description and motivation
        - Research on similar projects
        - Initial Specifications
    - Document review meeting with Dr.Richie (9/20/22)
    - Select a project and setup meeting times
    - Assign Roles
    - Divide and Conquer Part 2 due (10/7/22)
        - Discuss project specifications
        - Discuss further design specifications
        - Set up a list of materials and their costs
    - 60 page Draft Documentation (due 11/4/22)
        - Technology investigation
        - Standards
        - Documentation and design
    - 100 page report (due 11/18/22)

        - Design and sketch
        - Create schematic diagrams
    - Final Document (due 12/6/22)
        - Finalize and perfect 100 page report
    - Order materials and parts
    - Test project materials and start putting it together
- Senior Design 2:
    - Testing prototype
    - Redesign if necessary
    - Finalize prototype
    - Finalize documentation
    - Final presentation

House of Quality