PEDAL Bike

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Group 32

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Motivation

DM 

- No outlet to charge a device when away from home
- An increasing need to use renewable energy
- Wanting to charge or keep a device charged while on a bike ride
- Wanting to stay safe and connected while on a long trip
- Especially useful for trail bikers and delivery services

Goals and Objectives

DM 

- Two different sources to generate renewable energy
  - A generator on the wheel to create energy through pedaling
  - A solar panel that allows for daytime charging and storage
- Affordable when compared to similar products

Advanced goals (not completed)

- Fast charging

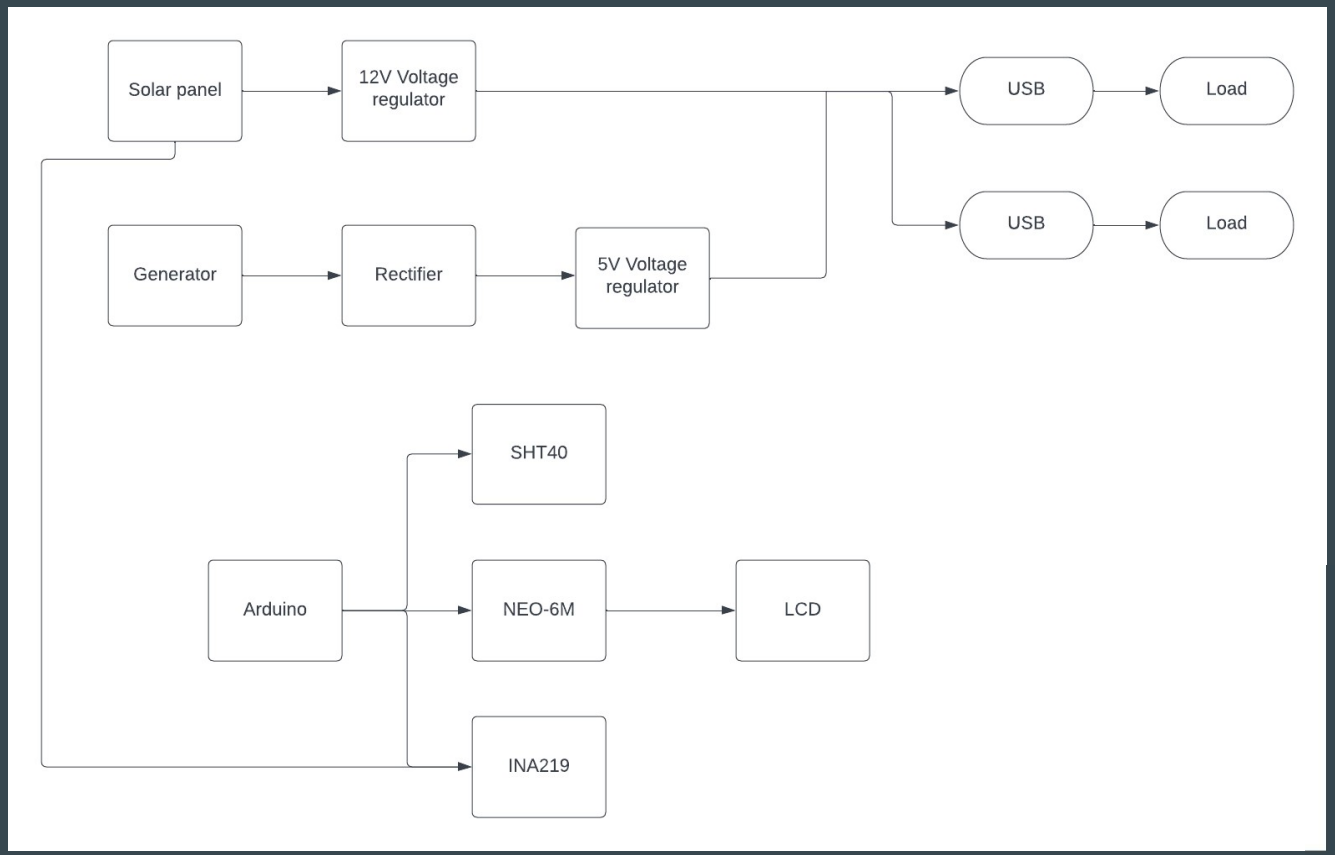
Specifications

MV

Parameter	Specification
Portable / Lightweight	< 5Lbs
Low cost	< $250
Output to phone	>=5V
Water resistance	IP34
Voltage regulator efficiencies	>80%

Overall Block diagram

RC

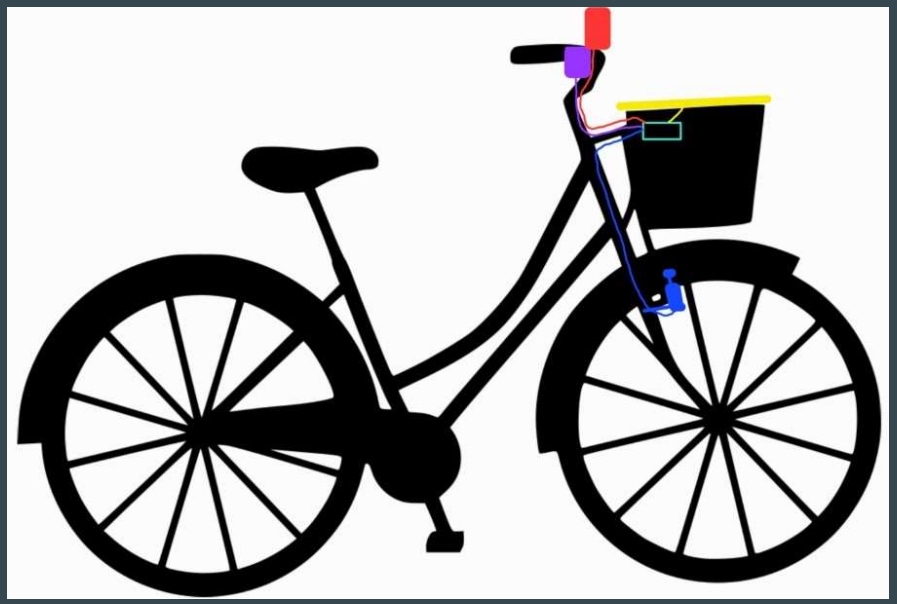


Power Generation

RC

Two sources of renewable power generation

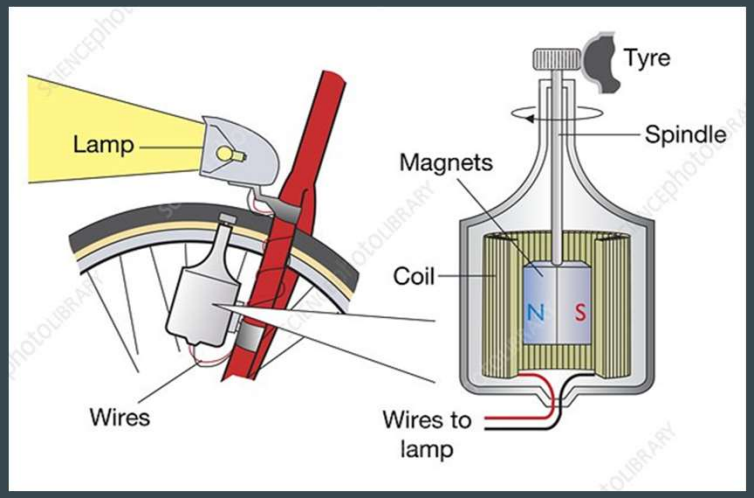
- Mechanical sidewall generator attached to bicycle wheel
- Solar panel for more continuous power generation



Sidewall Generator

RC

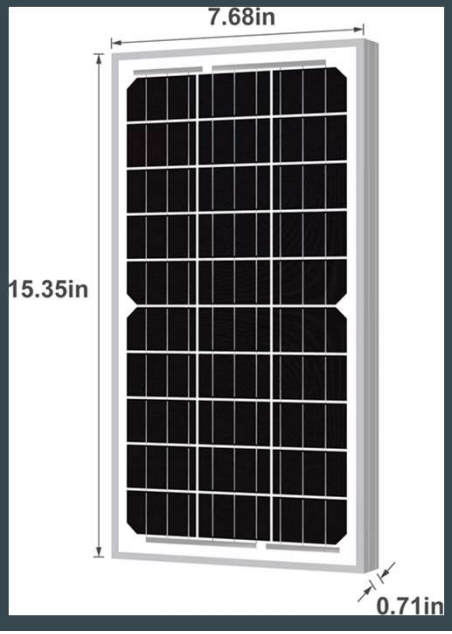
- Configurations of 12 Volt / 6 Watt / 0.5 Amps and 6 Volt / 3 Watt / 0.5 Amps
  - We chose a 12V / 6W / 0.5A generator
- Low cost and low weight

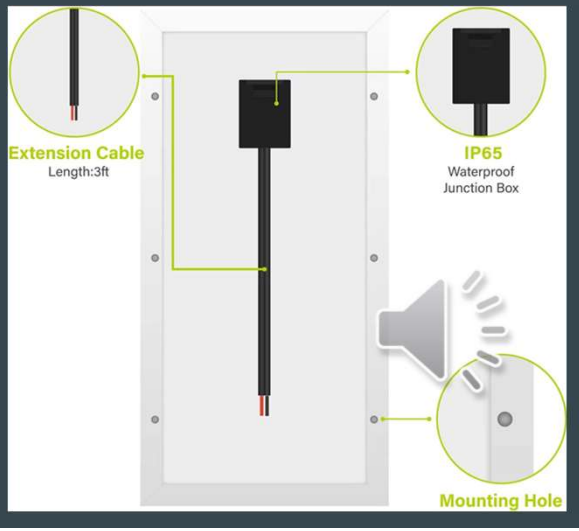


Solar Panel

RC

- Monocrystalline
- Conversion rate: 21-23%
- Dimension: 15.35*7.68*0.71 inches
- Weight: 2.0lbs
- Max Power Output(W): 10W
- Voltage MPP Vmp(V): 17.37V
- Current MPP Imp(A): 0.69A
- Water resistant: IP65





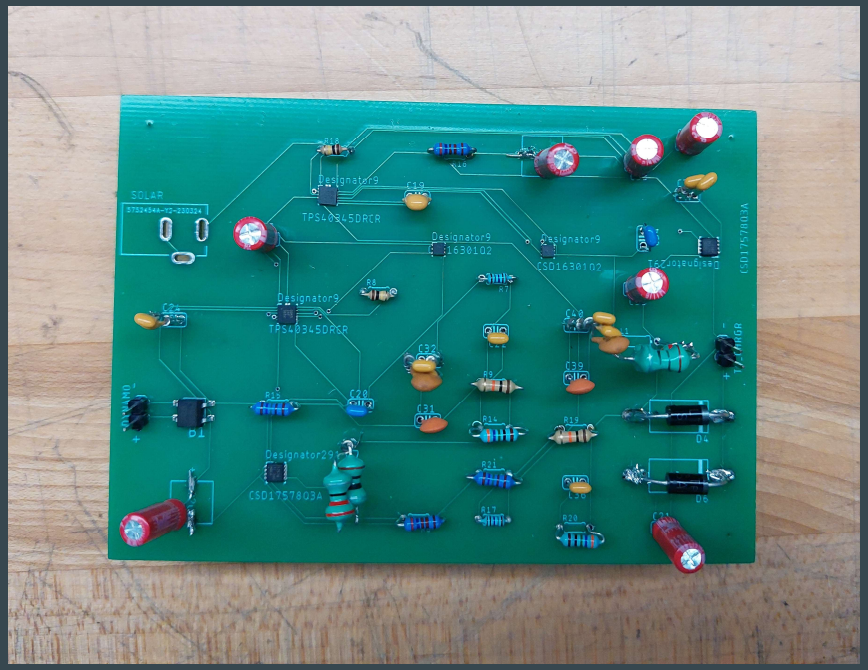
Initial design Voltage Regulation

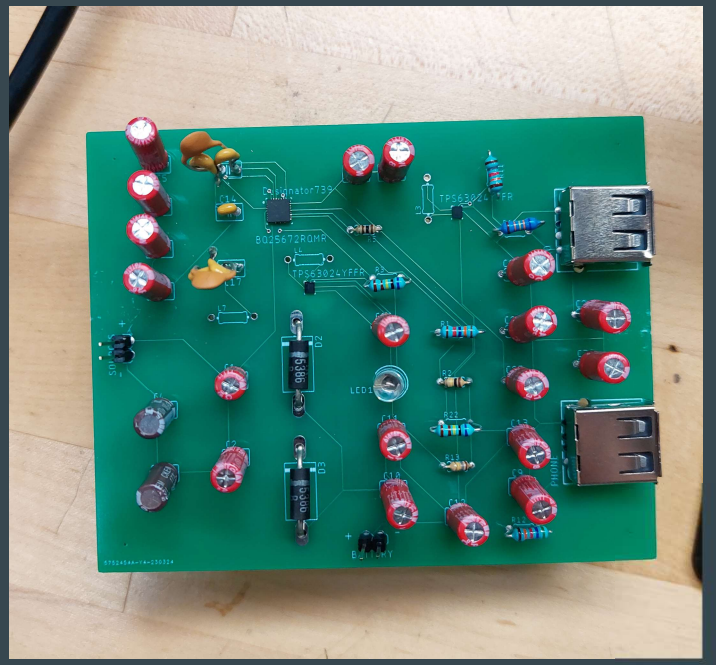
RC

- Used Webench to help design voltage regulators throughout our system
  - Footprint: <300mm²
  - Price: <$3
  - Schematic export available
  - Efficiency >80%
- From power sources to battery charger: TPS40345DRCR
  - Input: DC 5 V - 20 V
  - Output: 4.2 V at 3 A
- From battery to microcontroller
  - Input: DC 2.3 V - 5.5 V
  - Output: 3.6 V at 0.5 A
- From battery to phone
  - Input: DC 2.5 V - 5.5 V
  - Output: 3.3 V at 2 A

Initial PCBs

MV

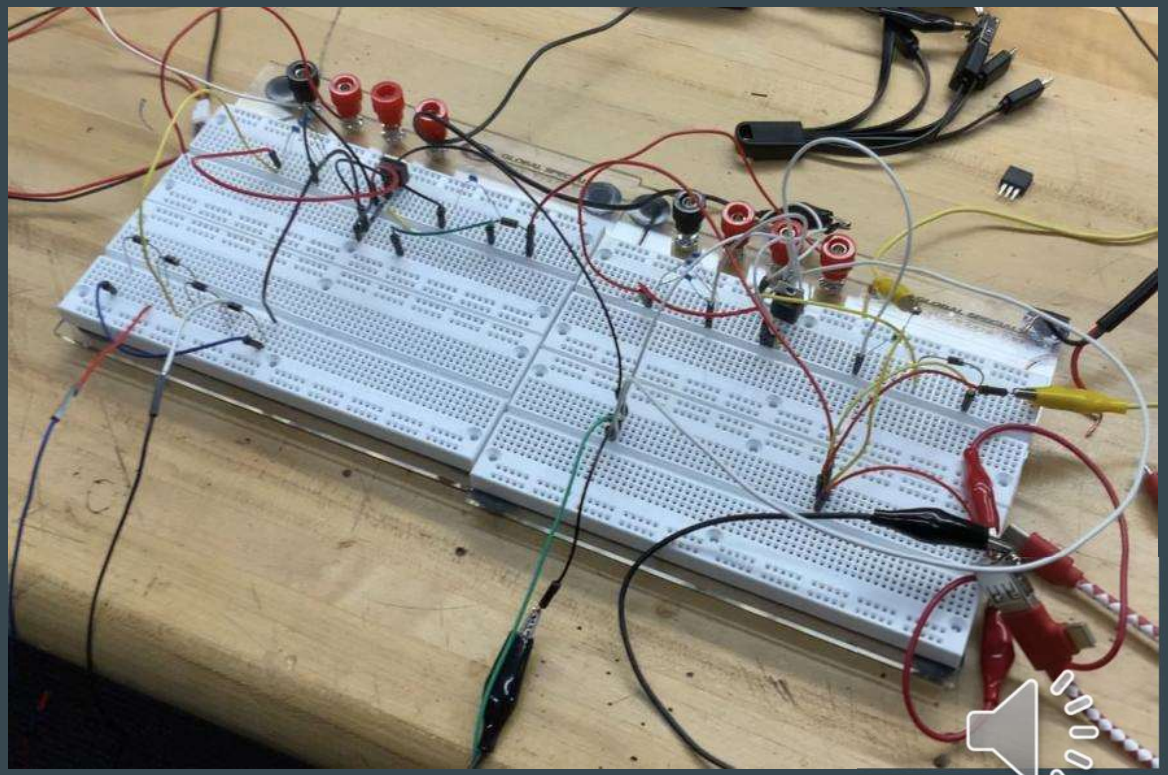




New Power Regulation

MV

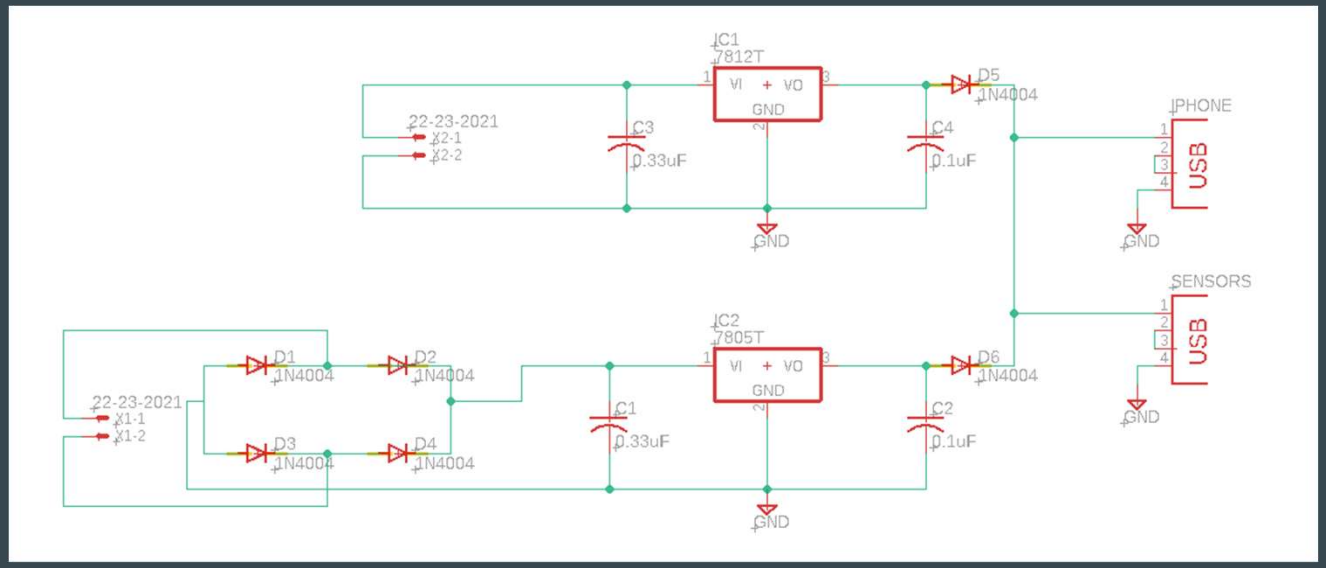
- Generator
  - 7805T
- Solar panel
  - larger output, ~ 17V
  - 7812T
  - Attempt at fast charging
- Both or one source running
  - Two loads are charge

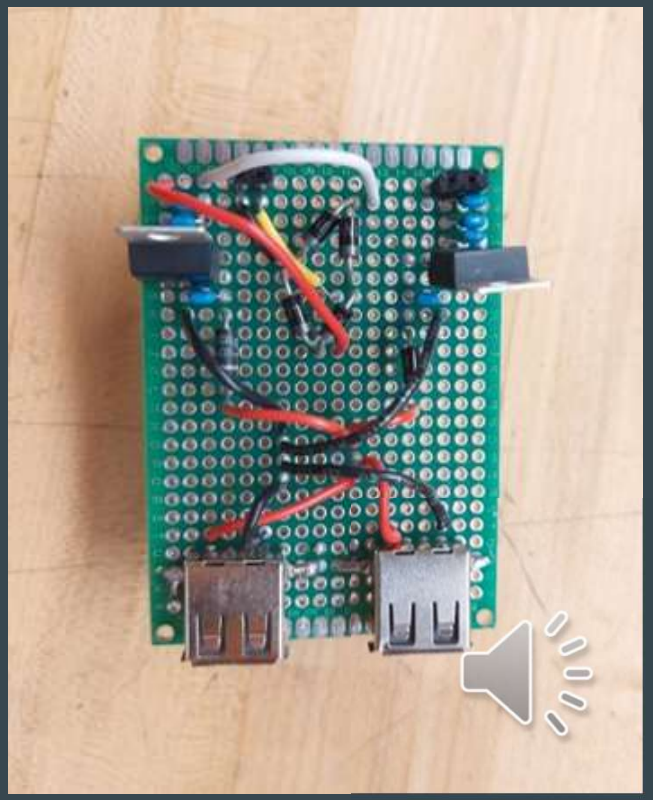


New PCB Design

MV

- Time contraint
  - Perfboard soldering

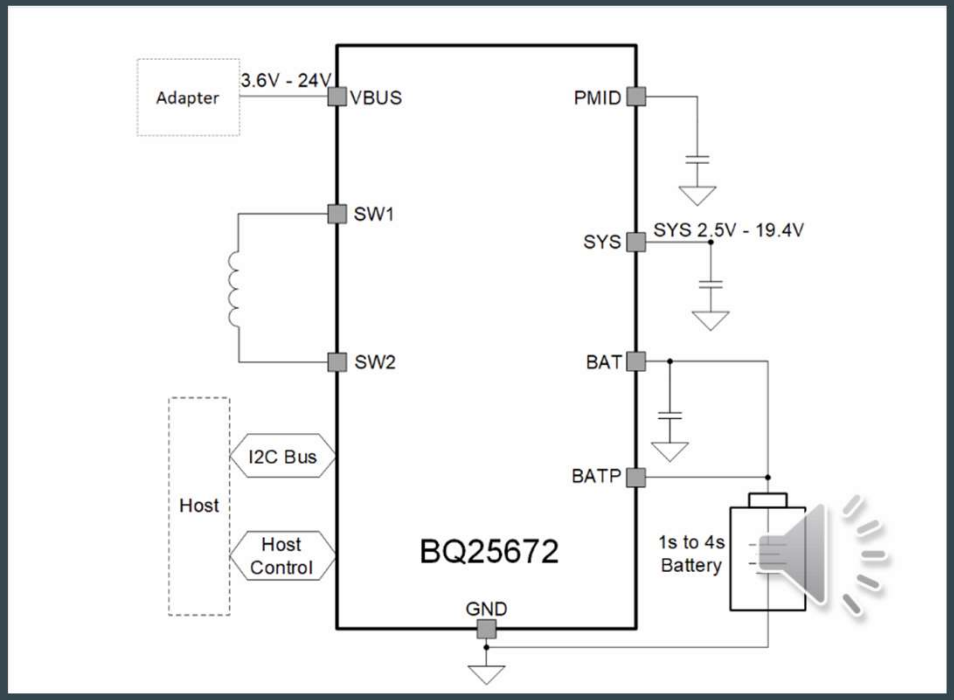




Charger - BQ25672RQMR (initial design)

DM

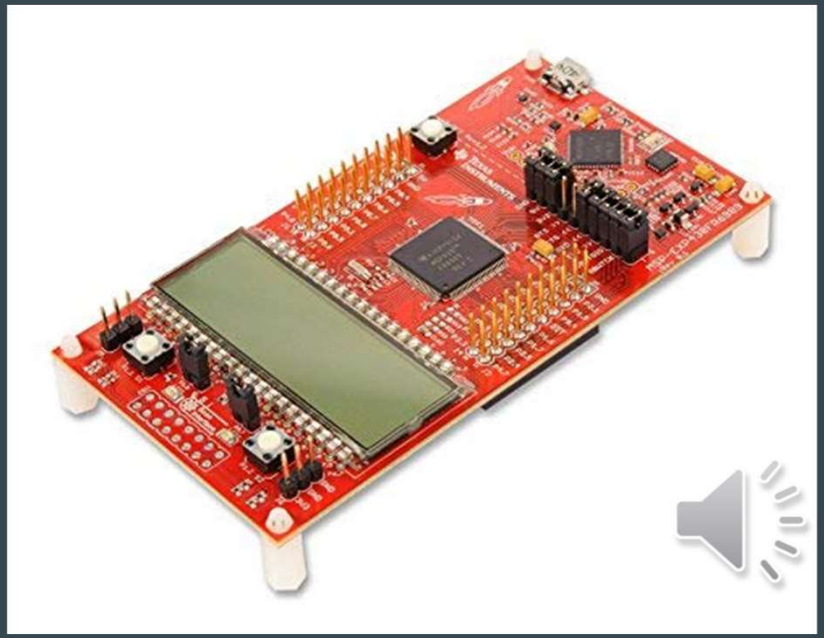
- Supports 1-4 cell batteries with a wide range of inputs
  - 3.6V to 24V and an absolute max of 30V
- Supports switching between sources
- Compatibility with photovoltaic panels
  - MPPT
- Auto charging
- Several built-in safety features
  - Thermal regulation
  - Over Voltage Protection
  - Displays statuses



Microcontroller (previous design)

DM

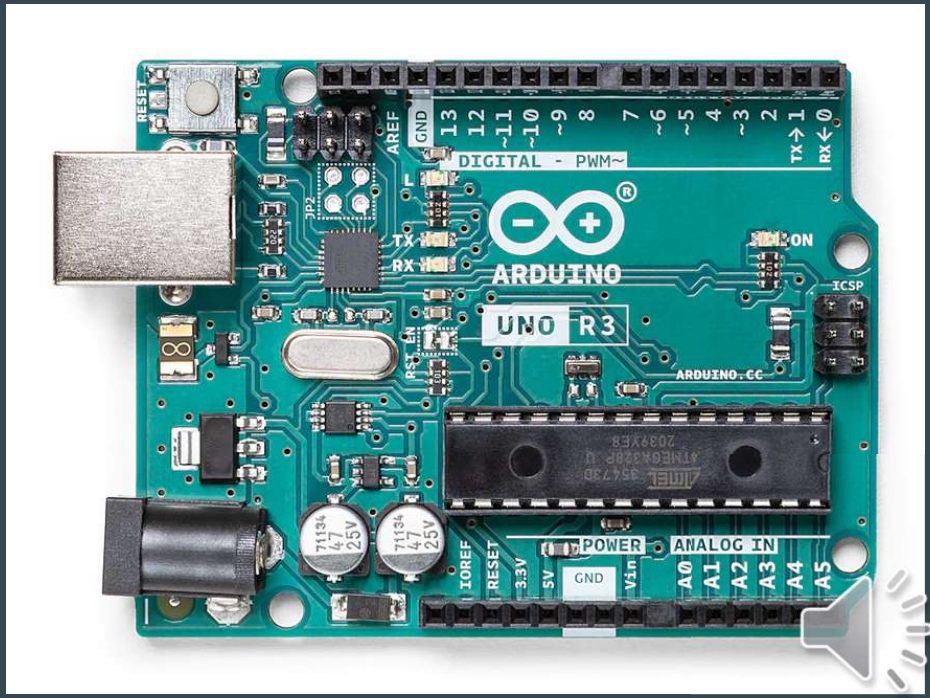
- With the MSP430FR6989 TI LaunchPad, several components will connect to the board, which will then connect to the PCB through a USB connection
  - LCD Display
  - Lights
  - Sensors
- Connecting these components allows for several features to show up on the display



Arduino Uno R3

EC

- Due to complications, microcontroller was changed from MSP to Arduino
- Less pins, but not an issue
- Higher Operating Voltage
- Intended use remains the same
  - Connecting sensors to microcontroller allows display to show a variety of info



Sensors

EC

NEO-6M	GPS/Speed	$10.50
Sensirion SHT40	Temperature/Humidity	$5.95
INA219	Voltage/Current/Power	$9.95

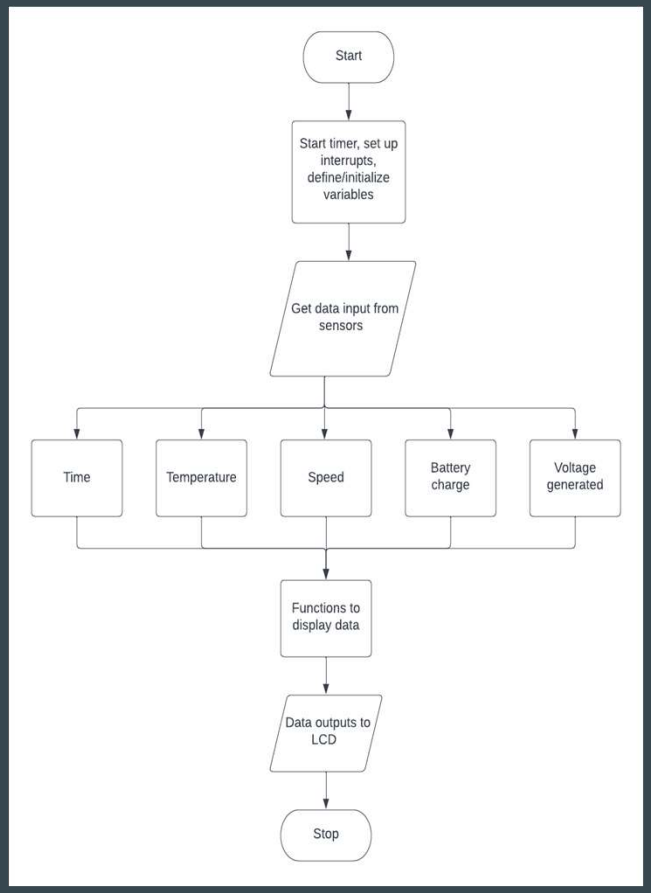
Display

EC

LCD2004	AMC2004HR-B-W6WFDW	ILI9341
$10.99	$11.18	$16.99
5V	5V	5V
64.5 by 16 mm	46 by 18.4 mm	36.7 by 48.9 mm
I2C	Parallel	SPI

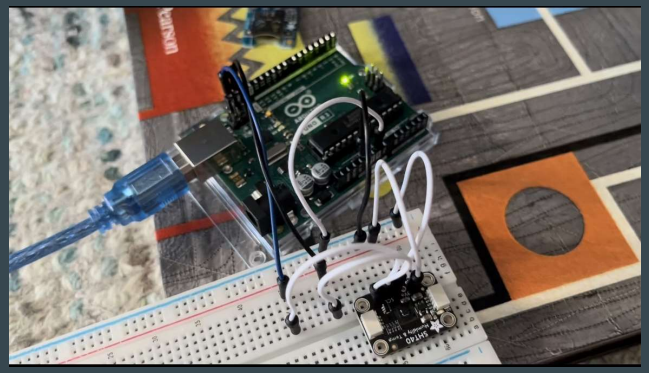
Software Block diagram

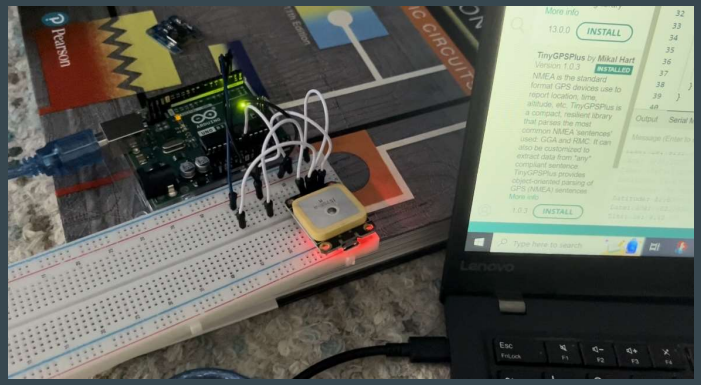
EC

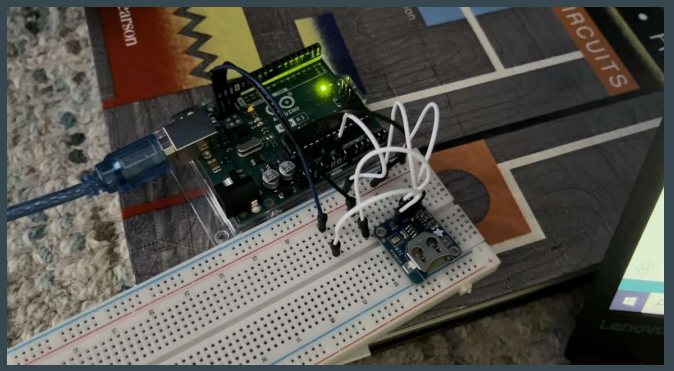


Sensor Testing

EC







Administrative Content

Work Distribution

EC

	Research	Software design	Power generation	Power storage	Sensor Design	Testing	Video Editing	Documentation	Eagle modeling	Soldering	Website creation
Roxanna	✓		☑			✓		✓	✓	☑	☑
Elizabeth	✓	☑			☑	✓	✓	✓			
Dexter	✓					✓	☑	✓			✓
Melvin	✓			☑	✓	✓		✓	☑	✓	

Budget: Money Spent

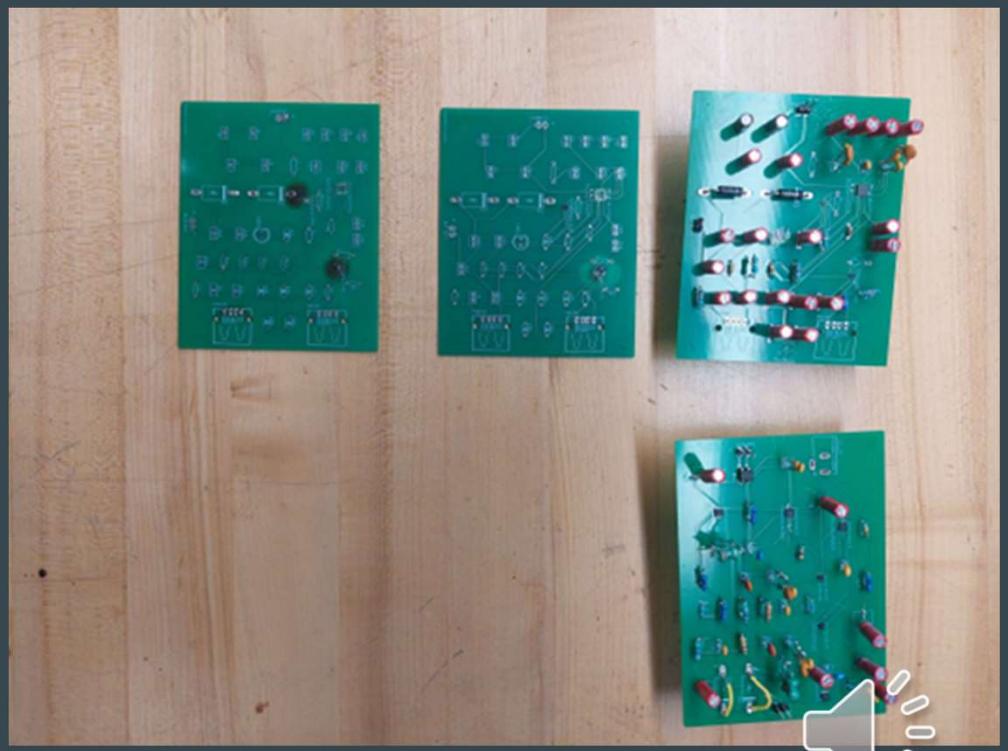
DM

Item	Quantity	Cost/item	Shipping + tax	total
bikes	1	$25.00	$0.00	$25.00
generator	1	$8.99	$8.80	$17.79
sensors (clock, temperature, voltage)	1	$30.00		$30.00
GPS module	1	$10.50	$11.00	$21.50
solar panel	1	26.5	0	$26.50
TI parts (BQ25672RQMR x2 + TPS63024YFFR x2 + TPS40345DRCR x5)	1	18	13.17	$31.17
lithium-ion battery	1	24.5	8.58	$33.08
pcbs	1	23.9	49.84	$73.74
containers for circuits, velcro, zip ties	1	19.61	1.27	$20.88
pcb parts	1	24.08	9.28	$33.36
arduino	1	27.1		$27.10
lcd 2004	1	10.99		$10.99
9v battery	1	15.99	0.98	$16.97
INA219	1	9.95	6.67	$16.62
surface mount parts	1	-	-	$37.68
total				$384.70

Issues

DM

- Small parts led to soldering mistakes
- Fast charging will require more power
- Shipping issues
  - PCB & assembly long lead time
- Attaching the Sidewall Generator



Questions?