Helios: Self-Powered Light Integrated in Wheel

Nathaly Navarrete, Fredy Cisneros, Travis Requena, Reynante Matias, Luis Lin Xiao, Roshini Thiagarajan, Marissa Dorfler, Ebisindei Adegbe

University of California, Merced

Mission Statement

The mission of MoonLight is to *design* and *develop* a *self-powered lighting system* for commuter cyclist to **increase conspicuity** during dim light conditions and **reduce** bicycle related **incidents**.
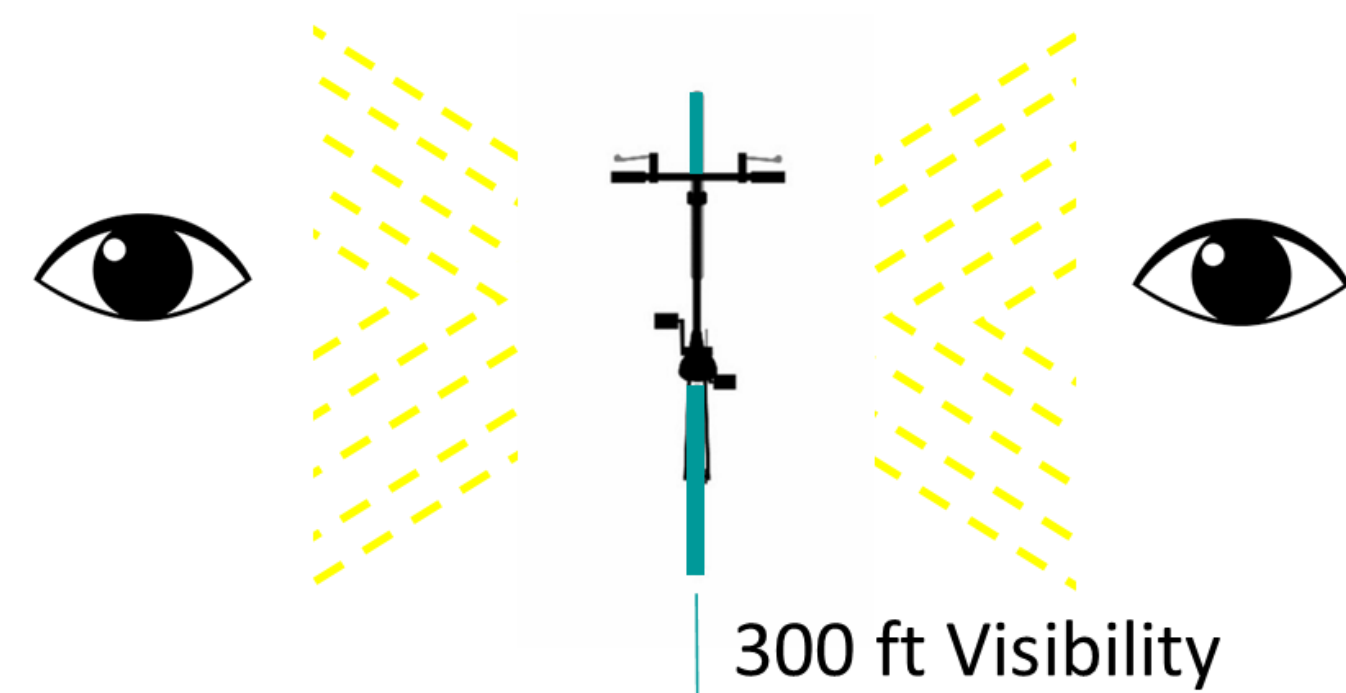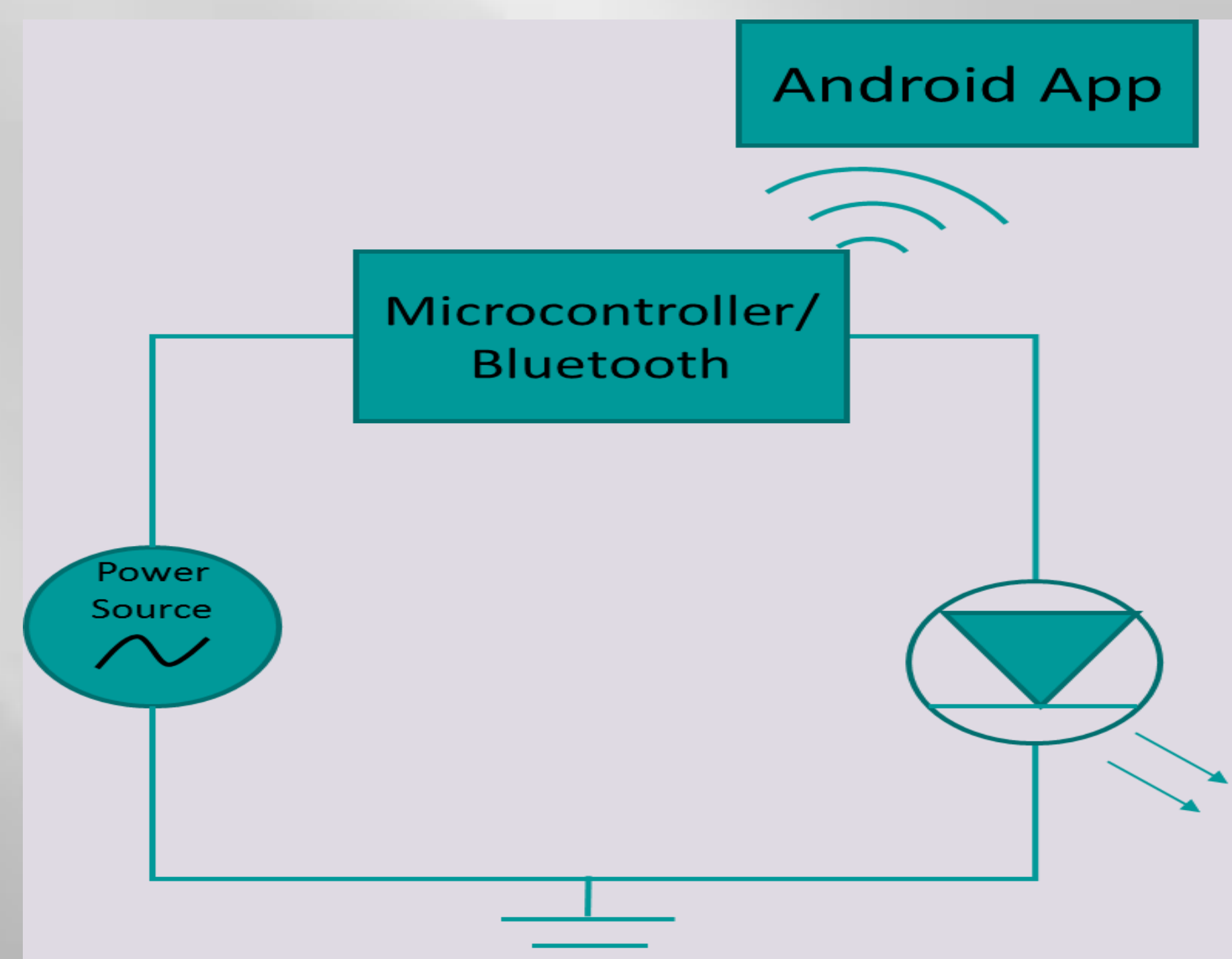
Introduction

The Problem
- Bicyclists among the most vulnerable road users
- Over 500,000 Bicycle related injuries reported in the US every year
- Most Incidents occur at night
  - Poor visibility of cyclists in both rear and sides of rider

Objectives
- Increase the conspicuity of light by creating side illumination
- Use a dynamo hub as a self-generating power source to design a modular illuminated wheel
- Develop a supporting Android Application, that also increases theft recovery

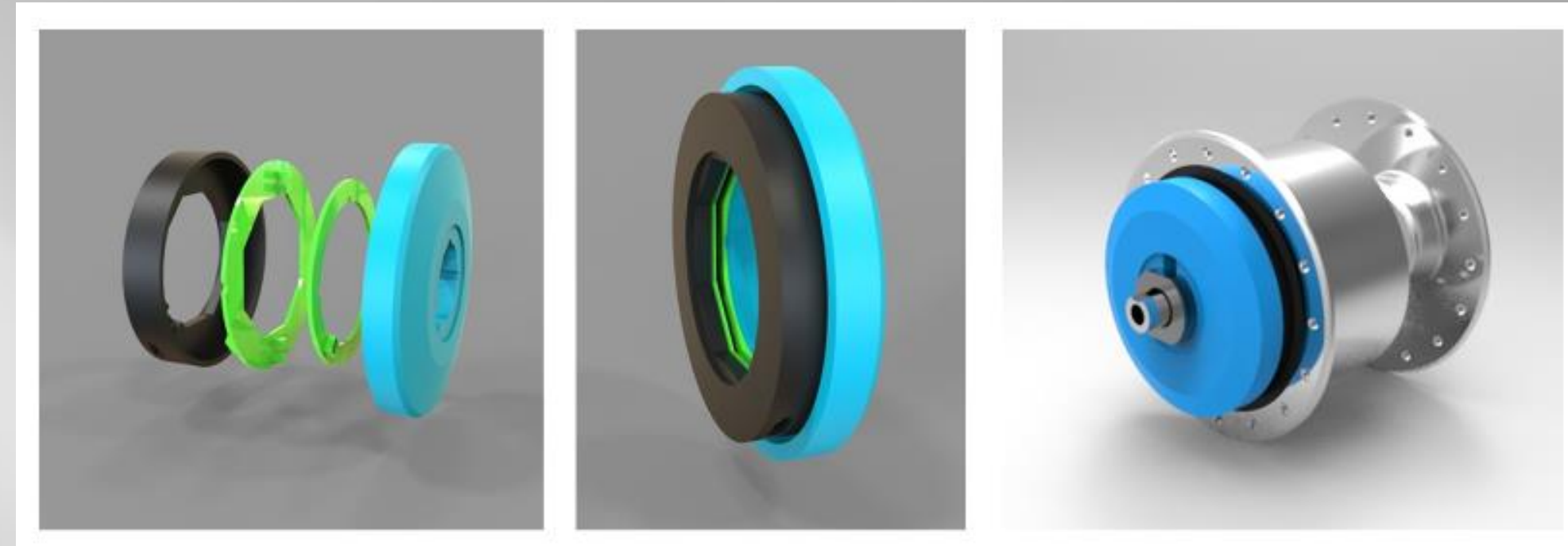300 ft Visibility

Overall General Prototype Design Circuit

Android App

Microcontroller/ Bluetooth

Power Source

Acknowledgements

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Power Source

- **Shimano DH-3N72 Dynamo Hub**
  - Self-Generating Electricity by means of wheel rotation
- **Power Transfer**
  - Slip ring design allows electrical transfer to stay within the wheel

Electronics

- Arduino Microcontroller
  - Controls the lights

- Bluetooth Low Energy Shield
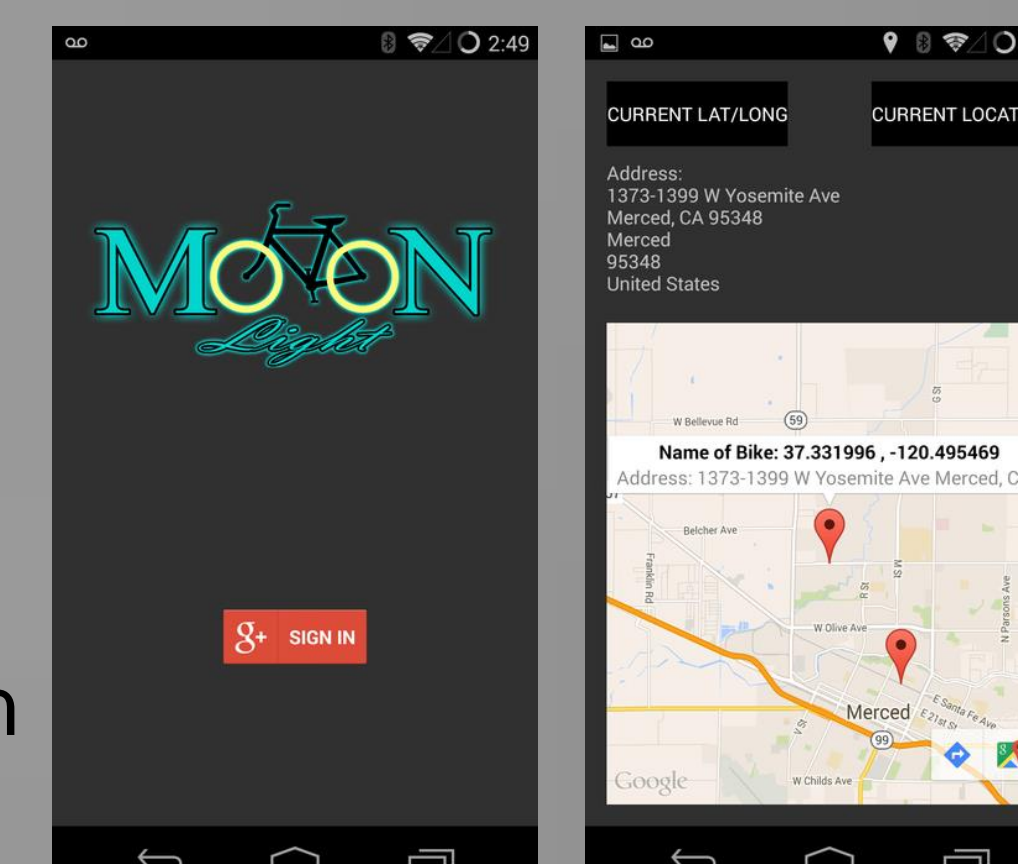 - Provides connection between arduino and Android mobile application

Lighting

Electroluminescent (EL) Panels
Used as a replacement for EL paint
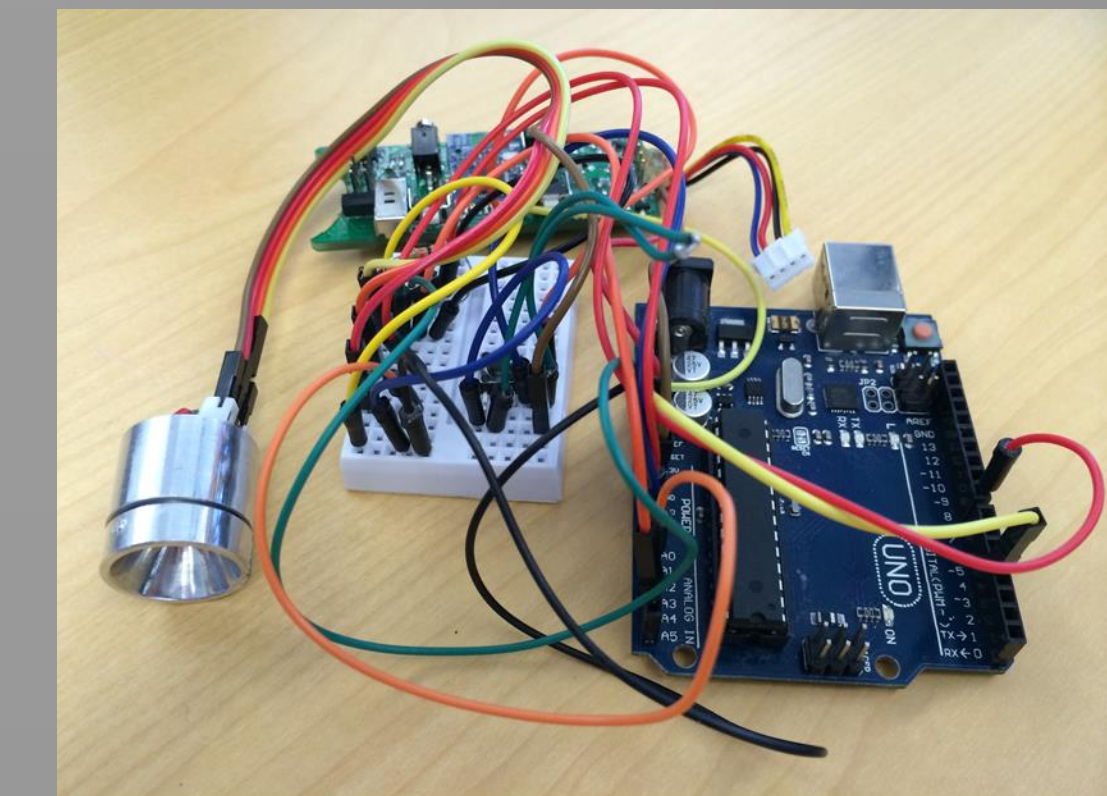
Android Application

Features
- Wheel light control
  - Blinks at a rapid frequency indicating a stolen bike
- Bicycle theft recovery
  - View last-seen location of lost bikes
  - Report your stolen bike

Wheel/Software Testing

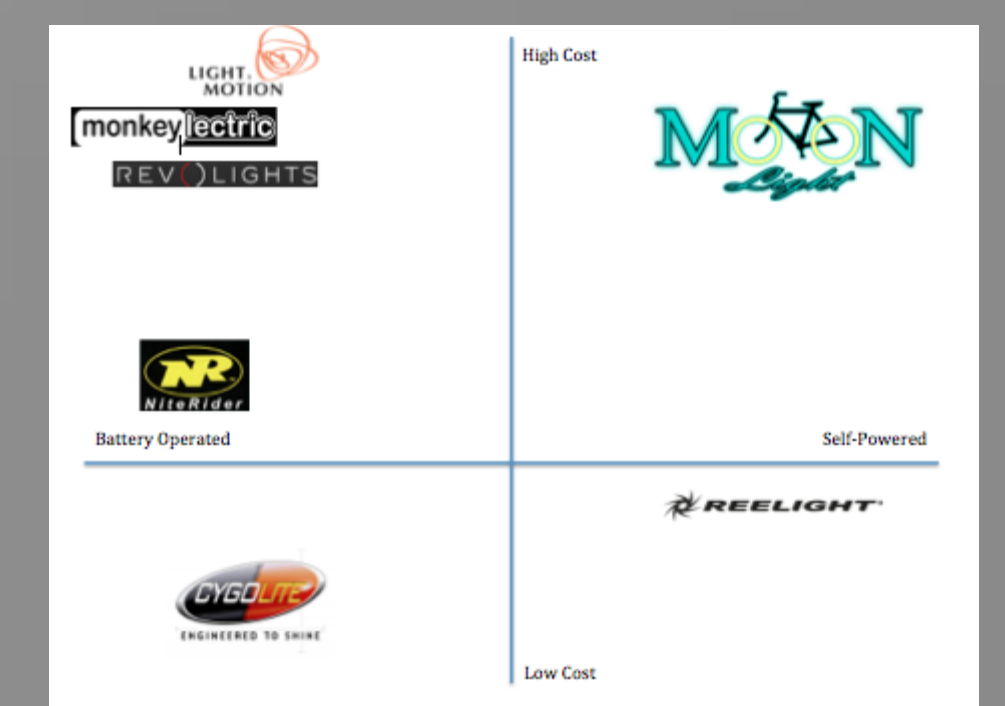- Mechanical
- Electrical
- Bluetooth connection

Market Analysis

- SWOT Analysis

Strengths	Weaknesses
•Self-Powered •Theft Prevention •Bluetooth and Android Application •Modular •Eco-friendly, sustainable •Revolutionary use of EL Paint	•Expensive to produce •Chance of electric shock •Limited resources for project
Opportunities	**Threats**
•First self-powered lighted bicycle wheels •Lower night time bicycle accidents •New innovative technology •Use of EL Paint	•Time constraints •Material Constraints •Other competitors in the market with lower prices

- Perceptual Map

Final Product Vision

- Modular Unit
- Aesthetically sleek looking wheels

Conclusions and Future Work

- Design electrical components in a condensed format
- Redesign dynamo hub to eliminate slip rings
- Use EL paint in final product
- Incorporate paired connectivity, chat system and automated police reports
- Display heat maps of crime rates at specific locations to prevent bike theft

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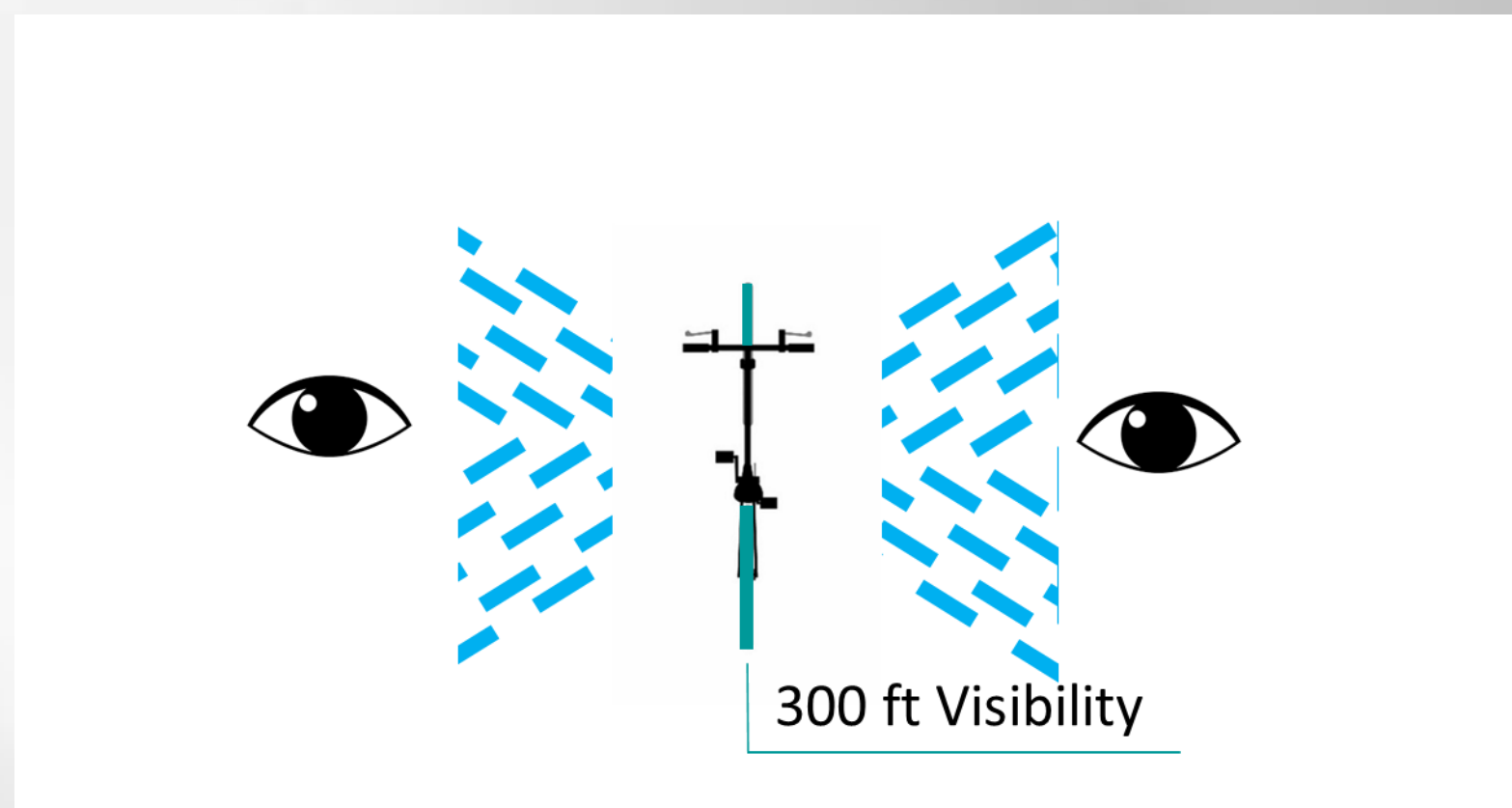
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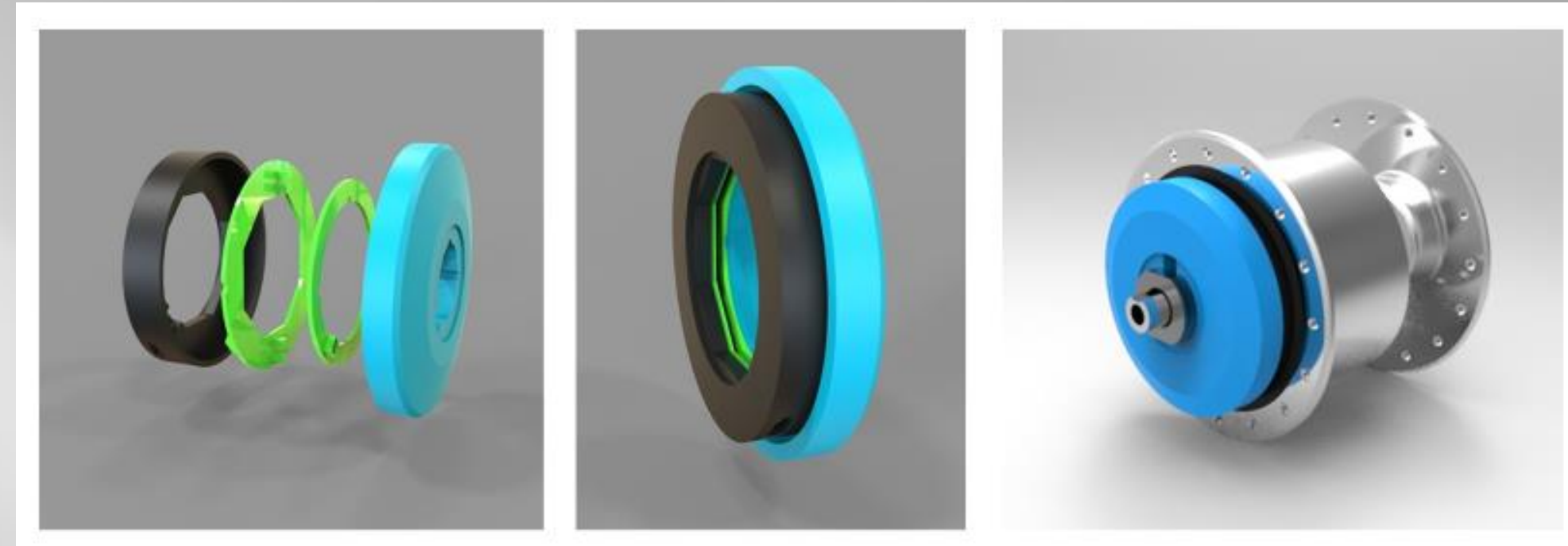 - Poor visibility of cyclists in both rear and sides of rider

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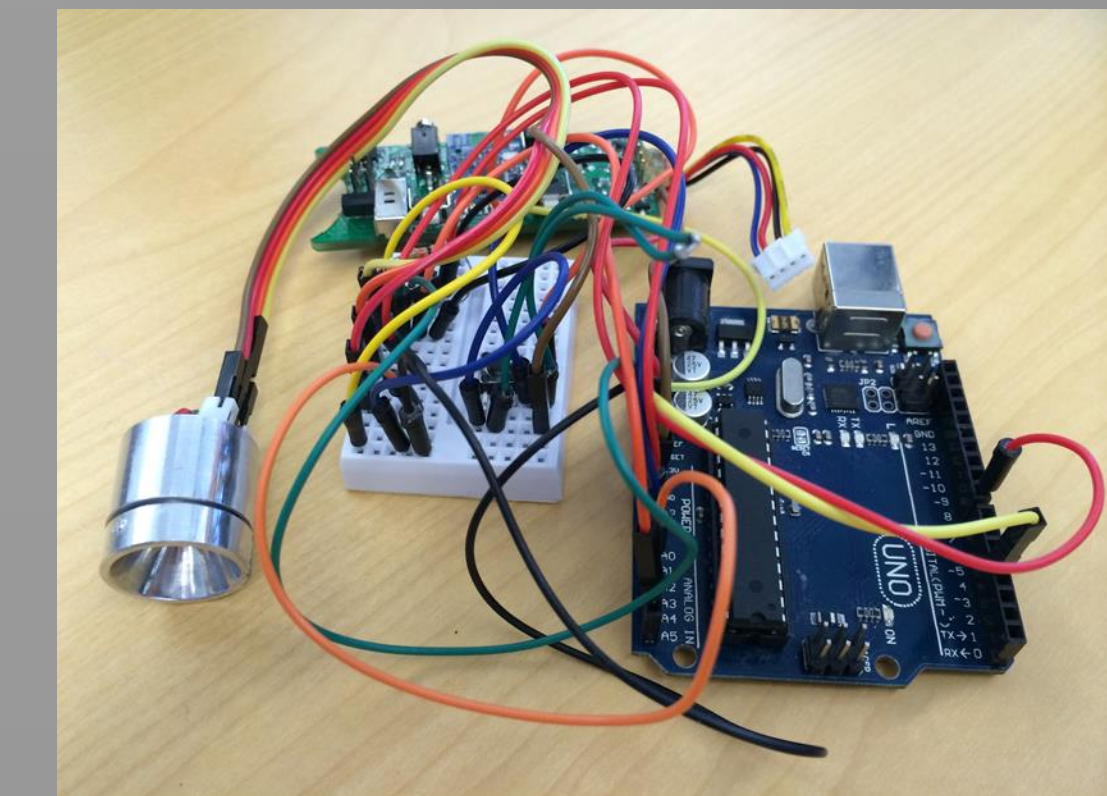
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Overall General Prototype Design Circuit

Android App
Full Bridge Rectifier
Step Up Voltage
Resistor
Arduino Microcontroller
BLE
Capacitor
Dynamo Hub
EL Converter
Resistor
Triac
Shimano-Redesign dynamo hub
EL lighting

Acknowledgements

Sponsors: Kenneth Gibbs
Seena Zandipout
Antonio Belmontes

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Faculty Mentor: Nihal Orfi

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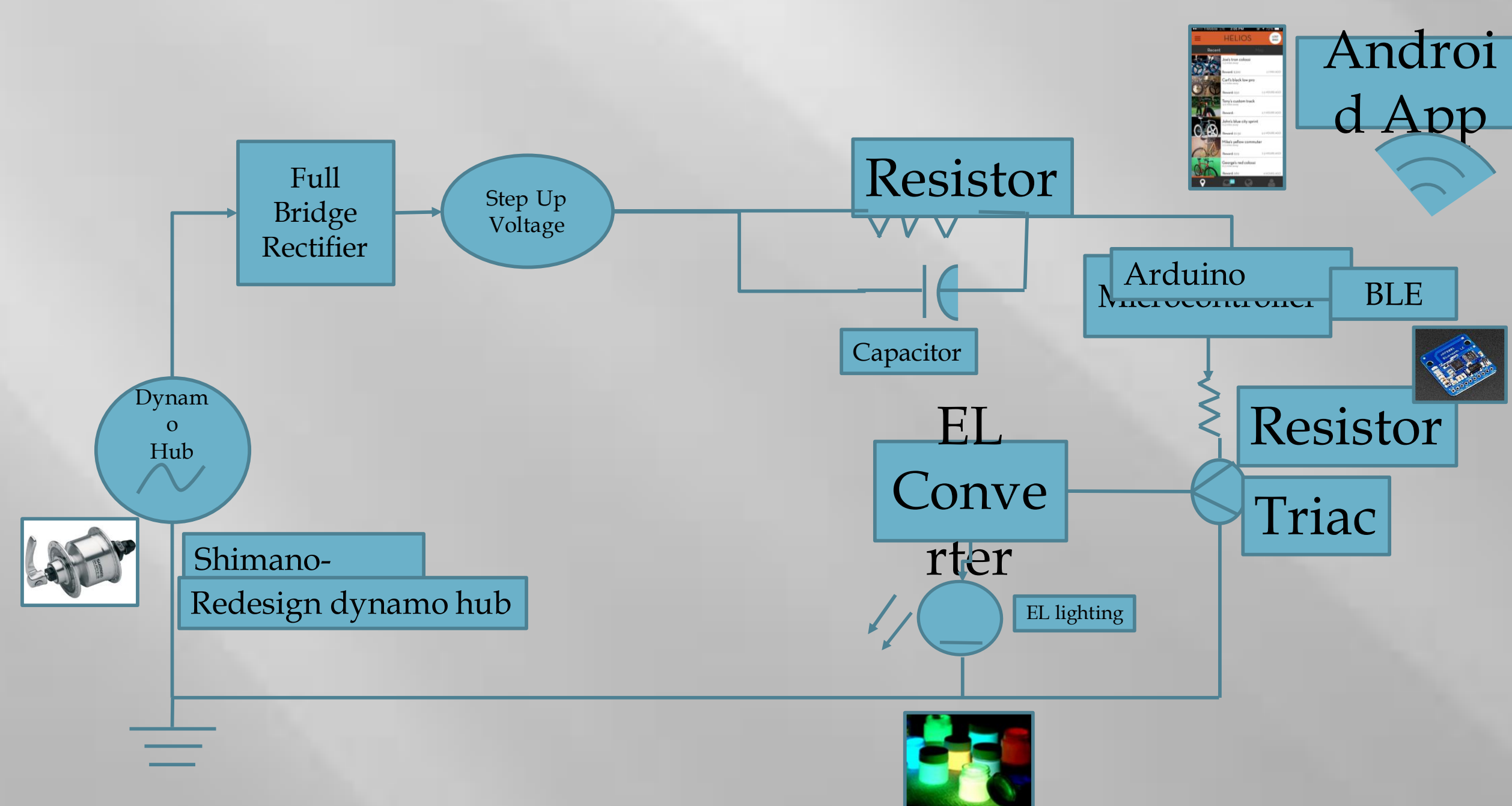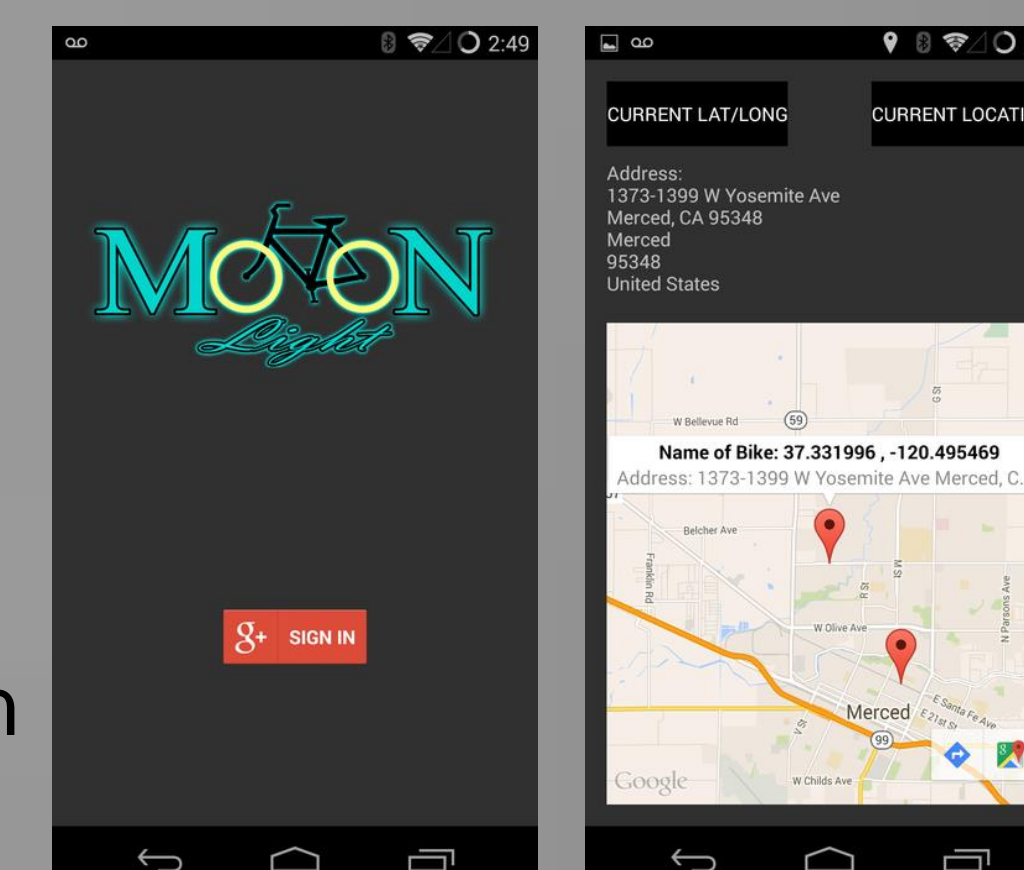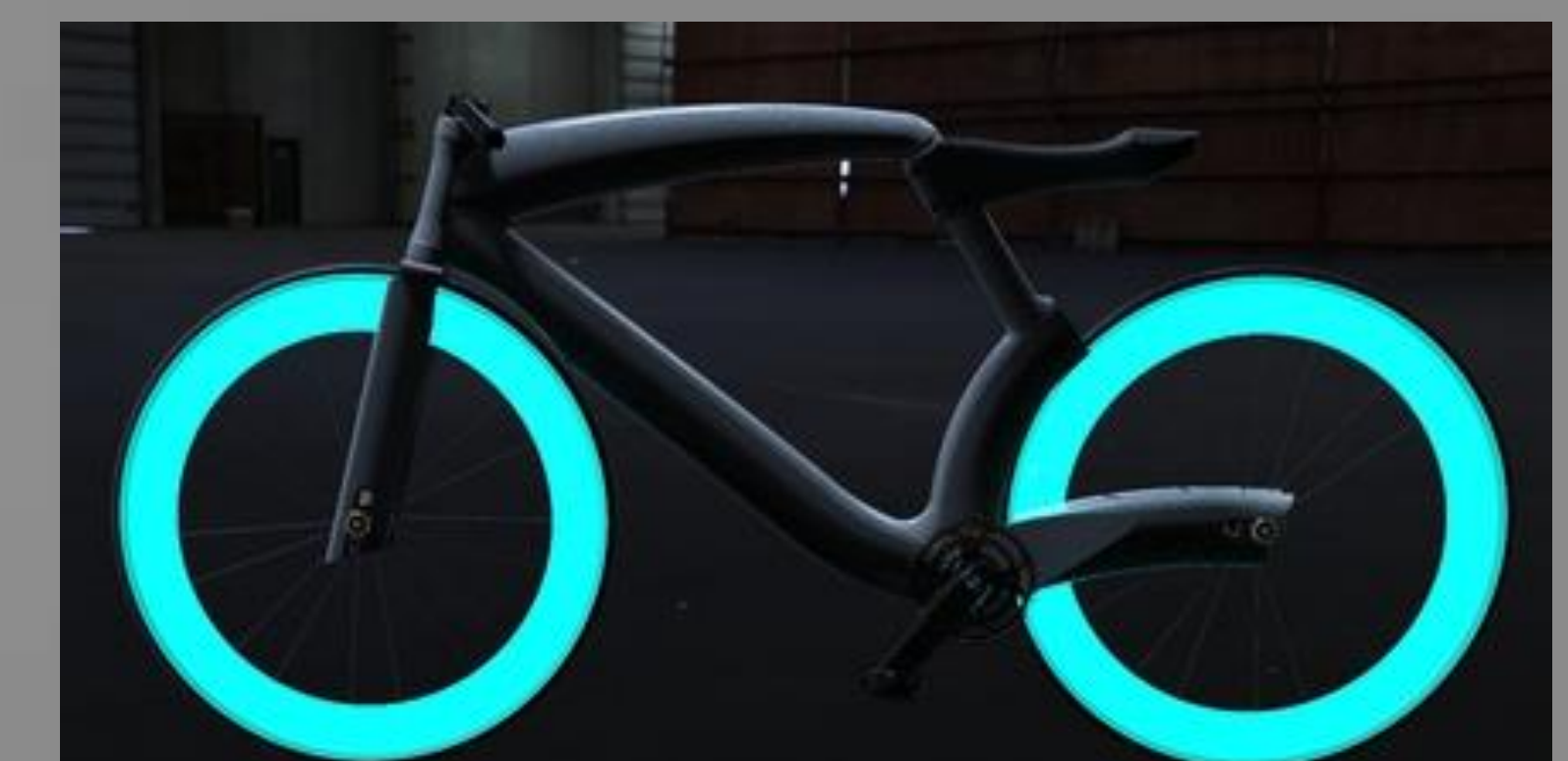- Mechanical
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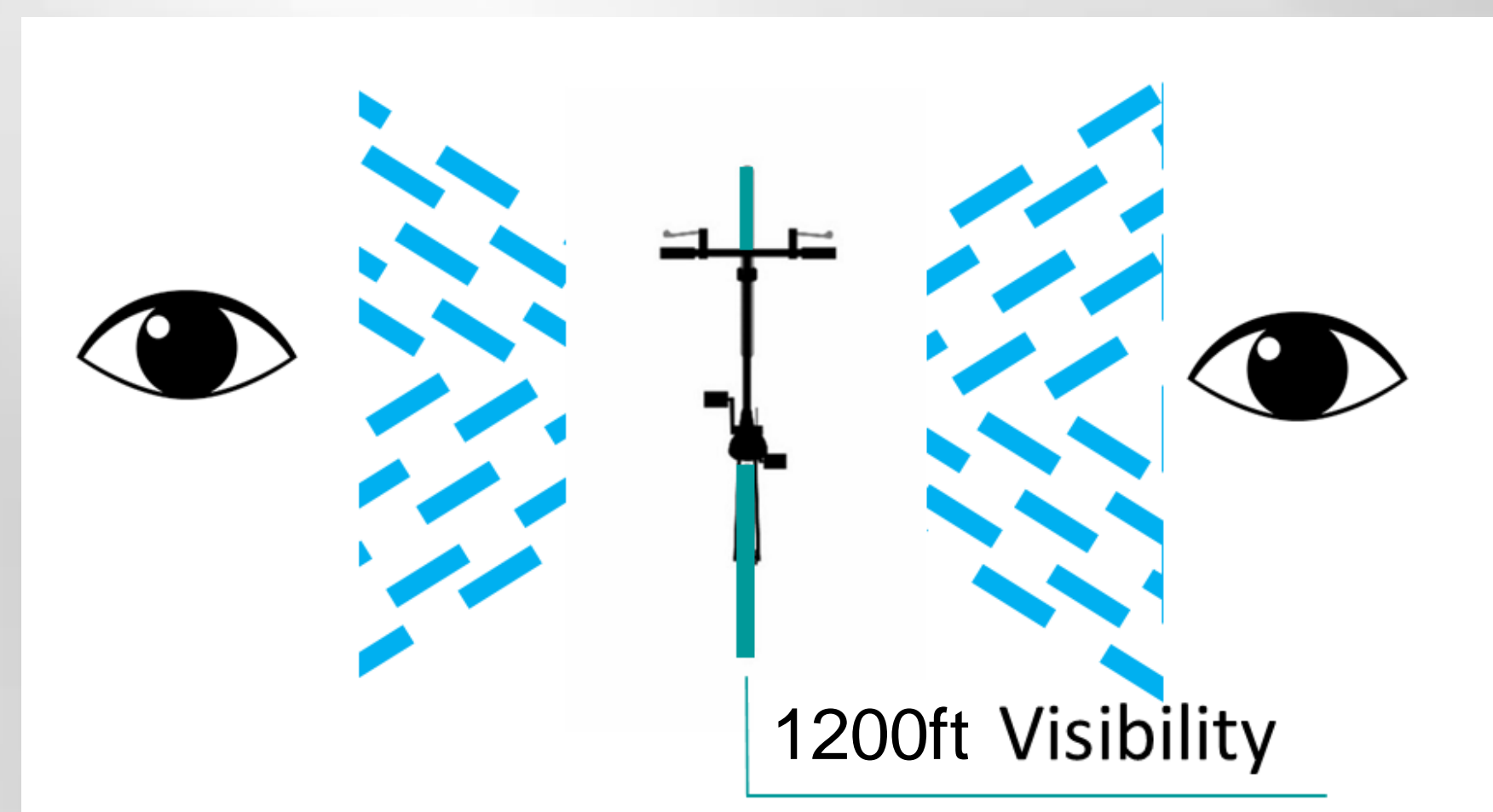
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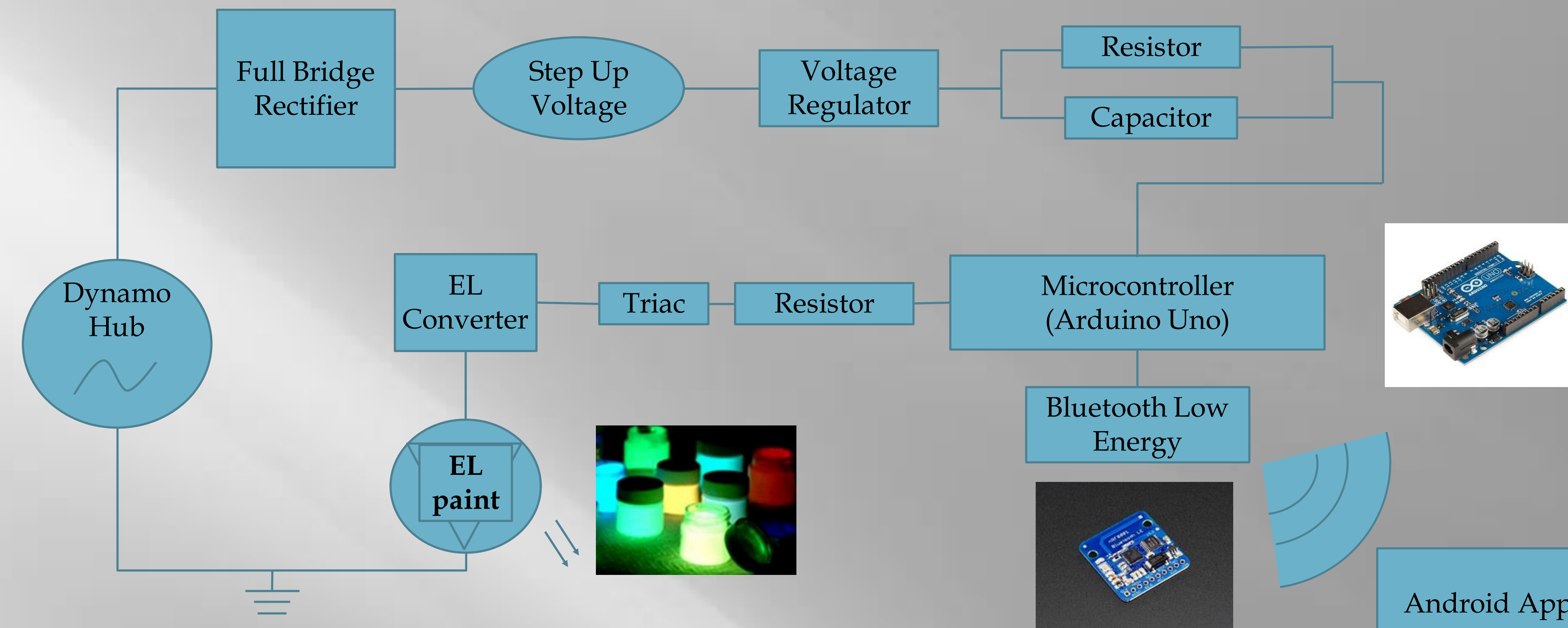
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1200ft Visibility

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Overall Final Design Circuit

Full Bridge Rectifier → Step Up Voltage → Voltage Regulator → Resistor / Capacitor

Dynamo Hub

EL Converter → Triac → Resistor → Microcontroller (Arduino Uno)

EL paint

Bluetooth Low Energy
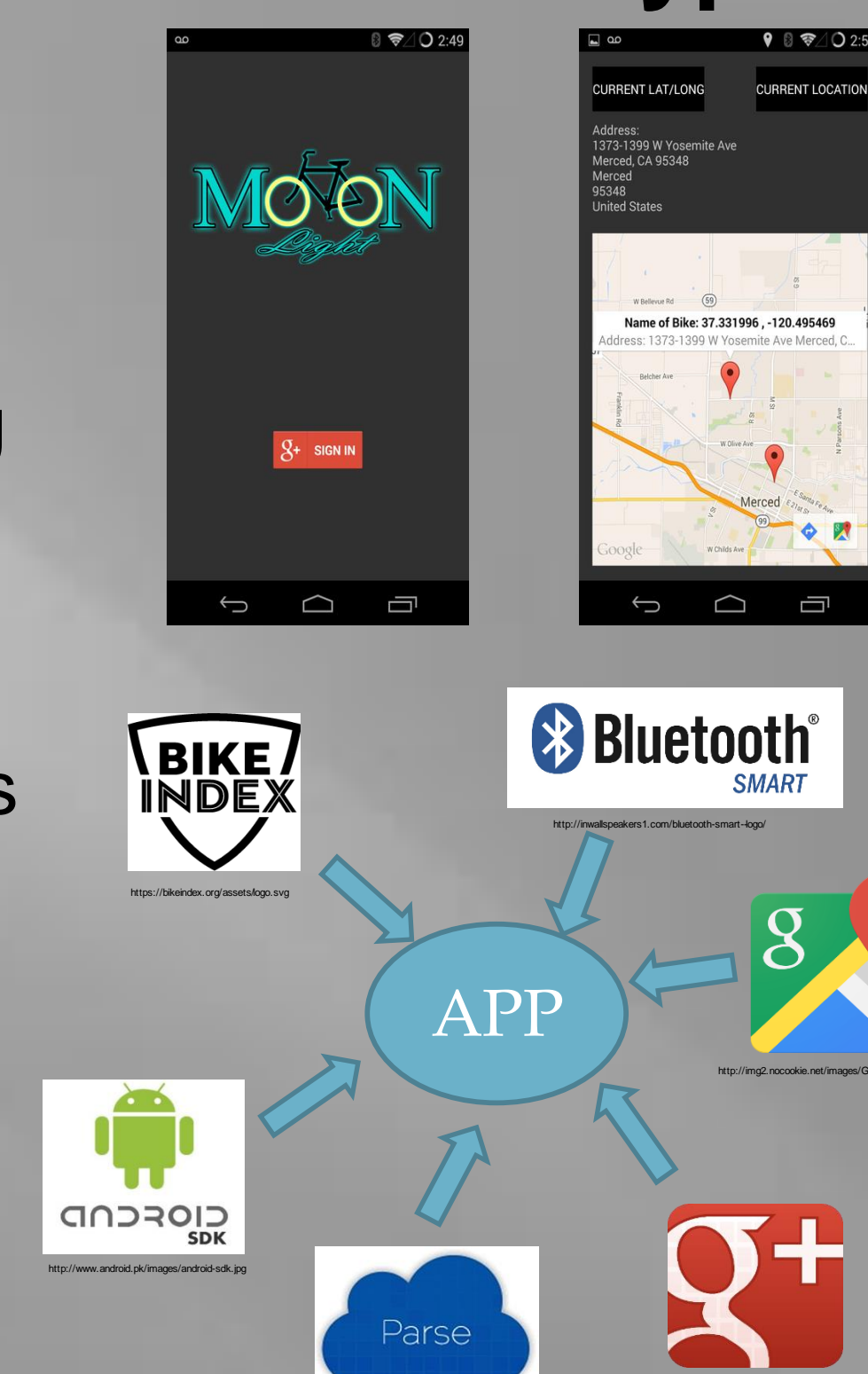
Android App

Power Source- Prototype

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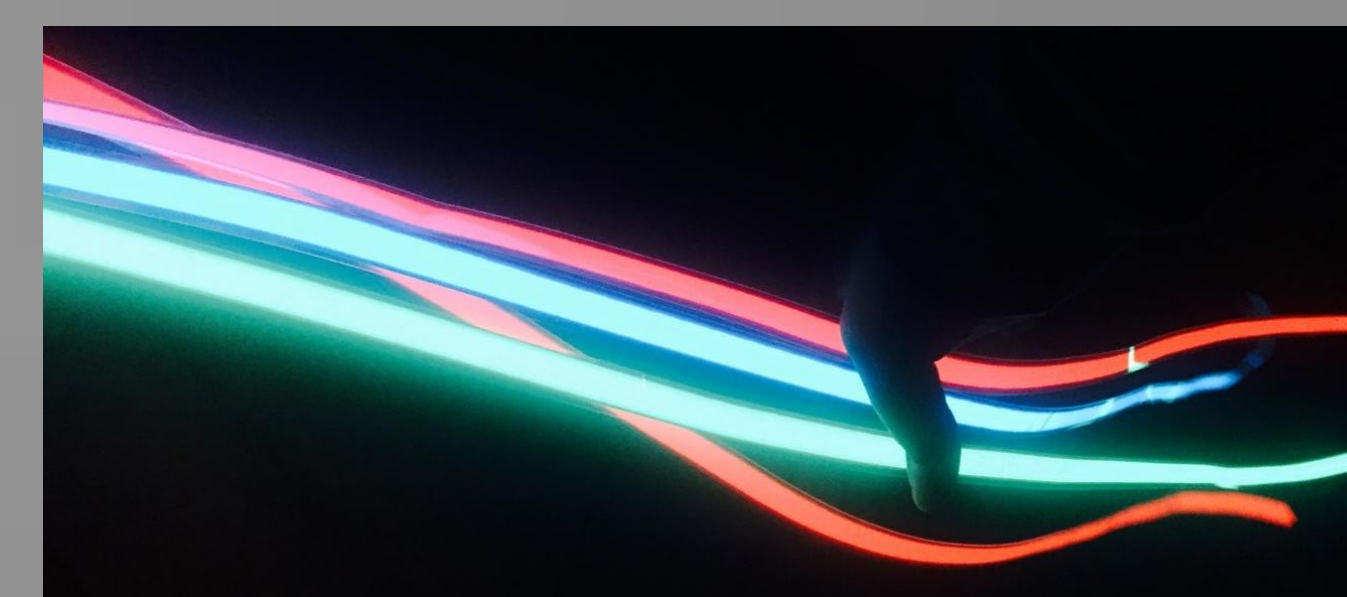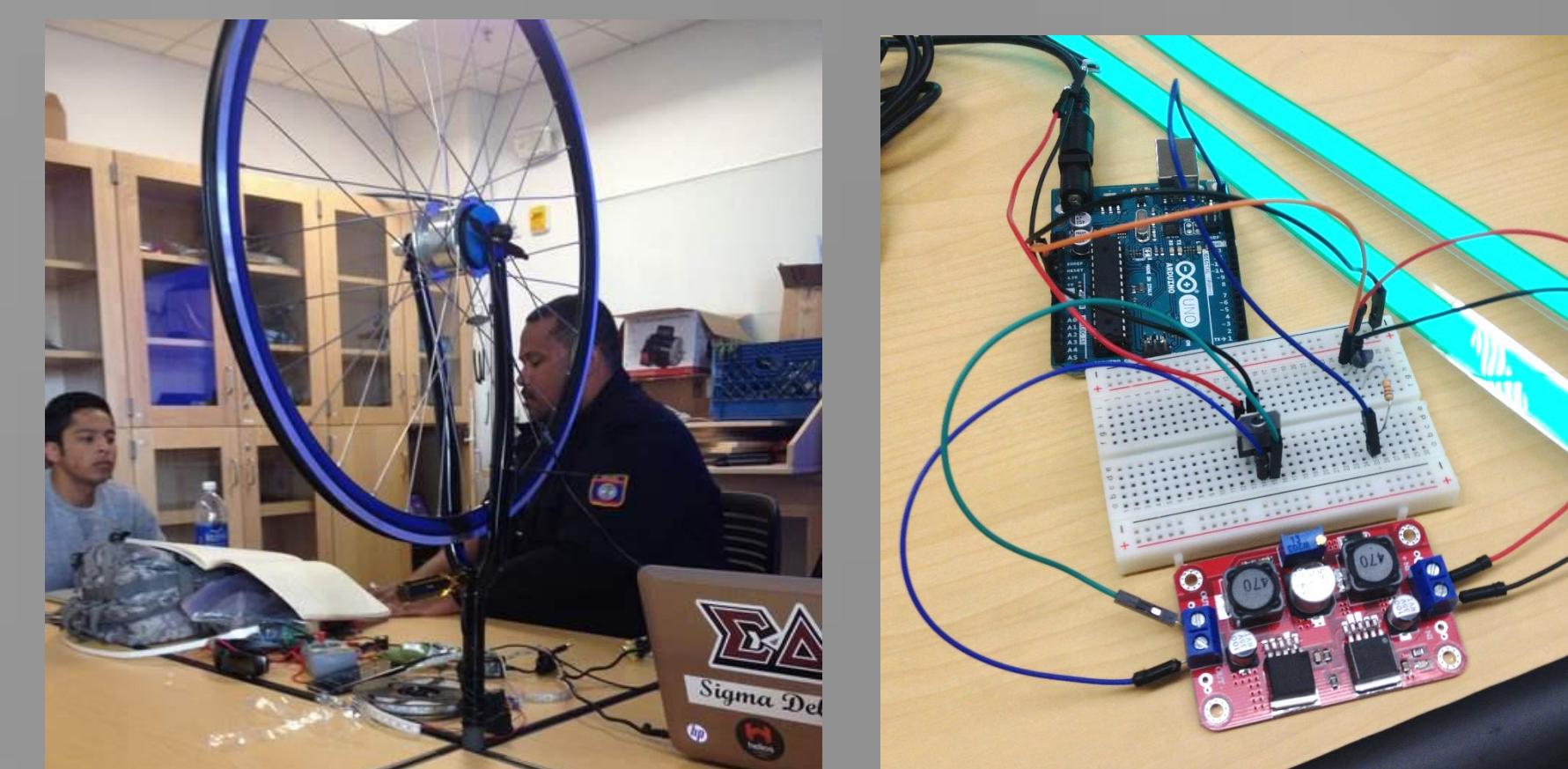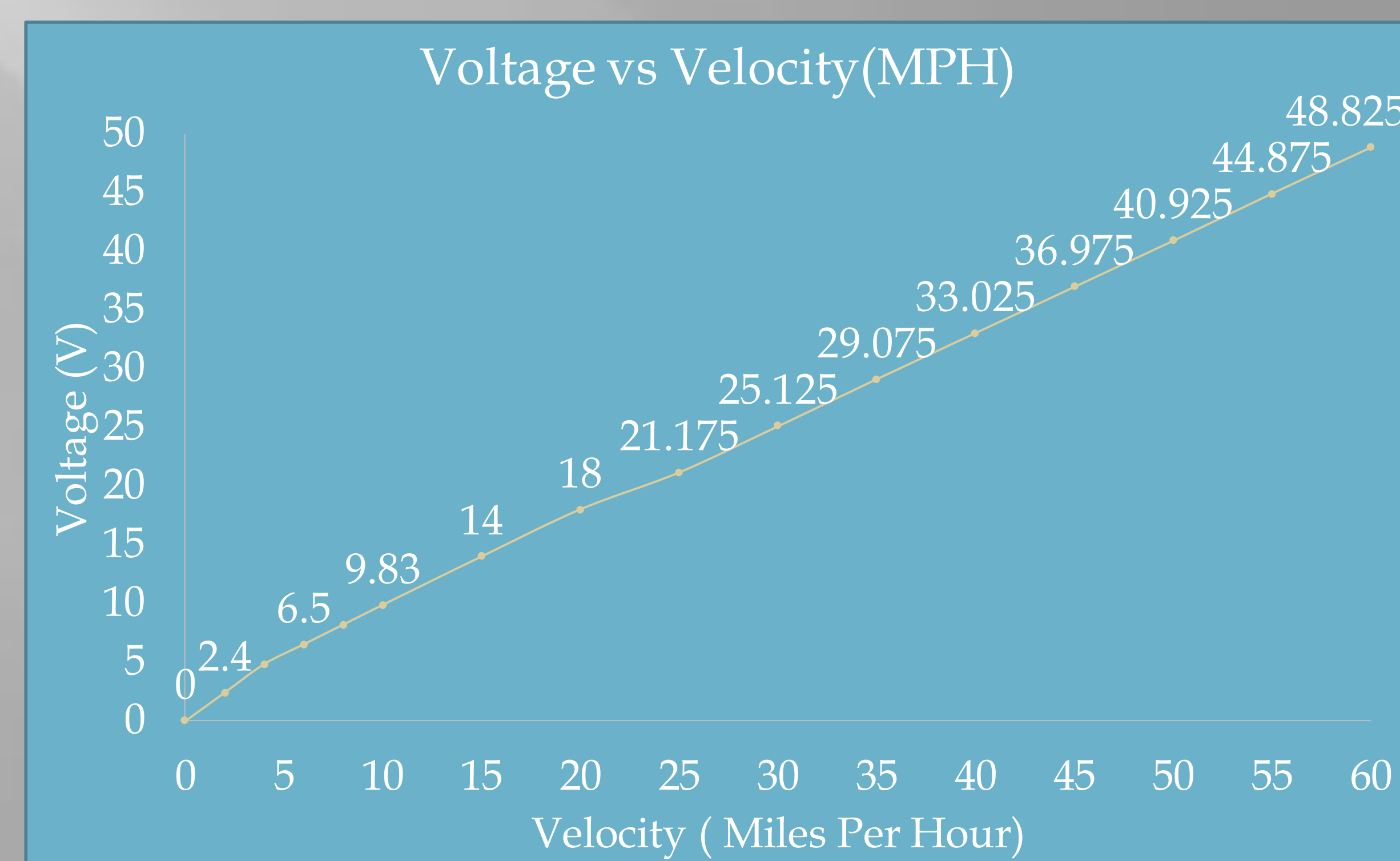 - Slip ring design allows electrical transfer to stay within the wheel
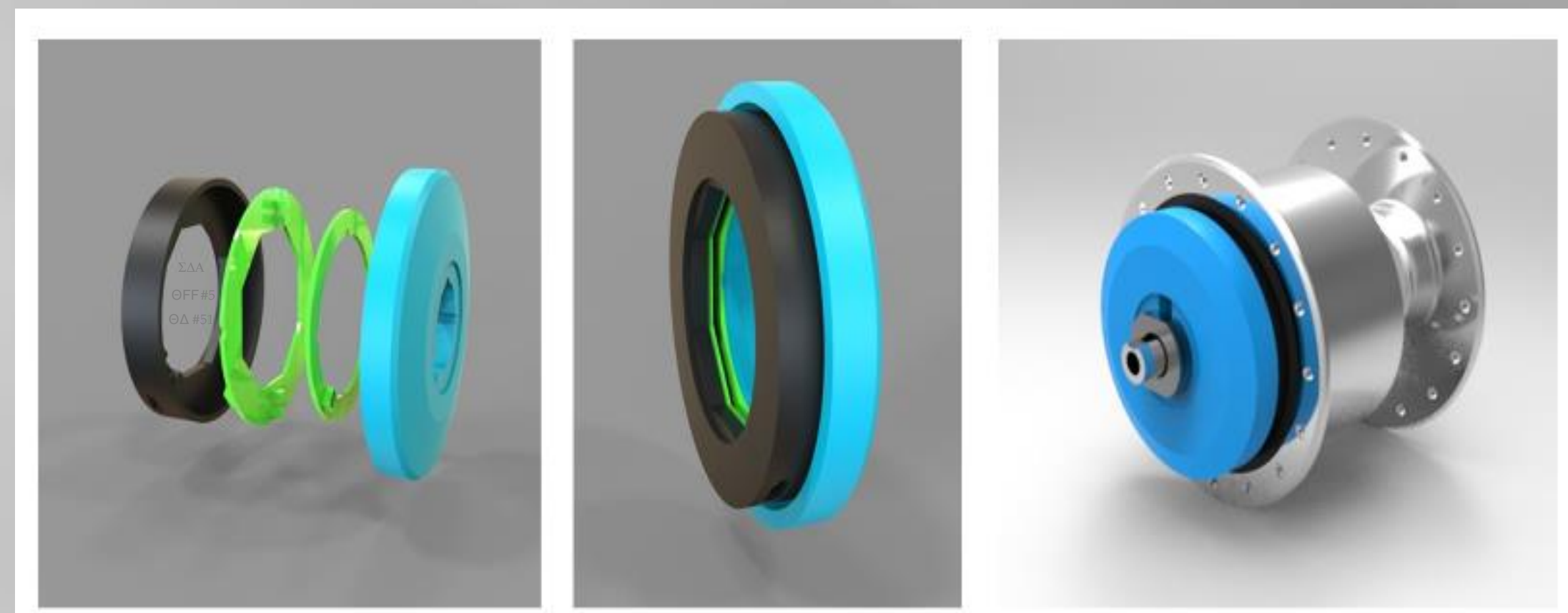
Android Application - Prototype

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APP

Wheel/Software Testing

Voltage vs Velocity(MPH)

Values shown on plot: 2.4, 6.5, 9.83, 14, 18, 21.175, 25.125, 29.075, 33.025, 36.975, 40.925, 44.875, 48.825

Voltage (V) axis: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

Velocity (Miles Per Hour) axis: 0, 5, 10, 15, 20, 25, 30, 35, 40, 45, 50, 55, 60

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