Concept Generation

Second Generation Bike

J. Alhabshy, R. Alzahrani, B. Gabrelcik, R. Murphy, R. Villezcas

Oct. 15, 2014

NORTHERN ARIZONA UNIVERSITY

Overview

- To design and improve the 2nd Generation Recharging Bike Station
- Allow the bike to be mobile as well as stationary
- The bike must have an interactive display that is easy to use
- The bike must be able to charge the majority of small electronic devices

Concept Generation – Electric Control System

- Converts mechanical energy from the rider into usable electricity
- Stores unused electricity for later use and to power the display
- Some designs will convert DC electricity to AC electricity for AC required appliances such as laptops

Concept Generation – Interactive Display

- Must be able to display power being generated, calories lost, and distance traveled

- Should display information in an educational and easy to understand manner

- Should display graphs of power outputs over time that will help the user understand the data provided

Concept Generation – Enclosure

- Must house and protect the electric control system
- Should hide any unpleasing wires for aesthetic purposes
- Should be lightweight
- Should be waterproof so that the electronics will not get damp or wet

Criteria – Electric Control System

- Cost/Expenses – Amount of dollars needed to build the design
- Efficiency – Minimal amount of energy wasted
- Ease of Build – Amount of time to construct the design
- Compatibility – Number of objects the bike is capable of charging
- Capacity - Volume of space that the design will take up

Decision Matrix Results – Electric Control System

Category #1:

Control System

Criterias:

Designs:	Cost/Expenses:	Efficiency:	Ease of Build:	Compatibility:	Capacity:	Total Score:
Weighted Score:	2	2.8	1.7	2	1.5	10
Super Capacitors	7	7.2	7	6.6	5.6	68
Lithium Ion / No Inverter	6.4	6.8	7.4	6.2	6.6	67
Lithium Ion / Inverter	7.4	7.2	7.6	7	6.8	72

Criteria – Interactive Display

- Ease of Use – Simplicity of operation and navigation
- Educational – Capable of teaching the user how it works
- Aesthetics – GUI that is pleasing to the eyes
- Accuracy - How precise the outputs are to their actual values
- Programming - Simplicity and capability of the programming language

Decision Matrix Results – Interactive Display

Category #2:

Interactive Display

Criterias:

Designs:	Ease of Use:	Educational:	Aesthetics:	Accuracy:	Programming:	Total Score:
Weighted Score:	2.5	1.6	1.7	1.8	2.4	10
B.G. Design 1 - C++	8.2	8	8.2	7.6	8	71
J.A. Design 2 - Python	8.2	7.2	7.8	7.4	6.2	65
R.A. Design 3 - C++	7.8	8	7.4	7.4	7.8	69
R.M. Design 4 - Python	6.2	6.8	6.2	6.8	6	64

Criteria – Enclosure

- Aesthetics - How pleasing the housing is to the eye
- Space/Room - Volume of space inside of the enclosure
- Durability – Ability to resist stresses caused by excessive use
- Cost/Expenses – Amount of dollars it cost to build the unit
- Ease of Build – Difficulty in designing and building the entire enclosure

Decision Matrix Results – Enclosure

Criterias:

Category #3:

Enclosure Design

Designs:	Aesthetics	Space/Room	Durability	Cost/Expenses	Ease of Build	Total Score:
Weighted Score:	1.6	1.7	2	2.6	2.1	10
Plastic Side Clip	6.6	7.2	7.2	6.8	7.2	70
Carbon Fiber	7.4	6.6	8.2	5.4	6.8	68
Treated Wood	6.8	7	7.5	7.6	7.2	73
Plexiglass	7	7.2	6.6	7.6	7.6	72

Combined Bike Designs

- Plexiglass w/Inverter – A combination of a plexiglass enclosure and lithium ion control system with an inverter
- Plexiglass w/Super Capacitor – A combination of a plexiglass enclosure and super capacitor with an inverter
- Wood w/ Inverter - A combination of a wood enclosure and lithium ion control system with an inverter
- Wood w/Super Capacitor -A combination of a wood enclosure and super capacitor with an inverter

Criteria – Combined Bike Design

- Aesthetics - How pleasing the entire system is to the eye
- Effectiveness – How quickly it can charge an electronic device
- Durability - Ability to resist stresses caused by excessive use
- Cost/Expenses - Amount of dollars it cost to build the entire system
- Ease of Build - Difficulty in designing and building the entire system
- Usability – Simplicity of operating and managing the system

Decision Matrix Results – Combined Bike Designs

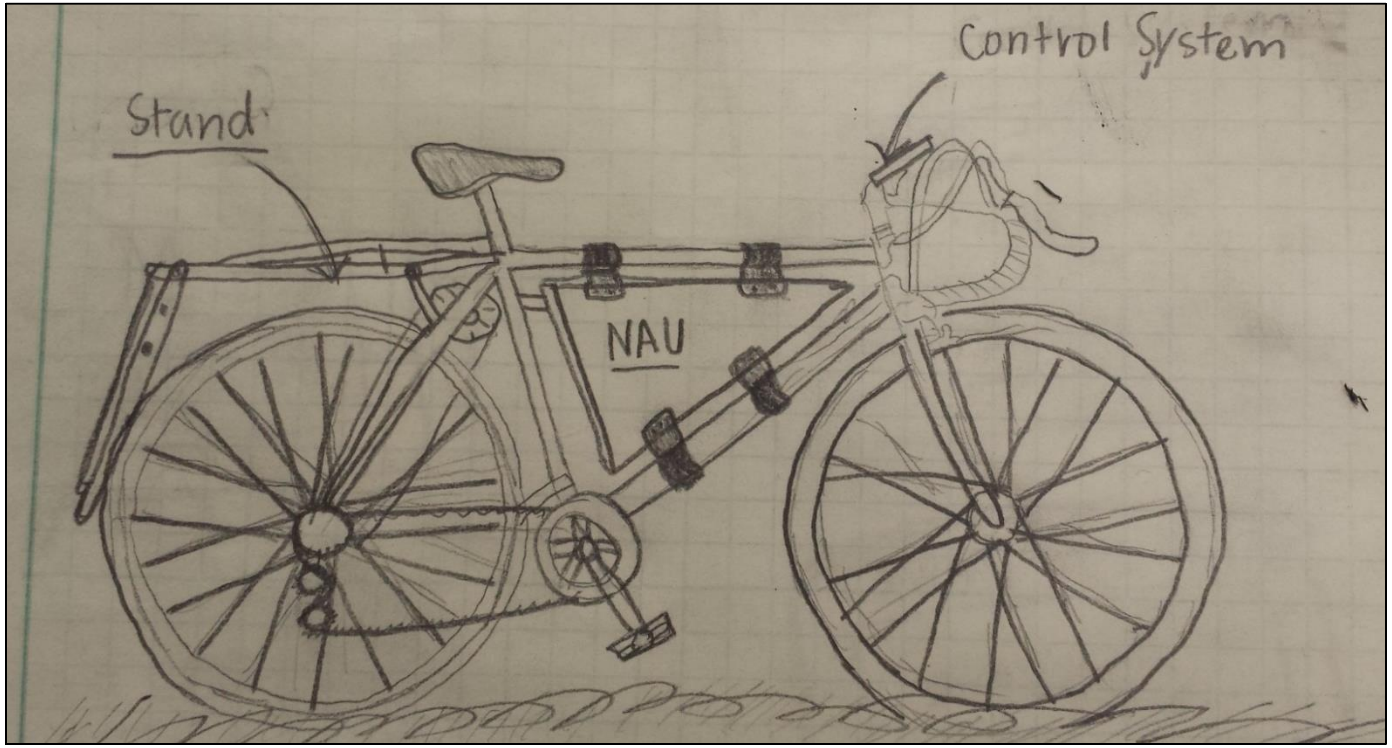
Criterias:

Final Category: Combined Bike Designs

Designs:	Aesthetics	Effectiveness	Durability	Cost/Expenses	Ease of Build	Usability	Total Score:
Weighted Score:	1	3	2	2	1	1	10
Plexiglass w/Inverter	8	8	8	8	7	6	68
Plexiglass w/Super Capacitor	6	7	8	7	7	9	68
Wood w/ Inverter	9	8	8	8	7	7	70
Wood w/Super Capacitor	7	7	8	7	7	8	66

Final Design Choice

- The final design that was chosen was the lithium ion control system with an inverter inside of a wooden enclosure. The interactive display will be written in C++ programming language.



Conclusion

- Defined three design categories
  - Electric Control System
  - Interactive display
  - Enclosure
- Defined criteria for each category
- Displayed final decision matrices
- Defined final combined bike design
  - Lithium ion with inverter
  - C++ programming
  - Wooden enclosure

Questions or Comments