

Second Generation Bicycle Charging Station

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Introduction



- 2012 - First Generation Charging Station Built
- Purpose of Second Generation Charging Station is to improve upon first generation and increase educational capabilities

Problem Formulation

Educational Potential:

- Demonstrate the importance of renewable energy sources
- Provide students of all levels with a way to understand and compare the amount of energy required to power and charge electronic devices with the amount of energy produced by pedaling a bicycle

Problem Formulation

Issues With First Generation Station:

- Not compatible with all major cell phones/AC Charging
- Cannot readily be transported to different locations
- Current display system is not user friendly and does not display adequate information
- User discomfort and non-adjustable
- No consideration towards varying power inputs (gearing and resistance)

Problem Formulation

Constraints:

- Charging station must be able to be moved easily around campus to be used in various buildings and at different events
- Power generation information will be displayed both as numerical information and graphically
- Station must incorporate various phone chargers and 3-prong AC outlet
- Charging station must be built within the budget of \$1,600 provided by Green Fund

Proposed Design

- Chain Driven Generator
- Adjustable seat
- Pivoting rear stand
- Transparent housing for electronics



Prototype Fabrication-Stand

Rear Bicycle Stand

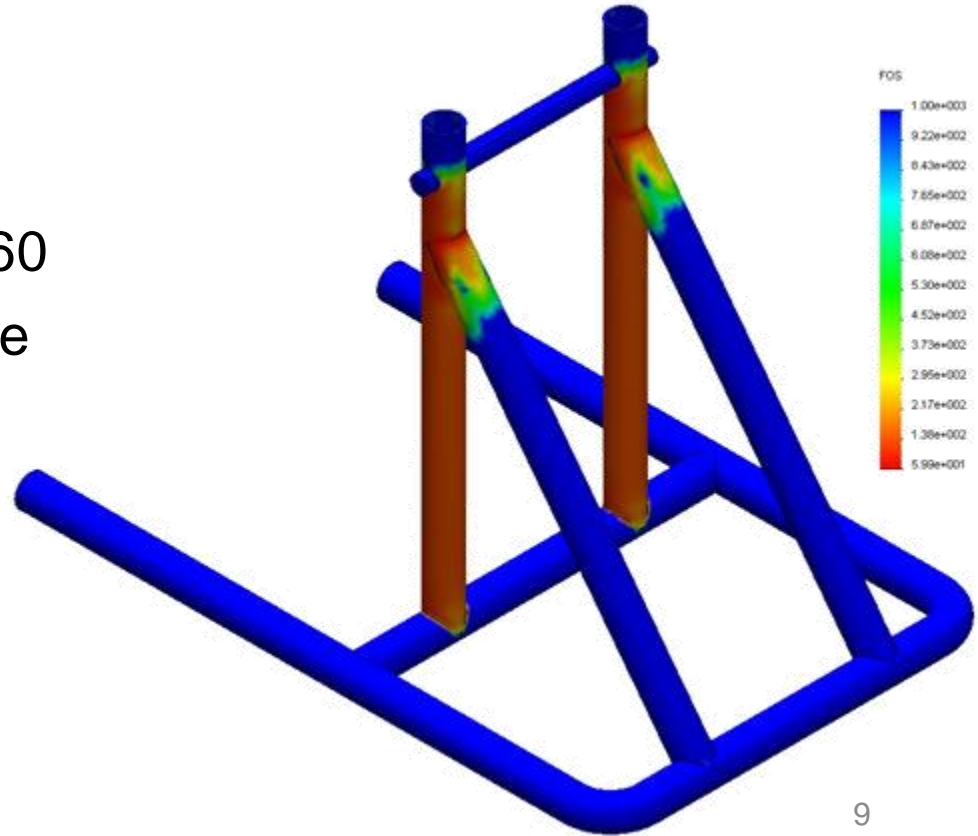
- Galvanized steel pipe fittings
- Emphasis on repeatability of assembly
- Non-permanent joints for maintenance



Prototype Fabrication-Stand

Rear Bicycle Stand

- 1000 N applied load
- Minimum factor of safety of 60
- Bending effects are negligible



Prototype Fabrication

Power Transmission

- 53 tooth gear to standard 7 gear cassette for the rear tire
- Custom 56 to 10 tooth gear from the rear tire to the generator for power generation
- Provides an input range up to 2700 RPM



Prototype Fabrication

Power Transmission

- Generator held to rear wheel stay by sheet metal plate and U-bolt fasteners
- Adjustable for realignment of chain between gears



Prototype Fabrication

Ergonomic Improvements

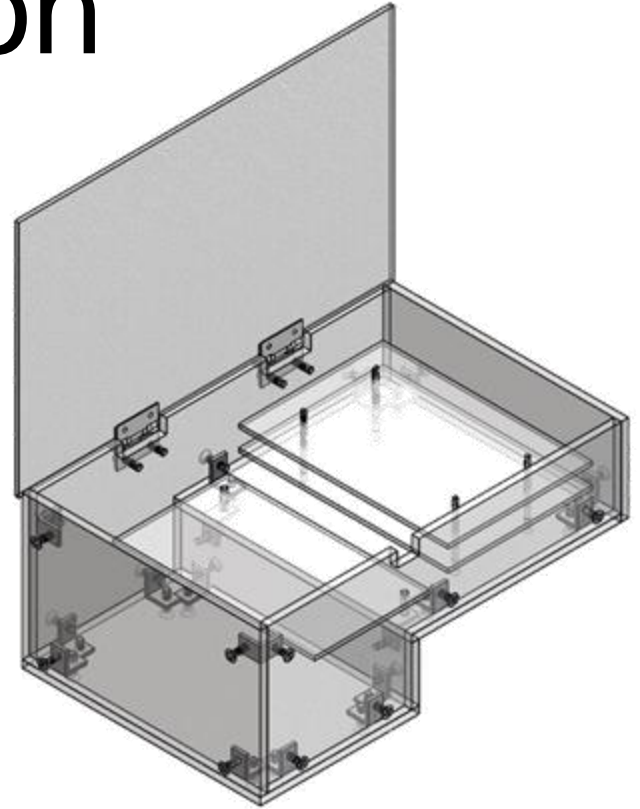
- Caged Pedals
- Trekking handlebars
- Adjustable seat height
- Comfort grips
- Handlebar ends



Prototype Fabrication

Display Housing

- Plexiglas for visibility of electrical components
- Can be disassembled for maintenance
- Can be used as a laptop stand



Cost Breakdown

| | |
|-----------------------|-----------|
| Stand Components | \$240.00 |
| Bike Parts | \$324.37 |
| Housing Components | \$71.96 |
| Electrical Components | \$504.8 |
| Total | \$1141.13 |

Process Summary

- Goal was to improve on concepts from 1st Generation with emphasis on educational potential
- Research and testing allowed for improvements in design while providing valuable information about system
- Project built within allocated budget of \$1600

Conclusions

- Second generation bicycle charging station features a low cost design that provides a portable device charging
- Provides users with a way to understand and compare the amount of energy required to power and charge electronic devices with the amount of energy produced by pedaling a bicycle

References

- [1] Lamb, M., The NAU Green Fund Addendum Application: Second Generation Charging Station. Feb. 2013
- [2] Whitt, F.R., Wilson, D.G., Bicycling Science. 2nd Edition. MIT Press, Cambridge, MA. 1982.

Questions?