

SEMESTER/EXPLORATORY GRANT APPLICATION

Cover Sheet

Amount Requested: \$1000

Project Information

Bott, Randall

Student Participant (Last, First)
Electric Bicycle Prototype


Project Title (10 words or less)

Samuel Hunter 1802

Faculty Mentor Name (last, first) Mail Code
East College Engineering, Applied Science & Technology

College (Weber State is the University, NOT college) Department

This project DOES/ X DOES NOT require review by the WSU Institutional Review Board for Human Subjects or the WSU Animal Care and Use Committee.


Student Signature

9/12/18

Date _____


Project Mentor Signature

9/12/18

Date Received by Mentor.
Must be 10 business days
before final deadline.

1802 Campus Mail 8570 Phone Ext.

9/24/18

Date Received by URC Rep.
Must be 5 business days
before final deadline.


Undergraduate Research Committee Representative

9/25/2018
Date


Faculty Mentor Department Chair

Please check if attended Research Proposal Workshop:

9/13/18

☒ Date Workshop attended 9/13/18

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Budget Worksheet

BUDGET ITEM	Department or College Funds	Outside Agency Funds	Personal Funds	Undergrad. Research Funds	GRAND TOTAL
Materials	Misc. metal for initial prototyping	-	\$600	\$1000	\$1600
Equipment	Existing lab equipment available for use	-	-	-	-
Research Scholarship (max request \$2,500.00)	-	-	-	-	-
Mileage to gather Data (.38 per mile)	-	-	-	-	-
GRAND TOTAL	-	-	-	-	\$1600

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Body of Proposal

Project Description

With continually rising fossil fuel shortage concerns and global warming, there is a growing interest in electric vehicles. The electric bicycle is part of an array of lightweight electric vehicles that provide convenient local commuting. “The electric motor and multi-speed transmission hubs are the individual electrical and mechanical devices of the electric bicycle and are essential components of the power and transmission systems” (Yi-Chang, Wu, & Lin Bo-Wei, 2014). As the demand for electric bikes increases, the global drive to use clean sources of fuel is also rising. New battery technologies have made the range on electric bikes far superior than they have ever been. “High efficiency motors also play a big role in the range of an electric bike. The electric controller is one of the most crucial components in an electric bicycle. The overall performance of the whole system heavily depends on the properties of the controller” (Zhou, H.B., Long, B. & Cao, 2013). Our research has led us to the Bafang BBSHD motor with an integrated controller that has the highest quality components on the current market. Other factors such as rider weight and terrain can affect the range as well.

“To fully assess the market potential of e-bikes, further research is needed to understand users' preferences and the range of factors that can contribute to people to shift from car use to low carbon vehicles such as e-bikes” (Arsenio, Elisabete, 2018). Current market e-bikes to meet our project requirements cost \$3,300. Our goal is to produce a less expensive, high quality, clean energy powered bicycle that can be used for commuting. Our team will build one for \$1,600 by April 2019. We believe we can build a bike that has superior range with minimal weight while still maintaining a stylish look to help further e-bike research.

To demonstrate and showcase skills acquired through Weber State University MFET and DET programs we will: design, construct and budget an electric bike. The e-bike team will accomplish this goal by analyzing existing designs and create one based on our project requirements. A specific

requirement of this build is to have an electric bike that is lightweight and able to hold an average person.

The design and required accuracy of parts will determine if the bicycle is feasible to manufacture at WSU facilities.

The project will be during two semesters. The first semester will cover design, prototyping, and presentation. The second semester will be focused on production, testing, improvements, and a final presentation of deliverables. Our work experience, education, and creativity will be used to effectively produce an electric bicycle with the desired weight, size, strength, power, price, range, and modern look. As a group, we will control all aspects of the manufacturing process such as product design, product planning, quality control, process control, engineering, prototyping, and safety. This project will be challenging and will require all six team members to work together for two semesters to complete. Upon completion, our goal is to enhance our skills and knowledge of manufacturing a product and preparing us for a career in our field of study. A working electric bike will be produced and presented to the Department Representative, Team Faculty Advisor, and team members in April 2019.

Students Role and Experience

My role on the team is to manage the team's assignments and help each member fulfill their roles. I will constantly be working along side my peers learning, teaching, and ensuring that we complete our goals on time. The faculty mentor's role is to teach students fundamental principles in project management, cost estimating, engineering economics and production management that will be necessary to successfully complete their senior project experience. The faculty mentor will be meeting with our group every Thursday to coach us and help us with any issues or questions we have.

Since I was a small child, I have loved to learn how things work. Growing up, I was always in my father's workshop building and inventing things. I have worked as a welder giving me a real-world experience of metal forming and welding procedures. I learned team leadership at another job as an engineering tech. I also learned problem solving and engineering skills. The combined experience of

laboratories and course work in design, statics, machining principles, metal forming/ casting, industrial electronics, advanced welding processes, and quality has prepared my team and myself to successfully design, plan, manufacture, and test a successful electric bicycle prototype. The members of our team have over 15 years of combined industry experience.

Final Product

A working electric bike will be produced and presented to the Department Representative, Team Faculty Advisor, and team members in April 2019 for our project presentation. The e-bike will have a 1” bent tube frame with handle bars. The bike will have an electric motor, 48v-14 ah lithium battery, 8 speed drive system, modern look, seat, brakes, pedals, and wheels. Our goal is to make the bike achieve a 30-mile range between charges. Upon completion, we will gather range tests. We will present our project at the annual research symposium. I will be contacting the Communication Department with the possibility to make a video to encourage other young inventors to choose an engineering field and inspire their dreams.

Project Methods & Timeline

The following is an abbreviated timeline of the key milestones:

Date	Milestone
9/25/2018	Initial Plan: Budget, WBS, MS Project Schedule
10/1/2018	Planning: BOM, Design, Schedule, Prototype
1/10/2019	Execution: Manufacturing, Testing
2/2/2019	Control: Quality, Safety, Inspection
3/18/2019	Close out: Cost Estimating, Presentations.

Budget Explanation

The department of Engineering Technology welding equipment and machining lab equipment will be employed for the Fabrication and testing of prototypes. The costs associated with the project are detailed in the listed below. The students in our team will meet together two times per week to discuss the budget, design, and manufacturing of our project coursework. I will use \$600 of my personal money to use for the Project. I will be requesting \$1000 of Funding to complete the project.

Products	Part Number	Costs	Number	Total individual
Derailleur	Sram x-4	\$18.90	1	\$18.90
Brakes	Tektro HD-m290	\$35	2	\$70
Chain	Sram pc 870	\$11.20	1	\$11.20
Gears	Sram pg 850	\$15.80	1	\$15.80
Grips	Sram	\$4	1	\$4
Shifter	Sram x-4	\$12.50	1	\$12.50
Head Tube bearing	QBP.com bearing set	\$50	1	\$50
1" Metal tubing and 1/4" plate	Metal supermarket	\$130	1	\$130
Cables	Sram 4mm cable set	\$20	1	\$20
Hardware and bolts	Mcmastercarr	\$30	1	\$30
Motor	BBSHD Bafang kit	\$632.50	1	\$632.50
Battery	14ah Samsung	\$330	1	\$330
Wheels	20" Kenda Krusade	\$172.50	1	\$172.50
Seat	Custom at WSU	\$30	1	\$30
Pedals	Vee pedals	\$20	1	\$20
Kick stand	Amazon kickstand	\$20	1	\$20
Estimated Shipping		\$32.50	1	\$32.60
			Total Cost:	\$1,600

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Additional Questions

1. What funding have you received from OUR in the past? Where has your previous project been disseminated?

I have not received prior funding for any project at Weber State University.

2. Is this project part of a required course? If so, please indicate the support (monetary and in-kind) provided for this project by the academic department.

This project is my senior project 4610/4610L/4620 classes. The Department of Engineering Technology will fund the use of design Software, cutting, machining, and welding equipment for the project.

3. What additional sources of funding have been solicited? Is your department willing/able to fund any equipment they will be retaining?

The Department of Engineering Technology will be supplying equipment time in the machining and welding labs. I will be providing the additional funding needed from my personal money to complete the project.

4. Where do you plan to disseminate the results of this project?

After the completion of the project, our group will present the results to the professors of the Engineering Technology department as part of the class on November 30th, and April 12th. In addition, we will present our project at the OUR Symposium in March 2019.

5. If you are requesting a Research Scholarship, please list all significant time commitments (5+ hours per week) that you expect to maintain over the duration of your project including, for example, class and work schedules.

I will be maintaining a combined 15 hours of course work with 20 hours of employment. For the remainder of the project. My team and I will be working on the project 5 hours total each week for a combined 30 hours per week (six members). This project will account for 780 total hours of our team's dedication.

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Faculty Recommendation Form

Student Name (last, first): _____ Bott Randall

Project Title: _____ Electric Bicycle Prototype _____

Mentor Directions: After carefully reviewing the proposal and assessing both the viability of this project and the qualifications of the student requesting funding, answer the questions found below. Please expand the sections as necessary (**do not attach separate letter**). If the project involves the use of human subjects or protected animals, be sure the student secures IRB or ACUC approval. If the project receives funding, it is your responsibility to work closely with the student, monitor the ongoing progress of the project and budget, and evaluate the project's results. Failure to do so will jeopardize funding for this project and any future projects.

1. How long and in what capacity have you known this student?

1 Month as the advisor to his senior project.

2. Briefly describe the proposed project. Is this part of a larger research project? Is this part of a course? If so, how is the project apart from the nature and scope of activities normally taken for the course (Please attach a copy of your course syllabus)?

This Project is for a course and follows the description of the course exactly.

3. Give an assessment of the project's significance to the student's discipline and of the project's educational and/or professional benefit to the student.

This project will help the team of students that are participating learn the process of product development, planning, team work, quality practices, budgeting and manufacturing a product. This project simulates what the student will experience in industry as engineers.

4. Comment on the qualifications of the student to successfully complete this project, both in terms of the project's scope and its time frame.

This is a 2-semester course for seniors to put into practice what they have learned over the duration of their college experience. The scope of the project is very reasonable to complete in the timeline they have been given. I have very high confidence that the team members have or will have all the skills necessary to not only complete but exceed my expectations.

5. Comment on the justification and appropriateness of the project budget, including the necessity of a Research Scholarship (if requesting one).

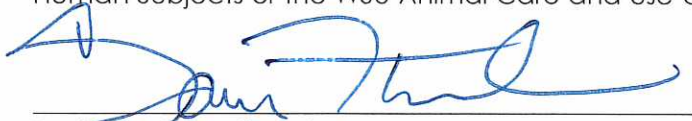
The funds will cover a considerable amount of the cost of this project. The students will have to contribute on their own to finish and have committed to that contribution.

6. Describe your role in the project.

I am the assigned advisor and meet with the students on a weekly basis to verify they are keeping on track and everybody is participating.

7. Include anything else that you think will be helpful to the committee in evaluating this application.

This project ____ DOES __X__ DOES NOT require review by the WSU Institutional Review Board for Human Subjects or the WSU Animal Care and Use Committee.



Project Mentor Signature

9.12.18

Date

1802

Campus Mail Code

8570

Phone Extension

References

- Arsenio, E., Dias, J. V., Sofia, A. L., & Helena Iglésias Pereira. (2018). Assessing the market potential of electric bicycles and ICT for low carbon school travel: A case study in the smart city of ÁGUEDA. *European Transport Research Review*, 10(1), 1-9.
doi:<http://dx.doi.org.hal.weber.edu:2200/10.1007/s12544-017-0279-z>
- Yi-Chang, W., & Bo-Wei, L. (2014). Design of a six-speed transmission hub with an integrated brushless permanent-magnet motor used for electric bicycles. *Engineering Computations*, 31(2), 160-176.
doi:<http://dx.doi.org.hal.weber.edu:2200/10.1108/EC-01-2013-0017>
- Zhou, H.B., Long, B. & Cao, B.G. *Int.J Automot. Technol.* (2013) 14: 283.
<https://doi.org/10.1007/s12239-013-0032-0>