Electric Vehicle Energy Management System: The VanCity E-bike Project

Status: Filled

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Sponsor(s):

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Project Description

This project aims to design, prototype and demonstrate the efficacy of an energy management system for a lightweight electric vehicle such as an electric bicycle or scooter. This project will work to develop a high performance e-vehicle with seamless integration of electrical, mechanical and computer elements. Prototyping will involve fabrication of an ergonomic, aesthetically pleasing and powerful vehicle designed for sustainable urban transportation.

This includes but is not limited to the development of the following:

- •BLDC motor drive system with dedicated microcontroller
- •Dynamic Regenerative Breaking; DC-DC boost converter
- •Novel battery management system (BMS)
- •System Integration and user interface design
- •Prototype design and fabrication

Eight-Month Project Goals Timeline:

January: •Drive circuit schematic design/feasibility study •Regenerative breaking schematic/f.1(c)-dn( )]TJnener55m g1 Tf10.6 0 TD0 Tc0 Tw( )Tj Project Goaont Time-dn( )study •Re Ben B5r8

of drive circuit with a parasitic analysis (oscilloscope captures with variable voltage, current and loads) •Plecs simulation

March: •Development and research into regenerative breaking using the back EMF of the BLDC motor and a bank of capacitors •Develop code for microcontroller to calculate DC-DC power conversion for regenerative breaking (variable input and variable output voltages, additionally capability of monitoring and adjusting regenerative-current) • Parametric study of novel BMS system to ensure no exploded Li-po/Li-ion batteries (determine failure conditions) •Plecs simulation

April: •LED driver circuit/thermal management/microcontroller integration •Ergonomic design of physical controllers on vehicle (acceleration, breaking, regenerative Breaking, gear-shifting (if geared bicycle), lights –turn-signal, breaking, headlight) •Final aesthetic design/integration of bicycle frame and modular components. •Solid works model •Determine mounting configuration for electronics.

May: • System failure/safety design review (incorporate fuses, inrush current limiters, digital and hardware fail safes for conditions such as watchdog failure/microcontroller lock up) determine any conditions for failure and design accordingly

June: •DIY PCB design for modular components (capacitor, FETS, Gate drivers, hall sensors, diodes microcontroller connectors, BMS circuit, temperature sensors, voltage sensors, current sensors) • Build circuits and weatherize • Mount components on Prototype and test.

July: •Develop and prototype bicycle seat design that houses 10 x (11.1V -1000mAh) = 110V – 1000mAh with BMS incorporated in design.

August: •Final aesthetic considerations/weatherizing •Final parametric testing and specifications for performance •Electronic/computer code speed limitations (for legal use in different municipalities at the flick of a switch) •Marketing/venture capital • Development of Android/apple bases app to interact with the vehicle. • Considerations/design of auxiliary battery packs for trips longer then 5km (integrated with backpack or shoulder bag to take into the office and charge while you work)