Electric Excursion

Nick DePaolis and Keith Garcia Advisor: Dr. Allen Katz

Department of Electrical Engineering, The College of New Jersey, Ewing, NJ

Abstract

Personal transport vehicles have emerged throughout college campuses and urban areas over the past couple of years. These “Micro Vehicles” are used for both recreation and commuting while providing a clean and simple propulsion (or ride) from destination to destination. Our team chose to create an electric excursion board because of storage and weight advantages as well as the ability to modify the individual components to allow for increased customization to the wide variety of user requirements.

Introduction

Our team recognizes the increased use of scooters, bicycles and skateboards and aims to increase the usability and consistency by implementing an electric assistive component. (Skateboard type)

The goals of this project are to:

- Test prototype Electric Excursion board
- Test and refine the speed control and acceleration curves
- Incorporate and test safety features
- Perform load and surface analysis on the overall system as it would be used in a real-world scenario
- Verify system integrity after each addition

Background

Part 1: Project Definitions

General System Parameters:

-Top Speed: 12 Mph
-Hill Gradient: ~10%
-Effective Range: 10 Miles
-Recharge Time: <5 Hours
-Battery Size: 170 Wh
- Max Load: 160 lbs
-Safety Features: > 1 (not PPE)

Figure 1: System Requirements

PARAMETER	REQUIREMENT	ACTUAL PERFORMANCE	VERIFICATION	COMPLETE
Top Speed	12 Mph	TBD	Test	0%
Battery Size	170 Watt-Hour	185 Watt-Hour	Inspection	100%
Effective Range	10 miles	TBD	Test	20%
Recharge Time	< ~5 Hours	~3 Hours	Test	100%
Ability to Climb (Hill Gradient)	10%	TBD	Test	0%
Max Load	160 Pounds	TBD	Analysis	0%
Safety Features	At least one (Excluding PPE)	TBD	Inspection/Test	45%

Figure 2: Project Budget Progression

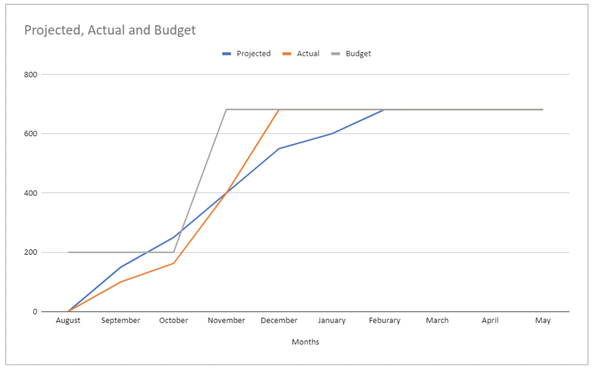
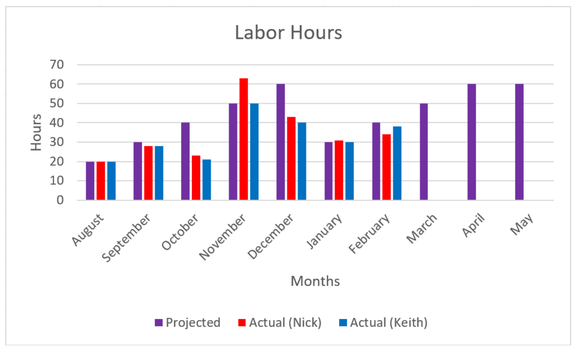


Figure 3: Team Labor Hours



Part 2:Setting VESC Parameters

The VESC software needed to be properly configured to yield the best results and as to not damage the system. The process can be seen below.

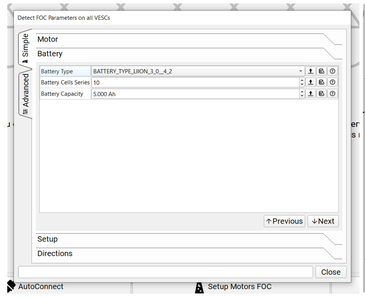


Figure 6: VESC Battery configuration

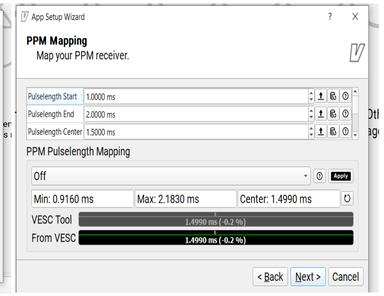


Figure 7: VESC Remote Control Tuning Part 1

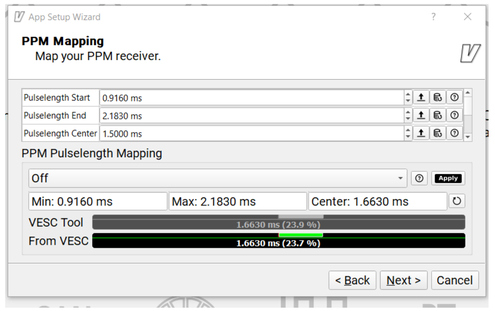


Figure 8: VESC Remote Control Tuning Part 2

Part 3: Data Gathering

The team through the controlled testing environment gathered various data and experience that provided an insight into the functionality of the system.

The team can utilize the Realtime data plot to record accurate data from the system

Figure 11: Standing on the EE Board

Figure 12: Constructing the Test Fixture

Parameter	Inrunner	Outrunner
Package Diameter	Smaller	Larger
Package Length	Larger	Smaller
RPM per Volt appl.	Higher	Lower
Torque	Lower rel.Torque	Higher rel.Torque
Efficiency	Better	Good
Heat Dissipation	Better	Good

Figure 13: Inrunner v. Outrunner

Conclusion

The students are currently testing and refining the system outlined above. The students are on track to have the system finished by the department deadline in the first week of May 2021.

DEMO

References

VESC Documentation HUB
https://vesc-project.com/documentation
Motor Inrunner vs. Outrunner
https://www.radiocontrolinfo.com/brushless-inrunner-vs-outrunner-motor/