Electric Motorcycle Battery Drain

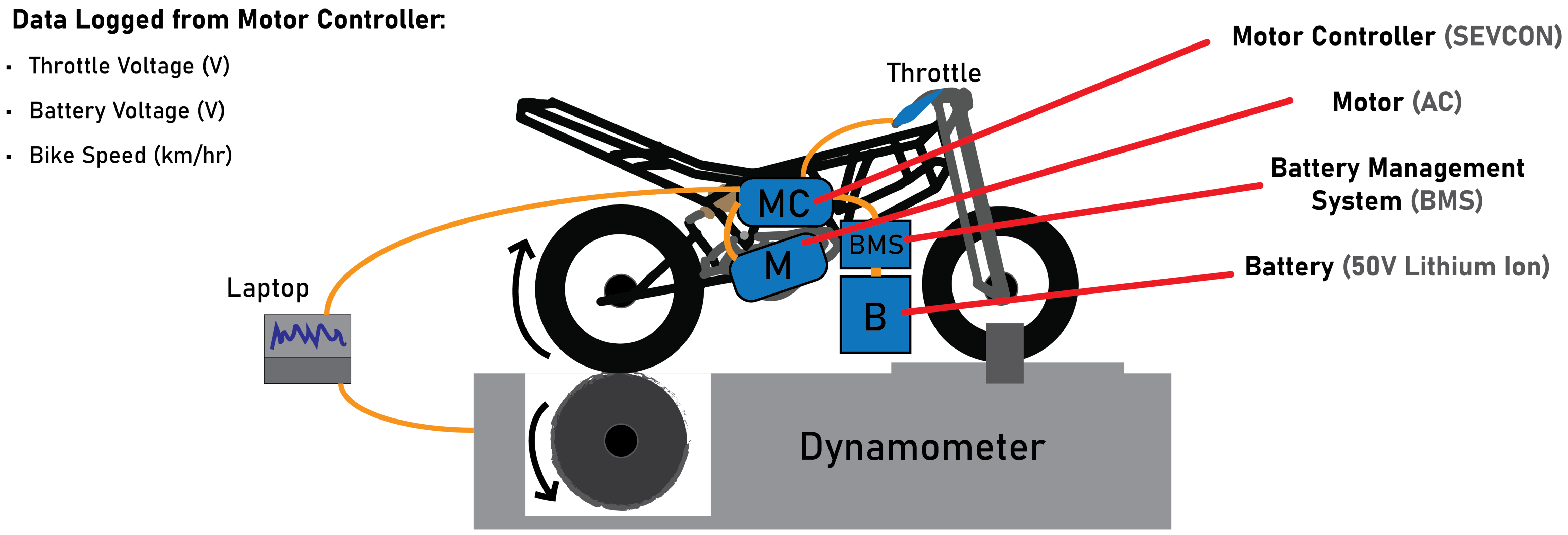
Miguel Talamantez

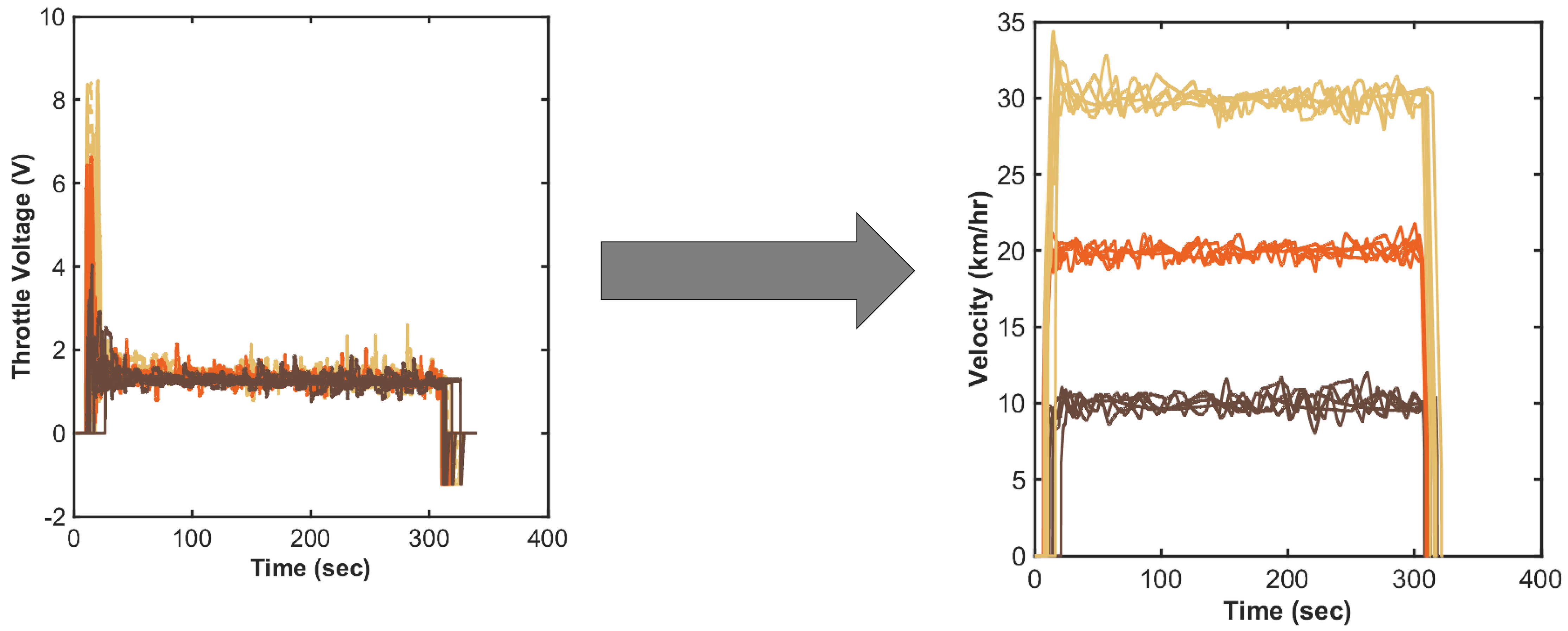
2.671 Measurement and Instrumentation

Abstract

From 2011 to 2021, the number of EVs on the road has gone from about 22,000 to over 2 million. [1] As this number increases, understanding how to make EVs more efficient becomes more important to users and manufacturers. Vehicles usually have certain parameters and boundaries in which they work most efficient in, and this experiment is meant to analyze those parameters using a dynamometer to drive an electric motorcycle under varying drive cycles. After running the bike under 3 different drive cycles of a set constant speed, the conclusion can be made that the battery of the bike drains the least in high speeds (excluding initial acceleration and air drag).

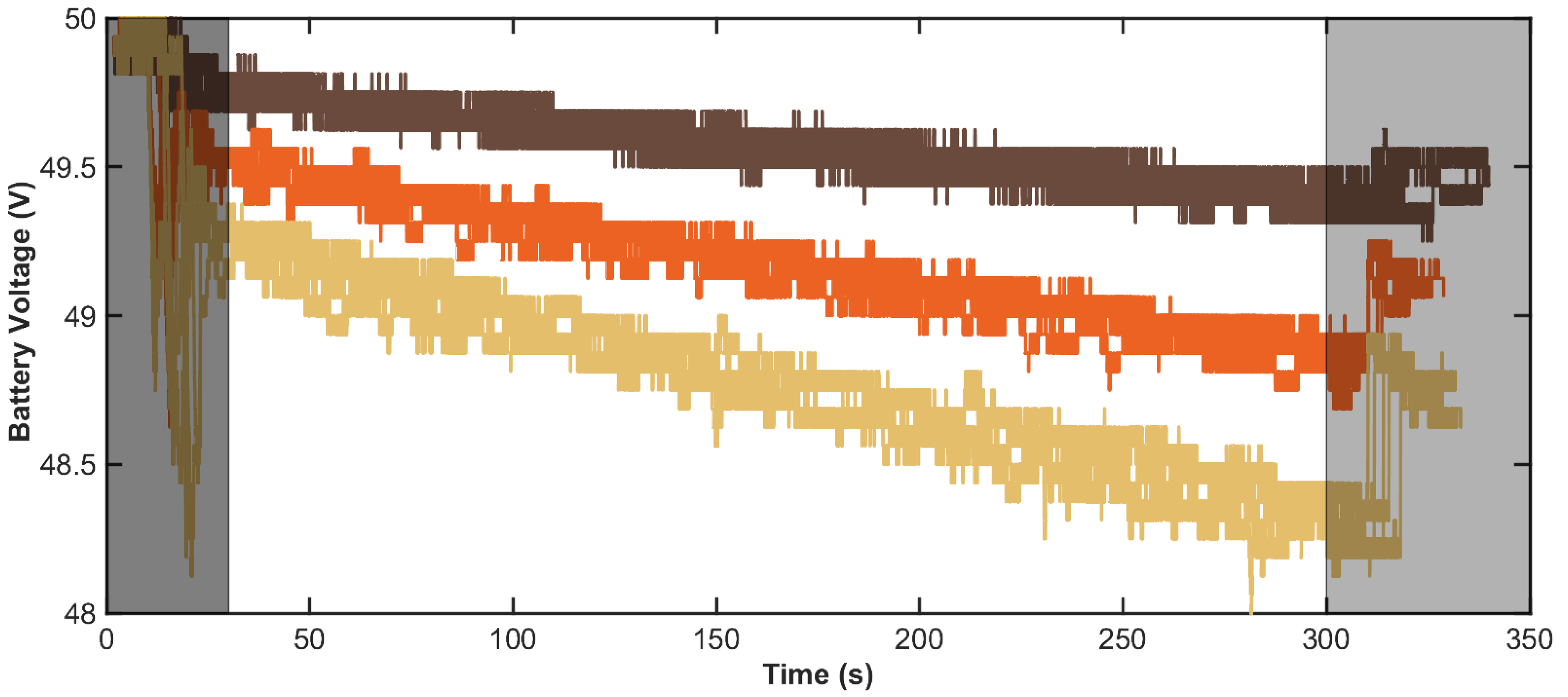
Experimental Design



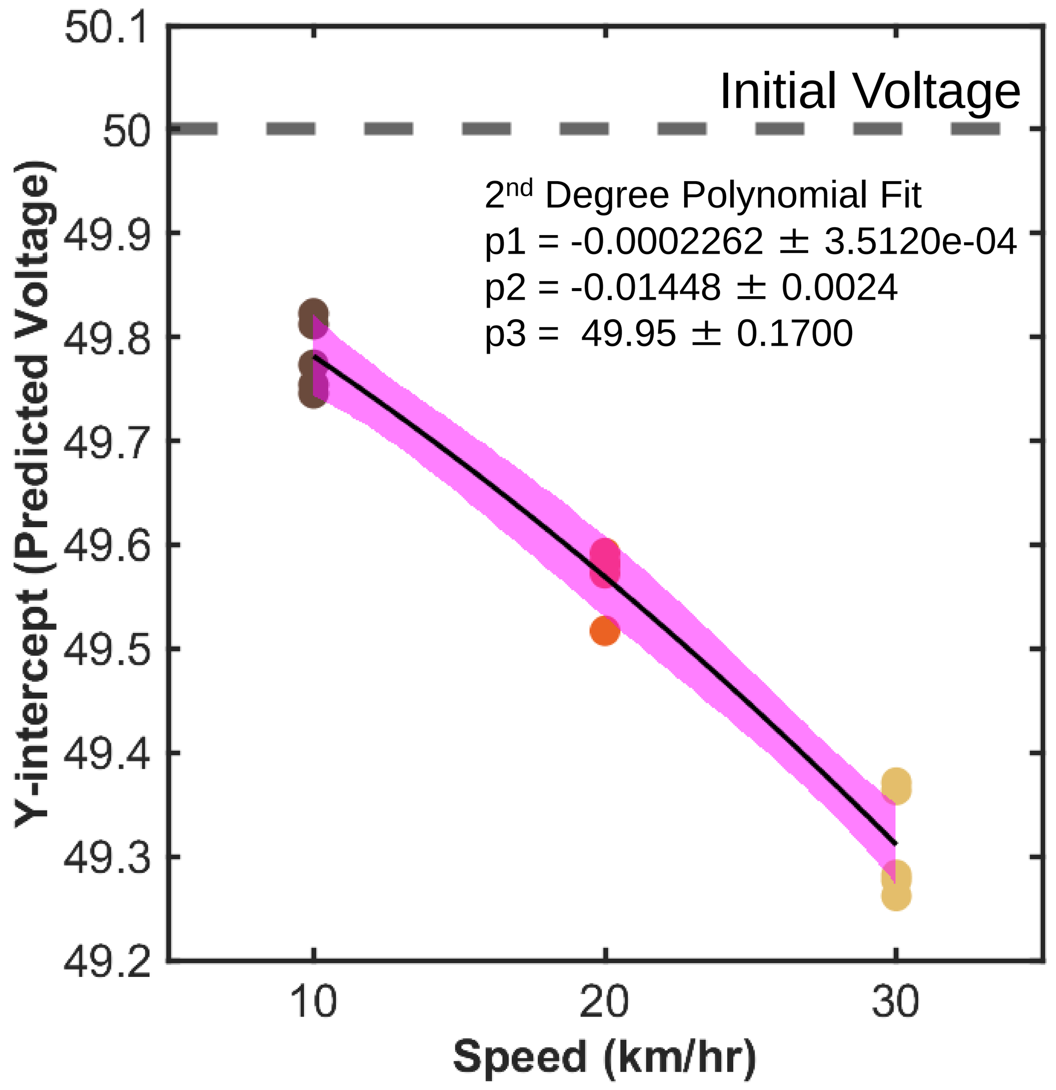


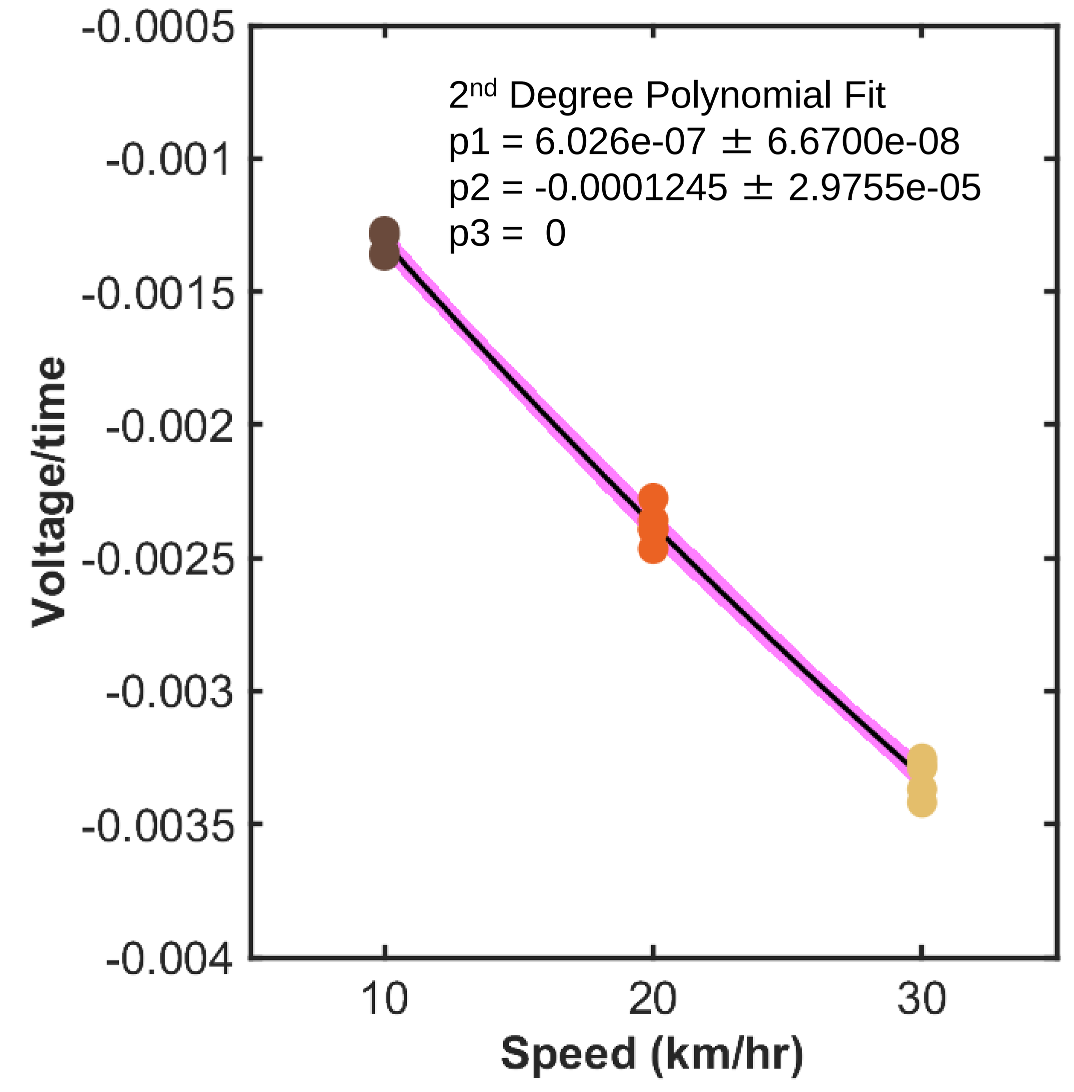
Throttle voltage (0-12V) dictates the velocity of the bike by controlling the torque demand on the SEVCON motor controller.

Battery Drain Data Analysis



The shaded regions of the battery voltage graph indicate that they are not used in the analysis because the initial drop is due to the acceleration period and the ending spike is due to regenerative braking.





Conclusions

- The Y-intercept from voltage over time curve fits show a nonlinear relationship observing that the 2nd degree polynomial fit is 8.8% better fit than a linear curve.
- The voltage drop slope (voltage/speed) also shows a small nonlinear relationship observing that the 2nd degree polynomial fit is a 26.5% better fit than a linear curve.
- Based on these observations, we can conclude that there are nonlinear relationship in voltage drain of the battery as speed is increased
- This tells us that as you increase speed on the bike, the voltage drain decreases making it better to go faster. What this conclusion doesn't include is the fact that the acceleration period of the bike causes a large initial voltage drop, and more importantly, that this experiment does not account for air resistance, which increases as speed increases which is why on a road, this conclusion may not be applicable.

Acknowledgements

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References

[1] "International Energy Agency (IEA): Global EV Data Explorer." n.d. IEA. Accessed September 27, 2023. https://www.iea.org/data-and-statistics/data-tools/global-ev-data-explorer.

[2] "Diesel Net" Accessed October 30, 2023. https://dieselnet.com/standards/cycles/nycc.php

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