UNIVERSITY OF VICTORIA ECE 499 SMART MARINE SOFTWARE PROJECT POSTER

We've been tasked with developing a python-based software to perform an energy analysis of a vessel (with a set of inputs and propulsion architecture), and visualize the results graphically.

Authors: Wenli Huang, Jose Guerrero, Emmanuel Ayodele, Obaid Raheem & Zee Gad

INTRODUCTION

The transition to hybrid-electric or full-electric propulsion is happening in the maritime industry, and the need for proper design and energy evaluation of the vessel for this transition is more than ever. That is why we are planning to make an open-sourced software and platform to provide the service free of charge for everyone.

OBJECTIVE

- Develop a Python software
- Calculate the energy analysis of the vessel
- Recommend a proper propulsion architecture
- Visualize the result graphically

METHODOLOGY— MATH

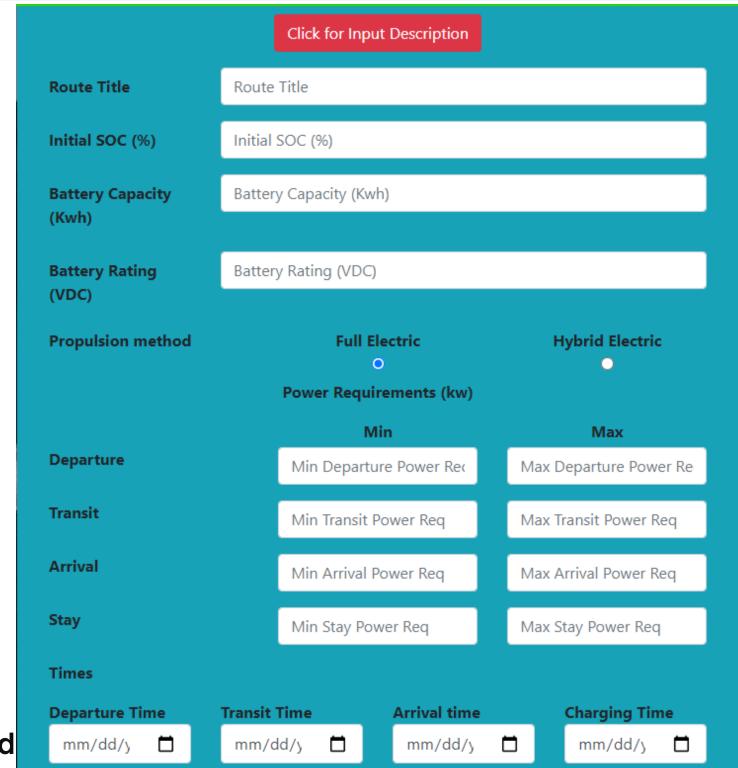Using the State of Charge (SOC) formula:

$$SOC(t) = SOC(t-1) + \frac{I_c(t)}{Q_n}\Delta t$$

- $SOC(t)$ = State of Charge(%)
- $I_c(t)$ = Discharge Current (A)
- Q_n = Charge capacity (Amp - hours)
- t = Time interval (Hours)

METHODOLOGY— SOFTWARE

- Responsive web application built with django, html, css, and javascript
- Hosted on the cloud for on demand requirements
- Security includes ssl redirecting, cross site forgery protection, and input validation
- Model-View-Controller architecture
- System testing, unit testing, and end to end testing employed

User Inputs Vessel Route Data

Click for Input Description

Route Title	Route Title
Initial SOC (%)	Initial SOC (%)
Battery Capacity (Kwh)	Battery Capacity (Kwh)
Battery Rating (VDC)	Battery Rating (VDC)

Propulsion method: ○ Full Electric ● Hybrid Electric

Power Requirements (kw)

	Min	Max
Departure	Min Departure Power Re	Max Departure Power Re
Transit	Min Transit Power Req	Max Transit Power Req
Arrival	Min Arrival Power Req	Max Arrival Power Req
Stay	Min Stay Power Req	Max Stay Power Req

Times

Departure Time	Transit Time	Arrival time	Charging Time
mm/dd/	mm/dd/	mm/dd/	mm/dd/

Software produces a Vessel Route Output for Coloumb counting method

View Available Routes | Route Name: | Submit

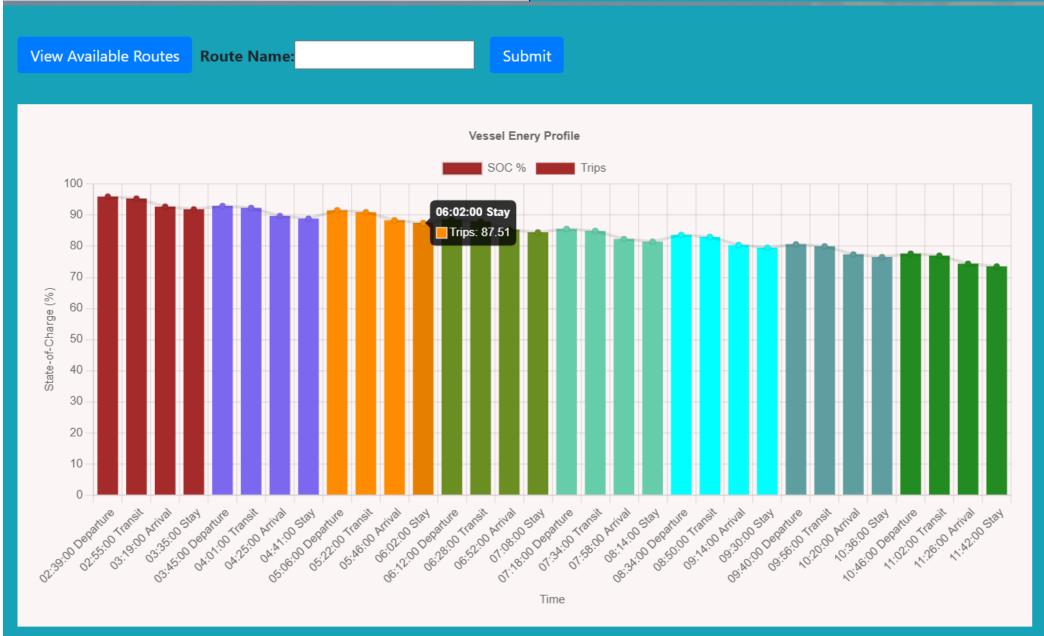Vessel Enery Profile

06:02:00 Stay
Trips: 87.51

RESULTS

For the Vessel route the user inputs the:
- Initial SOC (%)
- Battery capacity (kwh)
- The route name
- Battery rating (VDC)
- Threshold Power (Kw)
- Departure, Transit, Arrival and Stay Time
- Minimum and maximum power requirement for the Departure, Transit, Arrival and Stay Time

The software then produces :
- A graph highlighting the SOC% for the route with any indication of the SOC falling below the acceptable value of 30%.

CONCLUSION

At the end of the Project we deployed a web application that:
- Calculates the energy analysis of a given vessel
- Visualizes the results graphically with warnings if conditions are not met for the route

REFERENCES

[1] BC Ferries, "BC Ferries' Island Class," 18 06 2021. [Online]. Available: https://www.bcferries.com/in-the-community/projects/introducing-island-class-ferries.
[2] W.-Y. Chang, "The State of Charge Estimating Methods for Battery: A Review," International Scholarly Research Notices, vol. 2013, no. 953792, p. 7, 2013.
[3] A. A. Hussein and I. Batarseh, "An Overview of Generic Battery Models," in 2011 IEEE Power and Energy Society General Meeting, Detroit, Michigan, USA, 2011.