TartanHacks | Freight Force

By: Ryan Lin, Doreen Valmyr, Heathvonn Styles, Sri Manikantan

Feb 2024

Table of contents

01

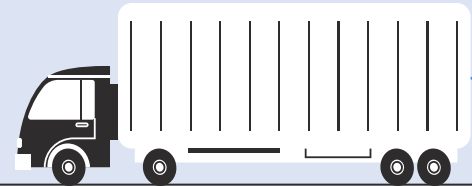# Problem Statement

Problem Statement: Optimizing Freight Shipping Amidst External Disruptions

**What are the External Disruptions?**

- Weather conditions, Road construction, Traffic conditions and other unforeseen events

What is the impact on Freight Shipping?

- These challenges lead to delays, increased costs, and disruptions in the supply chain.

Why is it important to solve this problem?

- Freight shipping is a critical component of the global supply chain, ensuring the timely and efficient movement of goods.
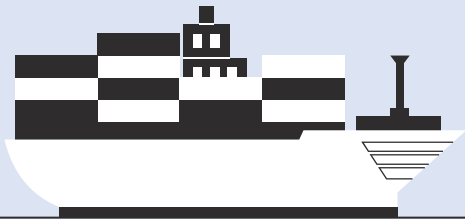
02

Project Aim

The Challenge

Design a **comprehensive solution that leverages technology to mitigate risks** associated with weather-related disruptions, road construction, and other external factors affecting freight shipping. The goal is to **enhance the efficiency, reliability, and safety of freight logistics** in the face of unpredictable challenges.

Project Goal

To develop a user-friendly application that seamlessly integrates **user inputs for route preferences** and **real-time data on traffic and weather conditions**, aiming to optimize shipping routes.

Our goal is t**o converge technology and logistics to enhance the efficiency and user experience** in the realm of shipping and transportation.

03

Key
Features

1 Route Planning optimized for TRUCKS

While other geolocation routing services mainly focus on basic point-to-point navigation, **our app sets itself apart by specializing in the optimization of travel routes tailored exclusively for truck**s, commonly used in freight shipping.

We **meticulously considered truck-specific parameters**, steering away from prohibited roads and favoring designated truck routes, such as those outlined by the National Surface Transportation Assistance Act in the United States or designated by state or provincial authorities.

Moreover, recognizing the variance in drive times between different vehicle types, **our app is finely tuned to calculate the optimal route by minimizing Truck Travel Time**. This consideration accounts for the physical limitations of truck speed, ensuring efficient, cost-effective, and compliant routes tailored to the unique needs of the logistics industry.

2 Integrating different APIs to display real-time conditions

We've seamlessly **integrated a diverse range of data sources to deliver a comprehensive and precise overview of current and upcoming obstacles** in shipping routes. Our focus lies on **real-time monitoring**, with particular emphasis on traffic and weather data, both refreshed every 5 minutes for accuracy.

Both our traffic and weather APIs **possess predictive capabilities, leveraging historical data for forecasting potential disruptions.** This enables proactive decision-making and route optimization, steering clear of high-risk areas.

Traffic Data:
Our dynamic traffic map service excels in measuring traffic speeds and incidents. Streets are color-coded for intuitive interpretation:
- Green (fast): 85 - 100% of free flow speeds
- Yellow (moderate): 65 - 85%
- Orange (slow): 45 - 65%
- Red (stop and go): 0 - 45%

Weather Data:
Drawing from the National Weather Service, we provide official warnings, watches, and advisories for the United States. Here's a quick breakdown:
- Warnings indicate a threat to life or property
- Watches suggest possible hazardous weather, with uncertain location or timing
- Advisories address less severe conditions

We aim to optimize routes by strategically avoiding these obstacles

Road Access

This looks into road closures, constructions sites that result in restricted road access

Road Traffic

This looks into the severity of road congestion affecting traffic flow

Harsh Conditions

This includes hurricanes, cyclones and tornadoes etc.

Weather Data

This looks into weather conditions that are not suitable for travel (e.g. high snowfall or precipitation)

③ Polygon Mapping

A polygon barrier **restricts passage through specified areas during network analysis**, allowing users to model and analyze spatial constraints.

Utilizing Polygon Mapping, we **conducted simulations to identify potential obstacles**, enabling our route optimization system to dynamically avoid adverse events.

This allows fo**r dynamic routing that is capable of real-time adaptation to changing conditions.** Moreover, it also bolster the **safety of our drivers by** delaying deliveries or recommending alternative routes.
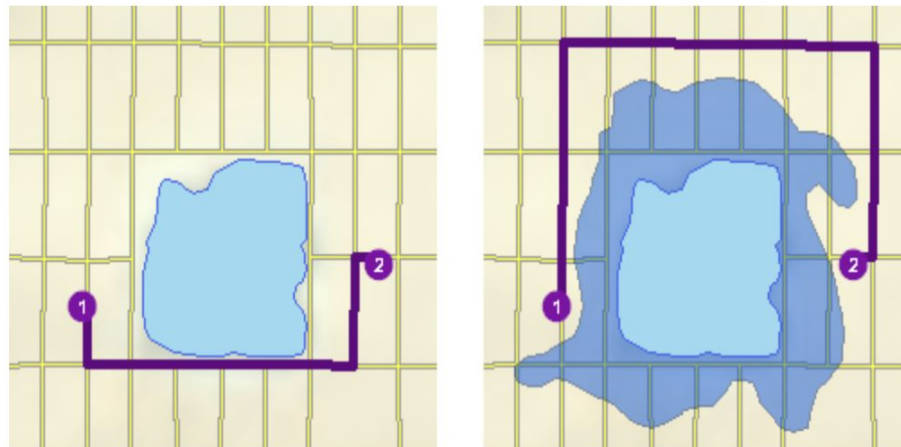
The first map depicts the shortest path between two stops. The second map shows a polygon barrier blocking flooded streets, so the shortest path between the same two stops is different.
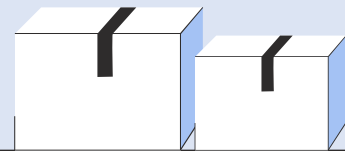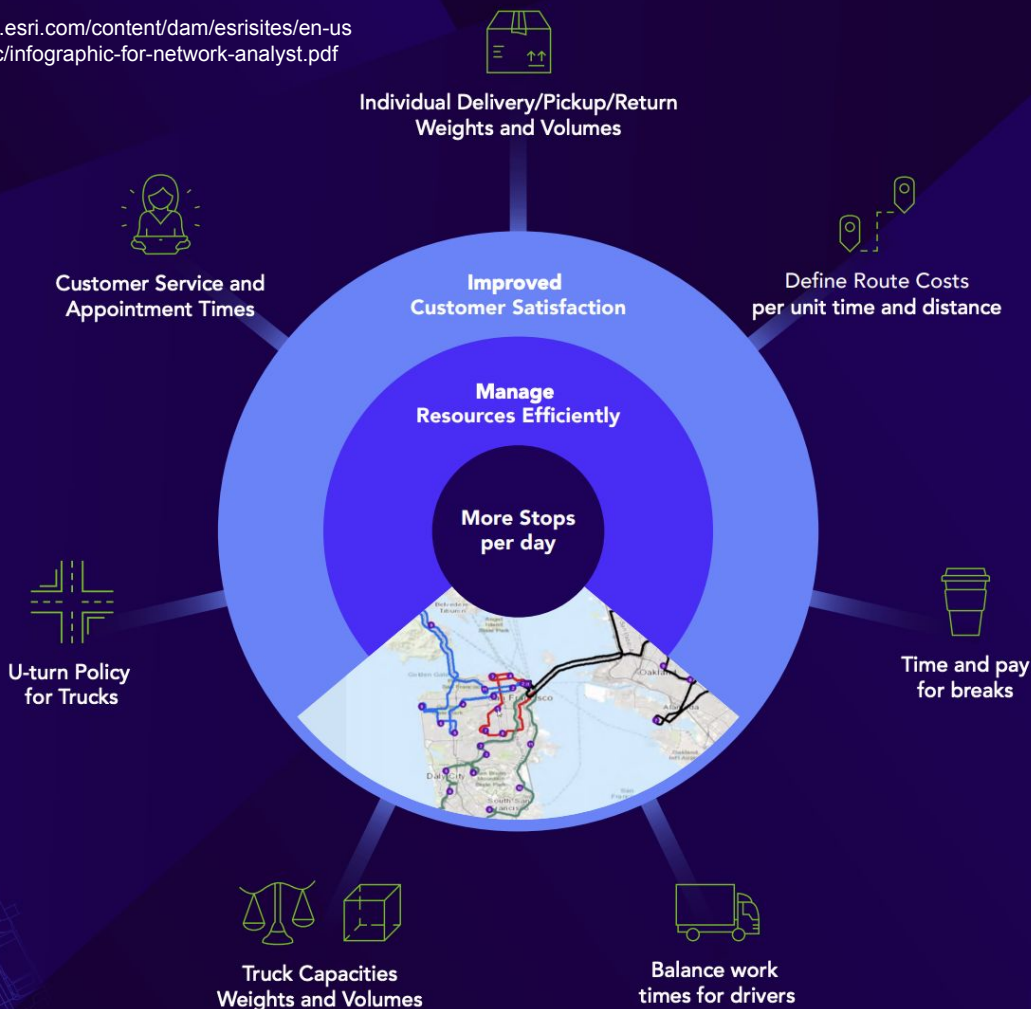
Simulation of Route Optimization and Polygon mapping

https://www.esri.com/content/dam/esrisites/en-us/media/misc/infographic-for-network-analyst.pdf

Individual Delivery/Pickup/Return Weights and Volumes

Customer Service and Appointment Times

Define Route Costs per unit time and distance

Improved Customer Satisfaction

Manage Resources Efficiently

More Stops per day

U-turn Policy for Trucks

Time and pay for breaks

Truck Capacities Weights and Volumes

Balance work times for drivers

We are excited to **explore using more ArcGIS features**, which has so much potential to revolutionise freight shipping.
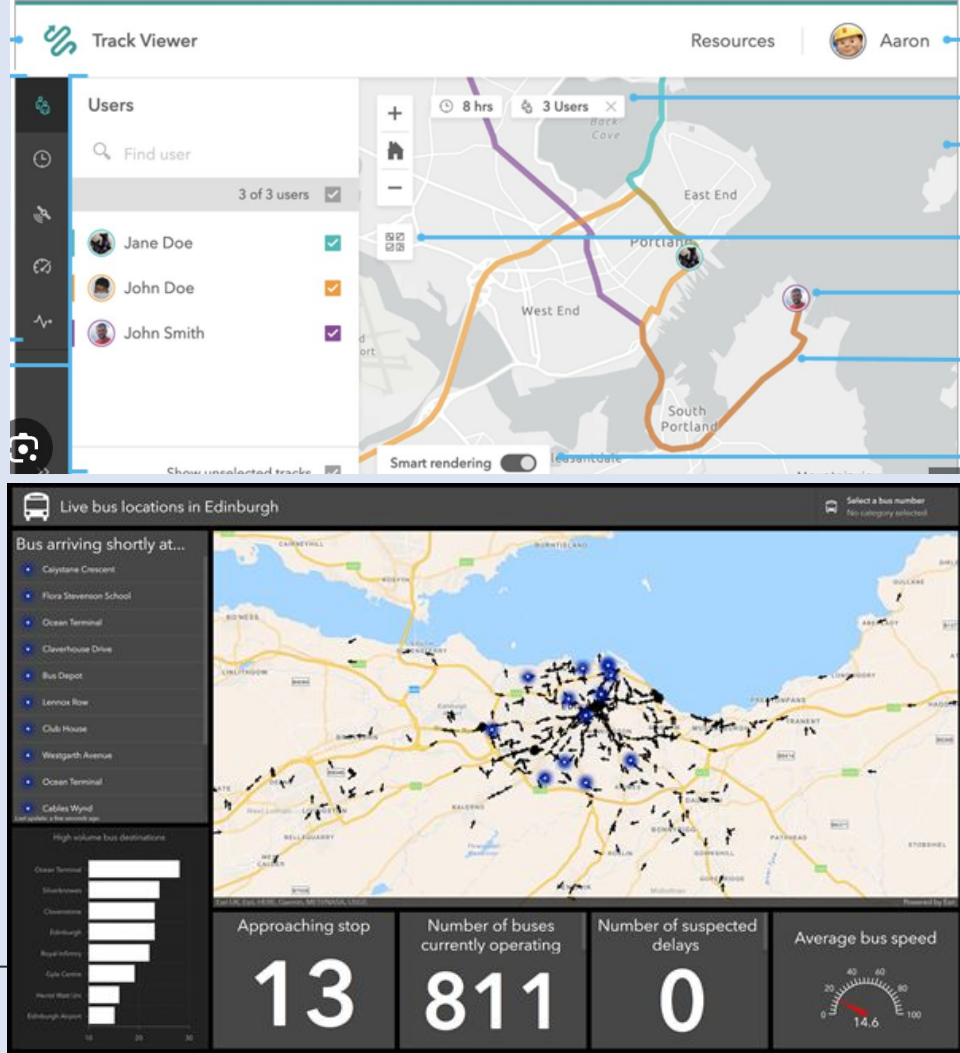
Currently, a lot of the functions **require paid subscription which limits us on what can be done**.

With better access, we envision **expanding our application to incorporate advanced features**, including those showcased in the image, and implementing a **comprehensive real-time tracking dashboard** for a more robust and efficient freight shipping experience.

One important feature we wanted to include would be **notification pop-ups or a virtual assistant chat for various stakeholders to share real-time updates.** For instance, integrating notification widgets can offer users immediate alerts on rerouting information.

Additionally, we could also implement **real-time tracking of vehicles or shipments, similar to ride-sharing platforms like Uber and Lyft.**

Due to constraints in time and access, we were unable to incorporate these features in the current iteration. However, these functionalities are something we **look forward to implementing in future development to elevate user experiences.**

THANK YOU :)