The Traveling Student Problem

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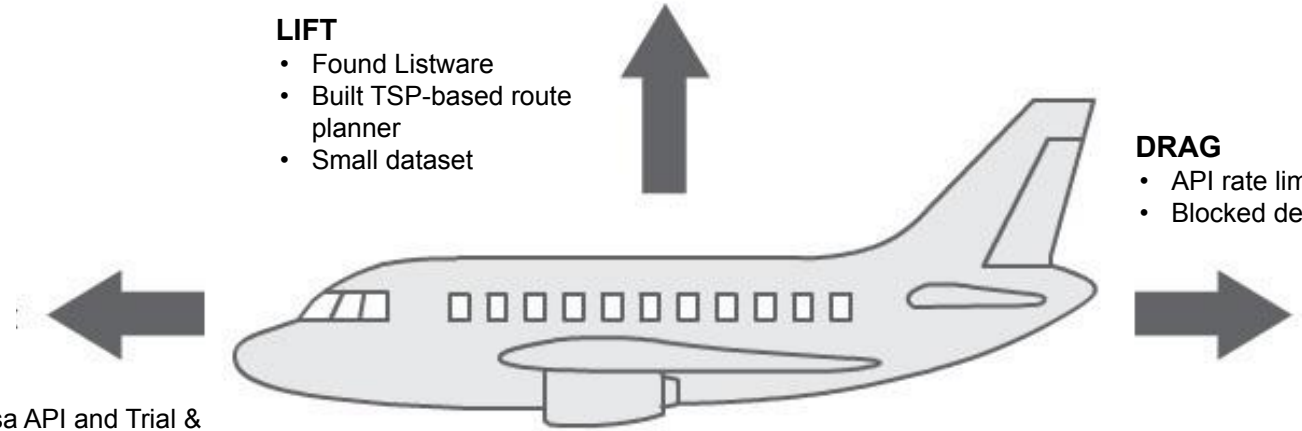
Motivation

- 💡 Community impact
- 📊 Empower businesses with accurate and high-quality data
- 🌐 Data Driven Optimization

How principles of flight apply to our project



LIFT
- Found Listware
- Built TSP-based route planner
- Small dataset

DRAG
- API rate limits
- Blocked devices

THRUST
- Melissa API and Trial & Error.
- Full-stack development
- Dynamic and Interative map visualization

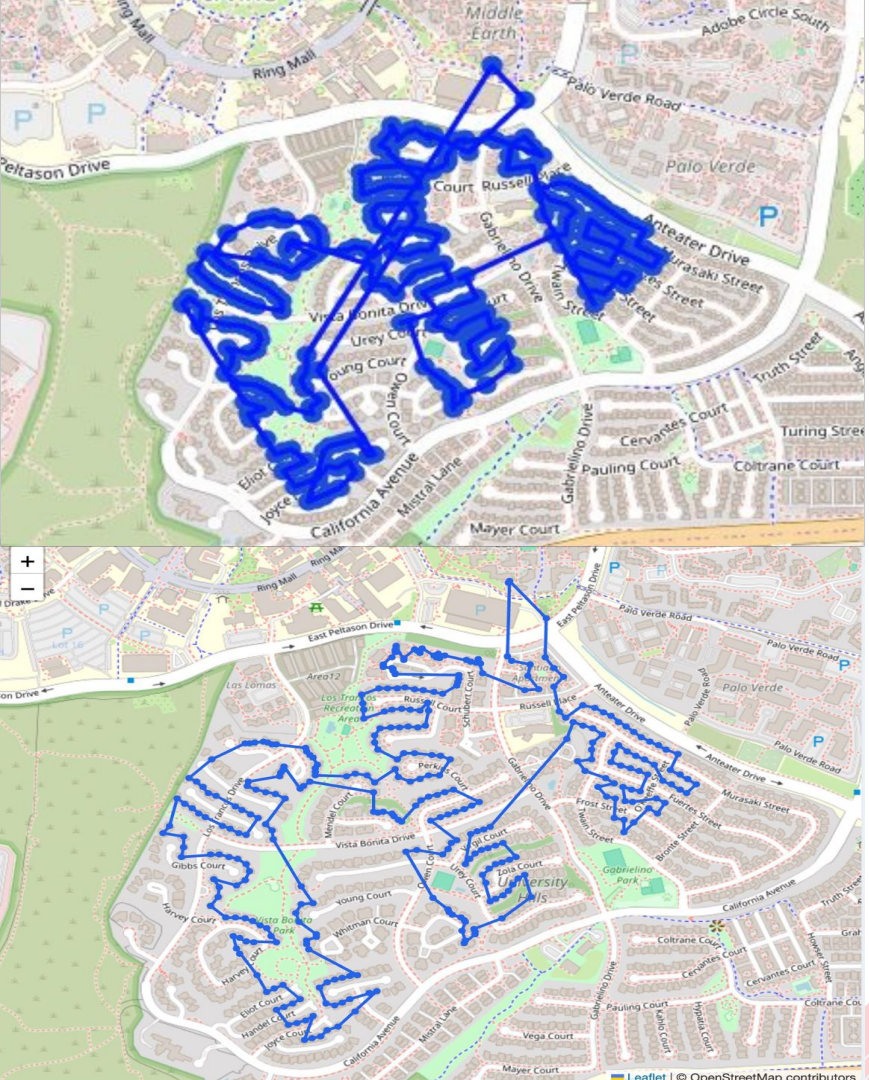
WEIGHT
- Balancing accuracy with functionality
- Route maps, summaries, and Google Street View integration.

Project Flow

API Output & Data Exploration

- Melissa's Global Database API
- Listware Online

RecordID	Address	City	State	Zip	MAK	Residential/Business status	latitude	longitude
1	515 E Peltason Dr	Irvine	CA	92617	1734132018	Residential	33.642963	-117.836463
2	4 Alcott Ct	Irvine	CA	92617	9933525478	Residential	33.640275	-117.841219
3	16 Joyce Ct	Irvine	CA	92617	5077460919	Residential	33.634868	-117.841251
4	11 Murasaki St	Irvine	CA	92617	9987920127	Residential	33.640608	-117.835352
5	10 Whistler Ct	Irvine	CA	92617	5154333585	Residential	33.635299	-117.840373
6	25 Harvey Ct	Irvine	CA	92617	9913158161	Residential	33.636319	-117.842609
7	18 Murasaki St	Irvine	CA	92617	9973045108	Residential	33.64048	-117.834396
8	20 Newton Ct	Irvine	CA	92617	5135870759	Residential	33.638972	-117.839477
9	26 McClintock Ct	Irvine	CA	92617	5048873218	Residential	33.634736	-117.840604
10	4 Gibbs Ct	Irvine	CA	92617	5065689242	Residential	33.638348	-117.84366
11	26 Whistler Ct	Irvine	CA	92617	5118532476	Residential	33.635755	-117.840366
12	20 Whitman Ct	Irvine	CA	92617	5222745396	Residential	33.636301	-117.841181
13	16 Whitman Ct	Irvine	CA	92617	2432488590	Residential	33.636547	-117.841026
14	22 Young	Irvine	CA	92617	2391963192	Residential	33.637222	-117.841091



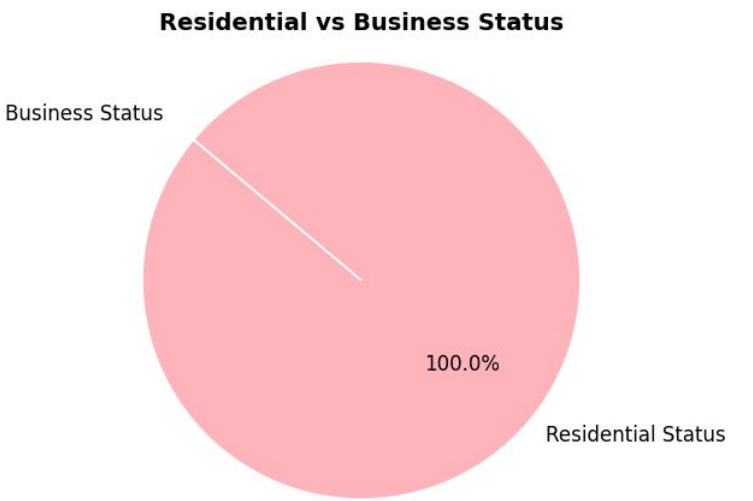
Route Optimization with TSP & Haversine

- **Distance Calculation:** Used the Haversine formula, which accounts for Earth's curvature, to calculate precise real-world distances between stop pairs using latitude and longitude.
- **Initial Approach:** Tested different algorithms for simplicity which resulted in inaccurate paths.
- **Optimal Approach:** Switched to symmetric Held-Karp TSP for the most accurate results and evaluated all possible routes to find the shortest.
- **Route Optimization:** Plotted 353 points on the map and optimized route for minimal total distance.
- **Outcome:** Accurate and efficient route planning along with reduced overall travel time and distance.

Insights

Route Overview and Statistics

- 🏡 **All Addresses:** Residential
- 📐 **Route Pattern:** Resembles the letter “m” (mirrored) for efficient traversal
- **Shortest Path Across 355 Stops near UC Irvine**
- 📏 **Total Distance:** 5.82 miles



DEMO

Technical Stack

Importance

- **Time-Saving Efficiency:** Optimized routes reduce total travel time and distance, simplifying multi-stop navigation.
- **Useful for Newcomers:** Ideal for students or newcomers unfamiliar with the area, making errands more structured and efficient.
- **User-Friendly Interface:** Simple UI with clickable routes, stop details, and integrated Google Street View ensures easy use for all.
- **Scalable Potential:** Can be integrated with platforms like Google Maps for real-time daily route planning.

THANK YOU!

🎤 Now open for questions!