



Rudi's Bakery Route Optimization

Presented by

Amandeep Bhardwaj

Anubhav Dubey

Sai Arvind Atluri

Sandeep Reddy Modugu

Problem Statement

Operation: Open 5 days a week (Closed on Wednesday and Sunday).

Staff: 2 drivers | **Working Hours:** 9hours per day | **Loading Time:** 15mins per store

Requirements:

To optimize the delivery routes in Colorado Springs.

Time Constraint:

Drivers must complete all deliveries and return to the depot by the end of their shift.

Delivery Constraints:

Costco: Deliveries required daily.

Other Stores: A minimum of 3 deliveries per week is required. Deliveries should not occur on 3 consecutive days.

Other Constraints:

There must be no overlap of store assignments between drivers. Stores cannot be interchanged once assigned.





Data Overview for Route Optimization

Data Collection & Cleaning:

- Gather comprehensive delivery route data, including historical records and store addresses.
- Meticulously clean data to remove duplicates and correct inaccuracies.

Data Validation & Geocoding:

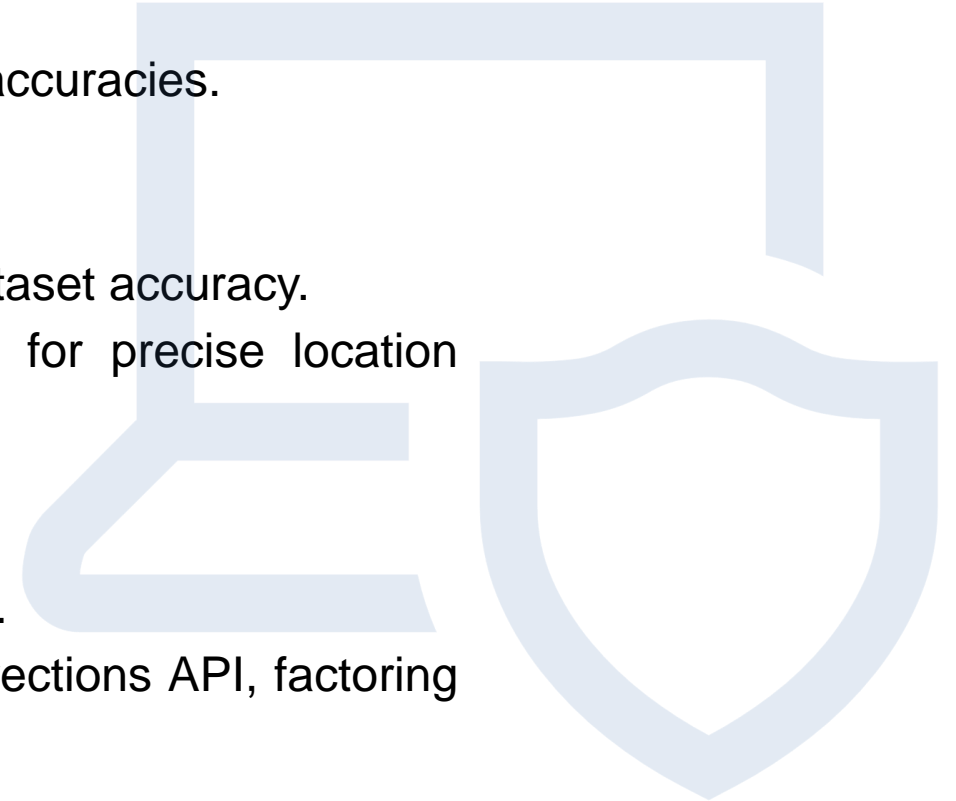
- Validate addresses with Google Maps Geocoding API for dataset accuracy.
- Transform textual addresses into geographic coordinates for precise location tracking.

Spatial Analysis & Matrix Creation:

- Organize coordinates for spatial analysis and route planning.
- Develop distance and time matrices using Google Maps Directions API, factoring in route options and traffic conditions.

Dynamic Data Integration & Optimization Preparation:

- Integrate live data for real-time adjustments to traffic and route changes.
- Prepare matrices for optimization to identify the most efficient delivery routes.





Clustering & Gurobi Model

Model Framework

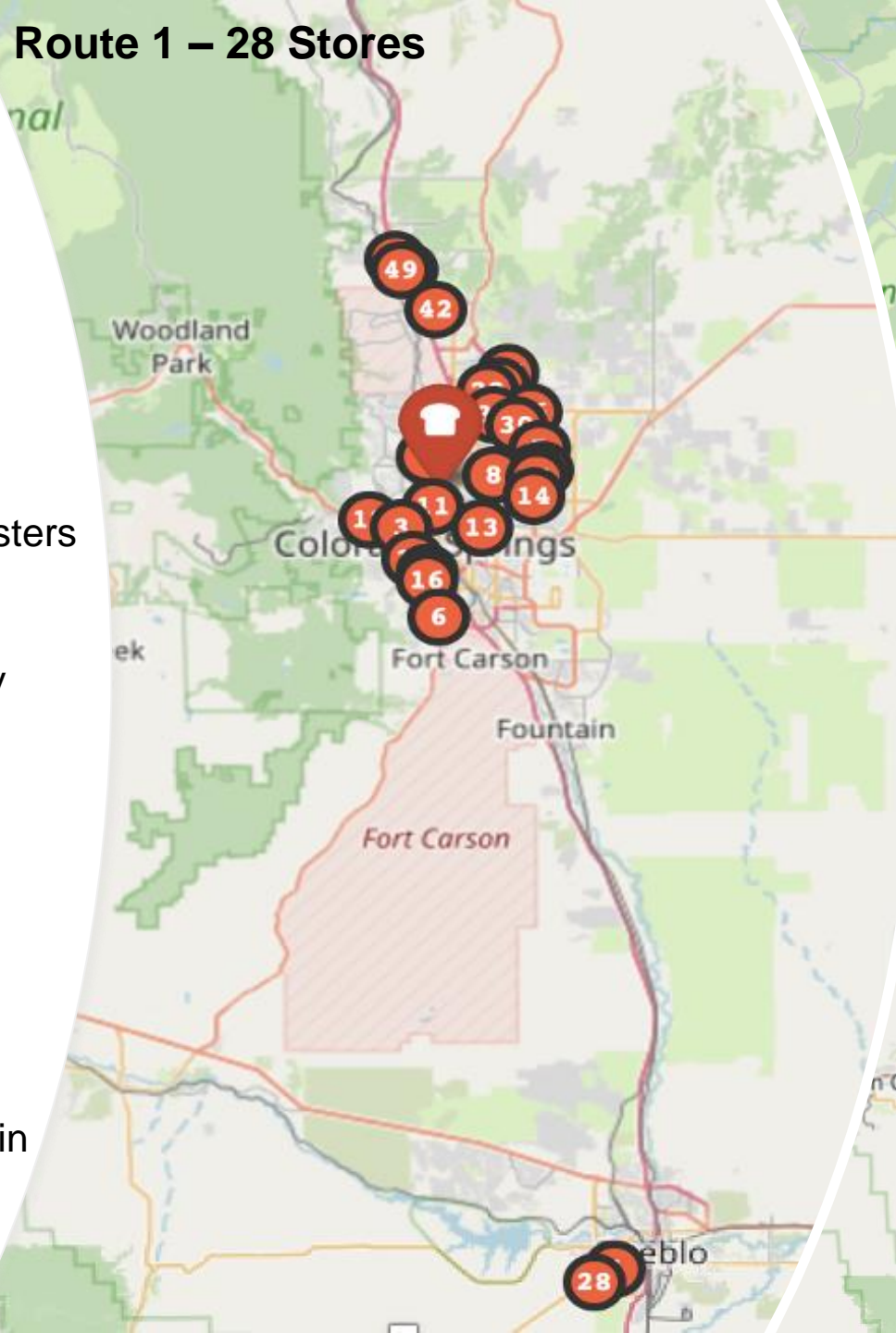
Clustering with K-Means:

- Groups delivery points into clusters based on travel time similarity.
- Simplifies route optimization by reducing complexity.

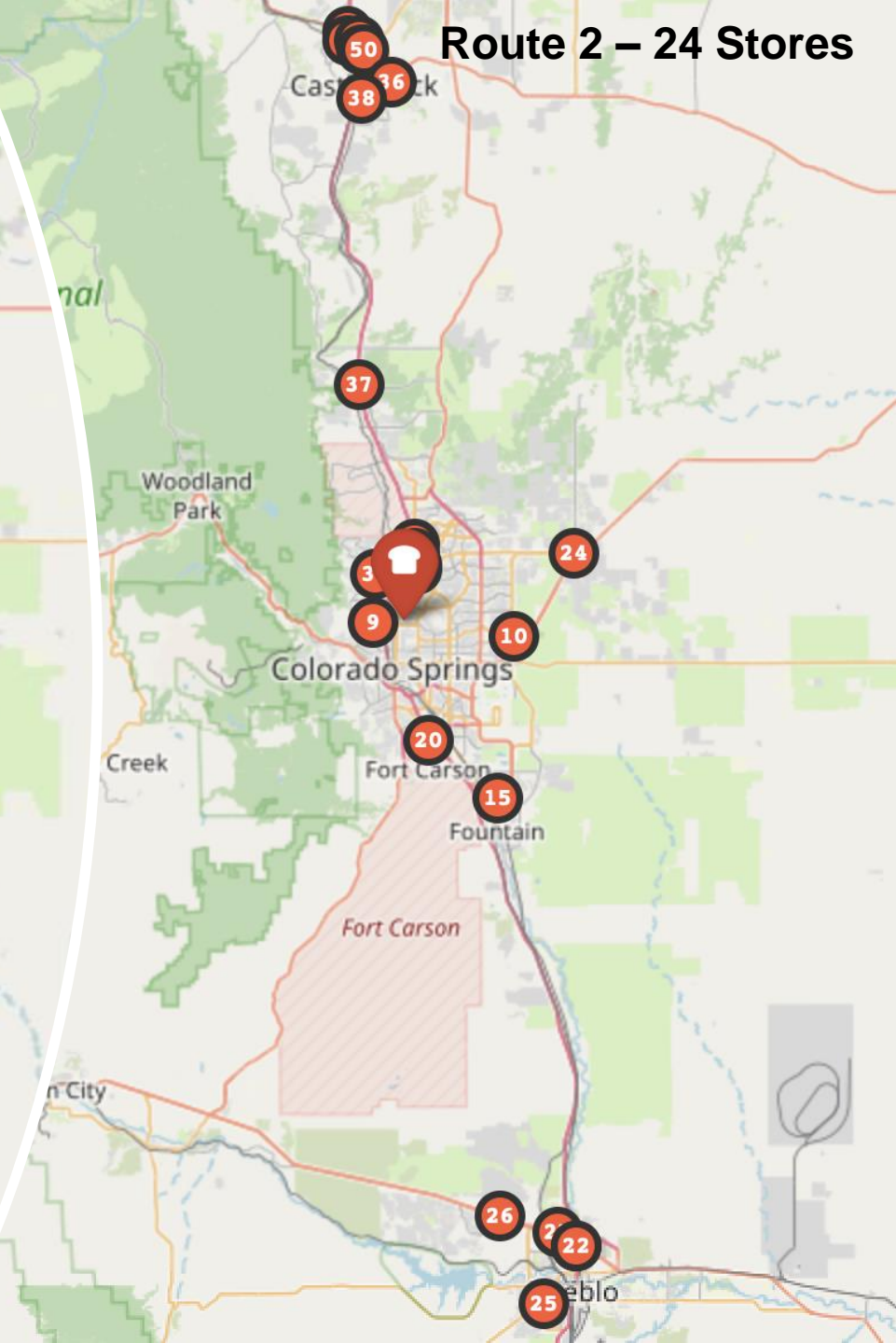
Optimization with Gurobi:

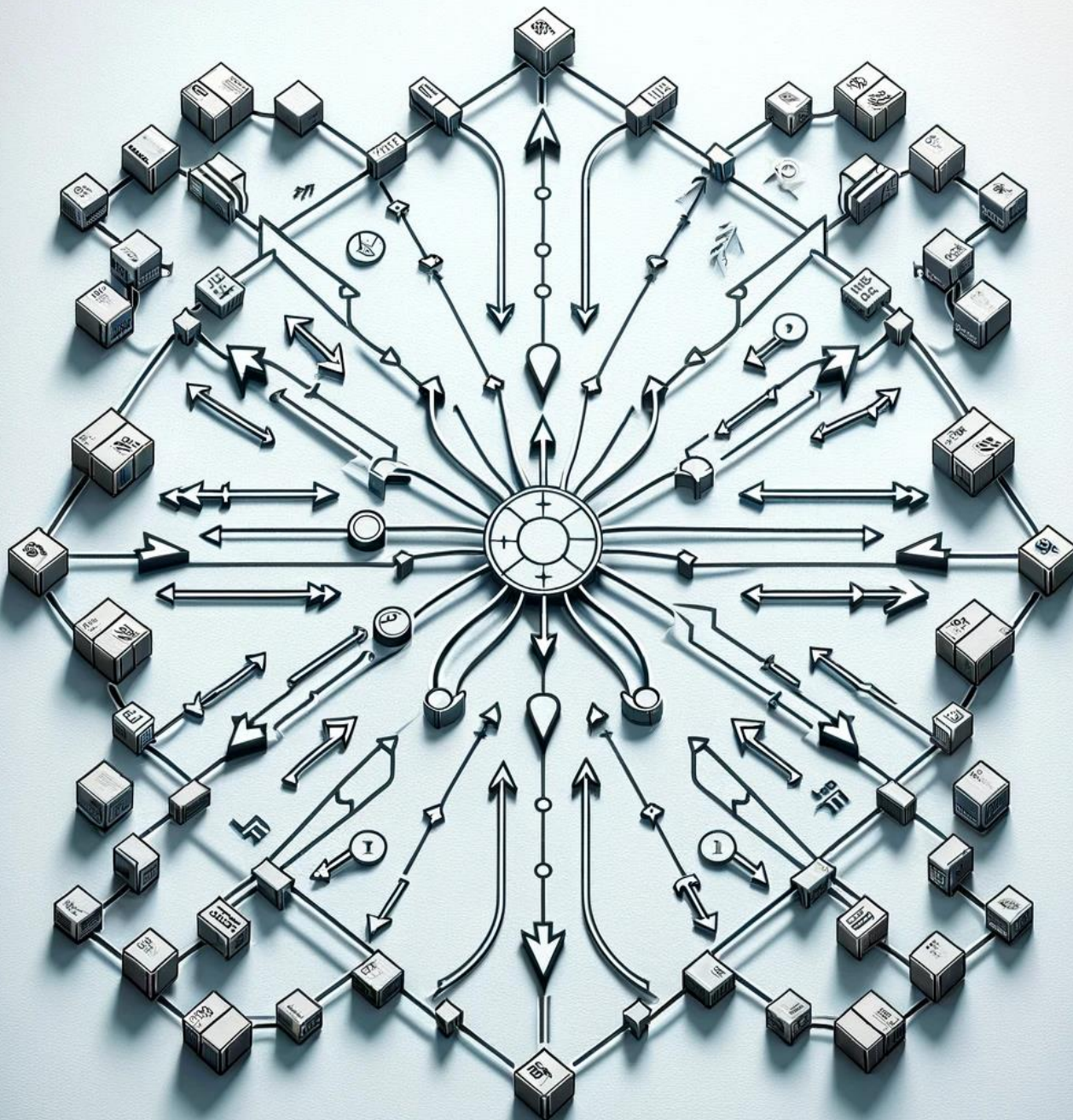
- Determines the most efficient delivery route.
- Minimizes total travel time within logistical constraints.

Route 1 – 28 Stores



Route 2 – 24 Stores





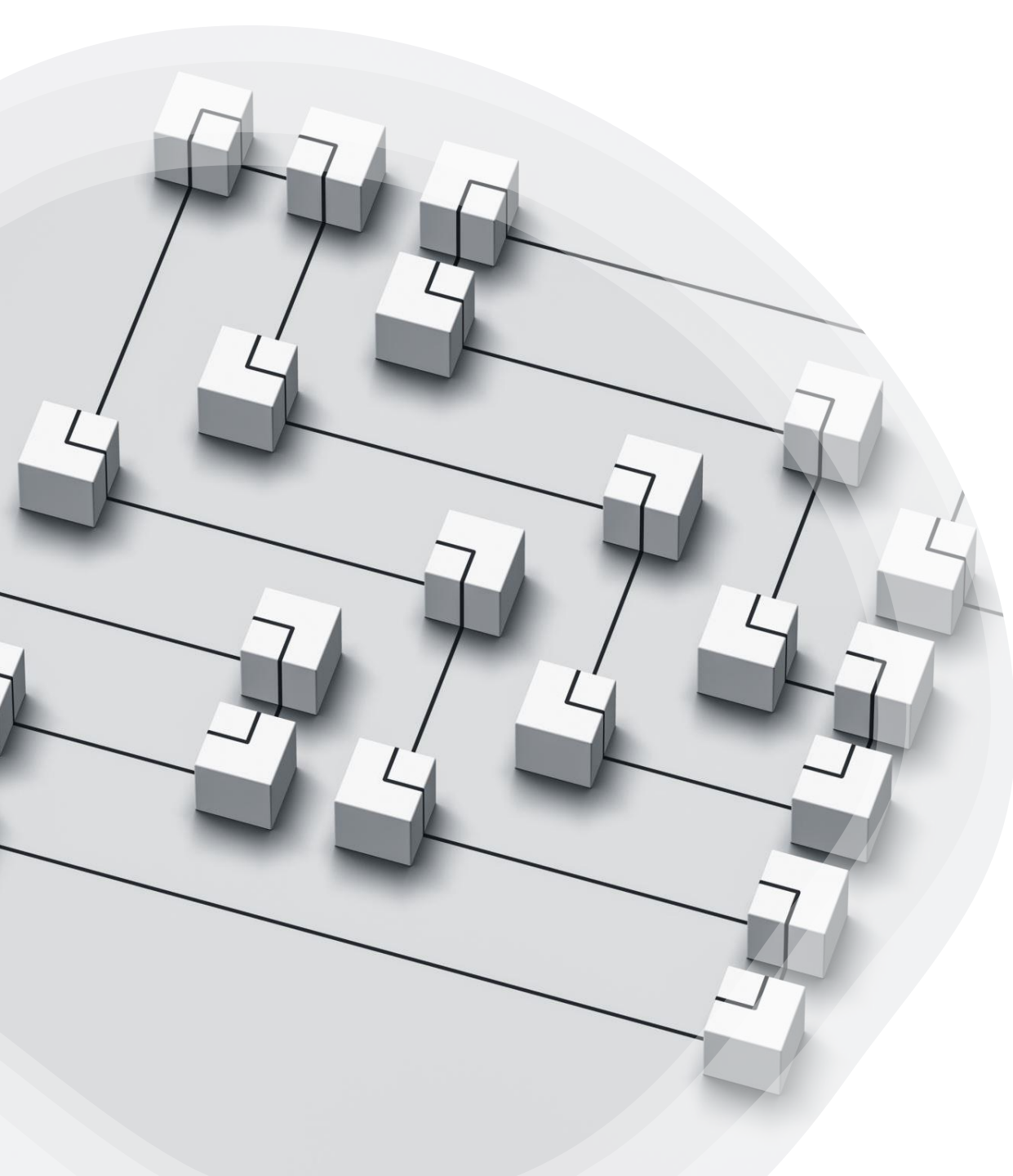
Optimizing Routes for Efficiency

Gurobi for Route Optimization:

- Employ Gurobi optimizer to find the most efficient delivery paths.
- Focus on minimizing travel time within logistical constraints.

Practical Constraints Considered:

- Each store is visited exactly once.
- Adherence to specific delivery schedules for stores like Costco.
- Compliance with drivers' working hours to ensure realistic routes.



Costs & Implementation

Cost Considerations:

- License fees for Gurobi
- Google Maps API usage charges
- Operational costs such as vehicle maintenance, fuel, and salaries

Model Implementation:

- Enhanced data management processes
- Employs clustering to reduce complexity before optimization
- Applies linear and integer programming for efficient routing
- Cost-Benefit Analysis



Optimized Delivery Routes Overview

Suggested Route 1

Total Deliveries: 88 deliveries

Total Travel Time: 44.14 hours.

Suggested Route 2

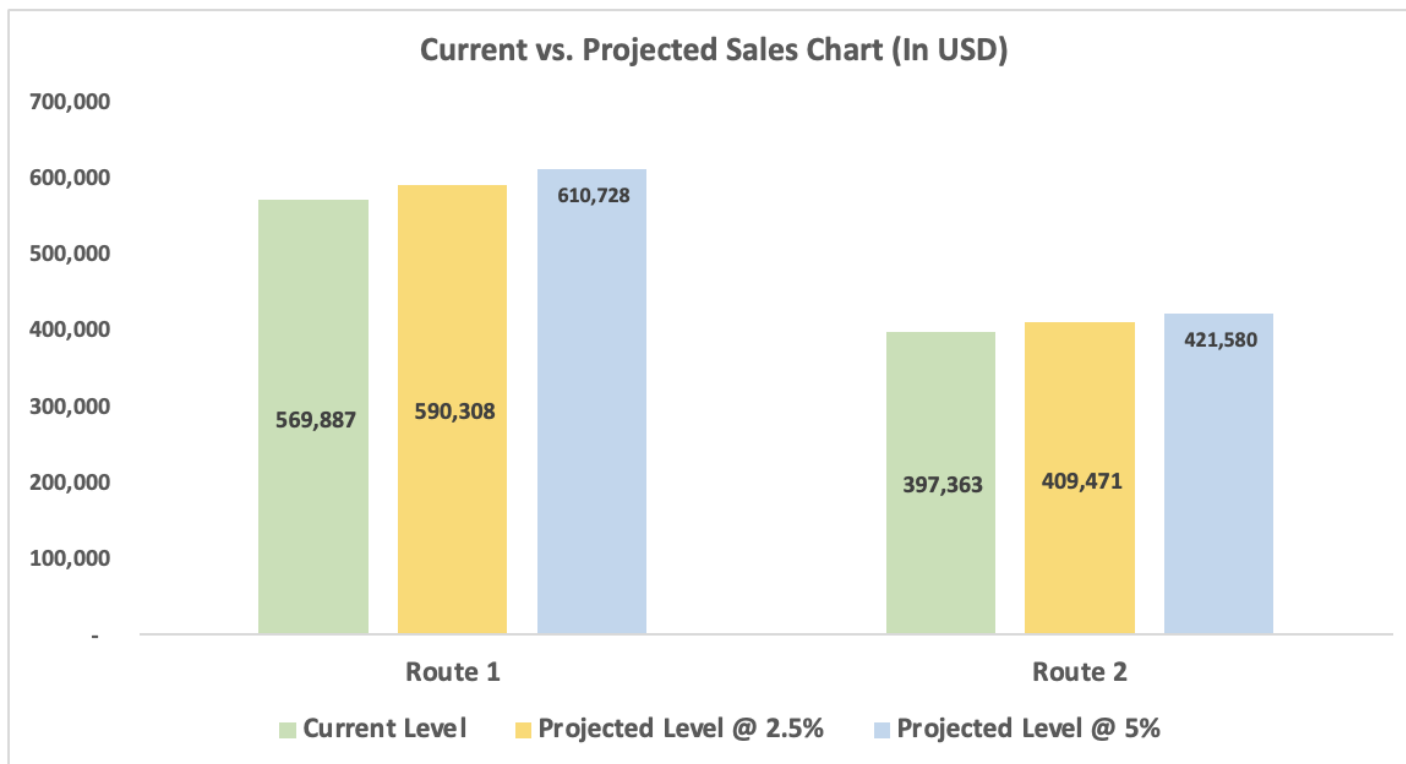
Total Deliveries: 72 deliveries

Total Travel Time: 44.53 hours.

Justification of Suggested Routes

- Utilized a clustering algorithm to optimize driving time and reduce operational expenses significantly.
- Aimed for an equitable workload distribution among routes to minimize driver idle time and ensure timely deliveries.
- Strategic planning involved to enhance service levels, ensuring timely and reliable deliveries to clients and improving the quality of services through operational excellence.
- Increased the number of total visits across all the stores by 66.

Driving Sales Growth through Route Optimization



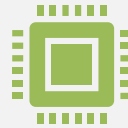
- Route 1: Projected to reach \$610,728 with a 5% increase.
- Route 2: Projected to reach \$421,580 with a 5% increase
- Both routes demonstrate strong growth potential and market preference, underscoring the effectiveness of our operational strategies.

Lessons Learned



Data-Driven Insights:

The importance of thorough data collection, cleaning, and validation to ensure accurate route optimization.



Technological Investments:

Benefits and costs associated with adopting technologies like the Gurobi optimizer and Google Maps API for route planning.



Operational Efficiency:

Achieving operational cost savings through efficient route planning while balancing workload among drivers.



Strategic Planning:

The critical role of considering logistical constraints in route optimization to enhance service levels and delivery efficiency.

Conclusion

- **Successful Route Optimization:** The project significantly enhanced delivery efficiency, balancing cost savings with operational effectiveness.
- **Advanced Analytical Tools:** Employed cutting-edge analytics, including clustering and optimization, to streamline routes and reduce expenses.
- **Operational Excellence Achieved:** Met and exceeded objectives for store visit frequency, operational cost reduction, and logistical efficiency.
- **Future-Focused Innovations:** Emphasized the importance of route flexibility, predictive demand modeling, and green logistics for sustainable growth.
- **Strategic Recommendations:** Advocated for a modular expansion strategy and the integration of direct feedback mechanisms to continuously refine delivery operations.



THANK YOU!