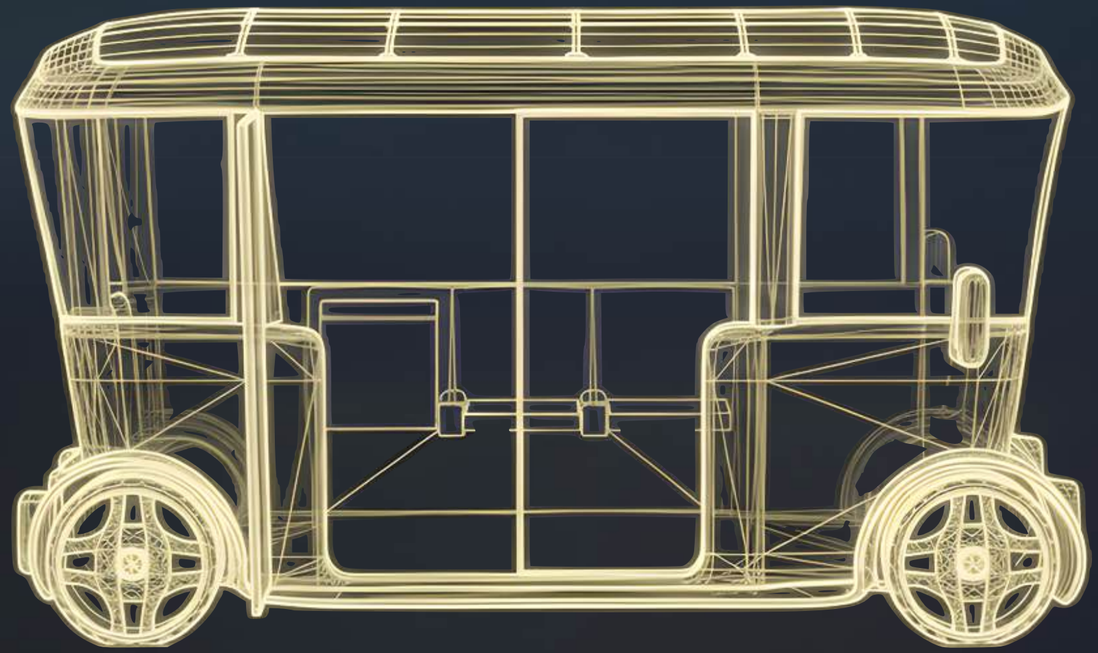


nytra

Hitesh Beedu | hiteshbeedu@gmail.com

Project Brief

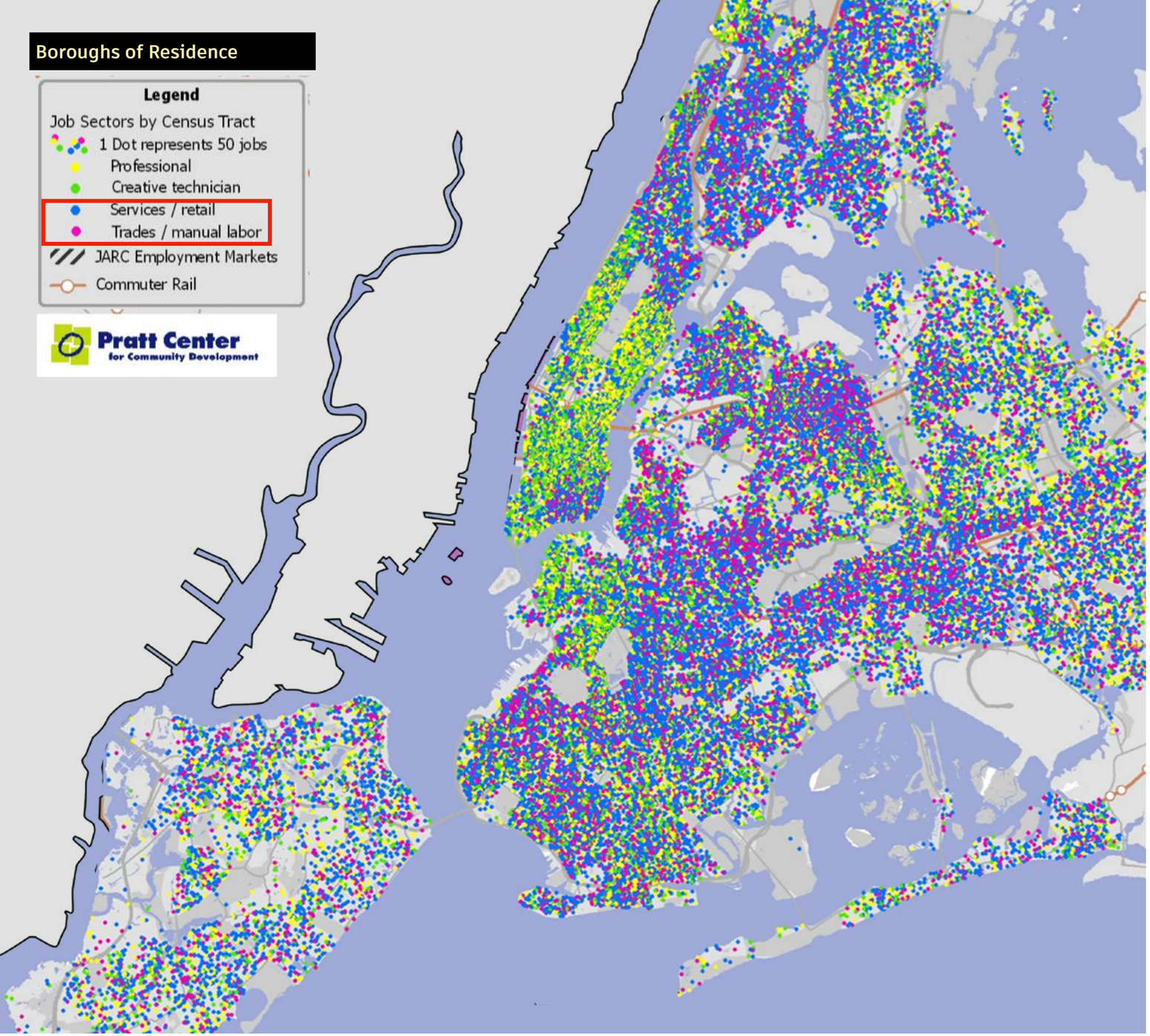
Design a service that improves last-mile connectivity for commuters in New York City by addressing gaps between public transportation and final destinations. The project focuses on understanding user needs, transit patterns, and opportunities to make commuting more convenient, safe, and accessible.

Adopted SDGs

A city not for cars

46% prefer public transportation

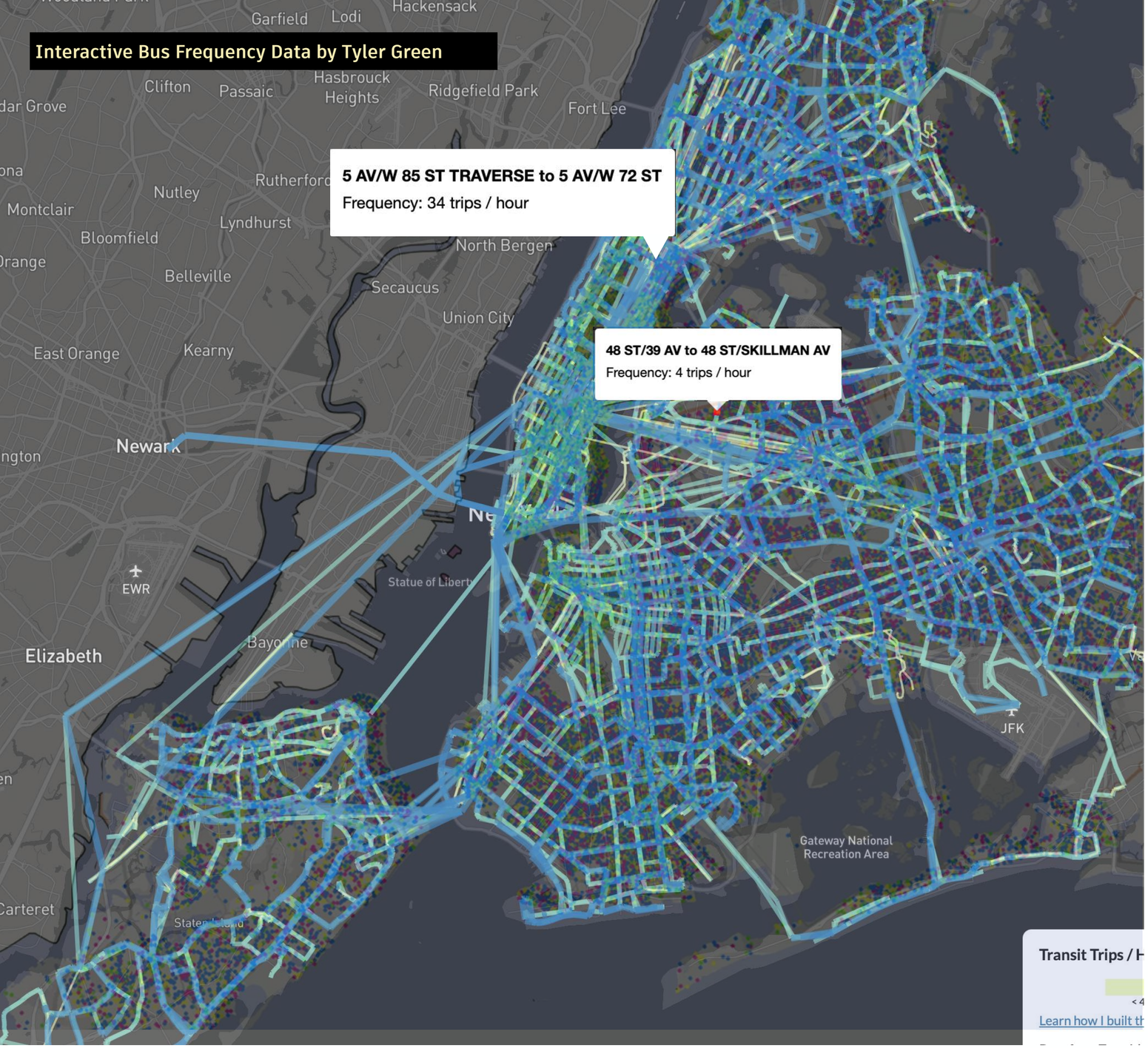
But the reliability is focused only on Manhattan!



Contextual Inquiry

Outer boroughs have seen the highest population growth over the past 50 years, largely accommodating middle & low income residents

Queens has a significantly higher mean share of blue-collar workers 35.45% compared with Manhattan's 22.85%. Conversely, professional and creative-tech employment is markedly lower in Queens (17.5%) relative to Manhattan (30.8%).



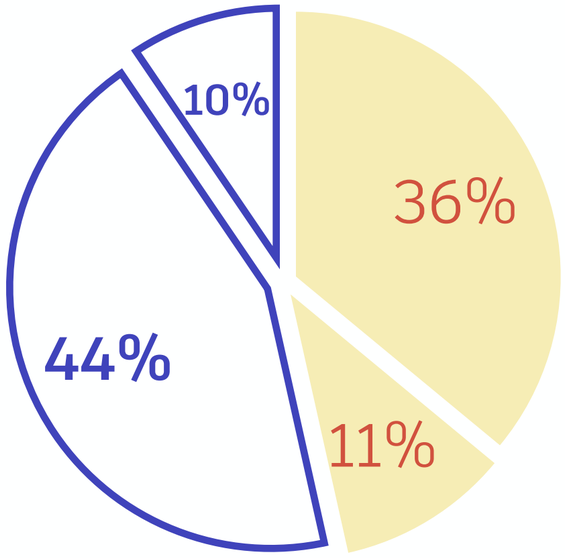
Contextual Inquiry

Outer boroughs have seen the highest population growth over the past 50 years, largely accommodating middle & low income residents

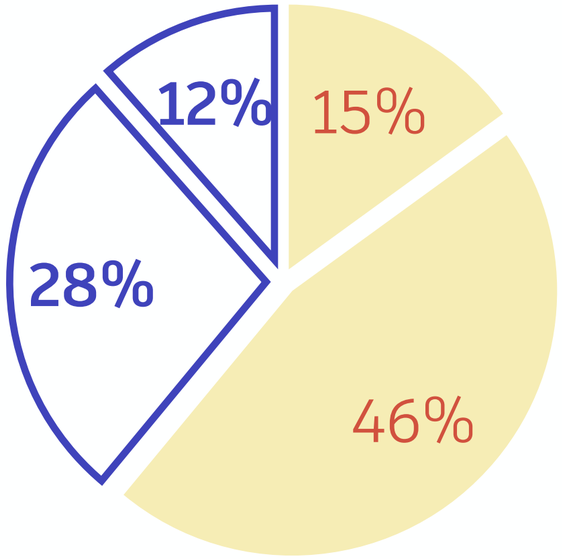
Inter-borough connectivity outside Manhattan is notoriously limited, creating challenges for college students, blue-collar workers, and specially challenged New Yorkers.

Tyler Green's interactive map shows bus frequencies on Fridays, highlighting gaps in service across boroughs.

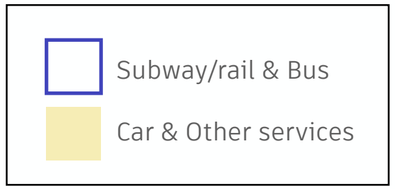
Mean Ratio of workers living & working in same/outside boroughs



Manhattan



Queens



Contextual Inquiry

Outer boroughs have seen the highest population growth over the past 50 years, largely accommodating middle & low income residents

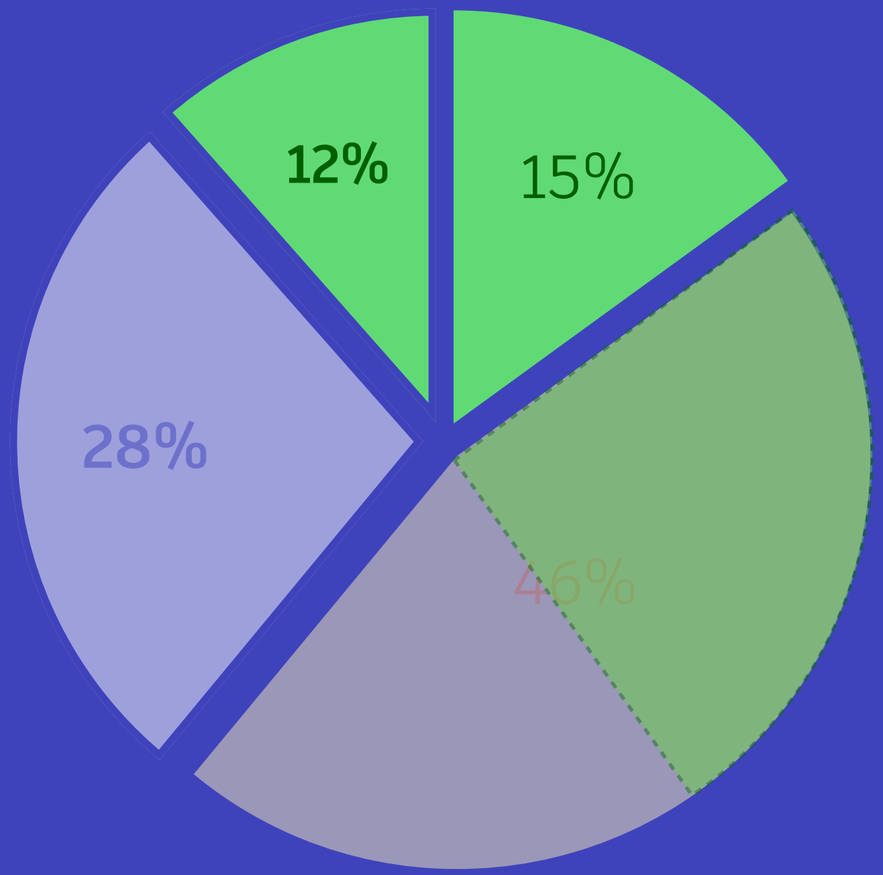
Inter-borough connectivity outside Manhattan is notoriously limited, creating challenges for college students, blue-collar workers, and specially challenged New Yorkers.

In Queens, the plurality of workers use cars for commuting within their borough of residence & to other boroughs

Outside Manhattan, public transit relies heavily on buses and inconsistent frequencies make the system unreliable for everyday commuters.

Redefined Project Brief

NYtra tackles the last-mile challenge in Queens, where uneven subway and bus connectivity leaves commuters stranded between transit hubs and their destinations. The project aims to design a seamless, reliable, and effortless last-mile solution that complements the existing public transport network and transforms daily travel for residents.



Decarbonization Entry Point 1

There is an opportunity to reduce carbon emissions from private transport by creating a more reliable last-mile mobility service. This can emerge either through low-cost private operators or through integration with the MTA.

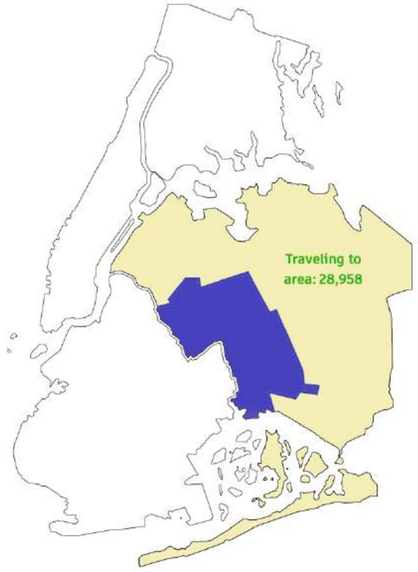
Contextual Inquiry Vision

Sub-Contextual Inquiry

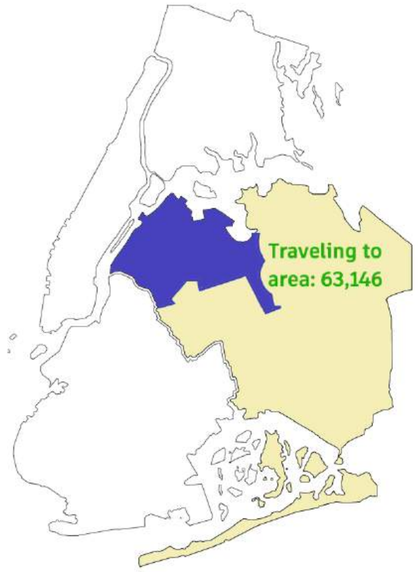
Of the 2.45 million workers citywide, 467,000 are Queens residents who commute daily, many of whom travel within the borough, highlighting key intra-borough hotspots for enhanced connectivity.

2000 Census data revealed estimates of 19%. of Workers Commuting from Queens to workplace

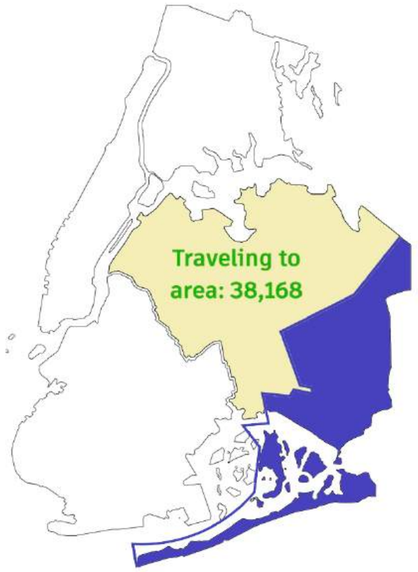
Southwest Queens



Northwest Queens



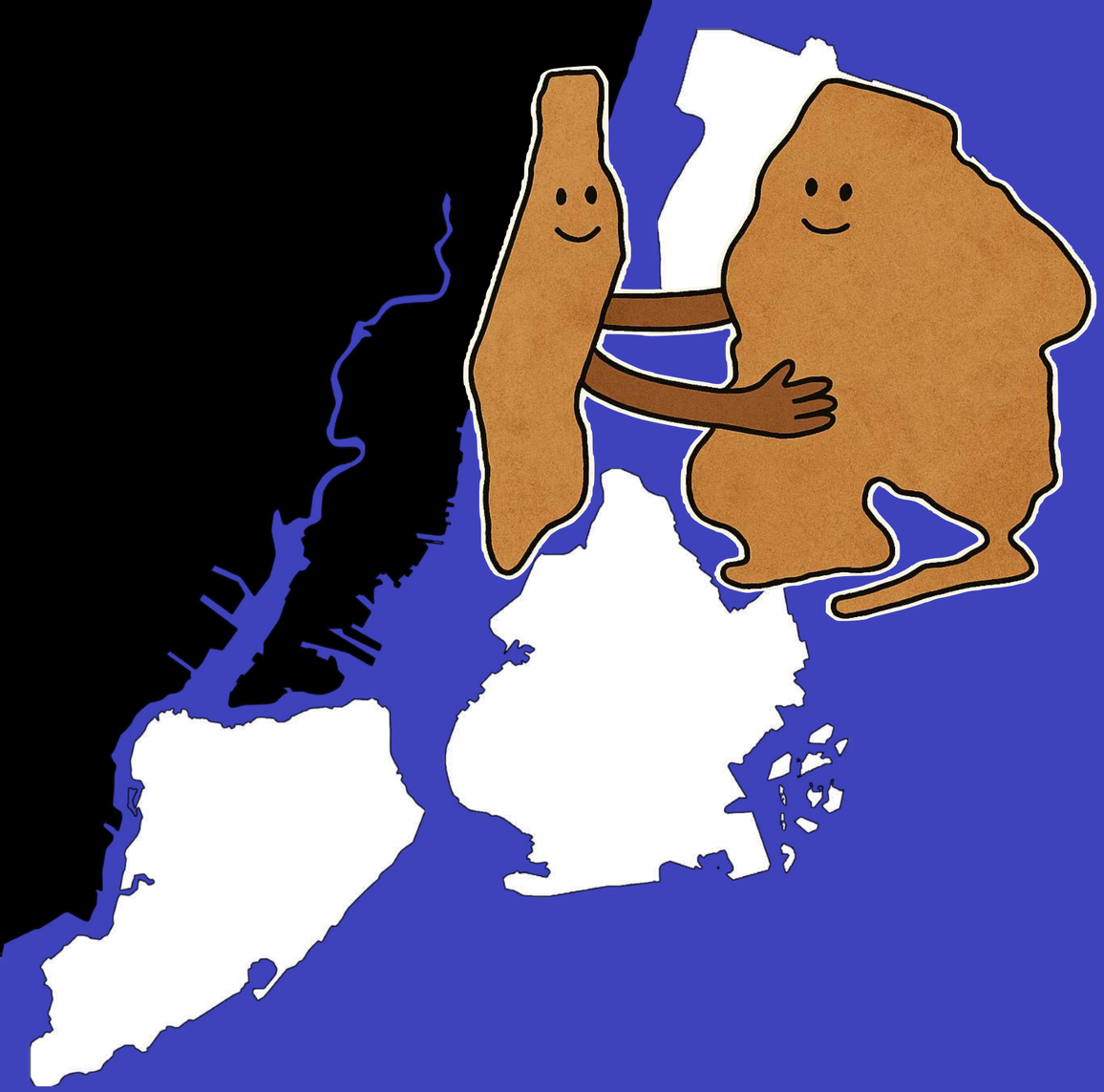
Southeast Queens



Gravesend/ East New York

Downtown Manhattan

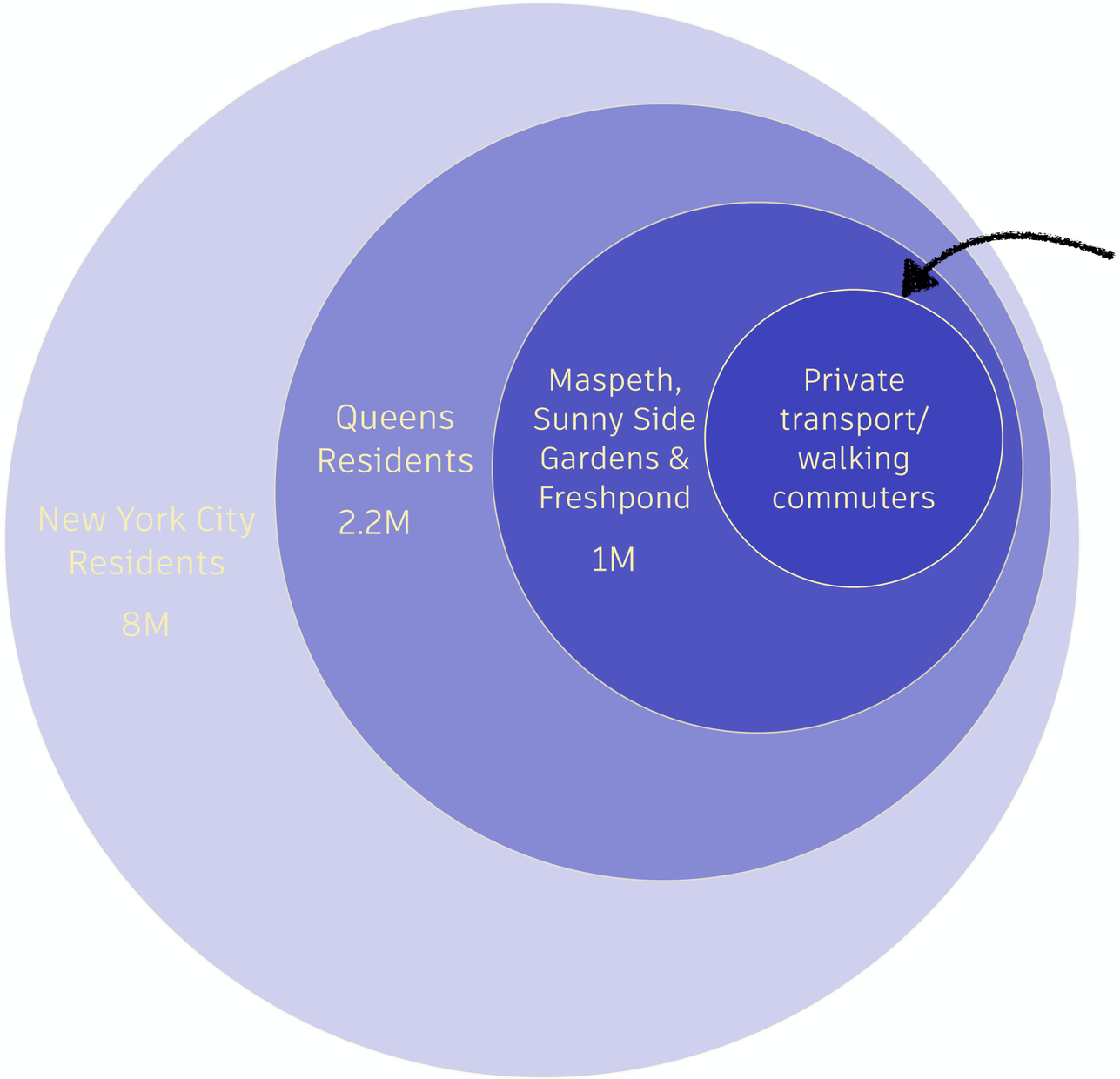
East Manhattan



Decarbonization Entry Point 2

By analyzing these intra-borough commuting hotspots, a multi-hub and spoke layout can be developed to strengthen last mile connections between homes, workplaces and subway stations.

Sub-contextual Inquiry Vision

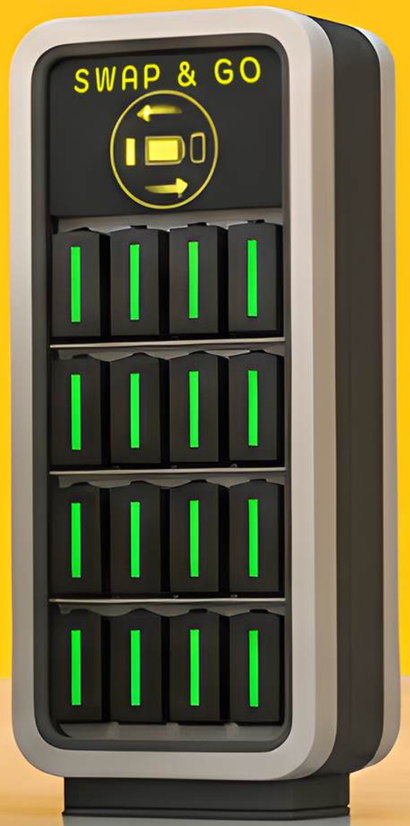


User Group

Similar to how Manhattan functions as an interconnected core, this approach draws the nucleus effect outward and enables Queens to integrate more seamlessly into the wider transportation network. This encourages higher public transit usage, reduces private vehicle dependence and contributes to a circular mobility ecosystem that supports decarbonization.

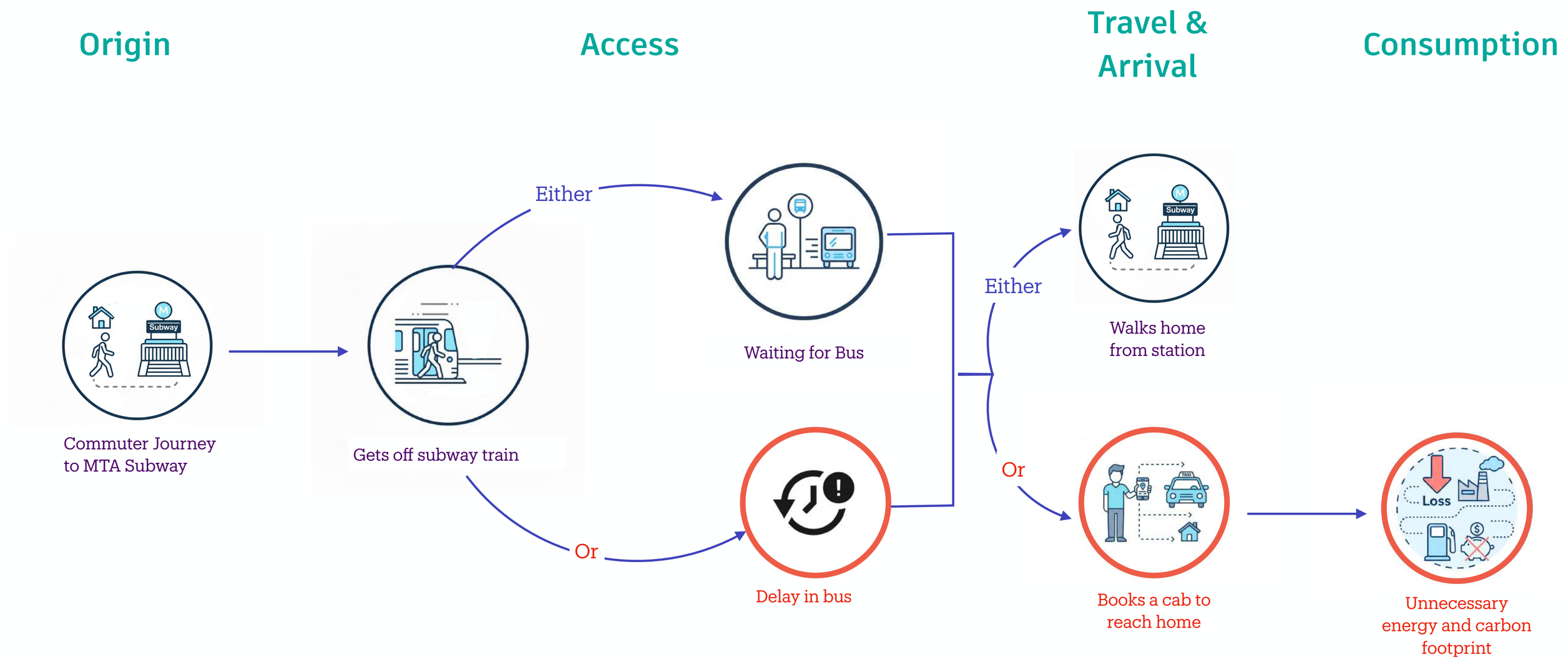
Research Summary

NYTra is a compact, low-speed vehicle (LSV) designed for last-mile urban mobility. Each vehicle can carry up to 8 passengers (average occupancy 5) and runs on short 3–6 mile loops, with a maximum range of 20 miles per battery before a swap.

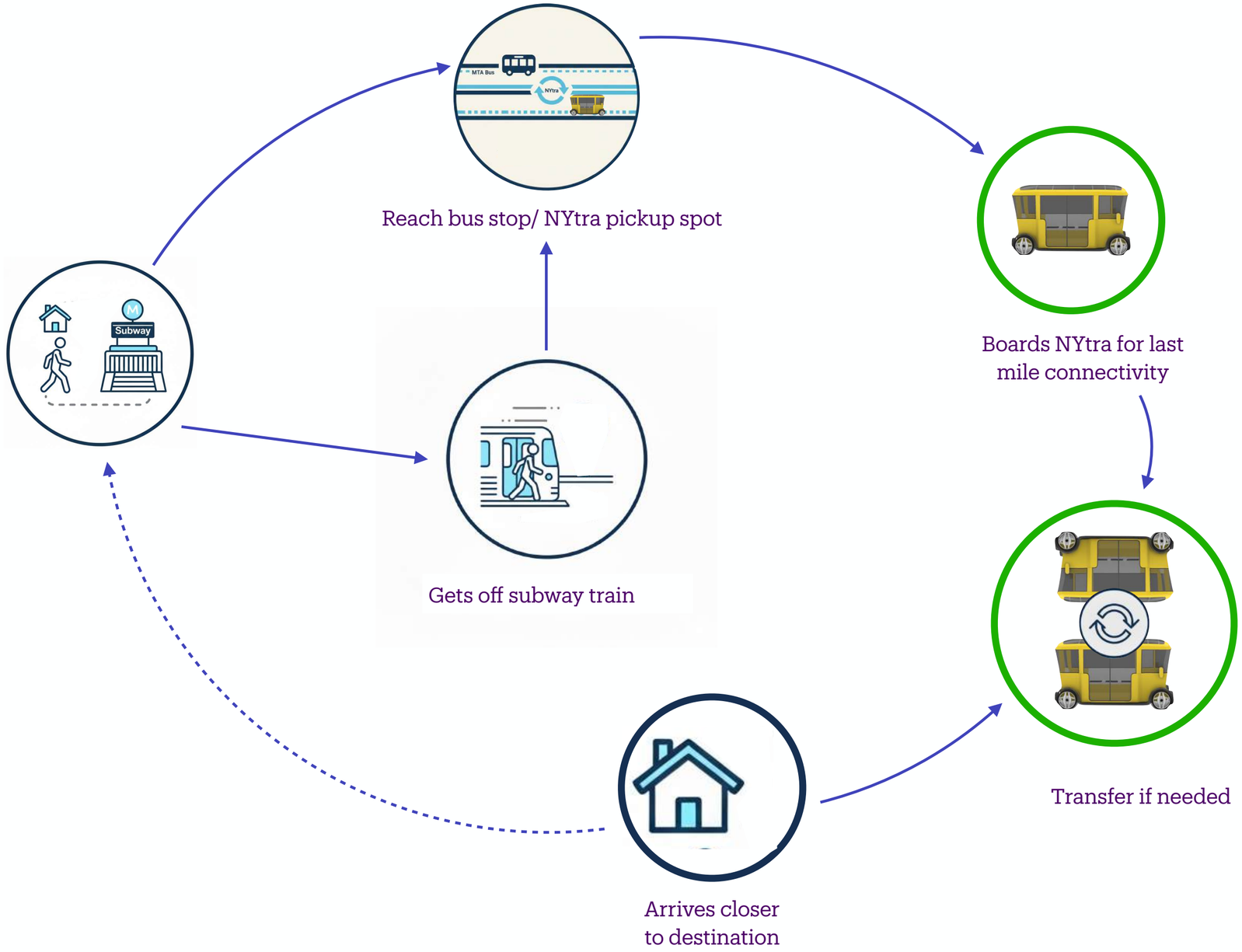


It combines human-powered pedaling with electric assistance, supported by swappable battery systems and solar-powered hybrid energy regeneration, for efficient and sustainable operation.

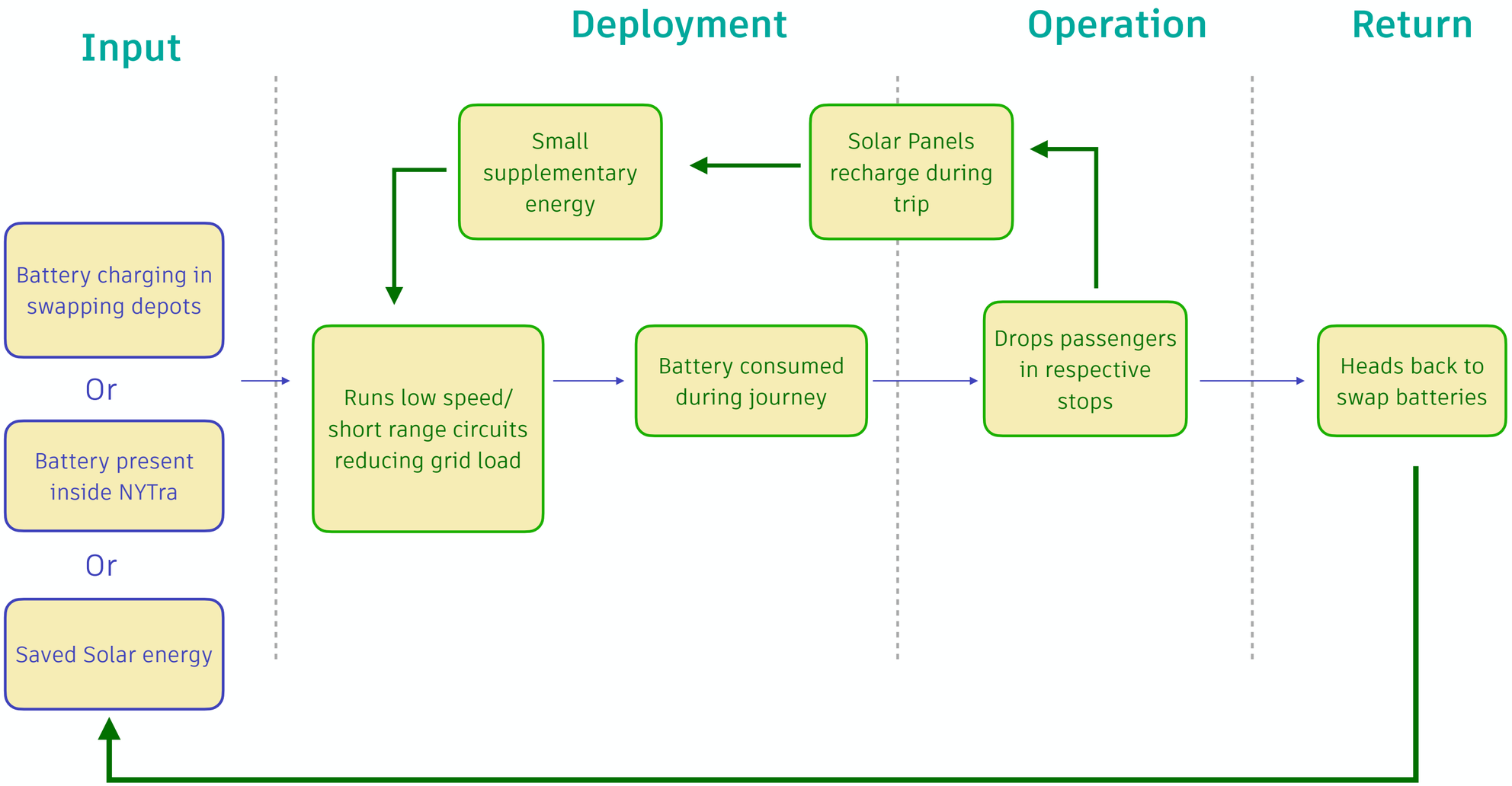
Existing Linear System Design of User Journey



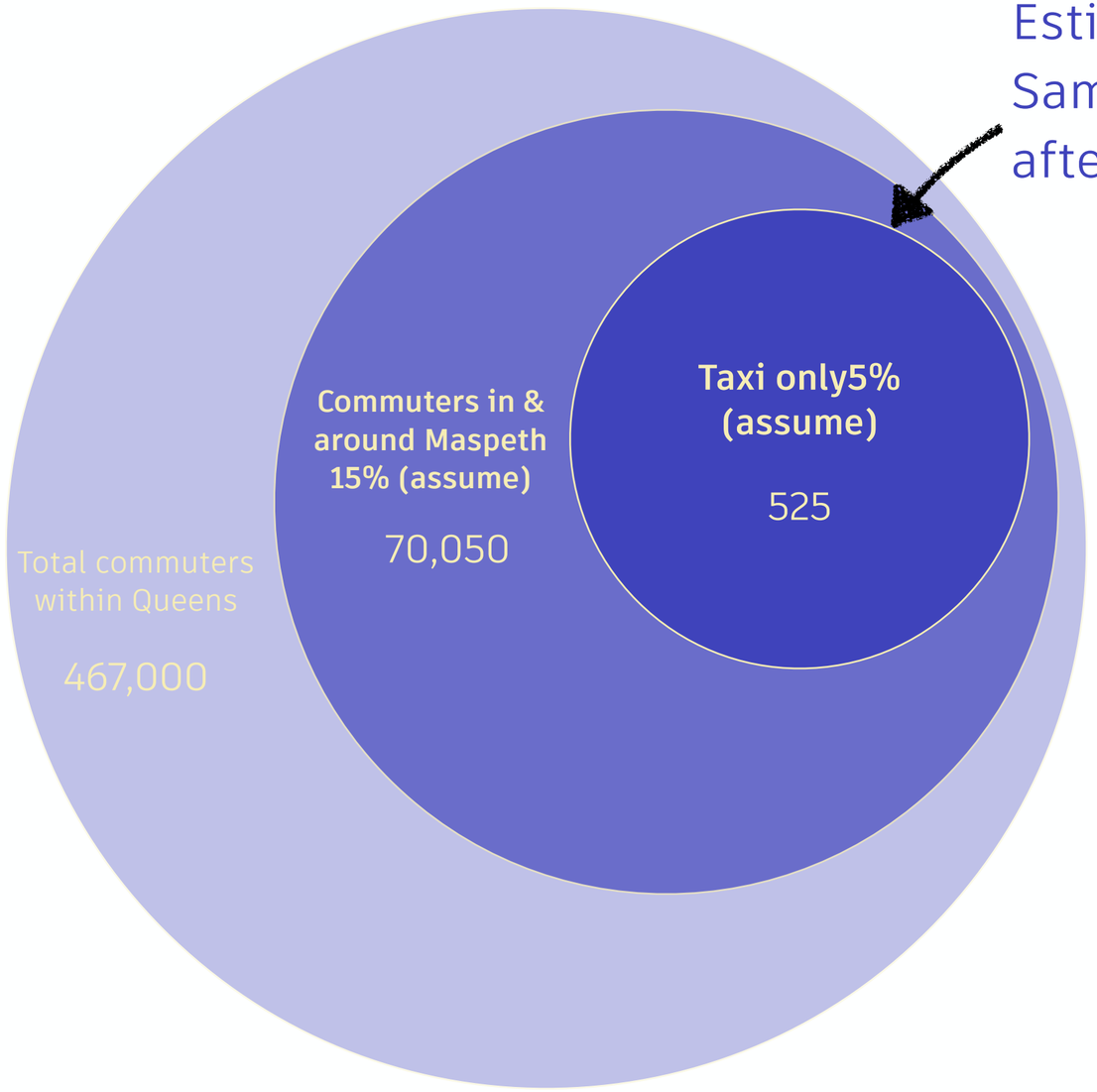
Circular Economy System Design for User Journey



Circular Economy System Design for Energy Consumption Journey



Calculating Sample Size for Vehicle Count per area



Estimated Sample Size after calculation

Result

TOTAL PASSENGERS
525 People

TOTAL LOOPS PER VEHICLE
20

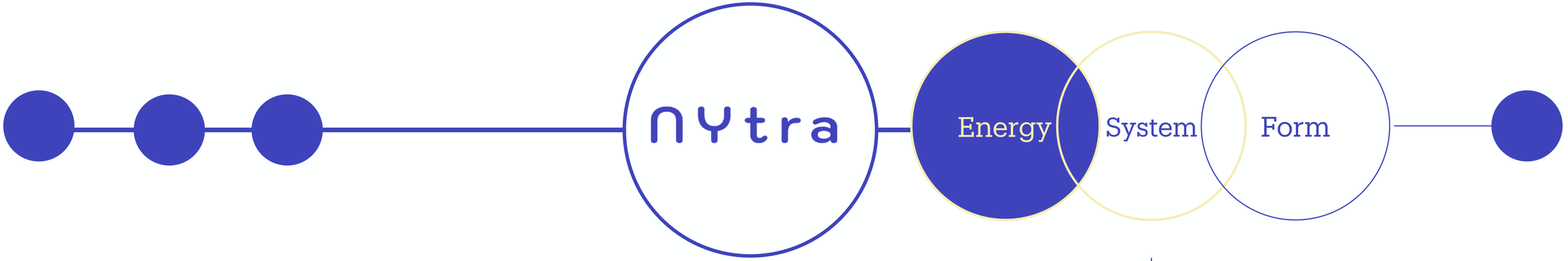
AVERAGE RANGE PER LOOP
4 miles

TOTAL VEHICLES DEPLOYED
6 miles

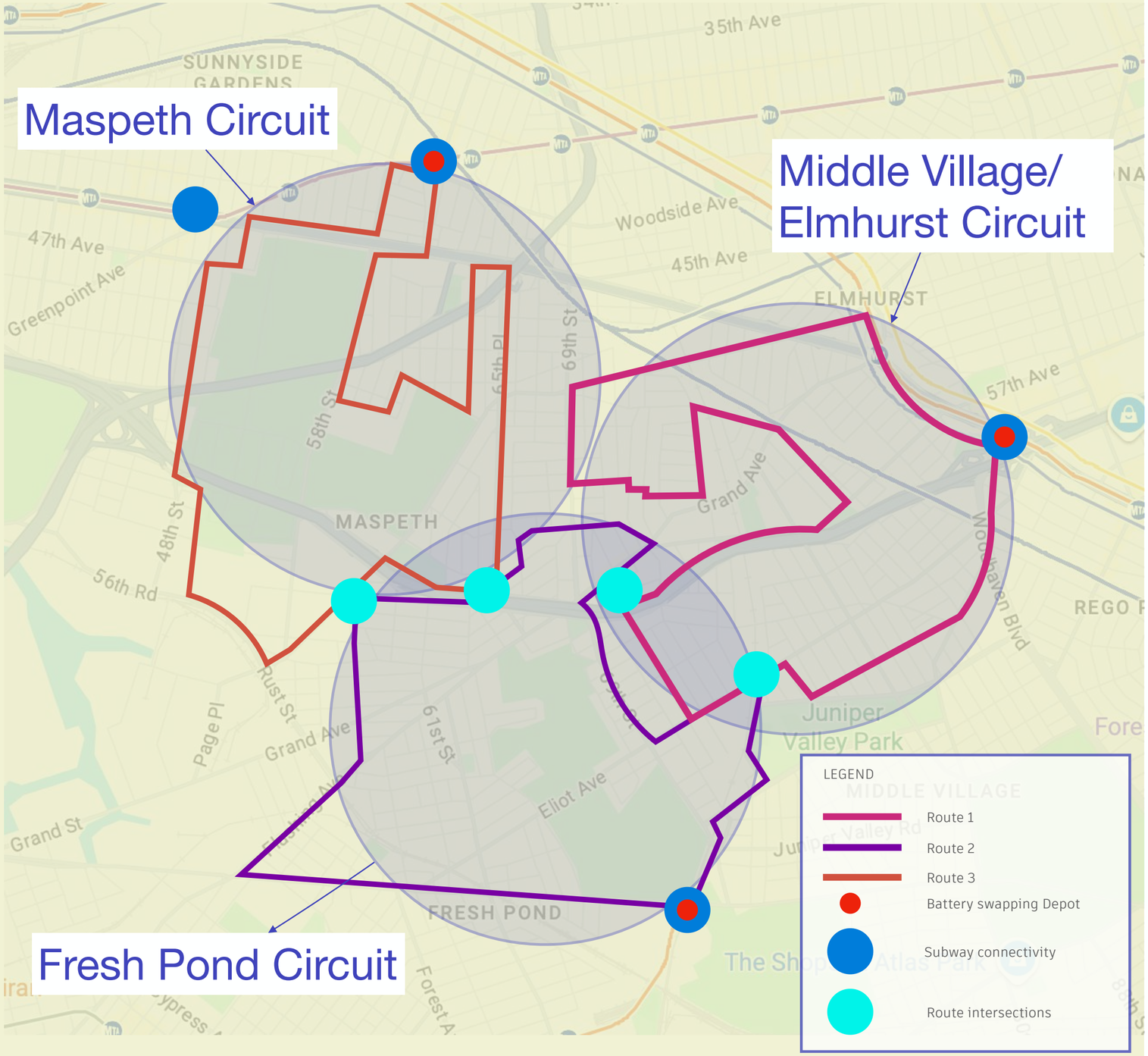
Energy Comparison

Taxi		nYtra	
1.5 miles	Average last mile distance	Average Circuit length	4 miles
787.5 miles/day	Total Passenger miles	Total distance covered in 20 loops & 6 nYtra's	400 miles
1.3 kWh/day	**Average energy per trip**		**0.2 kWh/day**
1061.5 kWh/day	**Total energy consumed**		**480 kWh/day**
2 kWh/day	**Energy Consumed per person**		**0.9 kWh/day (↑55%)**

Hatchback vehicle inclusion optimized through Google Gemini

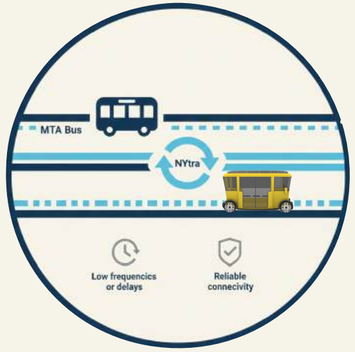

nytra
Energy
System
Form

System Layout

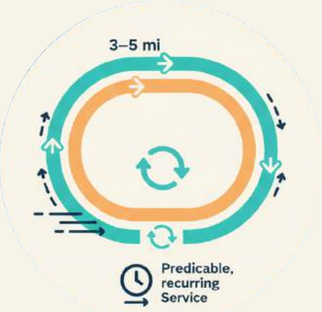


Hybrid routes connect key neighborhood destinations by using both major roads and important residential streets.

Brings commuters close to home while maintaining fast, smooth travel flow.



Aligns with MTA bus corridors so riders can easily switch to NYtra during low frequencies or delays, ensuring continuous, reliable connectivity.

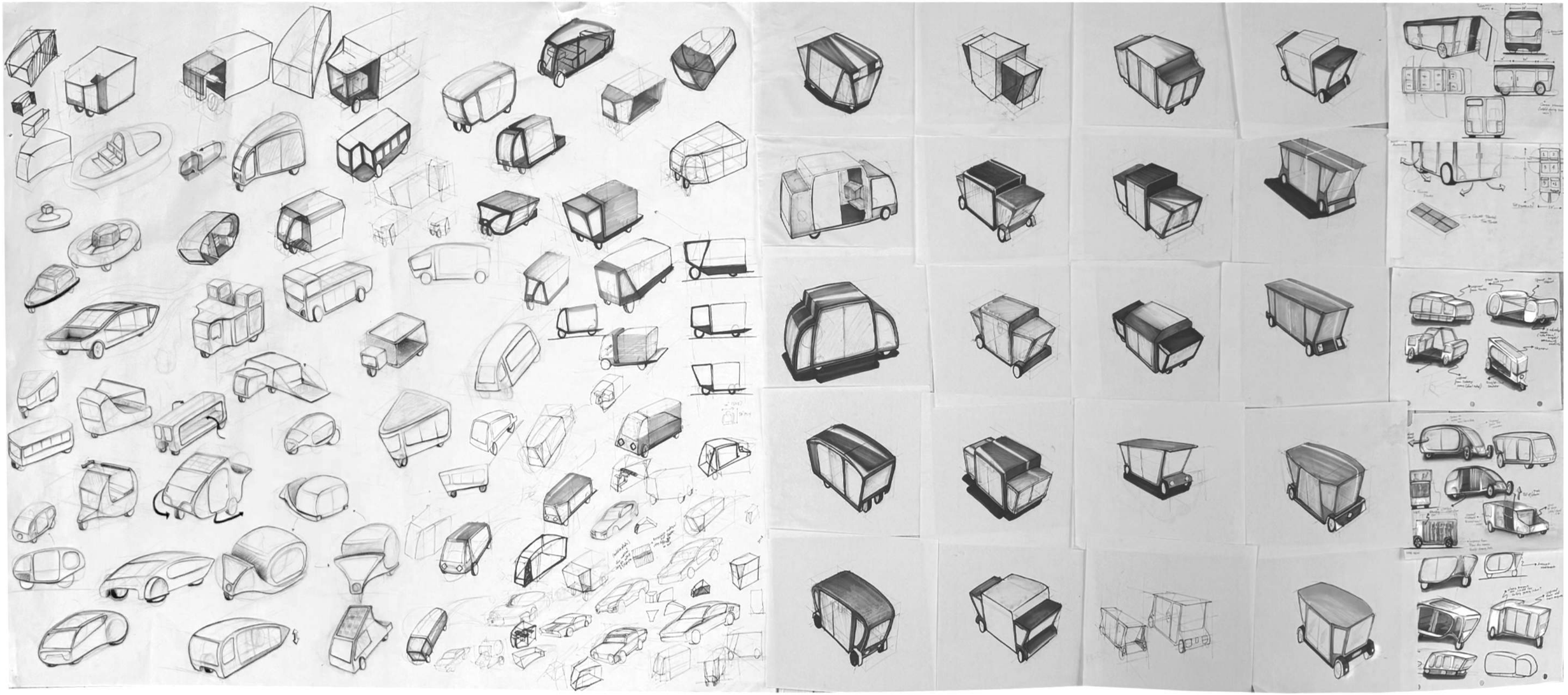


Each loop covers 3–5 miles, keeping service fast, frequent, and predictable, while overlapping circuits allow commuters to transfer seamlessly between NYtra routes as needed.

Inspired by India’s share autos and Turkey’s yellow dolmuş, these colonial-era Global South micromobility networks show how small, flexible, community-driven systems with adaptive routing and high frequency can outperform rigid, capital-heavy transport models like New York’s.

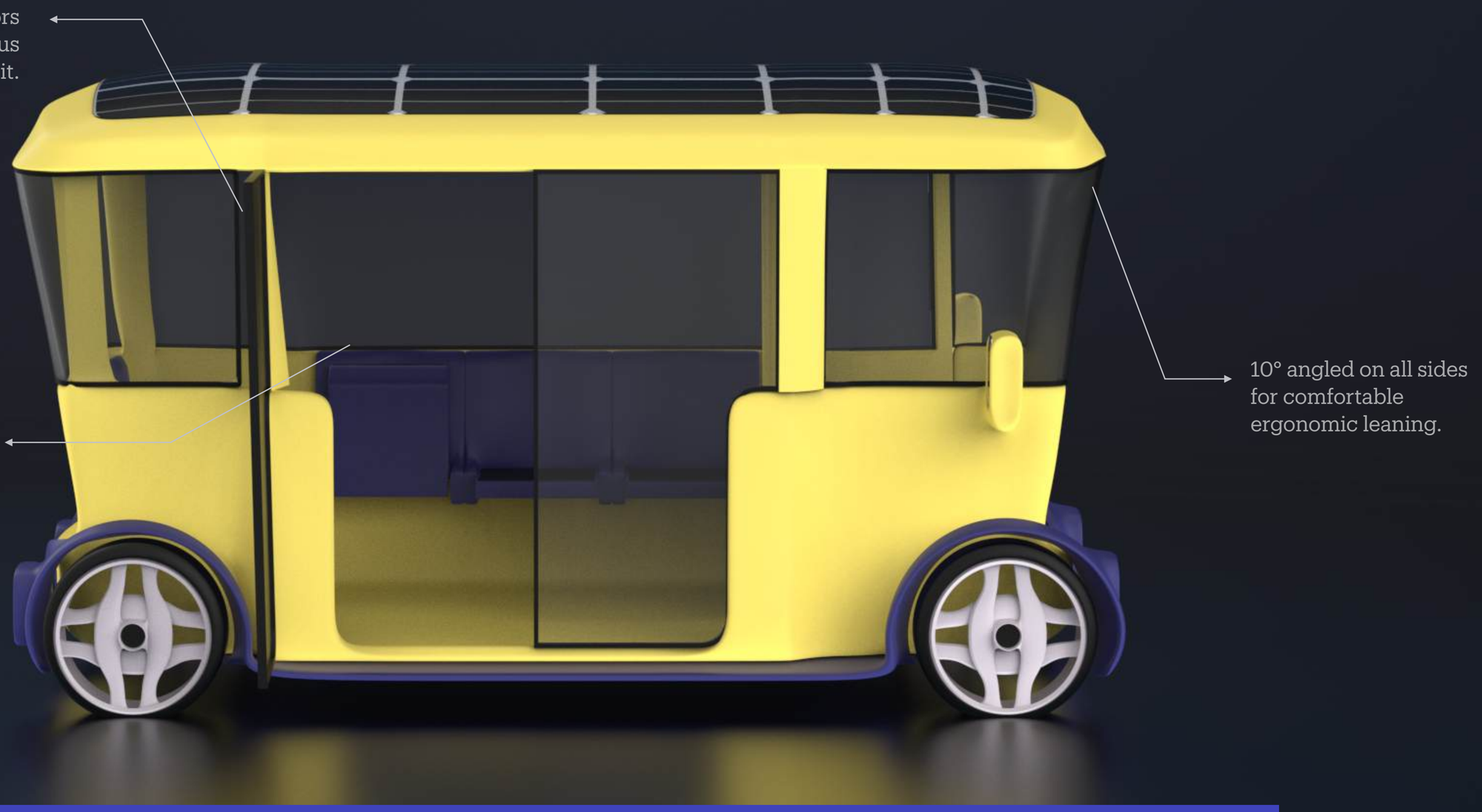
Unfair Advantage in New York

NYtra can take the speed and flexibility of informal systems from the Global South and adapt it to the United States, where most transport services are privatized and regulated. This allows the service to operate efficiently and responsively while staying within legal and safety frameworks, turning privatization into an advantage rather than a limitation.

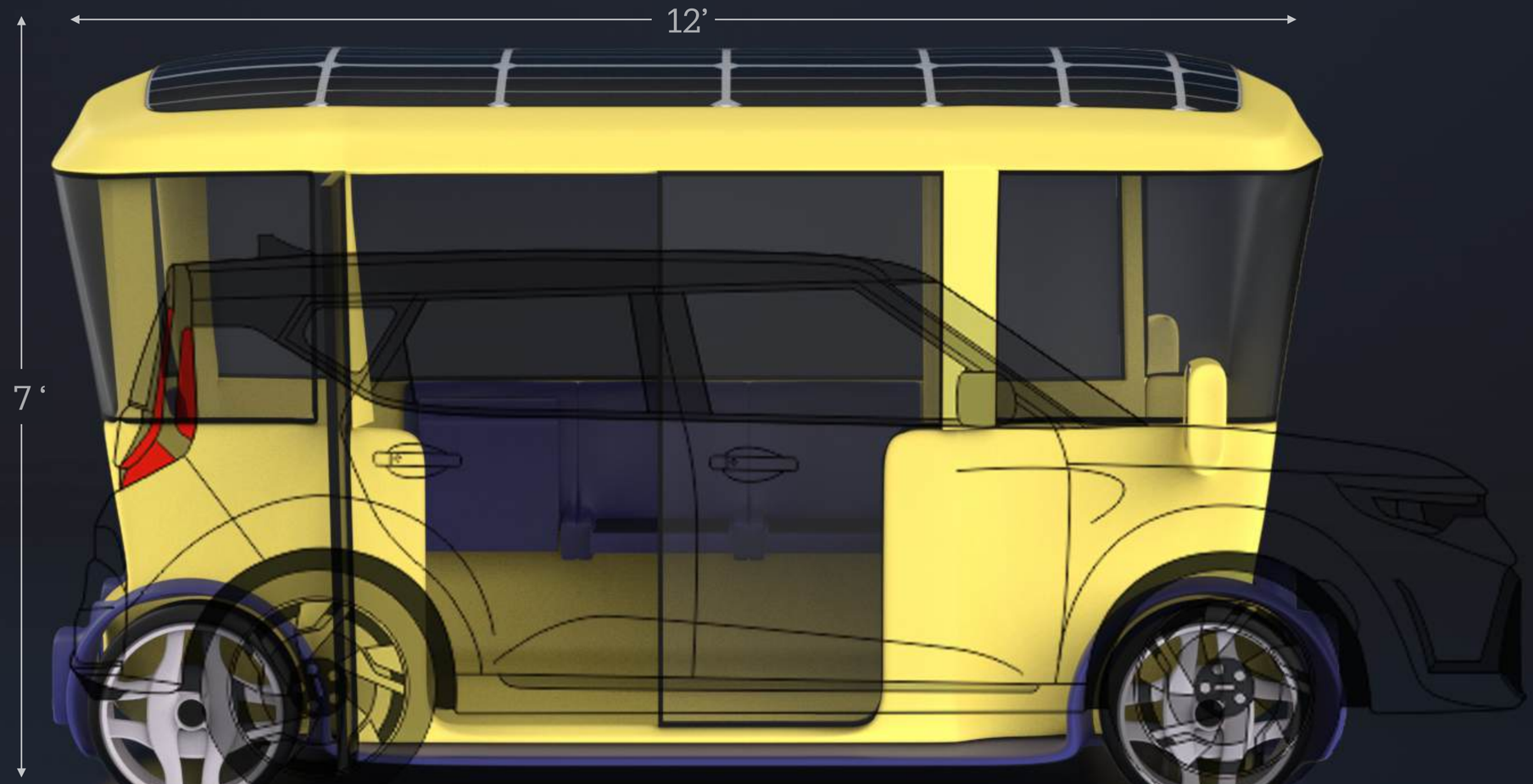


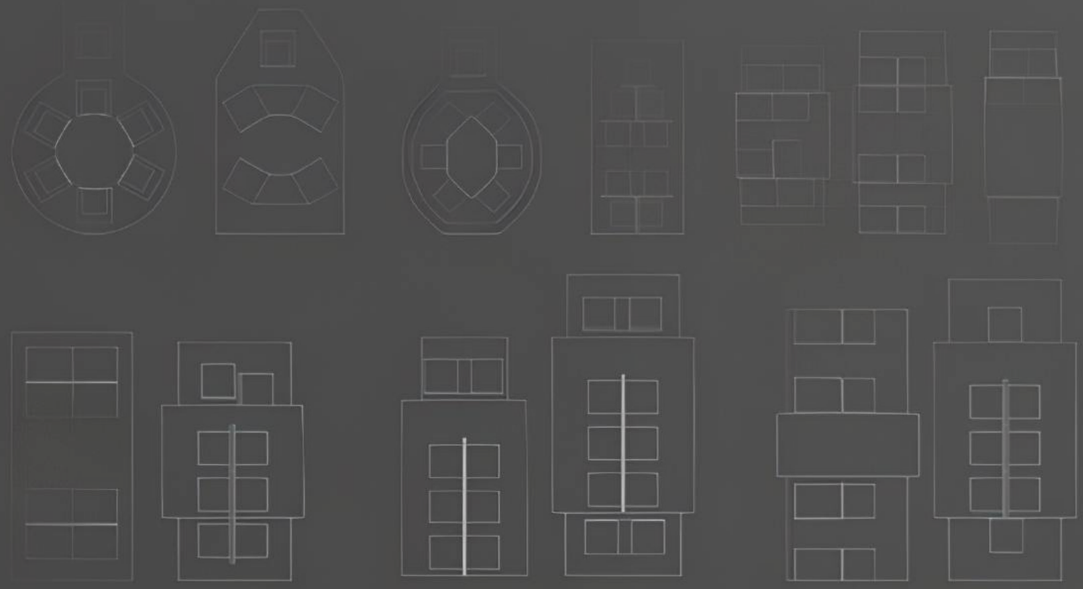
Features

Lighting of render optimized through Google Gemini

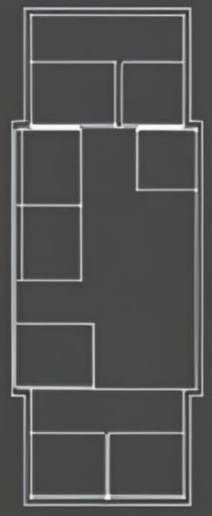

Wider suicide doors allow easy simultaneous entry and exit.
Foldable seats can convert into a perch bench when required.
10° angled on all sides for comfortable ergonomic leaning.

NYTra is designed to seat 5 passengers plus a driver, with a total capacity of up to 8 occupants when standing room is included.

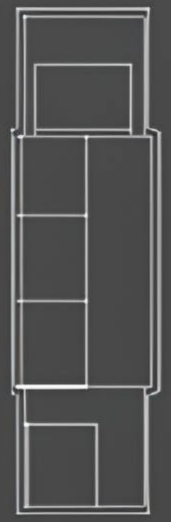




Layout explorations



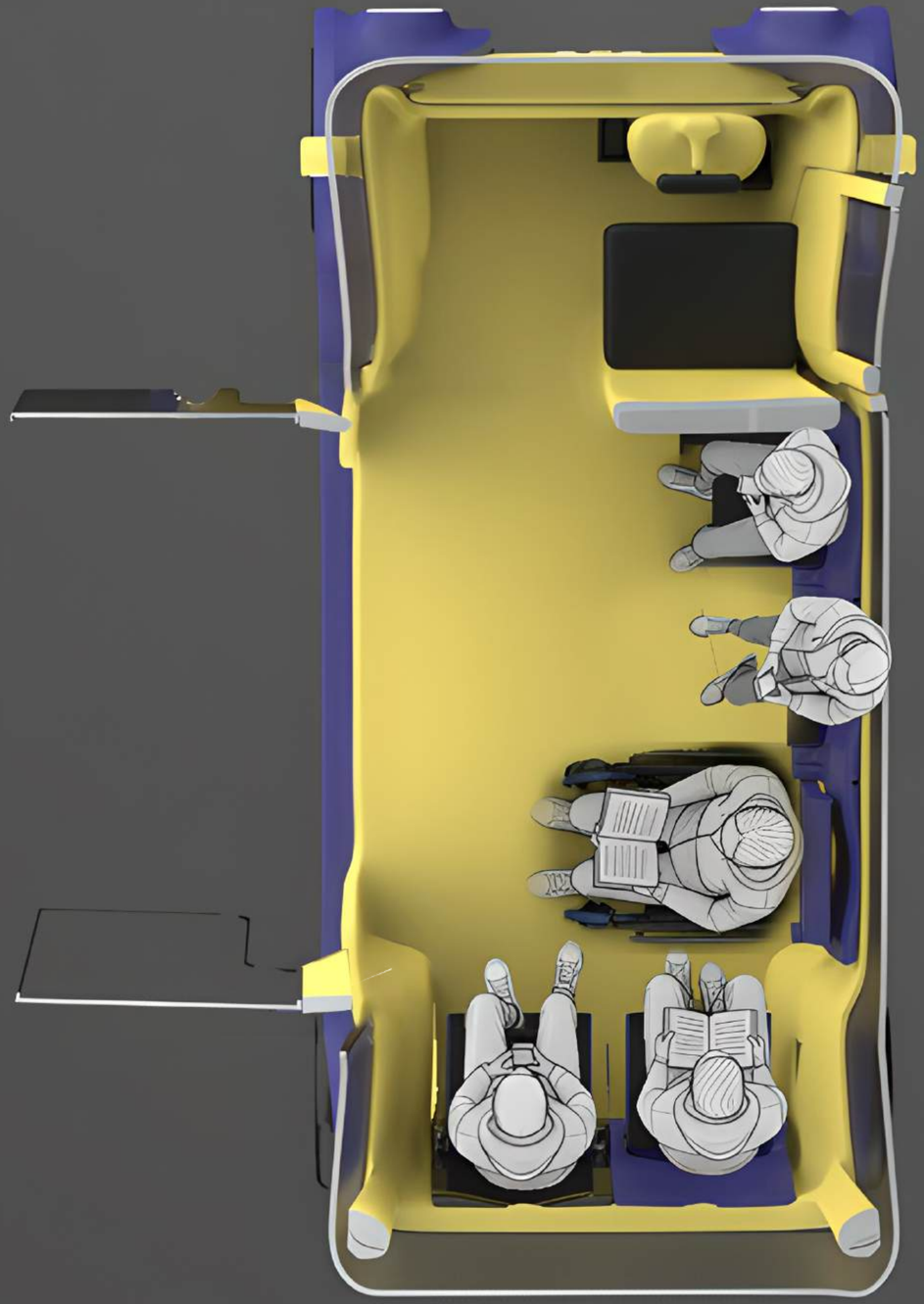
Current

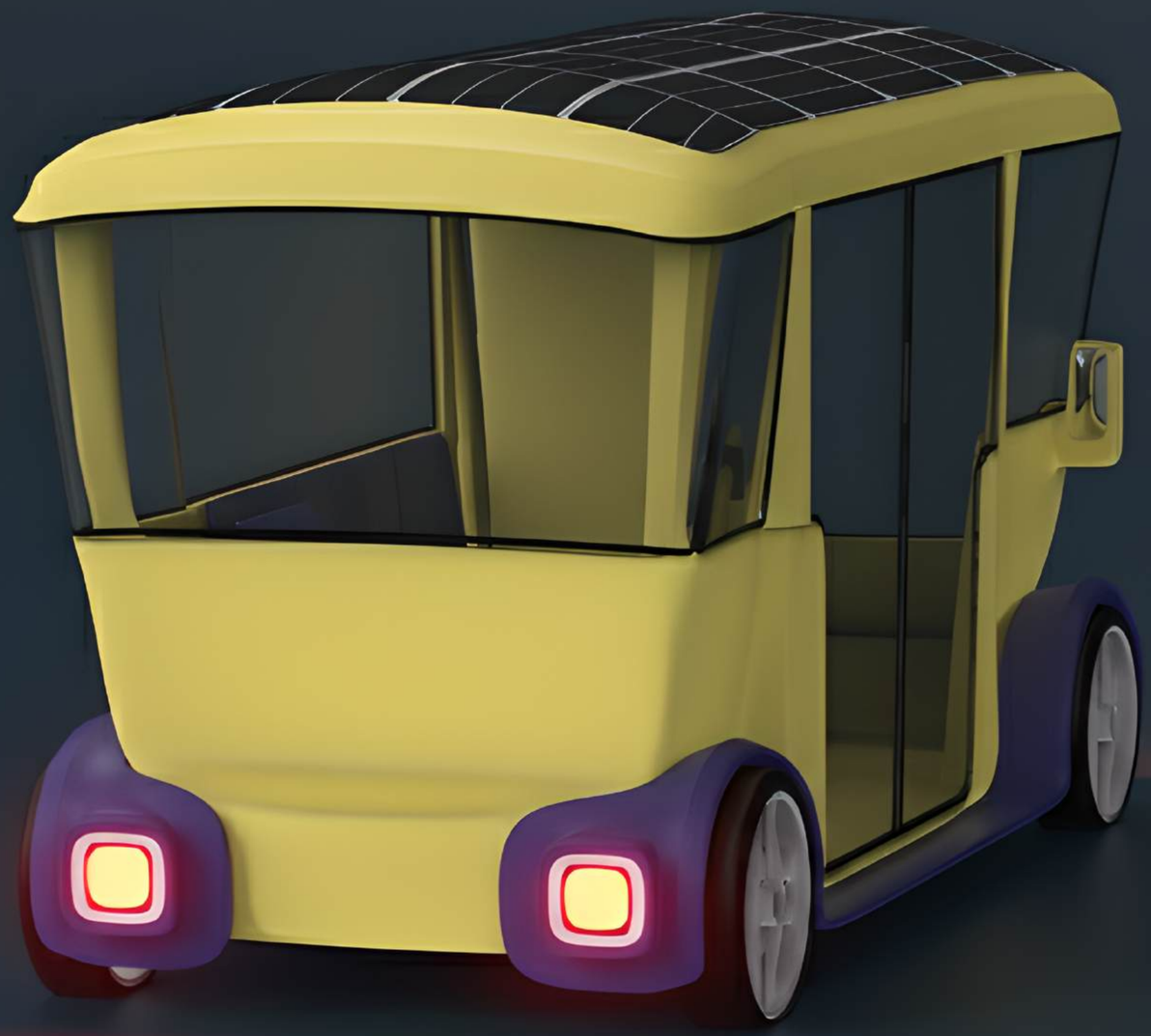


Future option

LAYOUT

This seating layout, developed through multiple layout explorations, accommodates 5 seated passengers plus a driver, with standing room for 3. Seats are designed to double as perch benches, allowing passengers to lean comfortably, while still providing space for occasional wheelchair users.





Category	Value
1. Model Name	NYTra (LSV)
2. Body Material / Finish	FRP body; glossy Yellow with Blue accents; textured FRP bumpers
3. Exterior Dimensions	3791 × 1801 × 2058 mm
4. Wheel Track	1425 mm
5. Interior / Cabin Width	1890 mm
6. Seating / Capacity	5 seats + 1 driver; standing room for 3 (total 8 occupants)
7. Door Type / Entry	Suicide door
8. Curb Weight	≈ 800 kg
9. Payload / Assumed Passenger Mass	≈ 600 kg (8 × 75 kg)
10. GVWR	~1,400 kg
11. Wheelchair Accessibility	Yes
12. Chassis	Skateboard chassis
13. Powertrain	Human-powered + electric assist hybrid
14. Motor Peak Power	6–12 kW recommended
15. Energy Consumption	0.20 kWh / passenger-mile
16. Range	20 miles (vehicle range target); *10 miles for battery sizing example*
17. Battery System	Swappable battery packs
18. Typical Battery Architecture	~20 kWh total; modular (e.g., 10 × 2 kWh modules)
19. Solar Regeneration	25% regeneration
20. Charging Method	Swappable dock system
21. Swap Station	25 mph
22. Top Speed	Pedal + electric assist
23. Acceleration	Independent suspension; hydraulic disc brakes
24. Suspension / Brakes	Transit-optimized tyres (size TBD)
25. Wheels / Tyres	1.0 kWh per vehicle-mile (at 5 passengers)
26. Energy per Vehicle-Mile	~80 miles/day (20 loops × 4 miles)
27. Typical Daily Vehicle Miles	~80 kWh/day
28. Energy per Vehicle / Day	~120–140 kg (for 20 kWh pack)
29. Estimated Battery Weight	0.50 m (assumed)
30. CG Height	1.425
31. Static Stability Factor (SSF)	~55.1°
32. Critical Tip/Roll Angle	FMVSS 500; UN-ECE R100/R10/R66; UL 2580; IEC 62619; UN 38.3; ADA; ISO 26262
33. Compliance & Standards	

Lighting of render optimized through Google Gemini


Render generated in Google Gemini

Future

Future

Geographic Expansion in Cities with high density and limited last-mile connectivity, like **Boston, Philadelphia, or Washington D.C.**, could benefit from a similar system.

Explore CMF to improve sustainability

Experiment with more efficient batteries, solar charging, or regenerative braking.

Track real-time energy savings and emissions reductions as part of a sustainability dashboard.

Finish presentation & send it to Mr. Zohran Mamdani

H **Hitesh Beedu** 10:57 PM (0 minutes ago)
to mamdaniz

Dear Zohran Mamdani,

I hope you're doing well. My name is Hitesh Beedu, originally from Chennai, India, and currently a second-year graduate student in Industrial Design at Parsons School of Design. I apologize for not properly introducing myself earlier.

I am reaching out to invite you to my presentation on **NYTra**, a human-powered, solar-assisted low-speed vehicle (LSV) designed to improve last-mile urban mobility. The vehicle is a proposal for an alternative to the infrequencies of public transportation in boroughs outside Manhattan

I understand you are actively supporting and improving free public transit across boroughs. I am particularly looking for potential developments and contributions from experts like you to help MTA authorities design a **valuable, just, and accessible transit system for all**. Since our work intersects around sustainable, community-focused mobility solutions, I believe this would be a valuable opportunity for us to connect and exchange insights.

It would be an honor if you could attend the presentation, and I would greatly appreciate your feedback. Please let me know a time that works for you, or if a virtual session is preferable.

Thank you for your time and consideration. I look forward to connecting with you.

Link to my portfolio & contact: https://www.behance.net/hiteshbeedu1?locale=en_US
LinkedIn: https://www.linkedin.com/in/hitesh-beedu-57a544382/

Best regards,
Hitesh Beedu

•••

Thank You!

- I want to express my sincere gratitude to Prof. Shaun Fynn and Zac Feltoon for their mentorship and guidance throughout this course. I truly appreciate the balance they provided.
    - Shaun inspired me with the philosophy of design and encouraged me to pursue my passion in the automotive industry.
    - Zac offered practical insights, provided key references, and gave me constructive feedback that significantly improved my project.
- Lew Epstein deserves special thanks for generously sharing his time and providing invaluable principles on sustainability and decarbonization.
- I am grateful to my batchmates for their constant motivation, encouragement, questions, feedback, and support, which pushed me to my limits and helped me pursue my interest within automotive industry.
- Finally, I want to thank Prof. Mark Bechtel, Yvette, and Rama Chorpash for their insightful feedback and guidance throughout the process, which greatly enriched the development of my project.
- Finally Thank you Google Gemini for offering the student account trial in the right time!

https://www.nyc.gov/assets/planning/download/pdf/plans/transportation/peripheral_travel_02c.pdf#:~:text=Except in Staten Island, New York City,accounting for three-fourths of all on-island commuters.

https://www.newyorkfed.org/medialibrary/media/research/regional_economy/charts/Regional_NY

https://www.nyc.gov/assets/planning/download/pdf/planning-level/nyc-population/population-estimates/current-population-estimates-2023-June2024-release.pdf?r=1#:~:text=Jul 2021 -,(-1.2)