



# ROUTABLE AI

## Member Success Case Study

### Routable AI

Suppose a technology was developed that could reduce our carbon footprint and traffic congestion while making it faster, more comfortable, and more convenient for us to travel in densely packed cities. Suppose further that this same technology could efficiently provide transportation to those with mobility needs and critical transportation to essential personnel in times of crisis, and further still, automatically allocate medical patients to hospital beds and facilities based on their individual needs. The beginning stages of such scenarios are already being put into motion, made possible by ride-sharing optimization research, some of which had begun at MIT. Routable AI, a startup out of MIT CSAIL, is working to build high capacity on-demand routing technology, taking ride-sharing to the next level and imagining what truly smart cities can be.

**“Our mission is to make mass transit feel like teleportation.”**

**Menno van der Zee, Co-founder of Routable AI**

#### **About the Company**

Routable AI is a platform that allows for extremely efficient, automated routing of high-capacity cars, shuttles, and buses. The startup company develops advanced fleet management and on-demand routing tools to improve transportation in cities and the ride-sharing experience, which helps passengers, drivers, and ride-sharing companies.

#### **The Challenge**

“Currently, public transportation doesn’t really get you to your destination very quickly. It takes longer to get from point A to point B, and it’s not very comfortable. At the same time, it’s becoming more and more difficult to drive your car in a city — it’s unsustainable; there’s just not enough space in cities,” said Menno van der Zee, co-founder of Routable AI. “What we believe is the solution is to actually use ride-sharing, but use it in a better way.”

Van der Zee explained that the problem with ride-sharing initially is that it has been difficult to find efficient ways to combine multiple passengers in the same vehicle, often taking long detours that inconvenience individual riders. The reason these detours happen is that “it’s extremely complex” to match routes and passengers who want to share a ride. “There are just so many different ways you can combine different groups of passengers in the same vehicle, different routes, and different ways you can assign vehicles to pick up and drop off certain passengers, that when passengers book a ride, it’s very difficult for computers to find in a matter of seconds which vehicles should serve which passengers, and which passengers should be in the same vehicle.”

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## The Solution

Routable AI has developed technology that can find efficient routes for shared vehicles — and large fleets with thousands of vehicles — in a matter of seconds.

“We’re not limited to vehicles that are being shared by three or four passengers,” said Van der Zee. “The technology is already very sophisticated to find routes for vehicles that are being shared by a few people, but we’ve created technology that can also be used for larger shuttles that are being shared by 12 or more passengers at the same time, and still get you to your destination without taking a much longer time.”

The routing engine interacts with riders and drivers in real-time. Riders share ride requests and driver locations with the application programming interface, and the Routable AI platform uses routing algorithms to find the optimal routes. It also gives helpful repositioning instructions to drivers after they finish dropping off passengers.

## Background

As a PhD student, Routable AI co-founder Alex Wallar worked with his academic advisor, CSAIL Director Daniela Rus, to develop algorithms that could make ride-sharing much more efficient. The results of this study, presented in a 2017 paper titled “On-demand High-capacity Ride-sharing via Dynamic Trip-vehicle Assignment,” showed that the new algorithm speeds up service by 20 percent, and that the number of taxis to meet demand in New York City could be dramatically reduced (from 14,000 to 2,000 vehicles) if everyone shared a ride.

“After this groundbreaking paper came out, there was a lot of press on it, and we figured this had a lot of potential to change the way we move about cities,” said Wallar. Months later, he received an email from Van der Zee saying that he was working on a similar project on mobility research at the Singapore-MIT Alliance for Research and Technology (SMART). The two met up in Singapore and discussed the potential of their work.

“I eventually realized that together, we would be able to do a lot more than we would be able to do separately,” said Wallar. They started working on a technology that ran simulations in Singapore and in Manhattan, showing that with 80 percent fewer vehicles in a taxi fleet, they could provide over half a million passengers per day with efficient and comfortable transportation systems by automatically pre-positioning vehicles in high demand and minimize the expected wait time.

Wallar said, “I got to the point where all the effort remaining to make this a practical solution that actually helped society were all engineering challenges and no longer academic challenges. At that point we realized that this is a startup, something that needs to go to market.”

“We saw that this technology could solve our commuting problem,” said Van der Zee. “We started to think, we shouldn’t work on this in academia anymore, because it’s gotten to the level where if we figure out the technology, we should get it into production and see how can we actually deploy this on the streets and make this fleet happen.”

## Engagement Type

[Startup Connect](#)

## Benefit to the Company

Routable AI has benefited from the Startup Connect program through CSAIL Alliances, especially when it comes to making connections.

“Being connected and still knowing what’s going on at MIT and at CSAIL, and seeing some of the other startups that have also sprouted out of research from the same organizations is really interesting and helpful,” said Van der Zee.

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**Benefit to the Company** *(continued)*

Not only do they make industry connections through the program, the company has also talked with Season Two Ventures through Startup Connect, a venture fund company that could “potentially be important” as the startup grows.

Some of the connections are a welcome surprise: Van der Zee, who hails from the Netherlands, got a chance to meet Dutch prime minister [Mark Rutte when he visited CSAIL in 2019](#). “Because of our connections at MIT, we were actually allowed to also be there and to have a very brief chat with the prime minister as well,” said Van der Zee.

**The Impact: Helping During Covid-19**

Routable AI’s technology is also being used to aid others in the face of the Covid-19 pandemic. They are working on ways to provide safer transportation for essential workers and allocating specific vehicles for those on the front lines of fighting the coronavirus. “One of the key things our technology can do is keep track of every single passenger, and so we can also constrain the number of passengers that will be on board a single vehicle at the same time,” said Van der Zee.

Through connections at CSAIL, they also received a request from the Boston Medical Center (BMC) and the Boston Health Care for the Homeless Program (BHCHP) that asked for programming help for a bed management system.

“I stopped everything I was doing, paused the sprint we were on, and responded to their email saying, ‘Yes, we’d love to help.’ Then I started programming,” said Wallar. “By the time they had responded back, we already had a system, a very initial demo, to show them that we could automatically allocate patients into beds using their general criteria.” For example, the criteria could specify that a bed is available only for positive patients, a bed only for patients that are quarantined, a bed near a bathroom, and the like, and the same flags would be assigned to each patient. Using this system, “we want to minimize any mismatch in the allocation and make sure patients don’t get ignored.”

Wallar explained that they were able to quickly solve this problem because “we had all the infrastructure in place, code that tells me how long it takes to go from A to B. We also already have libraries that we’ve developed to solve optimization problems of this kind. And thirdly, we had the expertise to model these problems appropriately.”

They modeled the allocation problem as an optimization problem with an objective function that they wanted to minimize, as well as a set of constraints. “The constraints in this model were that a bed can only be occupied by at most one patient, and a patient can only be assigned to at most one bed. And what we were trying to minimize was the overall cost of that allocation.” For example, they add a penalty for ignoring patients. If a patient is high-risk pending results, for instance, there is a higher cost for that patient being ignored than a patient who is low-risk pending results. “We had all these tables to determine what the best allocation would be, and that was given by live feedback from the BHCHP, from nurses on the ground there,” said Wallar. The platform is currently still under development.

“This problem, at its core, is exactly the same as optimizing routes for vehicles,” added Van der Zee. “With vehicles, you know you have a certain number of vehicles and seats within those vehicles available, you know that you continuously get incoming requests from people to get rides, and we want to make sure we use all of those vehicles in an optimal way, so that we can transport as many people as possible in the fastest possible way. So that’s why these two projects are related, and why Routable AI and the engineering team were able to do it and so quickly make this work. Because at the core, it is the same problem.”

**A Vision for the Future**

Aside from using their core technology for optimizing routes for large fleets of shared vehicles and transporting passengers, they are also looking to expand its applications.

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### **A Vision for the Future** *(continued)*

“What other things are moving around in cities?” asked Van der Zee. “You could look at food or parcels, for example, and the logistics of that. So can we next — when we were only transporting passengers — at the same time, with the same vehicle (so with a subset of that fleet), also start transporting food and parcels?” He envisions a universal fleet that covers all road transportation in any city.

He also wants to continue to improve transportation for passengers by integrating fleets with longer trips. If you were traveling from Boston to New York City, for example, you could book a ride and the Routable AI system would automatically tell you, “this is the perfect shuttle to pick you up at your house, which will bring you to this particular train station from this T stop.” It could then take into account the train ride and make sure that a shuttle is there waiting for you when you arrive at the train station in New York City. “All of this would be integrated,” said Van der Zee, “which is one extra step of complexity, a next step to make that happen.”

### **Read more about the company**

[Routable AI Uses Routing Technology to Help During COVID-19 Pandemic](#)