Using smart devices to schedule on-demand public transportation can save time and money

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Suburban residents often face challenges receiving reliable and
accessible bus transit—riders often complain about infrequent schedules and long waiting times. Often, transit agencies are unable to provide additional buses because population density in such areas is usually low.

**On-demand transit (ODT)** is an innovative transportation approach that enhances the accessibility and quality of service while reducing operating costs.

Despite the rapid growth of ODT services in various cities across Canada and the United States, the mechanism of placing ride-requests with many ODT service providers remains reliant on mobile applications, telephone calls or websites.

But privacy concerns may lead passengers to be reluctant to use mobile applications for booking a ride. And individuals without access to phones face barriers in accessing these services.

**Real-time information**

Our research investigates the potential of ODT by simulating a novel configuration that uses smart devices installed at bus stops. Smart City Network (SCiNe) devices are used for local communication with passengers that also provide them with real-time information. Prototypes of SCiNe devices, developed by BusPas, Inc., have been installed at bus stops in Montréal and Laval, Qué.

SCiNe devices provide useful information, such as estimated arrival time, potential delays and the number of passengers on transit services. Providing such real-time information can improve passenger satisfaction while enabling transit agencies to make data-driven decisions that optimize operations.

With such a proposed configuration, passengers at a bus stop equipped
with a SCiNe use the device to request a ride. Upon receiving a request from the passenger, each SCiNe sends the transit agency information, including bus stop location, request time and destination location.

The agency also receives real-time data from the fleet of vehicles, mainly vans, traveling across the network. This data allows it to be continuously aware of the status of vehicles in terms of availability, current position, requested locations and routes.

**Optimizing schedules and routes**

The real-time data received from vehicles and SCiNes are transmitted to the dispatching algorithm.

The dispatching algorithm is responsible for dynamically matching passengers to available vehicles by taking different parameters into account such as wait and detour times. The algorithm also considers how two or multiple requests can be addressed simultaneously.

When allocating rides to passengers, the algorithm considers vehicle availability, the proximity of passenger location and the expected duration of the trip. Once a vehicle is assigned to a passenger, the algorithm determines the optimal route for the vehicle to reach them. In order to select the best route, it takes real-time traffic conditions, distance and estimated travel time into account.

The dispatching algorithm assigns vehicles to passengers, and passengers receive personalized information through the SCiNes, which includes the estimated waiting time. Vehicles also receive information on the passengers who need to be picked up and the bus stop locations.

**Implementing on-demand services**
The proposed configuration was implemented to simulate ODT service for the first-mile, which is the initial leg of a commuter's journey. Terrebonne, a suburb of Montréal, was selected as the study area, and the proposed ODT service was compared with the existing bus transit service operating there.

Our simulation results suggest that if such an ODT service were available, transit users would result in reduced travel times compared to using a regular bus service. ODT streamlines getting around on public transit, making travel quicker and smoother.

Were such a system to be developed and adopted on a large scale, ODT could have a big impact on the organization and performance of suburban transit provision. Using innovative technologies, such as SCiNe devices and sophisticated dispatching algorithms, ODT offers a potential method to improve accessibility, reduce commute times and enhance the overall experience of transit users.

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