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Reimagining How Cities Can Leverage Cloud AI Platforms for Urban Mobility Solutions

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When it comes to designing transit and transportation solutions that reduce traffic congestion and improve on-time arrival rates, we seem to have a problem. It seems we are focused on all the wrong things. It's not all about building a better vehicle, or the technology that is used inside the vehicle. And it's definitely not about building bigger or more roads and bridges.

It's about re-engineering the way in which cities move people around. This is important because personal vehicles, mass transit, ride-sharing vehicles, commercial vehicles, emergency first responders, and pedestrians are all trying to get from point A to point B in the most efficient manner.

Traffic Solutions go Beyond Bigger Roads

Better in-vehicle technology, faster cars, autonomous cars, and more roads will not solve our problem individually. The solution is bigger than each of these, and it must have the ability to singularly connect, monitor, and orchestrate everyone's movements in a holistic, technology-agnostic manner.

One look at New York tells us we're learning this right now. The Governor recently ditched the city's planned congestion pricing launch, where drivers entering Manhattan would have faced an additional $15 surcharge to use local roads. This was going to be unfair to local residents and businesses, who would have been taxed over and over for roads they helped to initially pay for.

As cities worldwide grapple with ever-worsening traffic congestion, congestion pricing has become a preferred solution among urban planners and policymakers. While the benefits of congestion pricing are frequently touted, its adverse effects on local communities and the potential to exacerbate inequities in the transportation system are often overlooked. Advanced technology is proving there is a much better way to solve today's modern traffic issues, even in some of the most heavily populated cities.

Advanced Transportation Systems Being Implemented

Intelligent transportation systems (ITS) and connected vehicles are the future of reshaping this infrastructure. ITS systems are the application of sensing, analysis, and communications technologies to ground transportation to improve safety, mobility, and efficiency. While this technology shows great promise, the systems are only as good as the platforms on which they run.

To fully realize the promise of ITS and connected vehicles, transit agencies are now revisiting Transit Signal Priority (TSP) systems in the hopes of restoring route reliability and on-time performance. Over the last few decades, TSP systems haven't evolved much from being a transmitter on buses that send messages to receivers installed on traffic signals. The hardware cost for both signals and buses is quite high and annual maintenance is necessary to guarantee operation. Furthermore, it's hard to determine whether the system is working because the equipment generally doesn't produce event logs. When making such a large capital investment, it is very important to know whether the system is working so further expansion can be appropriately determined.

In today's age of highly reliable large-scale communications access, there exists the opportunity to eliminate the hardware cost of TSP solutions while maximizing the investment on current solutions. Many of today's signal controller firmware vendors have software functionality to facilitate the function of placing virtual priority calls. The information needed to place these virtual calls can be found at the transit agency.

To better manage fleets, agencies typically have implemented tracking devices on each of their vehicles to report to their computer-aided dispatch and automatic vehicle location (CAD/AVL) software. With vehicle locations known in near real-time, cloud-based software and networking driven by AI and machine learning is now being used to bridge the gap between transit vehicles and city signals to facilitate transit priority in a more reliable, sustainable and intelligent way.

The journey begins with a traveler's intent to get from point A to point B using the mode(s) that satisfy their needs for cost and convenience. An app from a service provider or a Mobility as a Service (MaaS) app for a multi-modal trip could be used to make the booking. A mobility service provider, such as a bus system, ride-hailing service, robotaxi, or other public or private provider, enables the journey. When a journey is booked, the mobility service provider needs to decide which vehicle to send, when to send it, and what route it should take. To do so, the mobility service provider uses a cloud-based platform that assigns missions to vehicles' self-driving technology or drivers' vehicle receptors. These vehicles can be personal cars and trucks, ridesharing vehicles, emergency units, buses, etc. The platform considers a variety of factors and sends missions that minimize passenger wait times and deadheading for service providers while also meeting their requirements for vehicle utilization and passenger convenience.

Taking a Control Tower Approach

It may be beneficial to think of this approach as a car-specific version of an air traffic control tower. Even though many different brands, sizes, and shapes of vehicles are used for air travel, air traffic control is still necessary to direct them safely from gate to gate both on the ground and in the air. Both scheduled and on-demand services are offered by commercial airlines and private aircraft, respectively. Air traffic controllers receive service requests from service providers with directions for the vehicles and pilots, including where to go, when they can go there, and which route to take. Service providers submit their reservations or flights with scheduled departure and arrival times.

On the ground, a similar cloud-based "control tower" technology platform can be used to systematically view each mobility provider (car, bus, rail, etc.) and assign signals to each so that they all move in constant harmony and rhythm with each other.

Key to this platform is the integration of traffic signals and intersections with the flow of traffic, which of course changes based on events, work hour vehicle demand, weather patterns, or emergency situations, such as the prioritization of emergency response vehicles that need to move freely through certain corridors to get to injured people or a fire. Much of this is already in use in several cities across the U.S., and all driven by AI.

How AI Improves the Flowof Traffic for Everyone

AI promises to streamline traffic flow and reduce congestion for many of today's busiest roadways and thoroughfares. Smart traffic light systems and the cloud technology platforms they operate on are now designed to manage and predict traffic more efficiently, which can save a lot of money and create more efficiencies not only for the cities themselves, but for individuals also. AI and machine learning today can process highly complex data and traffic trends and suggest optimum routing for drivers in real-time based on specific traffic conditions. By integrating everyone's real-time routing information, cloud-based traffic management systems can now optimize traffic light timing to the true needs of traffic.

Today's recognition algorithms offer enhanced insight on the mix of density, traffic, and overall rate of flow. Furthermore, these optimized algorithms can leverage data points by region resulting in a streamline pattern to reduce traffic problems while redistributing flow more optimally. Municipal traffic management systems can then make better decisions, and the control system has a much higher degree of failure tolerance as was previously demonstrated in legacy hub-and-spoke systems.

Enabling Smarter Commercial Transportation Systems

ITS and TSP technologies also represent a unique, advantageous approach to improving the efficiency of commercial vehicle fleet operations. The control tower approach can enhance delivery times, reduce fuel consumption and emissions, improve safety, and optimize route planning. In doing so, these technologies can significantly contribute to a more efficient and sustainable commercial infrastructure for cities. As urban areas continue to grow and evolve, the adoption of ITS and TSP will be crucial in meeting the demands of modern logistics and ensuring the smooth flow of goods and services.

The combination of AI, machine learning, and cloud-based technology has great potential to not only improve the throughput of signalized intersections but reimagine it altogether. This advanced technology is already in use with transit agencies and emergency first responders where it is demonstrating a connected, coordinated future between GPS, navigational apps, connected autos, and even taxi and ride-sharing services, to efficiently combine mobility data into a traffic control system based on real-time information.