Traffic Management and IoT in the Smart City

Traffic congestion in urban centers is a problem. According to INRIX, a global leader in in connected car services and mobility analytics, the average American driver lost almost 100 hours every year due to congestion before the pandemic. Furthermore, when INRIX studied traffic congestion worldwide, they found that drivers lost up to 191 hours in traffic before the pandemic. As workers travel back to offices, the temporary respite that the pandemic granted will disappear. Increasing population in cities coupled with growing demands to meet sustainability goals are leading cities to reevaluate traffic management as part of their overall transportation strategies.

Fortunately, technologies such as the Internet of Things (IoT) are helping speed the process along. IoT sensor-embedded devices can relay data from cars, bridges, roads, traffic, and roadside lights to central aggregation platforms that can use this data to ease congestion both in the near and long term.

How IoT Helps in Traffic Management

Sensors in vehicles that enable vehicle-to-vehicle communication (V2C) and vehicle-to-infrastructure (V2I) communication can alert traffic management authorities in real time when there's a congestion problem. Alternate routes can come into play—as in the popular navigation app, Waze—and cities can close or open high-occupancy lanes to alleviate congestion. Cities can also study congestion patterns, especially due to newly configured commuting habits in the wake of the COVID-19 pandemic, and plan on construction projects or other maintenance tasks around peak congestion times.

Parking availability and access to those parking spaces are vital components of IoT-driven traffic management efficiencies. With IoT sensors in garages and other parking units, vehicles can access real-time information about availability, pay for parking in advance, and use these assets efficiently. GPS systems in the driver's vehicle guide the driver to the spot. Directing drivers to the closest parking spots seamlessly saves both time and fuel instead of cars having to cruise around city blocks endlessly to find a spot.

Using IoT, cities can levy tolls intelligently and make them more granular depending on where the car travels and during what times. Cities can seamlessly collect congestion pricing fees during specific windows. The state of Oregon, for example, is exploring a pay-per-mile toll pricing model that will supplement a gas-based tax. Sensors in the car will record where the vehicle travels to calculate the toll. A more granular implementation of this version will also look at time windows to potentially add congestion fees.

Smart traffic signals, which can "talk" to each other, exchange data about congestion and vehicular movement, feed on IoT technology. Sensors embedded in traffic lights can not only relay information about real-time traffic conditions it can monitor surrounding areas for congestion or off-policy behavior.

Traffic engineering studies vehicular movement patterns determine the synchronization of lights and when and how to vary these commands. With IoT, these directions can be implemented on a more case-by-case basis and in real-time. Cities need not apply a one-size-fits-all blanket approach to the problem. Drivers traveling in non-peak hours need not idle at a red light forever based on pre-existing schedules. Synchronized traffic movement saves idling time and fuel.

Data from IoT-based devices can lend credible support to government policy related to traffic management. It also gives citizens transparency into the process as the miles logged when and where show up in a platform that everyone can access. All stakeholders are on the same page and work off the same data.

The Road Ahead

The challenges related to smart traffic management relate to the technology constraints concerning the "smart" aspect of the equation and governmental policy that will need to kick into place for smooth execution.

For traffic lights and other smart aspects of traffic management to work in real-time, cities will need connectivity in real-time. The demands on network infrastructure will

increase as more aspects of city components become IoT-enabled. A reliable wide area network (WAN) will be key to realizing the goals of smart traffic management. 5G technology will also help.

Who owns generated data and how to integrate it with existing systems will complicate the execution. Governmental bureaucracy is likely to present obstacles, so smart technology vendors will need experience in bridging the private-public sector gap.

City governments will have to lay the groundwork for integrating advanced technologies into their existing management systems. While attending to privacy and security legislation, figuring out what data to capture is just one layer to configure. Governments and smart technology providers will also need to integrate data layers to access insights from one central dashboard to act on them in real-time.

These challenges are already being addressed as smart city initiatives worldwide, like in Columbus, Ohio, demonstrate. By making "things" talk, IoT has the potential to make traffic management—and a variety of other city functions—smart. The net result is a better quality of life for citizens, budget efficiencies, and a lowered carbon footprint. It's a win-win on all fronts.