Crowdsourced traffic data can help ease time stuck in traffic, says transport expert

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A UNSW transport expert may have the found the solution to one of the biggest pet peeves of drivers: sitting in traffic.

Prof. Vinayak Dixit, from UNSW School of Civil and Environmental Engineering, has developed traffic signal technology that takes into account traffic congestion in real-time using data from navigation mobile apps.

These apps, such as Google Maps, Apple Maps or Waze, provide its users with real-time information on travel time, speed, location and traffic delays. These data types are used to understand mobility behaviors and congestion patterns at a considerably low cost.

"The current traffic signal network heavily relies on the sensors to determine when and how often green lights are allocated at each junction," he says.

"However, the problem with this is that they don't account for the time it takes for a driver to get from traffic junction A to traffic junction B.

"So you may be driving along a busy, or quiet, road and end up stop at every traffic light. This is because it doesn't take into account the distance you have to drive to get to the next traffic light, even though there may not be any cars on the road.

"We know that this information is already available on the mobile navigation apps that already help us get around—so why not use it to our advantage? And we've proven it can help ease congestion during peak hour, too.

"Inadequately timed traffic signals are a one reason why drivers sit in in traffic longer than they should—often resulting in increased travel times."

How do traffic signals work?

Traditionally traffic lights can be programmed to signal differently based on the movement of vehicles and people in that intersection. They rely on technologies such as sensors and cameras to help determine when the traffic lights should change.

The sensors, or loop detectors, are built into the road and can detect anything metallic such as a motor vehicle, motor bikes or buses and trucks. The signals are programmed with a max-pressure, or backpressure, which are routing algorithms aimed to minimize the queuing backlog in the network from one traffic signal timeslot to the next.

Prof. Dixit says the network also utilizes cameras to capture and analyze how big queues are at junctions however, the data is only limited to that particular junction.

"Traditionally, the high cost and limited access to delay data meant that most adaptive traffic signal systems relied on volume and queue length data," he says.

"In a traffic network that is based on speculative demand and a specific signal control policy, the network is only considered stable if the average number of vehicles in the system over time keeps within the expected volume.

"However, if the volume of vehicles is greater than expected, it becomes an unstable network—and the available capacity, which is partially determined by the traffic signal timing, is insufficient for the average demand.

"This is where we start to see a build-up of congestion happening on our roads."

Robust results overseas

Prof. Dixit and his team have proven using crowdsourced data reduces traffic congestion.

They conducted field experiments at 30 intersections across India and Indonesia—countries known for their bustling road networks.

Most of the intersections had a similar lane configuration resulting in near identical traffic flow rates.

A low-cost and open-source motherboard controller was installed at those intersections and received live input from Google data in five-minute intervals.

The controller was programmed to manage conflicts at traffic junctions and assign longer green lights based on the data collected.

The findings showed up to 37% reduction in delays.

"Ultimately, we want to ask Google or Waze, what is the delay between each intersection? And what is the travel time between the two?" says Prof. Dixit.

"Based on the live data, we program the signals to allocate more green lights to drivers in a certain area because there is a bigger build-up of congestion."

He says the technology is also a fifth to a tenth of the cost of current traffic control systems—requiring less maintenance, too.

"And because we're reducing congestion, there is an 8% decrease in car emissions because drivers are spending less time on their commute."

Paving the road for less congestion

Road traffic signal standards and regulations set by the governing transport agency of each state and have historically been built around sensor technologies. These standards control the design, construction, installation, maintenance, and replacement of traffic control signals.

Prof. Dixit says implementing the technology is only the first step in easing congestion and improving the driving experience for road users.

He says, "When forward planning traffic regulations, including the levels of quality we can expect from the data.

"We still need to figure out what level of accuracy we should expect from the data.

"Of course, we can't expect the data from these navigation apps to be 100% accurate all the time and we need to find out what level everyone is comfortable with.

"We don't want to abandon the traditional physical sensors. It's about expanding the scope to allow for and include other streams of data in the regulation."

Prof. Dixit and his team are currently collaborating with Sydney Coordinated Adaptive Systems (SCATS) to see how they can commercialize the technology and implement it here in Australia.

"I'm a firm believer that any data collected by drivers should be democratized to benefit all drivers behind the wheel," he says.

"There is an opportunity to tap into data that road users are already providing. If it's coming from us, it should be used by us."