NAIST® Research Highlights

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Transit systems

Swirl protocol cuts congestion

A system that directs traffic to circular routes in city centres reduces journey times

Poorly timed traffic lights are a cause of congestion in cities — wasting drivers' time, increasing air pollution and fuel consumption. A protocol, known as GreenWave, exists for controlling lights to cut congestion, but its effectiveness in city centres is poor. Now, researchers at the Nara Institute of Science and Technology (NAIST) have found a way to use GreenWave that, in simulations, significantly reduces journey times[1].

> **"The aim of GreenSwirl is to pump the traffic out of the city centre into the circular GreenWaves that surround the city."**

Most traffic lights work independently of those immediately before and after them, which means cars get stopped at red signals repeatedly. The GreenWave system makes lights on a major road turn green in a timed sequence, allowing a continued flow of cars across several lights without having to stop. But trials of the protocol in several cities worldwide have been disappointing — traffic crossings become congested, and queues of vehicles build up at intersections, waiting to turn.

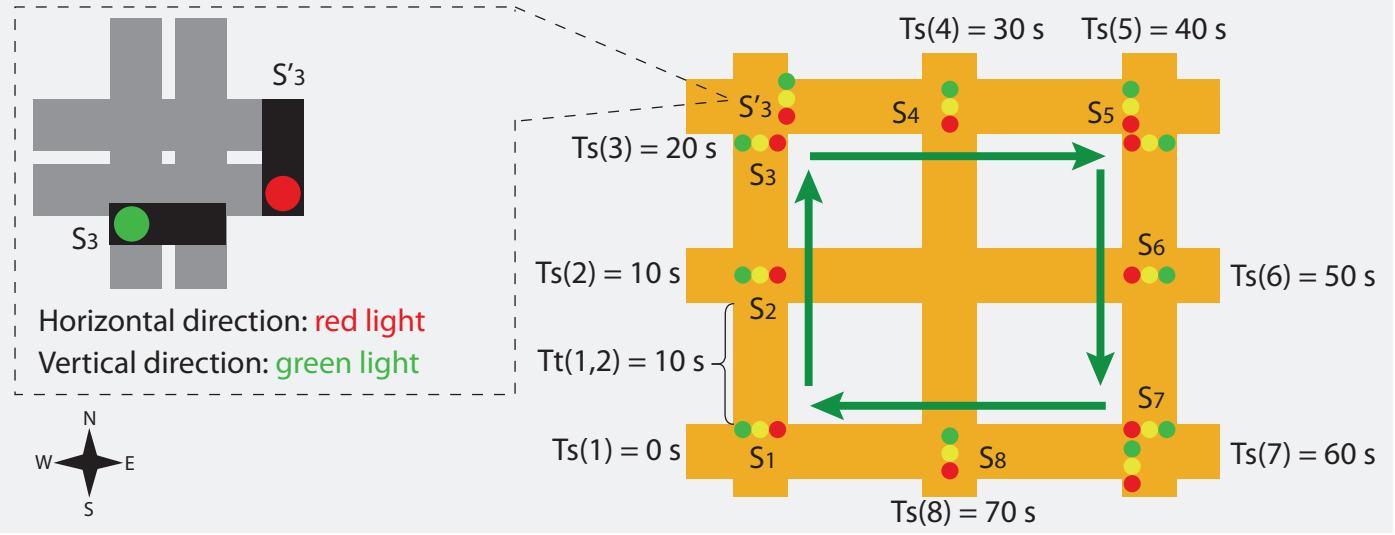
"GreenWave is usually implemented in the main streets going through the city centre. But the amount of traffic soon exceeds the capacity of the street, and any benefit is lost," says Naoki Shibata of NAIST. He and his colleagues had the idea of applying GreenWave, not to straight routes, but to circles surrounding the city centre. They call this approach 'GreenSwirl'.

"The aim of GreenSwirl is to pump the traffic out of the city centre into the circular GreenWaves that surround the city," says Shibata. Introducing GreenSwirl in isolation will not work, however, he cautions. "People will be reluctant to go through the swirls because they will see them as a detour." The answer is to jointly implement a navigation system, 'GreenDrive', which recommends the fastest route through the city to drivers with GPS systems in their vehicles. The team ran simulations, taking Manhattan in New York as an example. Using GreenSwirl alone reduced average travel time by 10–20 per cent; moreover, adding the GreenDrive navigation system reduced travel time by as much as 60 per cent in some scenarios.

Shibata thinks that, although drivers may initially be reluctant to divert to the swirls, they will soon learn that they will get to their destination more quickly. "Our objective is to smooth out the traffic over the city. The capacity of the whole network is maximized when the amount of traffic on each road segment is slightly less than its capacity. The best way for a driver to go will then be the route the navigation device suggests."

Reference

1. Xu, J., Sun, W., Shibata, N. & Ito, M. GreenSwirl: combining traffic signal control and route guidance for reducing traffic congestion. *Proceedings of the IEEE Vehicular Networking Conference (IEEE VNC 2014)*, 179–186, 2014.



Poorly timed traffic lights are a cause of congestion in city centres, but a system that directs traffic to circular routes can drastically reduce journey times.

More information about the group's research can be found at the Foundation of Software Laboratory webpage:
http://ito-lab.naist.jp/mediawiki/index.php/Main_Page/en