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“URBAN MOBILITY, ROADS NETWORK OPERATION AND ITS APPLICATIONS”

Utility-based Urban Traffic Control System

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Challenge

The research aims to carry out a system to control signal timings by a utility function which considers different impacts of urban traffic control (UTC) systems and based on real-time short-term prediction on traffic patterns on road. So that the system can perform better and more traveller oriented and environmental friendly.

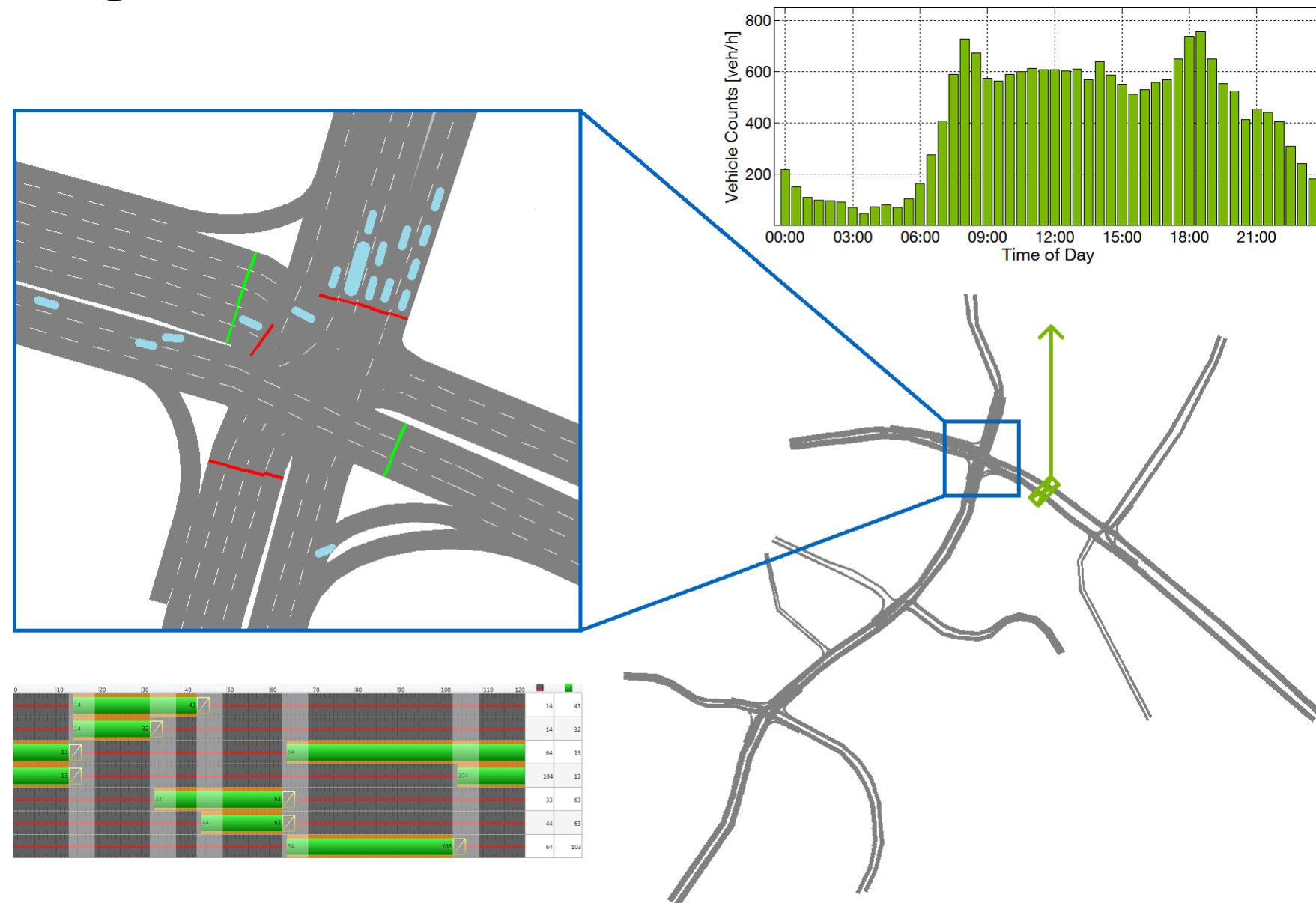
By implementing the utility function, the system should optimise the traffic signal timings for different purposes other than optimising vehicle flow, e.g. to optimise passenger flow, reduce totally emission and etc..

Content

Current UTC Systems

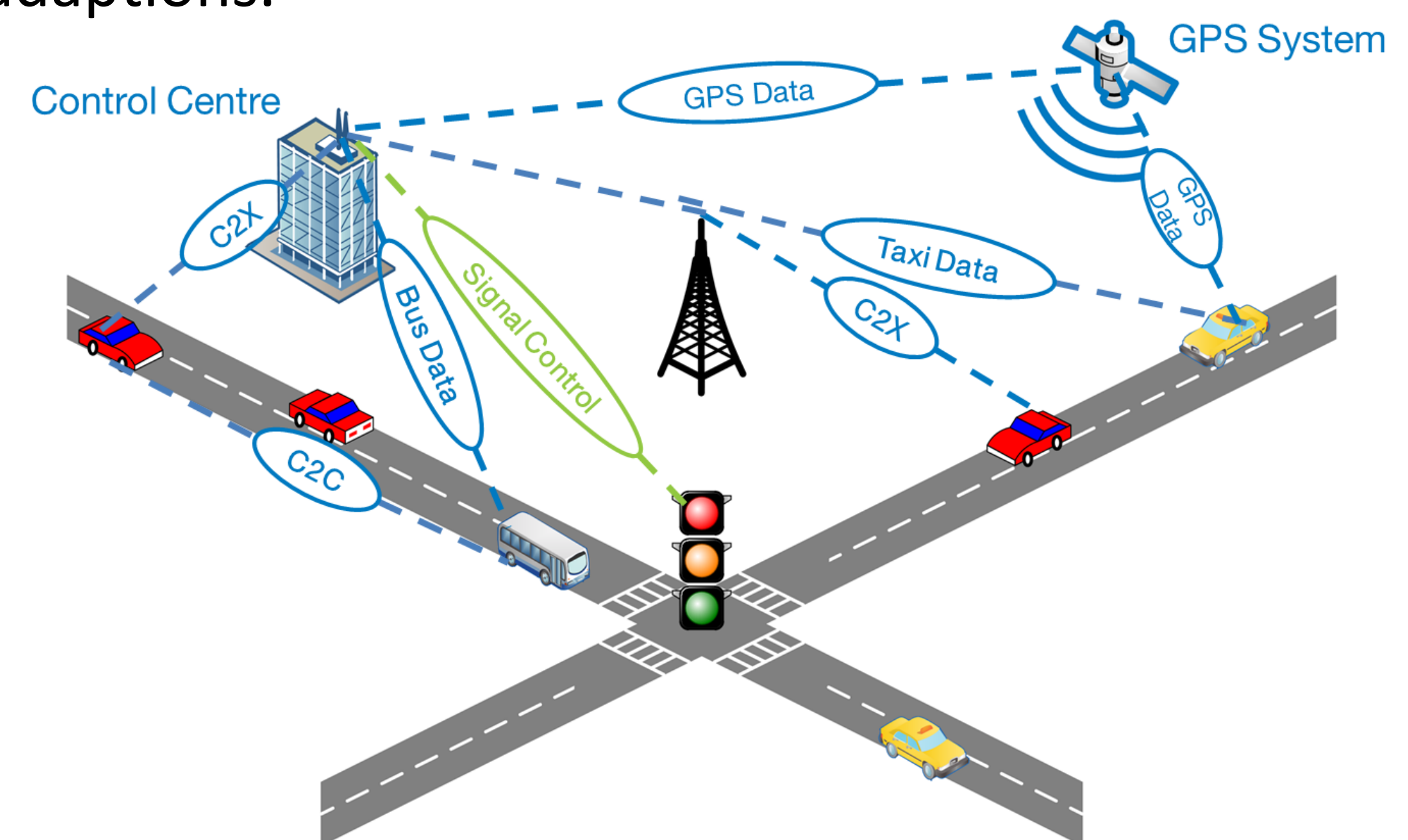
Traffic signal is one of the most important elements in the urban transport system. However, current UTC systems focus narrowly on vehicle flows. Some of them uses only historical data. These limits result in the following drawbacks:

- Other impacts, e.g. energy consumption and local emissions are not mainly considered.
- Some systems react to sudden on-road change slowly due to lack of real-time detection.



State-of-Art Technologies

Some state-of-art technologies can be used to improve UTC performance. For example, C2X/C2C and GPS systems can be used to estimate traffic conditions and hence to improve signal timing adaptations.



Impacts of UTC Systems

Economical

- Energy Consumption
- Driving Cost, e.g. expressway tolling, congestion penalty fee



Traveller-related

- Value of Time
- Value of Service Reliability
- Willingness to Pay
- Comfort



Environmental

- Local Emission, e.g. CO₂, CO, PM_{2.5}, NO_x
- Noise



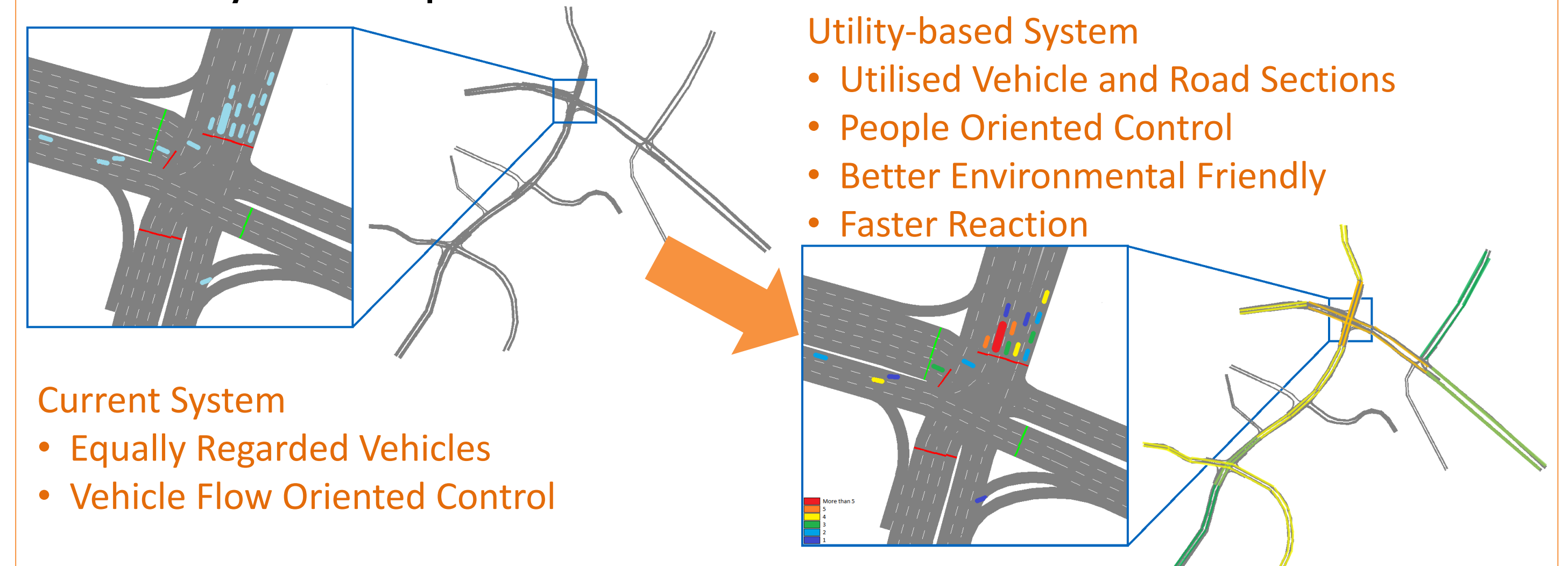
Vehicle-related

- Occupancies
- Vehicle Delay
- Vehicle Stops
- Public Transport factors, e.g. lateness, service reliability



Utilisation of Related Factors

The utility-based UTC system utilises different impacts of different vehicles and allocate utility points to vehicles. The system takes full advantage of state-of-art technologies to make a short-term forecast on traffic condition, and then to calculate the utilities. Signal timing will be adapted accordingly to optimise the utility and improve the traffic condition.



Outlook

The utility-based UTC system can be used to achieve a wide range of goals, which depend on the weight of each factor. One example is that the system may help to achieve passive bus priority. In cities without bus priority, the system may recognise buses as normal vehicles with higher occupancy after the weight for occupancy is raised, and thus link with buses will gain more utility and be served first. Another example is that the system may help to minimise the environmental impacts. Trucks with higher local emission and higher fuel consumption can be detected by the system and if higher weight of environmental factors is placed, the link with trucks will gain more utility and be served first to reduce additional local emission and to reduce fuel consumption.

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