



By Transparentor

Thailand

Deep Reinforcement Learning for traffic lights timing to minimize Commuting Time

Transparency is an act of government sharing the nation their data. So, their citizens and different sectors of those governments can create solutions ,or business from that data which it would be hard/impossible before.

Study the **international research** to solve this problem

MIT News

[Browse](#) or




Photo: Jose-Luis Olivares/MIT

[<](#) [>](#)

Traffic lights: There's a better way

MIT researchers develop an improved system for timing of urban lights to minimize commuting times.

David L. Chandler | MIT News Office
July 7, 2014

[Press Inquiries](#)

Anyone who has ever driven a city street and been frustrated by having to stop again and again for red lights has probably thought that there must be a better way. Now, researchers at MIT have developed a means of computing optimal timings for city stoplights that can significantly reduce drivers' average travel times.

Existing software for timing traffic signals has several limitations, says Carolina Osorio, an assistant professor of civil and environmental engineering at MIT. She is lead author of a forthcoming paper in the journal *Transportation Science* that describes the new system, based on a study of traffic in Lausanne, Switzerland.

"Usually in practice, when you want to time traffic lights, traditionally it's been done in a local

RELATED

[Carolina Osorio](#)

[Department of Civil and Environmental Engineering](#)

[School of Engineering](#)

ARCHIVES

Reference: <http://news.mit.edu/2014/traffic-lights-theres-a-better-way-0707>

If you ever come to Bangkok.
You may have seen these things



AVERAGE PEAK HOURS
SPENT IN CONGESTION

RANK
COUNTRY

GLOBAL COUNTRY RANKING



Countries are ranked by a weighted average of their cities' peak hours spent in congestion. Countries around the world are challenged to keep congestion levels in check while economies develop. Data-driven insights can help leaders make decisions on where investment is needed to support growth.

All data and insights provided by INRIX

Wasted time average

61 hours/year/person

Fuel lost/year

1810 million Baht

Total time value loss/year
(Only people locate in Bangkok)

8,154 million Baht

Total value loss for traffic jam

9,964 million Baht



By person

Assume working 8 hr/day

300 Baht

Lost value

$61 \times 300 / 8 = 3,564,635$ Baht

By the whole city

Fuel lost

0.025 litre/minute

Latest fuel cost

28 Baht/litre

Population in city

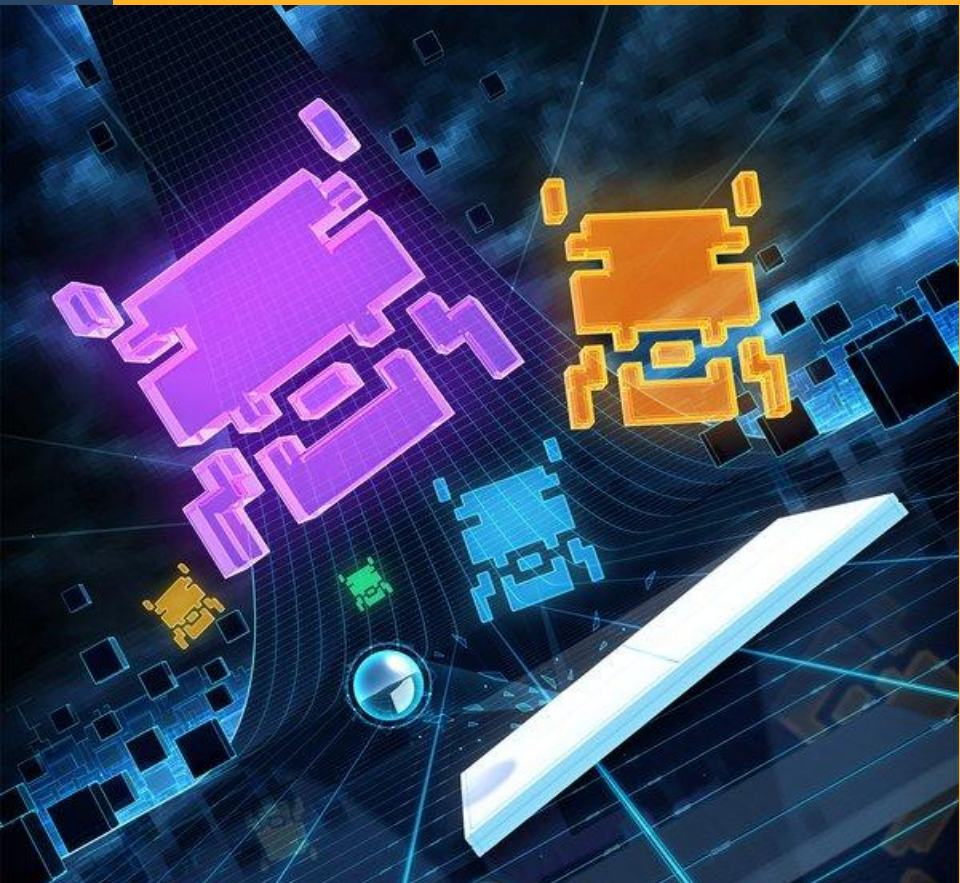
1782371.5

Reference:

<http://inrix.com/resources/inrix-2016-global-traffic-scorecard>

<https://www.quora.com/How-much-gas-does-a-car-burn-per-hour-while-idling>

<https://www.edf.org/climate/reports/idling>



Solutions

DQN + Simulation

Why deep reinforcement learning?

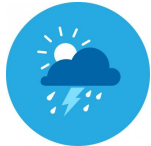
- Can learn transition probability by trial-error
- Can handle unexpected situation



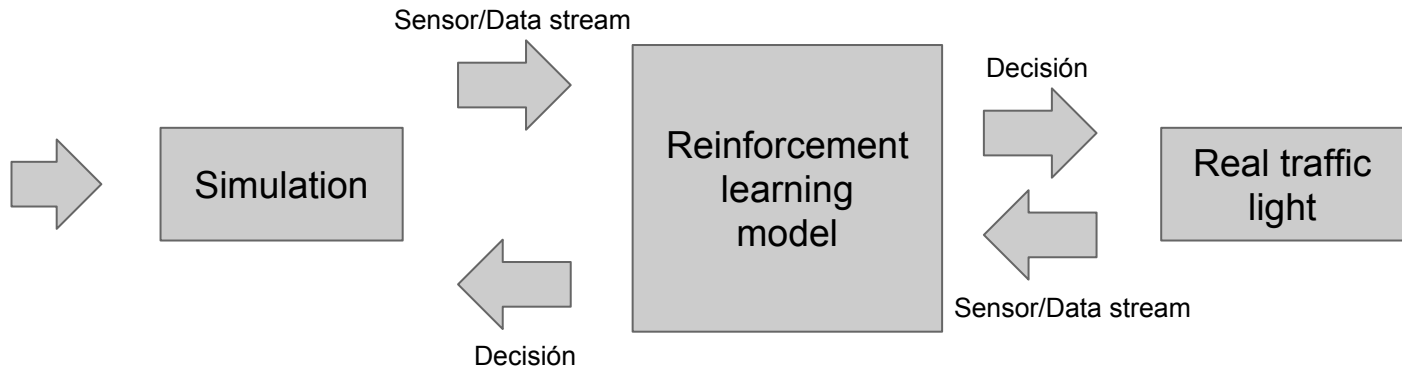
Datasets

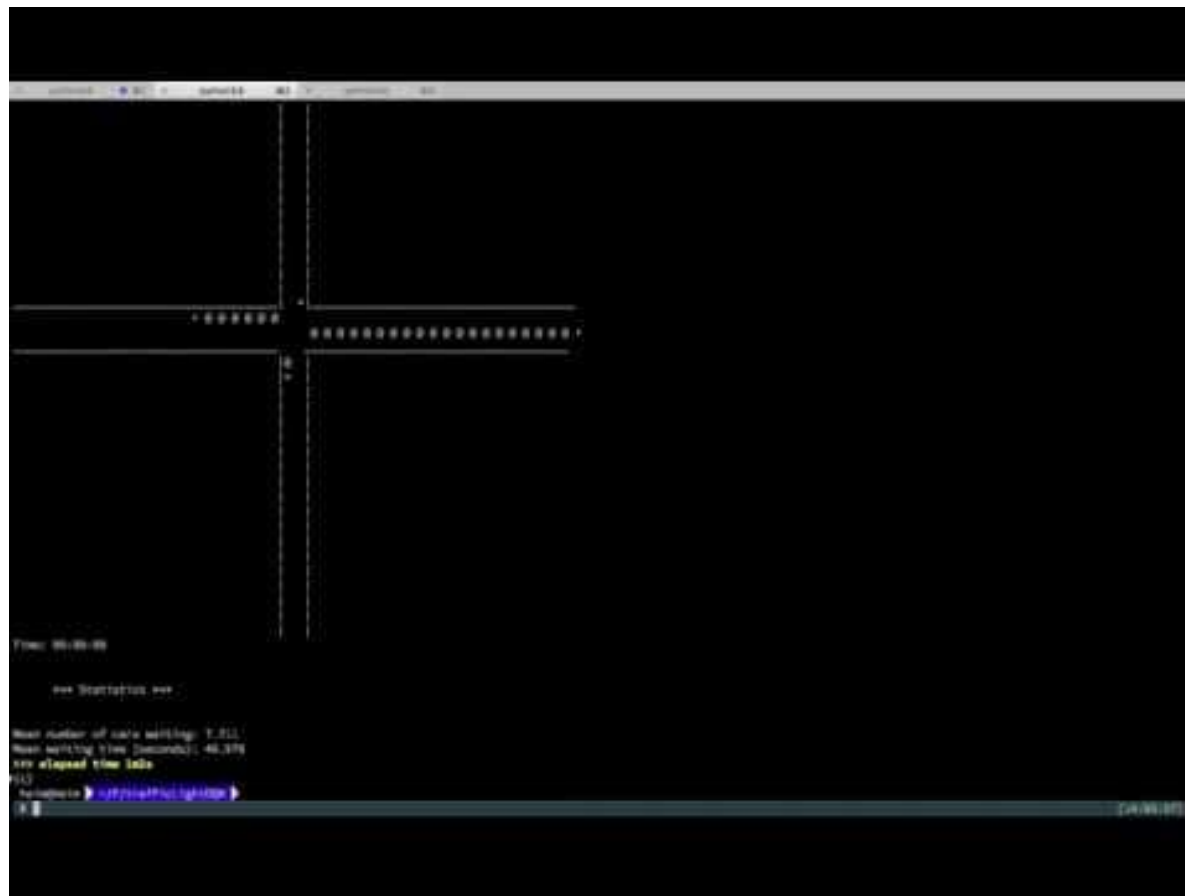
Dataset	Source (Government Organization)
Traffic status	กรมการขนส่งทางบก (Department of Land Transportation)
	จส.100 (JS100)
	กระทรวงคมนาคม (Ministry of Transport)
Weather data	กรมอุตุนิยมวิทยา (The Meteorological Department)
Event data	Social Network
Date/Time	Local date/time

Use **deep reinforcement learning** to control lights timing



Input





trafficLightDQN waiting_time_min:0.csv trafficSystem

Project trafficSystem.py trafficGame.py dqn.py

trafficLightDQN ~/PycharmProjects/trafficLightDQN

analytics.twb display.py

init

Match Case Regex Words 9 matches

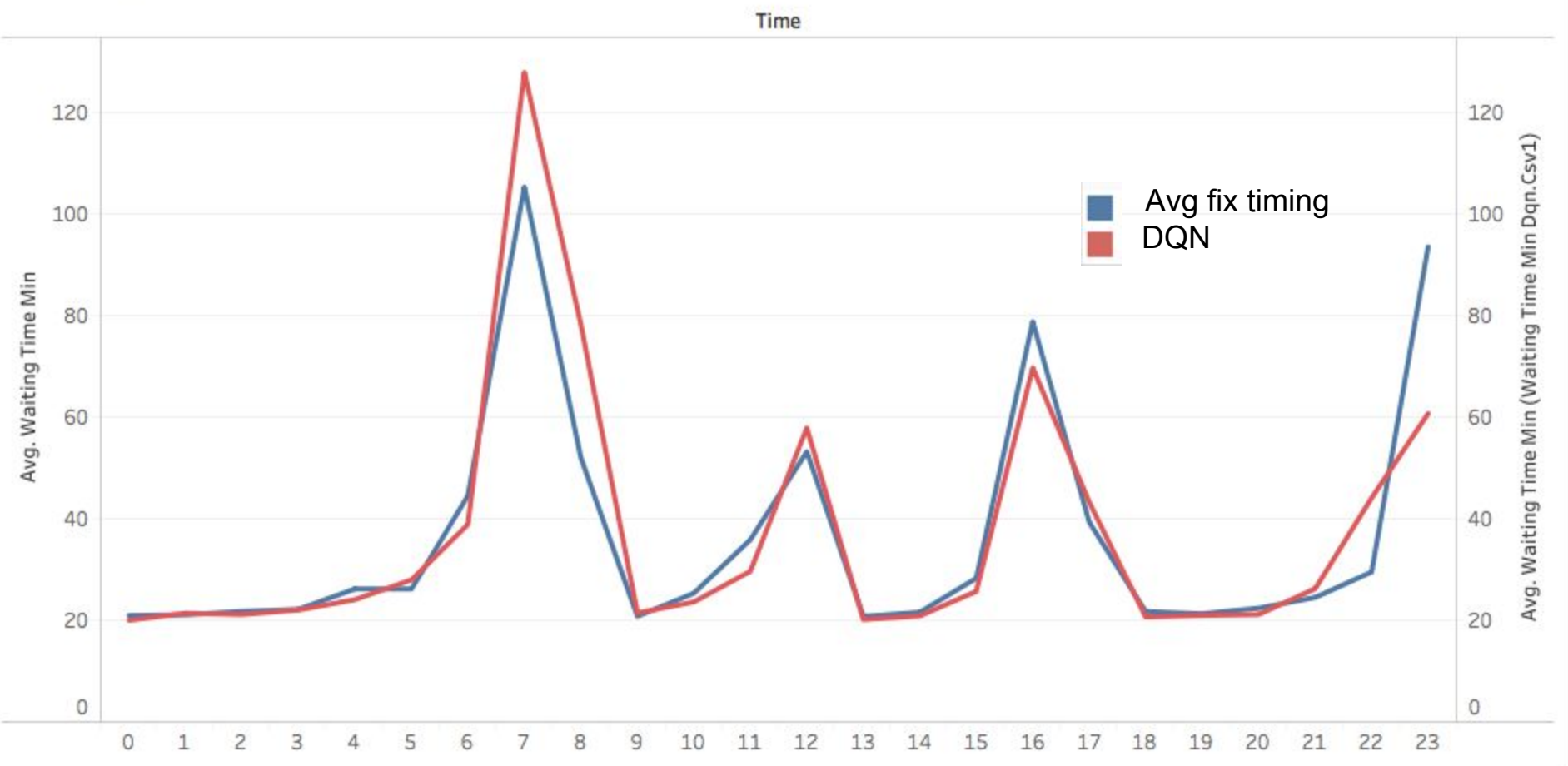
Run: trafficSystem dqn

```
TIMESTEP 81270.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
TIMESTEP 81270.36794050179 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
TIMESTEP 81271.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
TIMESTEP 81271.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.3076670021 / Q_MAX 0 / Loss 0
TIMESTEP 81271.208861259209 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.4088793276 / Q_MAX 0 / Loss 0
TIMESTEP 81271.25057454959 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81271.32196087587 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81272.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81272.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81272.32861832745 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81273.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81273.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81273.01668670664 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81273.26736192974 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81273.42369773152 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -41.2536790624 / Q_MAX 0 / Loss 0
TIMESTEP 81273.50546919284 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -39.6261015335 / Q_MAX 0 / Loss 0
TIMESTEP 81273.51690567167 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -39.4441157505 / Q_MAX 0 / Loss 0
TIMESTEP 81273.79949819579 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -39.4441157505 / Q_MAX 0 / Loss 0
TIMESTEP 81274.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -39.4441157505 / Q_MAX 0 / Loss 0
TIMESTEP 81274.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -39.4441157505 / Q_MAX 0 / Loss 0
TIMESTEP 81274.09388632709 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -39.4441157505 / Q_MAX 0 / Loss 0
TIMESTEP 81275.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -39.4441157505 / Q_MAX 0 / Loss 0
TIMESTEP 81275.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -39.4441157505 / Q_MAX 0 / Loss 0
TIMESTEP 81275.60870912591 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -39.3435470768 / Q_MAX 0 / Loss 0
TIMESTEP 81275.63799197339 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -37.9349046038 / Q_MAX 0 / Loss 0
TIMESTEP 81276.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -37.9349046038 / Q_MAX 0 / Loss 0
TIMESTEP 81276.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -37.9349046038 / Q_MAX 0 / Loss 0
TIMESTEP 81276.00889024299 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -37.9349046038 / Q_MAX 0 / Loss 0
TIMESTEP 81277.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -37.9349046038 / Q_MAX 0 / Loss 0
TIMESTEP 81277.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -37.9349046038 / Q_MAX 0 / Loss 0
TIMESTEP 81277.55244519102 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -37.9289726256 / Q_MAX 0 / Loss 0
TIMESTEP 81277.80358384339 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -38.0694041865 / Q_MAX 0 / Loss 0
TIMESTEP 81278.0 / STATE observe / EPSILON 0.0001 / ACTION 0 / REWARD -38.0694041865 / Q_MAX 0 / Loss 0
TIMESTEP 81278.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -38.0694041865 / Q_MAX 0 / Loss 0
TIMESTEP 81279.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -38.0694041865 / Q_MAX 0 / Loss 0
TIMESTEP 81279.0 / STATE observe / EPSILON 0.0001 / ACTION 1 / REWARD -38.0694041865 / Q_MAX 0 / Loss 0
```

Python Console Terminal 3: Find 4: Run 5: Debug 6: TODO

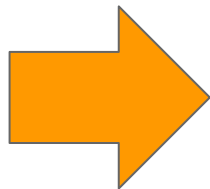
Event Log

waiting_time





20 min
trained



8% improved

Our DQN model just had been
trained(simulation elapsed time)

in average waiting time compare to the fix
time approach

The individual result may vary on many factors such as train time, random seed, distribution, fidelity of simulation, etc.

Conclusion



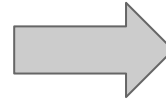
Looking at whole system



Fast execution



Minimize
commuting
time



Impacted field	Result
Logistic	Shipping faster
Individual	More free time to family
Environment	Less pollution
Emotional	People happier
Transportation	Ordering of traffic

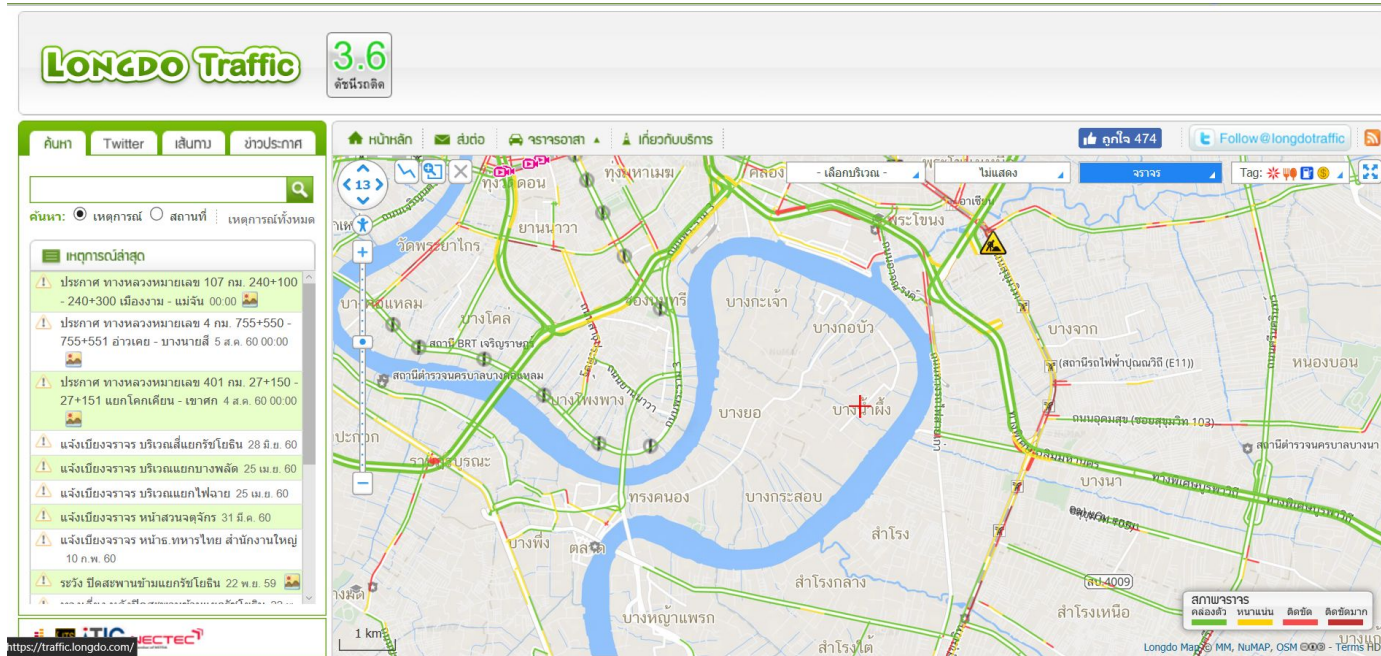


GitHub

[github.com/wasdee
/trafficLightDQN](https://github.com/wasdee/trafficLightDQN)

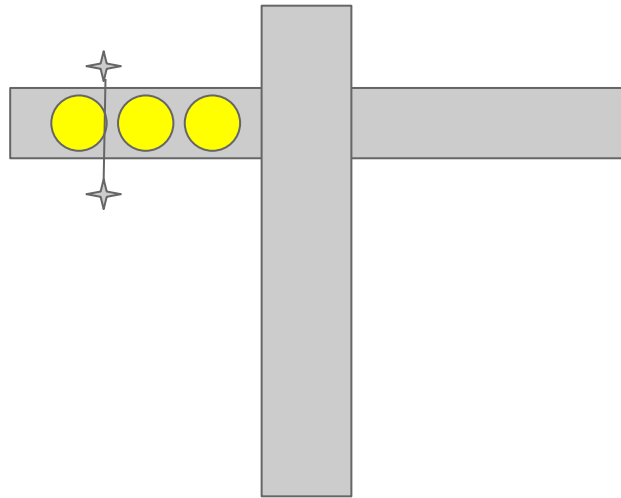
Code - Result - Slides

Study about **index** that measure the congestion of traffic



Provided by iTIC and T-Square

Simple Simulation Design



Vehicle



Sensor

