Travel time estimation in mixed traffic by using Wi-Fi scanner

Traffic ENGINEERING GROUP

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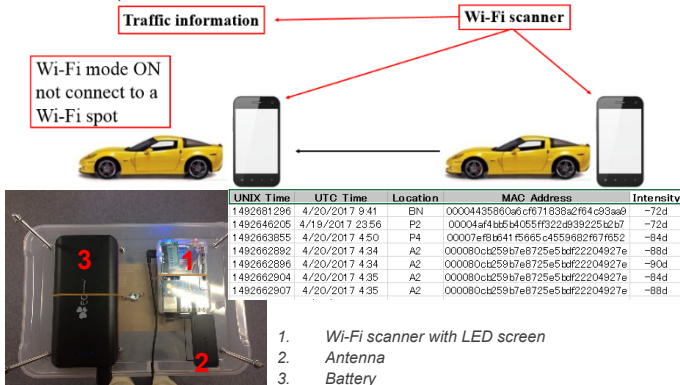**ITS Center — THE UNIVERSITY OF TOKYO 次世代モビリティ研究センター**

Introduction

It is difficult to get travel information in **mixed traffic** by **typical methods** such as traffic detectors, GPS, or probe cars due to the high number of vehicle and chaotic order of them in the road, especially in peak hours. Lack of information makes operators difficult in control traffic in big cities.

Passive data collection could be a great solution since this method could provide a huge amount of traffic data automatically with relatively low required budget, which is good for developing countries where mixed traffic normally takes place.

By using **Wi-Fi scanner**, the signal from **smart devices**, like smartphone, tablet, or laptop, will be tracked, and **travel time** of vehicles in **mixed traffic** could be estimated.

How Wi-Fi scanner works

Each smart device has their own unique media access control **(MAC) address**. Wi-Fi scanner could track this MAC address, and by the matching process among MAC address, Wi-Fi scanner **location** and **recorded time**, travel time of smart device carrier, which could be known as driver, will be defined.

Traffic information ← **Wi-Fi scanner**

Wi-Fi mode ON not connect to a Wi-Fi spot

UNIX Time	UTC Time	Location	MAC Address	Intensity
1492681296	4/20/2017 9:41	BN	00004435860a6cf671838a2f64c93aa9	-72d
1492646205	4/19/2017 23:56	P2	00004af4bb5b4055ff322d939225b2b7	-72d
1492663855	4/20/2017 4:50	P4	00007ef8b641f5665c4559682f67f652	-84d
1492662892	4/20/2017 4:34	A2	000080cb259b7e8725e5bdf22204927e	-88d
1492662896	4/20/2017 4:34	A2	000080cb259b7e8725e5bdf22204927e	-90d
1492662904	4/20/2017 4:35	A2	000080cb259b7e8725e5bdf22204927e	-84d
1492662907	4/20/2017 4:35	A2	000080cb259b7e8725e5bdf22204927e	-88d

1. Wi-Fi scanner with LED screen
2. Antenna
3. Battery

Overview of experiment

To verify the usage of Wi-Fi scanner, experiments were conducted in **Hanoi** (Vietnam), a typical example of mixed traffic with the dominant rate of **motorbike**.

Two-days trial in Aug 2016 and three-days experiment in Apr 2017 were conducted in the **arterial road** connect the city center and sub urban area.

Wi-Fi scanners were set up along this road during **morning peak** until **evening peak** to get the traffic information.

Probe vehicle also be used to verify the actual travel time in this segment.


City center

Sub urban
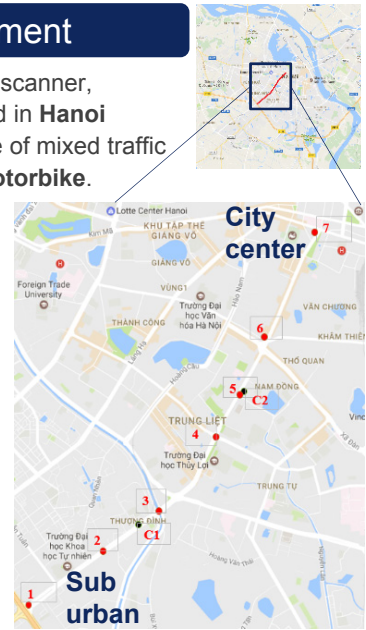
Results and future works

Wi-Fi scanner could provide big data for traffic analysis: In 12-hours experiments in Apr 2017, nearly **1,000,000 MAC address** signal were recorded. The distribution of captured information proportion with the real traffic volume imply that based on recorded data, traffic volume could be draftly estimated.
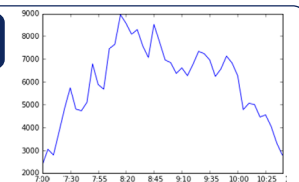
Noise data of Wi-Fi scanner data based is a large value: Due to the sensibility of smart devices as well as the Wi-Fi scanner itself, and some situations, such as drivers stop for working or shopping, the raw data contains noise that do not have transportation meaning. In general, after cleaning process, about **10%** of raw data could be used for travel time estimation purpose.

Travel time of traffic flow could be defined: after data processing and compare with traffic volume from video camera, Wi-Fi scanner can detect **around 3% of all trips** in this route. Base on the travel time information of each MAC address, travel time graph of traffic flow could be demonstrated like the figures below.
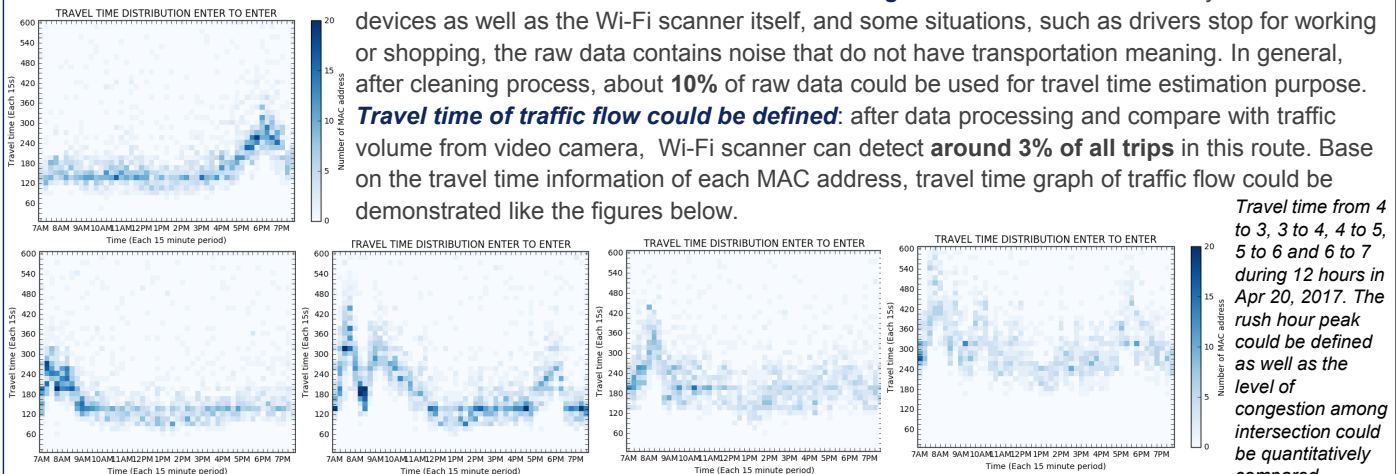
Travel time from 4 to 3, 3 to 4, 4 to 5, 5 to 6 and 6 to 7 during 12 hours in Apr 20, 2017. The rush hour peak could be defined as well as the level of congestion among intersection could be quantitatively compared.

Challenges and future works: Since information about exact location of MAC address is unknown, the way to use time value effectively and precisely need to be improve. In the future, validation data from probe vehicle will be use more to fortify the travel time estimation method.