“Utilization of GPS/GNSS Big Data from Probe Vehicle for Traffic Management in the context of Nepal”

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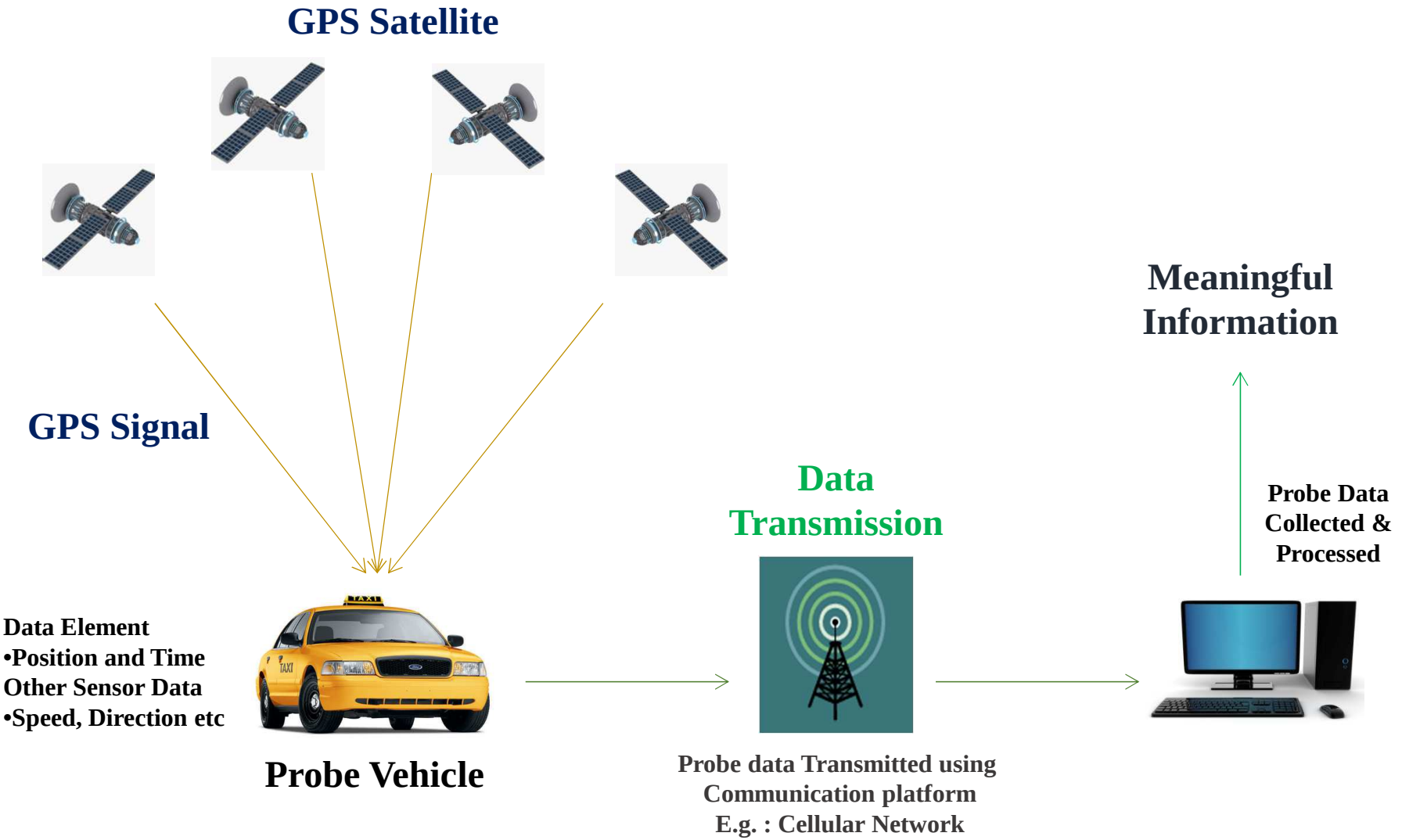
Introduction

Introduction to Probe Vehicle Data

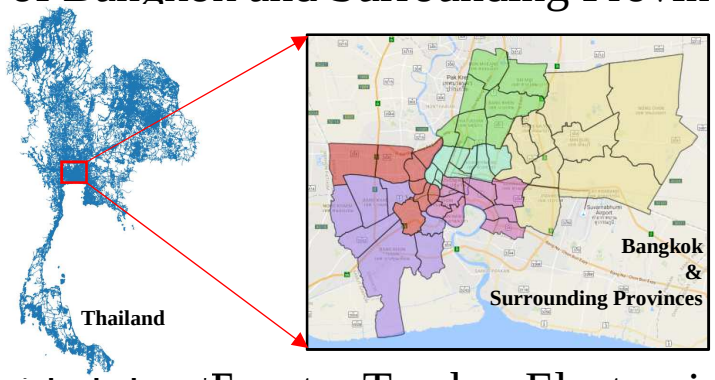


Probe Vehicle Working

Introduction

Toyota Tsusho Electronic Thailand Co Ltd and Its Taxi Probe Data

- Equipped 10,000 GPS device into Taxis of Bangkok and Surrounding Provinces.
- Collects raw data from 10K taxi probes every 3 to 5 seconds.
- Provide traffic information of Bangkok and Surrounding Provinces.



Probe vehicle data that is provided by Toyota Tsusho Electronic Thailand Co Ltd has specification of data set as follows

- IMEI (International Mobile Station Equipment Identification)
- Latitude (In Decimal Degree)
- Longitude (In Decimal Degree)
- Error
- Speed (Km/Hr)
- Direction
- Engine Status (0/1)
- Meter Status (0/1)
- Unix Time Stamp
- Data Source

Taxi in "TSQUARE" Group

Big Data

Collection of data sets which is large and complex that exceeds the processing capacity of conventional systems.

GPS Probe data collected for one day
Number of data points collected in one day: 44,417,694 (44 Million)
File size: 3.5 Giga Byte (Approximate)
Time for one day = 86400 second
Data points collected = 514 / second
Data Generation Rate = 42.4 kilobyte / second

Big data describe the exponential growth and availability of the data.

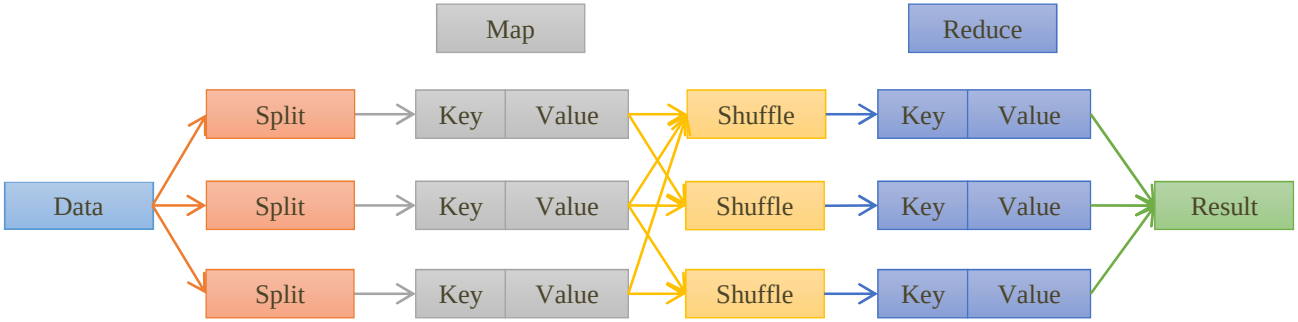
Volume ***Velocity*** ***Variety***

Source: Interview: Eric Fischer on Data Visualization

Methodology

Apache Hadoop Distributed System

Map Reduce framework that works on Distributed File System for handling big data.



Apache Hadoop Architecture

Combine streaming with batch and interactive queries

Hive : Data warehouse software facilitates reading, writing, and managing large datasets residing in distributed storage using SQL built on top of Hadoop which enables easy access to data through query execution.

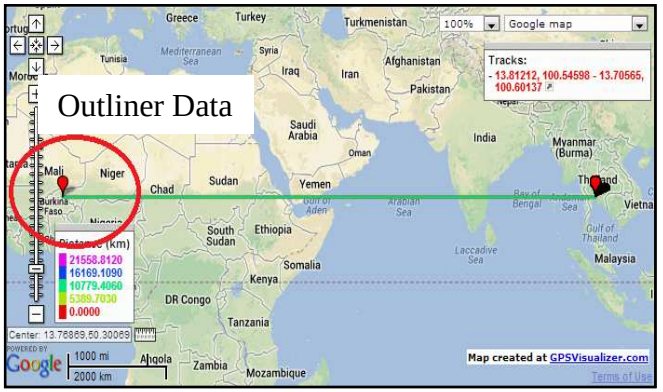
Apache Spark : Combine streaming with batch and interactive queries. Spark runs on Hadoop, standalone, or in the cloud. Spark can run using its standalone cluster mode, on Hadoop YARN with Machine Learning libraries.

Preliminary Data Analysis

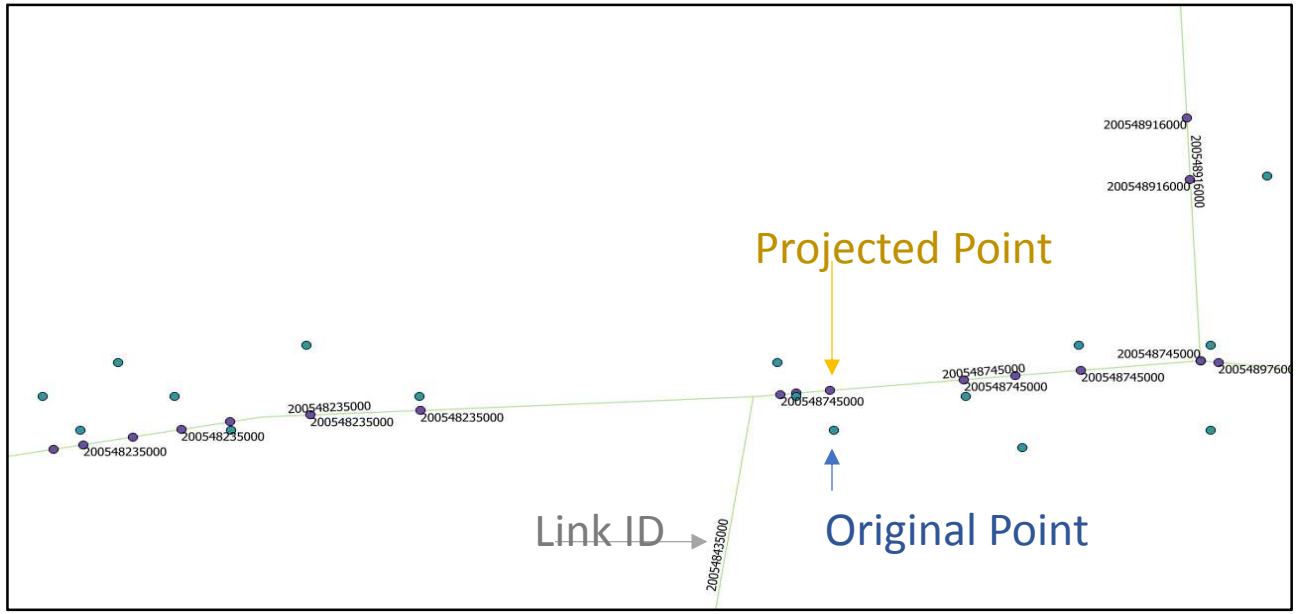
Filter/Remove Outliner Data

ID	IMEI	latitude	Longitude	Speed	Direction	Error	Acc	Meter	Timestamp	Data source
3755	16005611	0	0	0	0	0	0	1	1378400412	9
9722	16005461	0	0	0	0	0	0	1	1378400404	9
9909	16005375	0	0	0	0	0	0	1	1378400428	9
15307	16005611	0	0	0	0	0	0	1	1378400443	9
19842	16005648	0	0	0	0	0	1	1	1378400415	9
21092	16005953	0	0	0	0	0	1	1	1378400409	9

Outliner Data



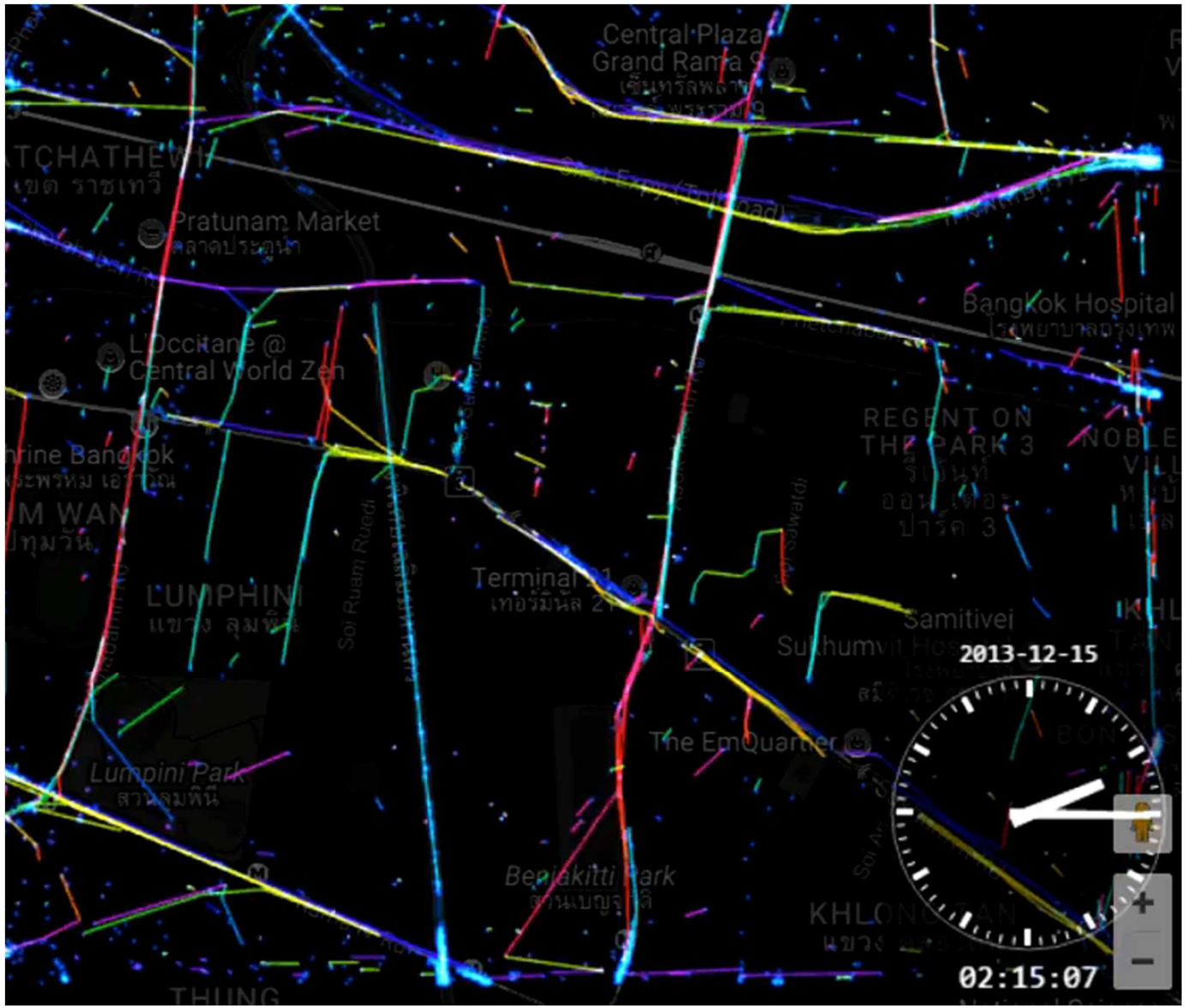
Indexing/Map Matching



Map Matching and Indexing GPS Point to OSM Road Network using Hidden Markov Model.

Data Analysis: Visualization

Visualization of Taxi GPS Probe Data

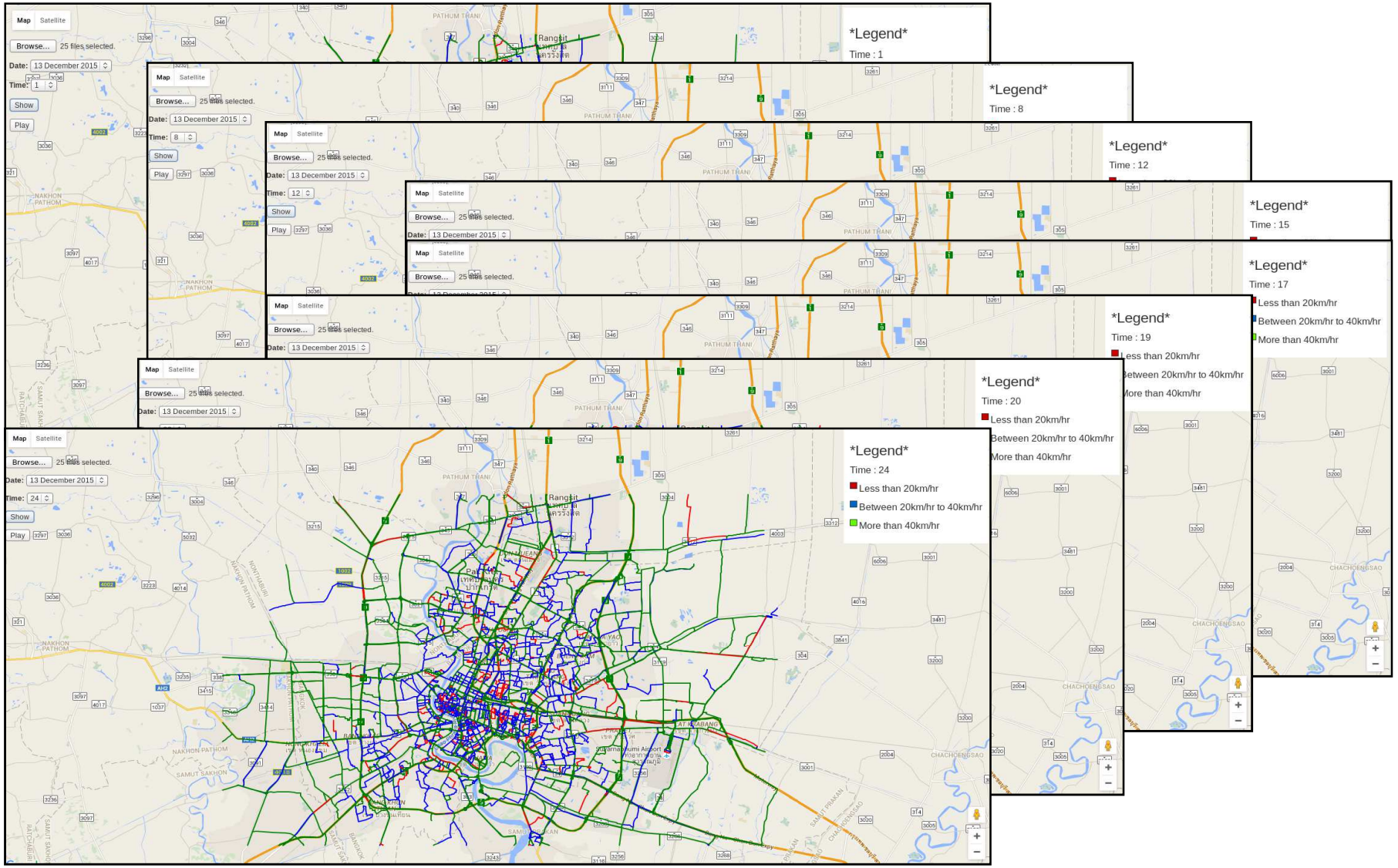


Data Analysis: Visualization

Visualization of Taxi GPS Probe Data

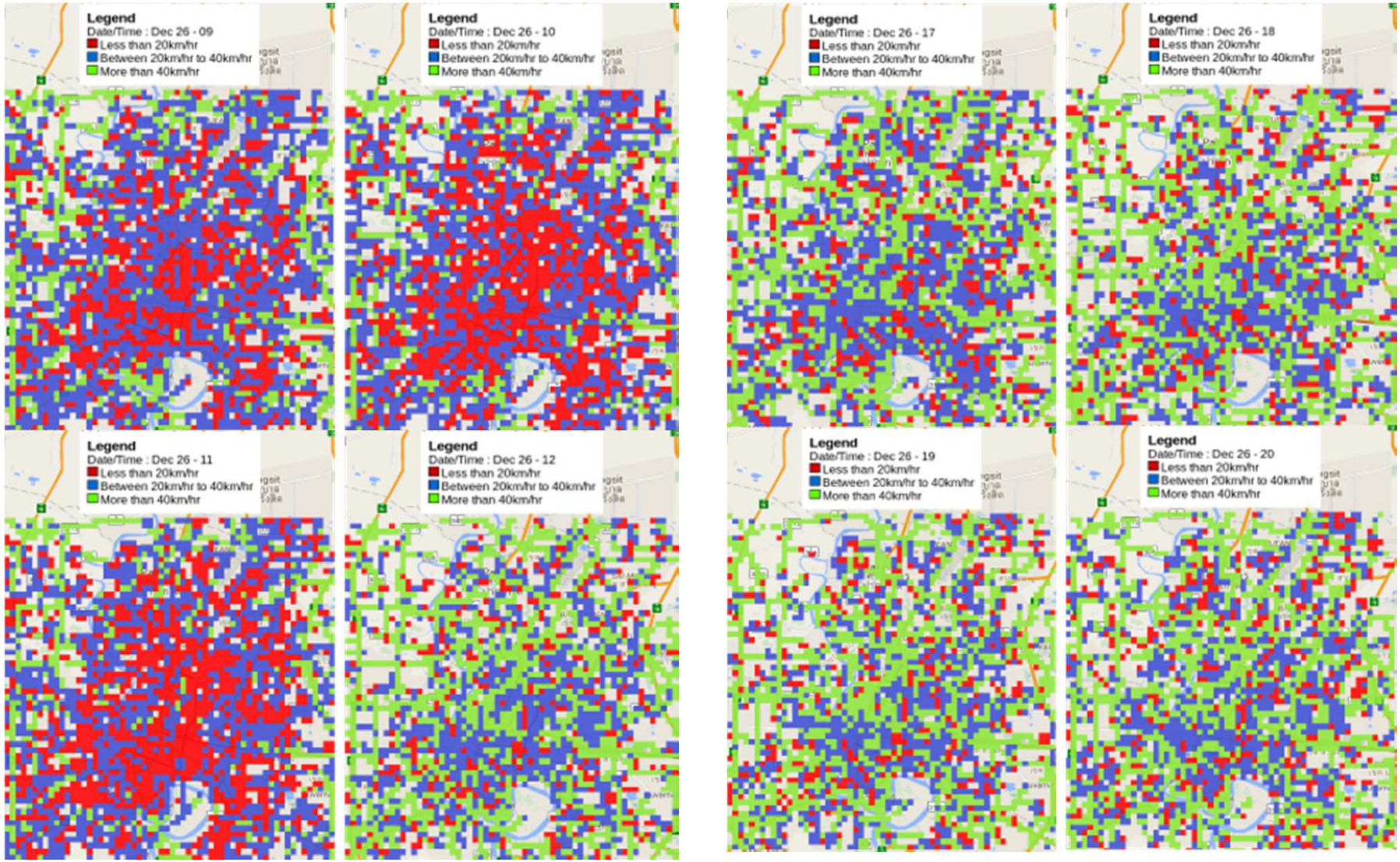
Data Analysis: Congestion Mapping

Traffic Congestion Mapping using Taxi Probe Data



Data Analysis: Congestion Mapping

Traffic Congestion Mapping using Taxi Probe Data



Traffic congestion map visualization 500x500 meter grid size

Why Probe Data in the context of Kathmandu, Nepal?

Why Probe Data in Nepal

Traffic Condition in Kathmandu, Nepal

Un Managed
Traffic Condition
in Major
Road Segments

Why Probe Data in Nepal

Traffic Condition in Kathmandu, Nepal

Traffic Congestion affecting commuters

Why Probe Data in Nepal

Traffic Condition in Kathmandu, Nepal

Traffic Congestion affecting ambulance

Why Probe Data in Nepal

- Traffic management in one of the big issue especially in Kathmandu where there is no proper Traffic management system.

- GNSS/ GPS data from the probe vehicle can utilized to extract the information about the traffic situation in a near real time basis which can then be used for managing/monitoring traffic situation.

- Knowing Traffic condition in near real time, commuter can essentially avoid such road and choose other alternative path to destination.

- Moreover such probe data can be a valuable assets for future urban planning and development work to improve traffic condition by introducing or building new road links where congestion problem is severe.

- In addition, probe data can be evaluate to monitor the driver behaviors while driving as well, in order to improve quality of driving.

Conclusion

- We already have the GPS technology to be used.
- We already have technique/ methodology to analysis the GPS data and get meaningful information.
- Lets implement this “Space Technology” To make our life better by solving various “Urban Issues”.

Future Perspective

We as a Young Researchers

Experience. Expertise. Exposure.

Complementary expertise to each other.

Data Center: Collect, Control, Quality Check, Standardize, Secure and Sharing Mechanism

Various Institutional Linkages.

Knowledge sharing, Capacity development, Education

Business Solution Providers.

Information Technology Based

Integratory Platform for Heterogeneous Data Management

GPS/GNSS - RS - GIS

Thank You Very Much For Your Kind Attention