Visualization of Questionnaire-based Person Trip and its Analysis

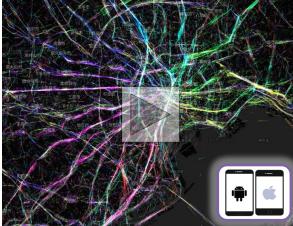
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Introduction

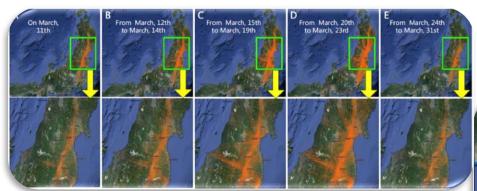
Due to the development of ITC, dynamic personal movements have been studied by tracking taxi and mobile phone data.



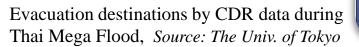
Big data of people flow in Tokyo during the East Japan Earthquake *Source: The Univ. of Tokyo*



Big GPS data visualization by taxi probe in Bangkok *Source: Rangit (2014)* The level of use and number of mobile phones users are increasing, analyzing the individual trip behavior using mobile phone can be a powerful tool to capture a human behavior and provide useful information.



The discovered evacuations in Fukushima, Miyagi and Iwate Prefectures, *Source: The Univ. of Tokyo*





Introduction (cont.)

- The Greater Mekong Sub-region Economic Corporation Program (GMS-ECP) facilitated the market-liberal policies which provide excellent opportunities to develop various sectors in South East Asia.
- These developments restructure life style and behavior of local people.
- Information of person trip would be very useful to assess socio-economic and environment impacts from such developments even in South East Asia.



Problem statement

- 1. Distribution of mobile phones in rural areas in the developing courtiers is very few.
- 1. Even though person trips are supposed to be changed along with various environmental changes such as rapid increase of foreign investments, infrastructure and land cover change, changes of trip patterns in the least developing countries such as Myanmar can not be traced due to non existence of established methods, lack of existence of secondary data and its distrusted reliability.
- 1. Traditional transportation analysis tool is unable to assess diverse person trip at large scale.

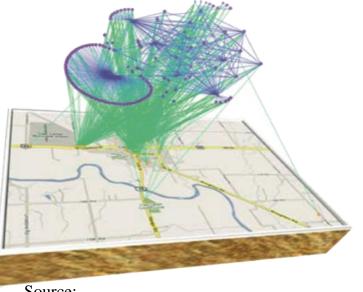
Research objectives

General Objective

To study the person trip pattern and its monitoring and analysis method

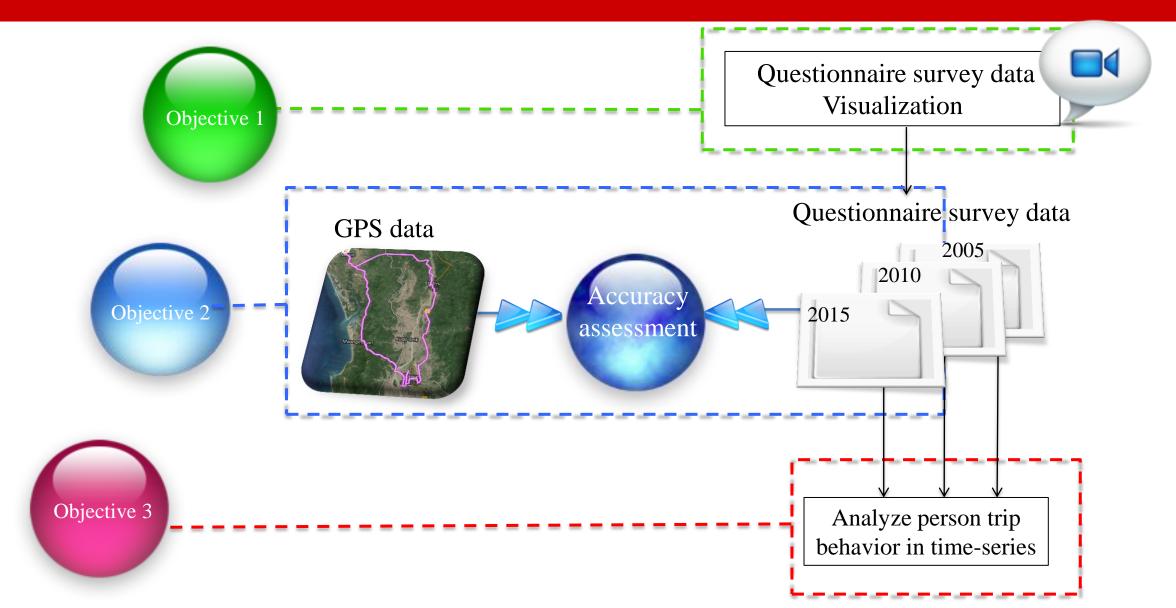
Specific Objectives;

- 1. To visualize questionnaire-based person trip patterns
- 1. To validate the questionnaire-based person trip data by applying GPS loggers
- 1. To assess the change of person trip in 2005, 2010 and 2015



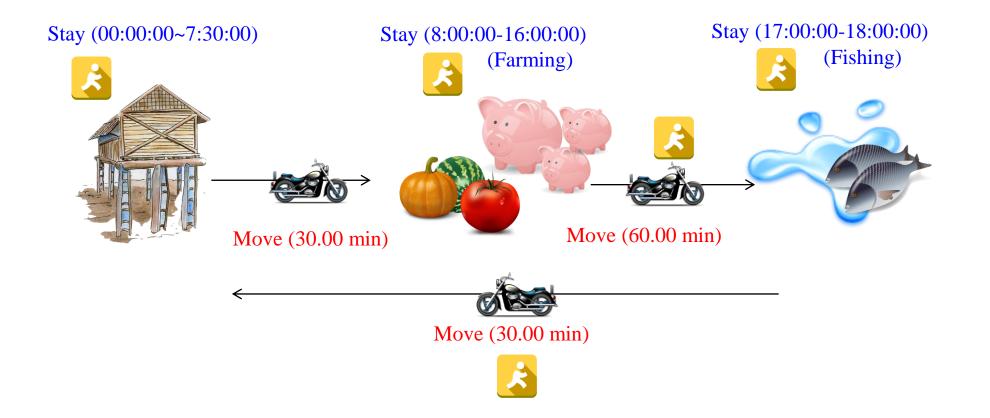
Source: http://www.nature.com/srep/2012/120905/srep0 0632/fig_tab/srep00632_F8.html

Overview of research methodology



What is person trip?

- Identifying origin, destination, purpose, trip mode and time.
- Person trip survey in the developing country, where mobile phones are not well distributed, will help tracking local villagers' trip patterns.



Survey design

- Study area: Dawei, Myanmar
- Survey duration: 7 Mar- 3 April 2015
- Methods: Questionnaire survey with a GPS and 38 GPS loggers
- Sample size: 345 of which 331 were available for further analysis

Questionnaire survey

- Individual profile: age, sex, ethnic, marriage status, head of HH, occupation, HH income etc.
- Acquired Person trip information with spatial information (e.g. trip origin, destination, direction, distance, trip tool, activities, and time) in 2005, 2010 and 2015



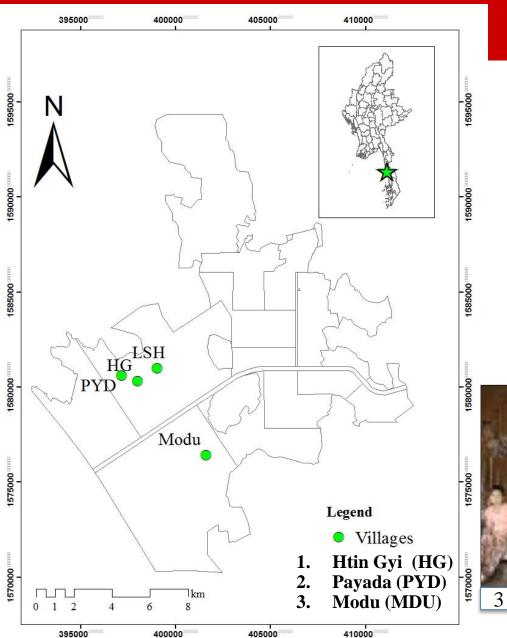
Study area

Road infrastructure construction



Sea port construction



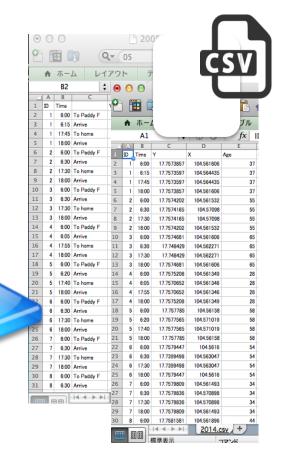




Conversion of person trip information to the spatial information

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Profile and person trip information in 2015, 2010, 2005

Visualization of person trip

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11	3	6:30	Arrive	6	2	6:00	17.7574		104.561532	
12	3	17:30	To home	7	2	6:30	17.7574		104.57098	
13	3	18:00	Arrive	-	2	17:30	17.7574		104.57098	
14	4	6:00	To Paddy F	9	2	18:00	17.7574		104.561532	
15	4	6:05	Arrive	10	3	6:30	17.748		104.562271	65
16	4	17:55	To home	12	3	17:30	17.748		104.562271	65
17	4	18:00	Arrive	13	3	18:00	17,7574		104.561606	
18	5	6:00	To Paddy F	14	4	6:00	17,7575		104.561349	
19	5	6:20	Arrive	15	4	6:05	17.7570		104.561346	
20	5	17:40	To home	16	4	17:55	17.7570	652	104.561346	28
21	6	18:00	Arrive	17	4	18:00	17.7575	208	104.561349	28
22	6	6:00	To Paddy F Arrive	18	5	6:00	17.757	785	104.56158	58
23	6	17:30	To home	19	5	6:20	17.7577	565	104.571019	58
24	6	17:30	Arrive	20	5	17:40	17.7577	565	104.571019	58
25	7	6:00	To Paddy F	21	5	18:00	17.757	785	104.56158	58
20		6:30	Arrive	22	6	6:00	17.7579		104.5616	
28	- 7	17:30	To home	23	6	6:30	17.7399		104.563047	
29	7	18:00	Arrive	24	6	17:30	17.7399		104.563047	
30	8	6:00	To Paddy F	25	6	18:00	17.7579		104.5616	
31	8	6:30	Arrive	26	7	6:00	17.7579		104.561493	
_	_			27	7	6:30	17.7579		104.570898	
		amll		28	7	17:30	17.7579		104.570898	
				29			17,7579		104,561493	34



Non-spatial Information





Visualization tool Source: The Univ. of Tokyo

Validation of Questionnaire-based person trip

Application of GPS loggers

Set Tracking Interval
Mode 1 Waypoint logging interver 5 Second(s) Best battery power: 30 Hour(s) approx
Mode 2 Mode 2
Mode 3 Change interval to 1 sec. Image: Change interval to 1 sec. Image: Change interval to Image: Change interval to Advanced Image: Change interval to Image: Change interval to Image: Change interval to Image: Mode 3 Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Change interval to Image: Ch
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GPS Logger: IgatU GT 600Quantity: 38Recording interval: 5 seconds

Sample size: 345

Data processing of the obtained data from GPS loggers

Stay Point Detection:

Distance $(p_{start}, p_{end}) < D_{threh}$ and TimeDiff $(p_{start}, p_{end}) > T_{threh}$ Where $T_{threh} > 20$ minutes and $D_{threh} <= 300$ meters

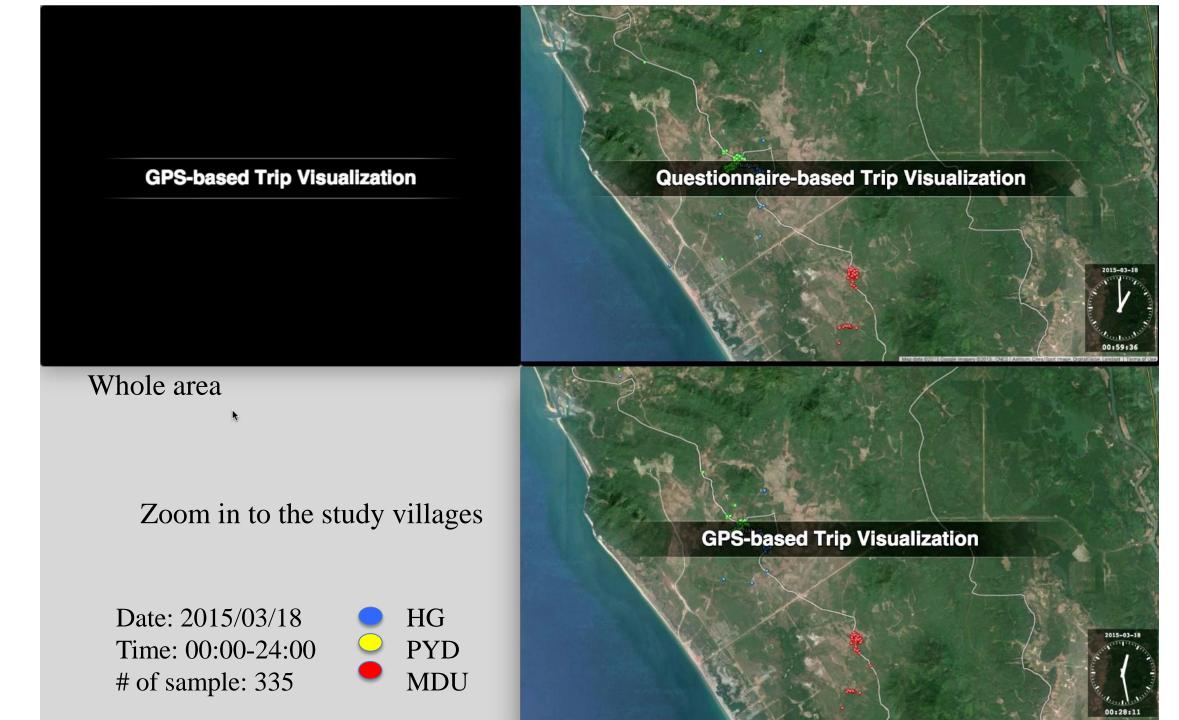
Difference Calculation:

Relative Change (x, y) = Absolute difference/ Max (x, y)*100 = $|\Delta|$ / Max (x, y)*100

Where x is the data from questionnaire and y is the data from the GPS logger.

- * Considerable respondents from a total of 331 is
 - 331 samples in 2015
 - 241 samples in 2010
 - 250 samples in 2005





Result 2: Validation of data from questionnaire

Avg. difference of two data

	Avg. differences (%)										
(A) No. of Person Trip	25.3										
(B) Trip Distance	34.86										
(km)											
(C) Trip Time (min) 🧲	38.03										
Average number of person trip, trip distance											
and trip tin	me by year										
	2005	2010	2015								
(A) No. of Person Trip	2.25	2.07	2.96								
(B) Trip Distance	2.26	4.38	9.18								
(km)											
(C) Trip Time (min)	40.62 58.37 46.										

Identified causing factors

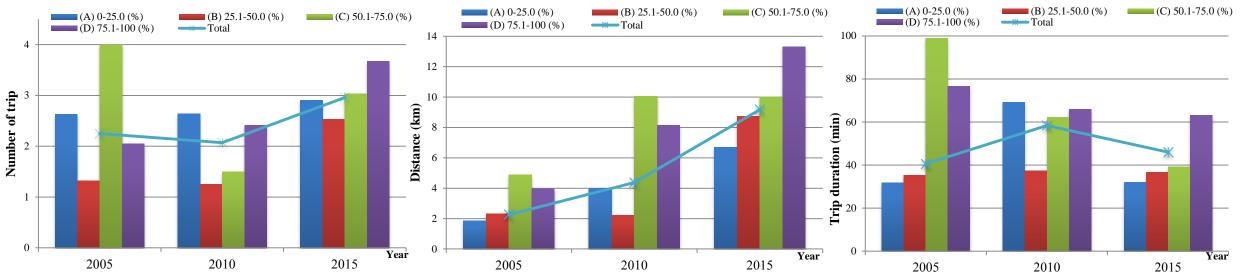
Human error:

Short trips and exact trip routes tend to be under reported among the respondents.Staying more than 20 minutes on the way to a destination were not counted as a trip by respondents due to unimportance.

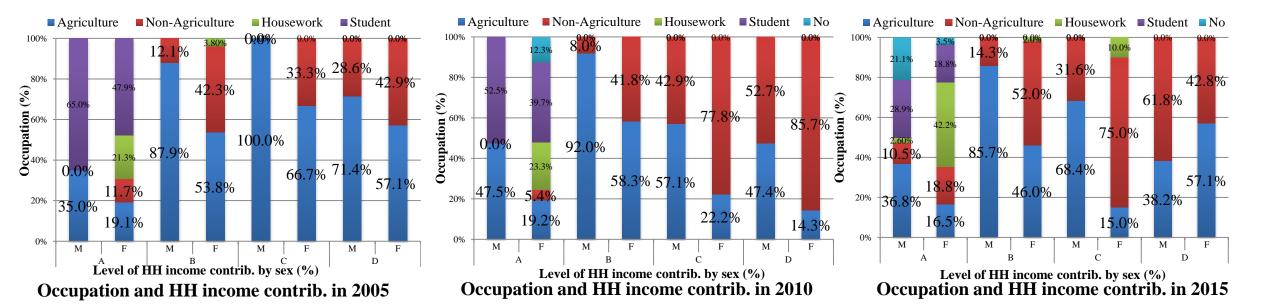
> Data processing error:

Short trips ranging less than 300 meter more than 20 minutes and short stays on the way to the next destination during trips were not counted.

Result 3: Trends of Trip Behavior by Household Income Contribution



Avg. number of trip and HH income contrib. by year Avg. trip distance and HH income contrib. by year Avg. trip duration and HH income contrib. by year



2015

Result 3: Trip mode by HH income contribution level by year

Trip mode by HH income contribution in

2010

2005

															-	-			
Income contrib. (%)	Stay	Walk	BC	MB		Income contrib. (%)	Stay	Walk	BC	MB	Others		Income contrib. (%)	Stay	Walk	BC	MB	Car	Others
(A) 0-25.0	25.4 (23.1)	63.4 (44.8)	3.7 (0.8)	7.5 (0.8)		(A) 0-25.0	23.0 (22.1	49.6	15.9	8.0	3.6		(A) 0-25.0	25.0	33.3	0.8	38.6	1.5	0.8
	47.5	44.1	1.7	6.8)	(27.4)	(9.7)	(2.7)	(2.6)		`	(21.8)	(25.8)	(0)	(18.9)	(0.8)	(0)
(B) 25.1-50.0		(15.3)		(0)			50.8	31.1	0.0	18.0	0.0			17.8	27.8	1.1	52.2	1.1	0.0
	(27.1)	07.5	(1.7)	0.0		(B) 25.1-50.0	(36.1	(16.4)	(0)		(0)		(B) 25.1-50.0	(16.7)	(16.7)	(0)	(22,2)	(1.1)	(0)
(C) 50.1-75.0	0.0	87.5	12.5	0.0			43.8			(6.6)				23.1		5.1	(22.2)		
	(0) 23.8	(37.5) 57.1	$\begin{array}{c} (0) \\ 0.0 \end{array}$	(0) 19.0		(C) 50.1-75.0	43.8 (43.8	31.3	0.0	25.0	0.0		(C) 50.1-75.0	23.1	17.9	5.1	53.8	0.0	0.0
(D) 75.1-100	(4.8)	57.1	(0)	$\begin{array}{c} 17.0\\(0)\end{array}$		(C) 50.1-75.0)	(12.5)	(0)	(0)	(0)		(C) 50.1 75.0	(23.1)	(10.3)	(2.6)	(15.4)	(0)	(0)
		(28.6)					14.8	48.1	0.0	37.0	0.0			8.2	29.5	0.0	59.0	3.3	0.0
	30.2	58.6	3.2	8.1		(D) 75.1-100	(3.7)		(0)	(3.7)	(0)		(D) 75.1-100	(3.2)		(0)	(14.5)	(0)	(0)
Total	(22.1)	(35.1)	r trin	(0.5)	10.	especially		(22.2)		Ć.	• ` ´	$\overline{\mathbf{d}}$	a from wo	11 .	(21.0)	1			
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• In this study, changing trip can be explained by increase of vehicle ownership, increased of female driver and employee work engagement and is consistent with the case reported by [16] in Tamil Nadu, India where increase in vehicle ownership (both two-wheelers and car), the number of employee and increase of female driver has resulted into increasing driving travel demand.

(3.7)

Conclusion

- Questionnaire-based trip data were visualized and the trip data were validated by employing GPS loggers.
- Average differences between the two data in average number of person trip, trip distance and trip time were found as 25.3, 34.86, 38.03 respectively.
- The trends from 2005 to 2015 were examined and large increase of trip distance was found due to change of mode from walk to motorbike especially among female increasing the amount of household contribution.
- Quantitative measurement associated with survey questionnaire is an alternative tool to validate data reliability and help tracing dynamic changes of person trip by socio-economic status in areas where data availability is extremely limited.
- With along to urbanization resulted from rapid economic growth in Asia, exploring trends of these trip changes associated to the rate of urbanization by focusing socio-economic diversity in the society, enables researchers and decision makers to conduct future assessment that would be crucial in making informed decision on appropriate transportation design and management for sustainable development.

Khob Khun Kha

Thank you

