

# An Effective Tracking Technique of Public Transportation toward Passenger Generated Vehicle Location System

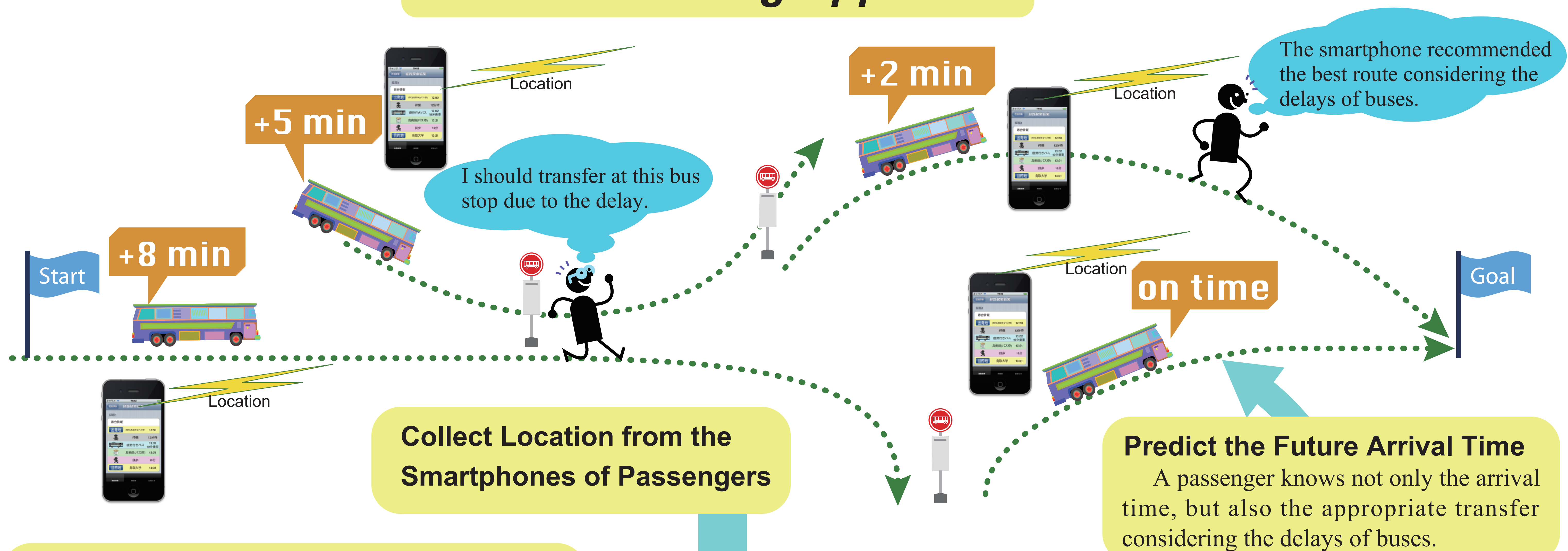
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This paper proposes an automatic vehicle locating (AVL) system which gains the geographic location data of a vehicle by passengers' sending the data via their smartphones in order to support public transportation users. While the existing AVL systems with specialized facilities costs a large amount of money and currently only large cities can introduce the system to their public transportation system, such user-generated approach will reduce the costs to collect the location data of a vehicle, and will enable small transportation system to adopt an AVL system. This paper developed a matching technique of location with a timetable, and demonstrated the system in the route buses in Tottori Prefecture with 70 smart phones, and evaluated its performance.

## Basic Idea

### Crowd Sourcing Approach



Collect Location from the Smartphones of Passengers

Predict the Future Arrival Time  
A passenger knows not only the arrival time, but also the appropriate transfer considering the delays of buses.

Koyama Route				
Tokun Station	17:10	17:50	18:30	19:10
Honori	17:17	17:57	18:37	19:17
Kawabata	17:16	17:56	18:36	19:16
Honmachi	17:10	17:50	18:30	19:10
Kencho	17:20	18:00	18:40	19:20
Nishimachi	17:22	18:02	18:42	19:22
Tsukubono	17:24	18:04	18:44	19:24
Asai Cho	17:26	18:06	18:46	19:26
Jyohoku Danzhi	17:27	18:07	18:47	19:27
Jyohoku Shogakko	17:26	18:06	18:46	19:26
Matsunari Cho	17:29	18:09	18:49	19:29
Yachyo Bashi	17:30	18:10	18:50	19:30
Yasunaga	17:33	18:13	18:53	19:33
Matsuyama Center	17:35	18:15	18:55	19:35
Iwayashi	17:36	18:16	18:56	19:36
Koyama	17:38	18:18	18:58	19:38

#### Static Data in the Database

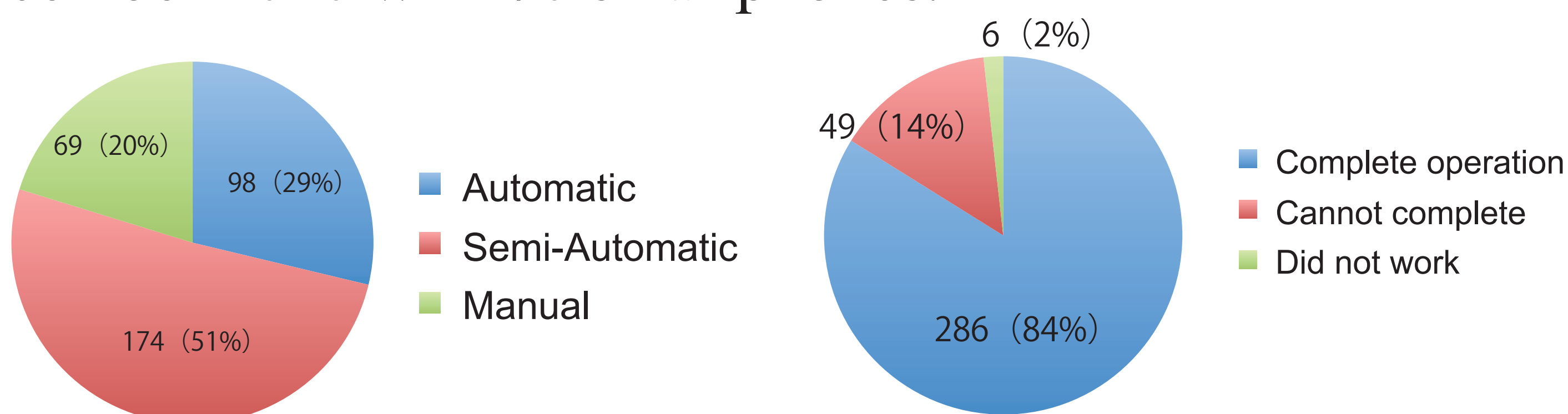
- Names and locations of bus stops
- Maps of routes
- Timetables of buses

#### Semi-automatic Matching with the Entry on the Timetable

The system gives a list of the possible buses based on the user's location. If there is only one bus, the system determines it to be the exact bus (automatic). If there are two or more, then the system asks a user to select (semi-automatic). Even a user does not select, the system narrows the possible buses down as the bus runs, and automatically determines the exact bus.

## Preliminary Experiment

We developed an application for smartphones, and conducted the experiment on the buses in service in cooperation with bus companies in Tottori Prefecture, Japan. As the aim of the experiment was to demonstrate the mechanism to match locations to the timetable of the bus, we settled the smartphone on the dashboard of the buses, and asked the drivers to operate the smartphone when he/she starts the bus. We conducted the experiment for two months since December 2010 with 70 smartphones.



A. The ratio of the selected matching mechanism

B. The success rate of tracking the bus

Figure A shows how the matching mechanism worked. Automatic or semi-automatic matching works in 80% of the trials. Figure B shows if the tracking complete while running the bus. Due to tunnel, signal strength of 3G etc, 14% of the trial cannot complete, and 2% cannot even start tracking.

