

Realization of a high-accuracy detection system between electric wheelchairs and the moving object on the community road

06/03/2015

NTT DOCOMO, INC

Smart-life Solutions Department

Hisakazu Tsuboya

1. Background

In Japan, "aging society with fewer children progresses", more than 65-year-old elderly, in the next five years is forecast to increase by 6.4%, in the next decade is predicted to 8.5%. Highly usage of mobility supports, for instance wheelchairs and senior cart, shall increase any traffic accidents.

Remote control and management technologies enhanced by mobile network are expected to restrain and reduce any conflicts between those mobility supports.

Fig.1) Age-specific population estimates of Japan

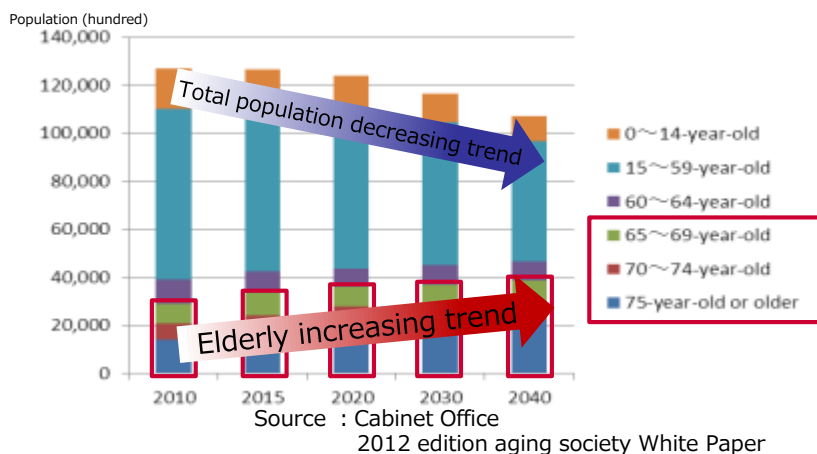


Fig.3) Trends in the number of traffic accidents

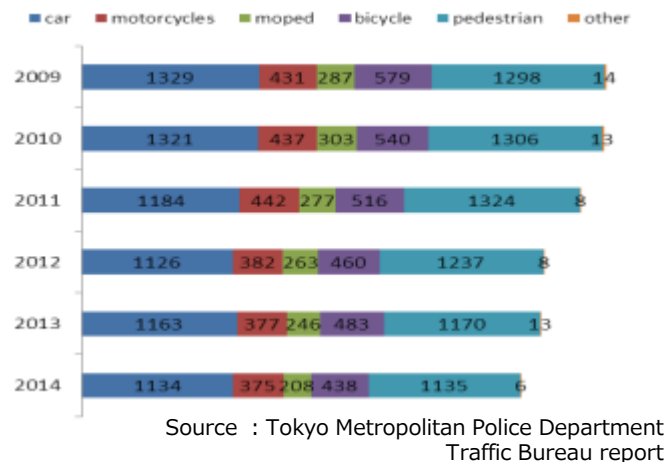


Fig.2) Cumulative shipments of electric wheelchair

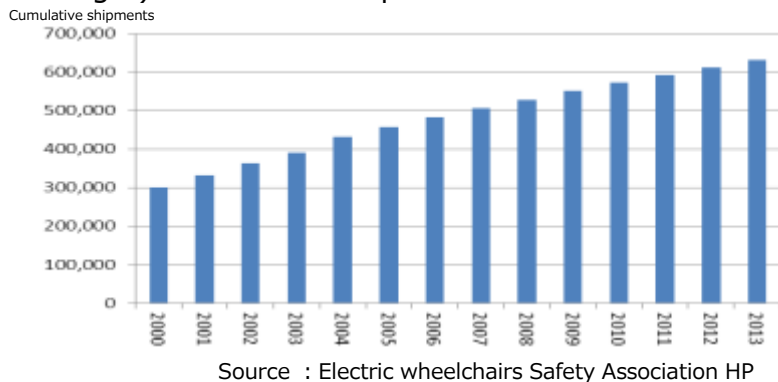
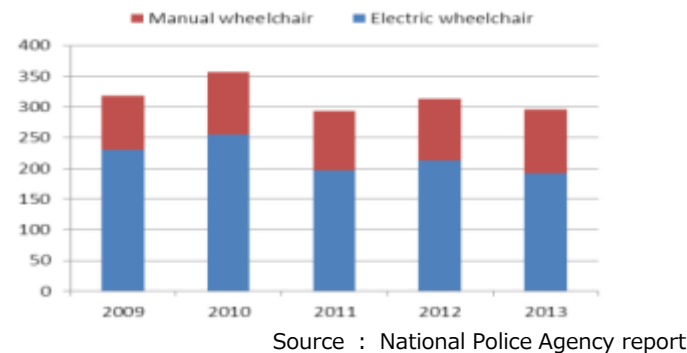
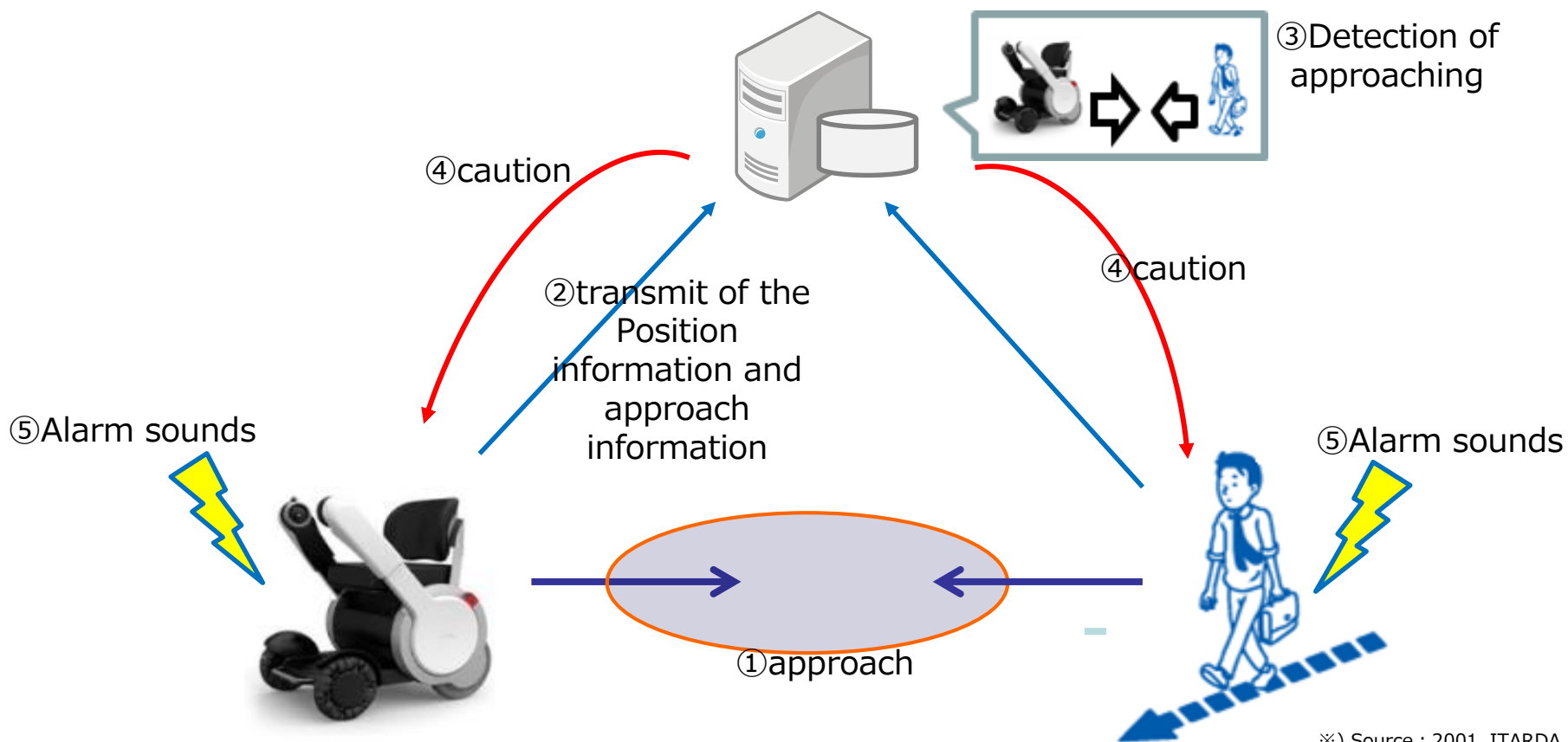


Fig.4) Trends in the number of wheelchair accident



2. Solutions for reducing accidents

In traffic accidents, “cognitive delay and mistake” occupied 70% of the causes.※) It can be understood that decline in cognitive abilities of the elderly people would have sever influences. On the other hand, being able to notify in advance danger, the accidents will be reduced. Considering the recent mobile technology innovations, we investigate the detection system with mobile remote sensing functions detects the degree of proximity between the moving object.



※) Source : 2001 ITARDA report

3. Technology approach

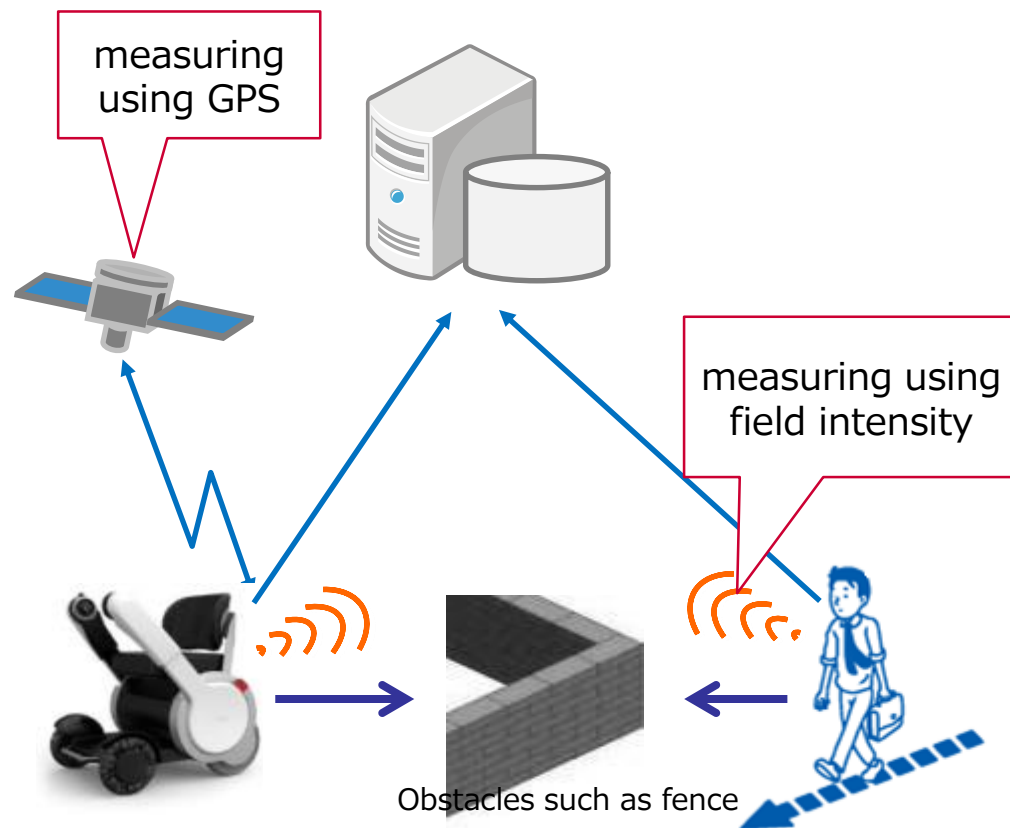
Electric wheelchair accident occurs on a community road.^{※)} Therefore, even if shield or view is blocked, it is necessary to be able to confirm the relative positions and to be able to detect the moving object.
So, we have established a detection system by measuring using GPS and field intensity.

※) Source : National Police Agency report

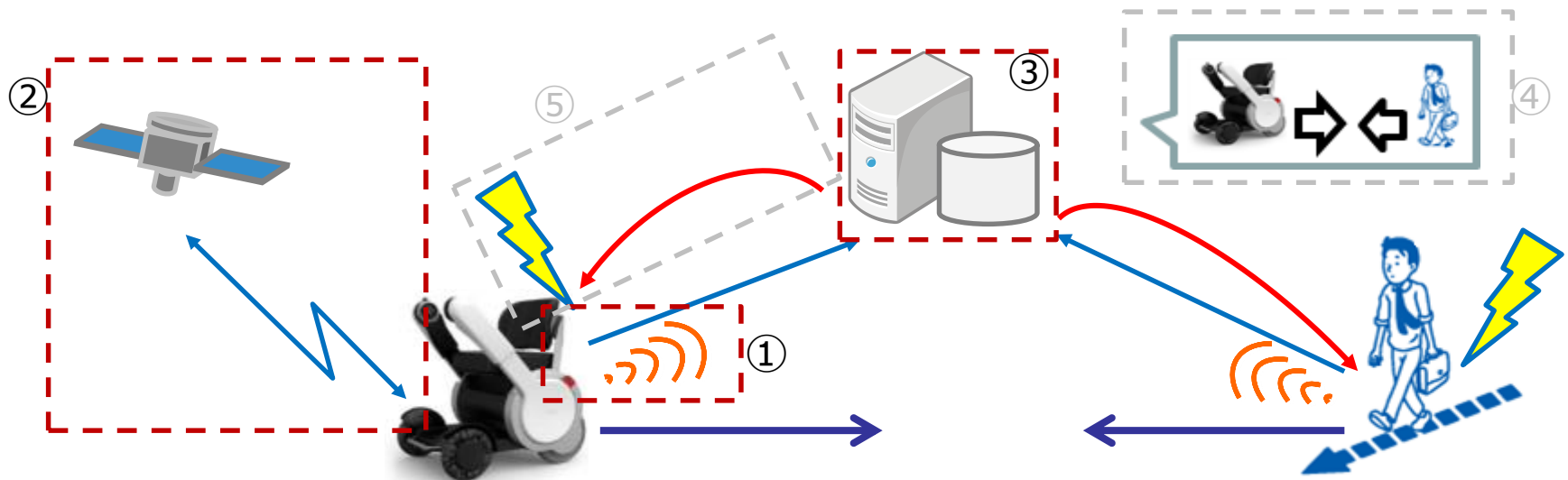
Image processing and radar waves has been implemented in the automotive, that is not good at the environment that wall and complex buildings housing is gather in the near.
Even if shield, it is necessary to be able to confirm the relative positions.



We have established a detection system by measuring using GPS and field intensity.



- **Research goal** : To confine a positioning error of a moving objects within 1m. Give a caution to take action avoiding before 3 seconds. (Set the appropriate number of seconds in the study)
- **Outcome** : We reduce the electric wheelchair-related traffic accidents will increase, and contribute to welfare.
- **Commercialization plan** : We consider providing an optional service to ensure the safety,



<2014 fiscal year>

- To build a detection system between moving objects and to build a detection system with network information
- ① Measuring the relative position using field intensity
- ② Measuring the absolute position using GPS and quasi-zenith satellite
- ③ Development of server system (Implementation of data storage function)
- Collect the data by the basic experiment

< 2015 fiscal year>

- To build an approach detection system
- ④ Implementation of the position calculation technology
- ⑤ Implementation of the notification technology
- Improvement of a detection system between moving objects
- Set the appropriate number of seconds to take action avoiding

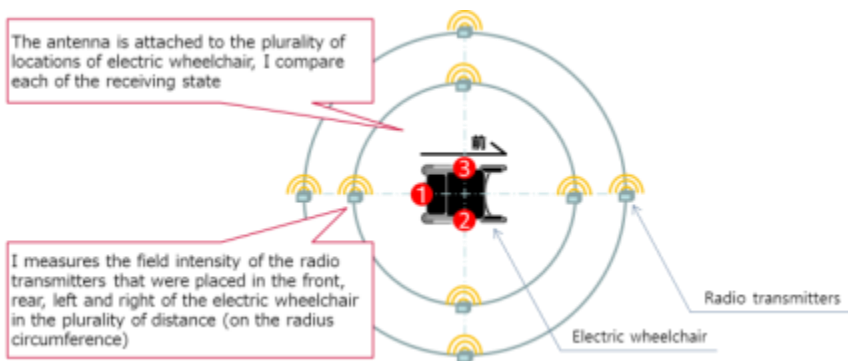
< 2016 fiscal year>

- Improvement for practical use
 - The calculation and evaluation experiment of the position information
 - Measurement experiments in crowded environment
 - Collection of big data
 - Study of a method for analyzing big data

This year, we constructed a detection system between moving objects and a detection system with network information. And We collected data by basic experiments.

【Test-1】 Measurement of characteristics

purpose : Confirmation of a radio wave characteristics due to the receive direction and distance



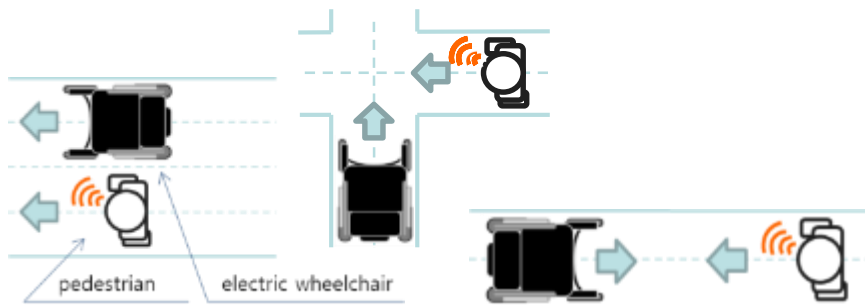
【Test-2】 Detection test : static - moving

purpose : Accuracy check of proximity detection using BluetoothLE in the case of one of the electric wheelchair or walker (or both) is static



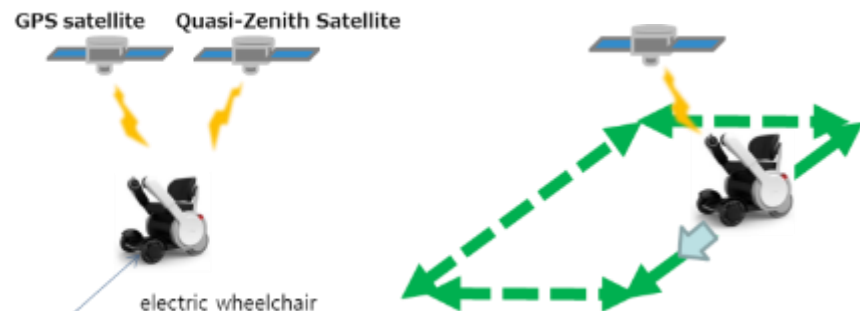
【Test-3】 Detection test : moving - moving

purpose : Accuracy check of proximity detection using BluetoothLE in the case of electric wheelchair and pedestrian move together



【Test-4】 Detection test with NW information

purpose : Accuracy check of measuring the electric wheelchair position using GPS + quasi-zenith satellite



Please see the presentation slide

Please see the presentation slide

The next fiscal year, we will (1) improve the basic technology that was developed this year, and implement (2) the position calculation technology and (3) the notification technology to the server. At the same time, we I consider how many seconds / meters we should notify before. Also at this time, we narrow the accident case of electric wheelchair. Not only pedestrian, and also consider bicycle and automobile running in the alley at a low speed as an accident case.(4)

