

## **Development of Pedestrian Information and Communication Systems (PICS)**

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### **SUMMARY**

Purposes to develop PICS are to support elderly and disabled persons for "their safe, convenient and comfortable movement to improve their daily lives."

Infrared communication technology is applied as an essential media for the development of PDA based on the experiences of infrared beacon used for VICS.

For visual impaired persons, the information is provided via voice message (PICS-A). For elderly and other disabled persons, the information is provided via literal, imagery and voice messages (PICS-B).

An experimental unit of PICS-A was built and installed at an intersection in Yokohama-city for field tests during November and December 1998. The results showed that the system works very well, especially effective for visually impaired at intersection.

As for PICS-B, the fundamental functions required for each subsystem and essential contents for services should be identified for further development. Field tests to be conducted by elderly, hearing and locomotory impaired persons are planned.

### **INTRODUCTION**

In Japan, there are 19.33 millions of elderly persons (older than 65 years) as of 1997 year end and the population of elderly persons is increasing rapidly with the fastest rate in the world. Consequently, traffic accident of elderly people is also increasing,

especially the ratio of elderly people over total pedestrians' traffic accident was 5.1% in 1996 became 15.8% in 1997. Numbers of victim due to traffic accident are also increasing year by year, 17,847 people were injured in 1997 which was 2.6% higher than 1996. Meanwhile, the numbers of dead due to traffic accident were 1,566 which was 1.4% lower than 1996.

There are 3.69 millions of disabilities in Japan, which includes 310 thousands of visually impaired persons, 370 thousands of hearing impaired persons and 3.01 millions of locomotory impaired persons. Numbers of dead and injured using wheelchair were 208 in 1997.

For these persons, it is indispensable to consolidate desirable pedestrians' environment enabling them to expand their mobility with safety and comfortableness, also enabling them to join social community.

Development of PICS (Pedestrian Information and Communication System□) has been examined in the UTMS (Universal Traffic Management Society of Japan) since April 1998.

The purposes to develop PICS are to provide necessary information in timely manner with pedestrians such as elderly and disabled persons supporting their safe, convenient and comfortable movement, which contribute them to improve their daily life.

In Japan, car-navigation-system as an information provider for automobiles has already been popularized to 3.93 millions as of 1998 year end and VICS (Vehicle Information and Communication Systems) providing more real time information has been popularized to more than 1.02 million.

It is considered as possible to provide pedestrians with same level of services as VICS if the required communication functions can be added to PDA (Personal Digital Assistants) to communicate with the infrastructure.

From experiences of the technology to use infrared beacon for the VICS, it can be expected that the said system can provide necessary information through infrared beacon with pedestrians such as elderly and disabled persons, which will contribute them to expand their mobility with safety. Infrared communication has a merit of low power consumption, low cost, and use in designated communication area, which is also suitable for equipping with PDA. Therefore, we developed our system to apply infrared communication as an essential media for PDA.

We have investigated users-needs, trends and the application for elderly people and/or disabled. And we have designed the system configurations. One of the systems is for the visually impaired. And field tests of the system have been conducted to verify whether it can provide the necessary information relative to the traffic intersection, where the infrared beacon transmitter is installed, with visually impaired persons who carry and scan the hand-held infrared receiver to the aimed direction.

## **NEEDS SURVEY AND APPLICATIONS REQUIRED**

Group interview has been conducted to check what kinds of application are required by visually, hearing and locomotory impaired persons while they are walking. Questionnaire is set in three phases like (1)before leaving their home (2)on the way to the place to go (3)at the place where they arrive. We asked them what kinds of information are required in each phase. As results of interview, we found the following

needs and applications are required to support their safe, reliable, convenient and easy mobility.

## **APPLICATIONS ON SAFETY AND RELIABILITY**

### Information required at Intersection

Generally speaking, disabled people are very afraid of walking around intersection. For the visually impaired persons, it is required to provide the guide to the intersection (name and direction), the status of pedestrian signal lights, the proper direction to walk. For the elderly people and locomotory impaired, extenuation of the walking time for walk through pedestrian crossing is required, because they have several experiences that signal lights turned to red during crossing and met dangerous situation.

### Function required for Emergency call

In case of emergency such as sudden illness, accidents involved conditions, etc., SOS message can be transmitted using Mayday call button.

### Information required for Status of route to destination

They basically need the information to predict the risk on the way. For hearing impaired, they want to know the information about current status surrounding them, especially in case certain traffic accident occurs, they want to know what is happening and alternative way to the destination.

## **APPLICATIONS ON CONVINIENCE AND COMFORTABILITY**

### Route Guidance Services

Before leaving their home, they basically need the information about route to the destination, transfer point, estimated arrival time. For locomotory impaired persons, they want to know the route without road gaps in addition. For elderly persons, they want to know the route with less staircase.

If they will need to use several different transportation services, the seamless transfer route information is required.

The information about optimum route from their home to the destination considering various conditions they select is required.

Visually impaired persons especially need the information about facility inside layout after arrival.

### Self-position Information Services

Information about the location of wheelchair usable toilet, police box(KOBAN), remarkable landmark etc. is required.

### SYSTEM CONFIGURATION

The system is composed of an infrared beacon transmitter/receiver installed near pedestrian pavement and the hand-held PDA. For the visually impaired person, the information is provided by voice (PICS type A). And for others, the information is provided by image, character, voice etc. (PICS type B)

System configuration is described as figure-1.

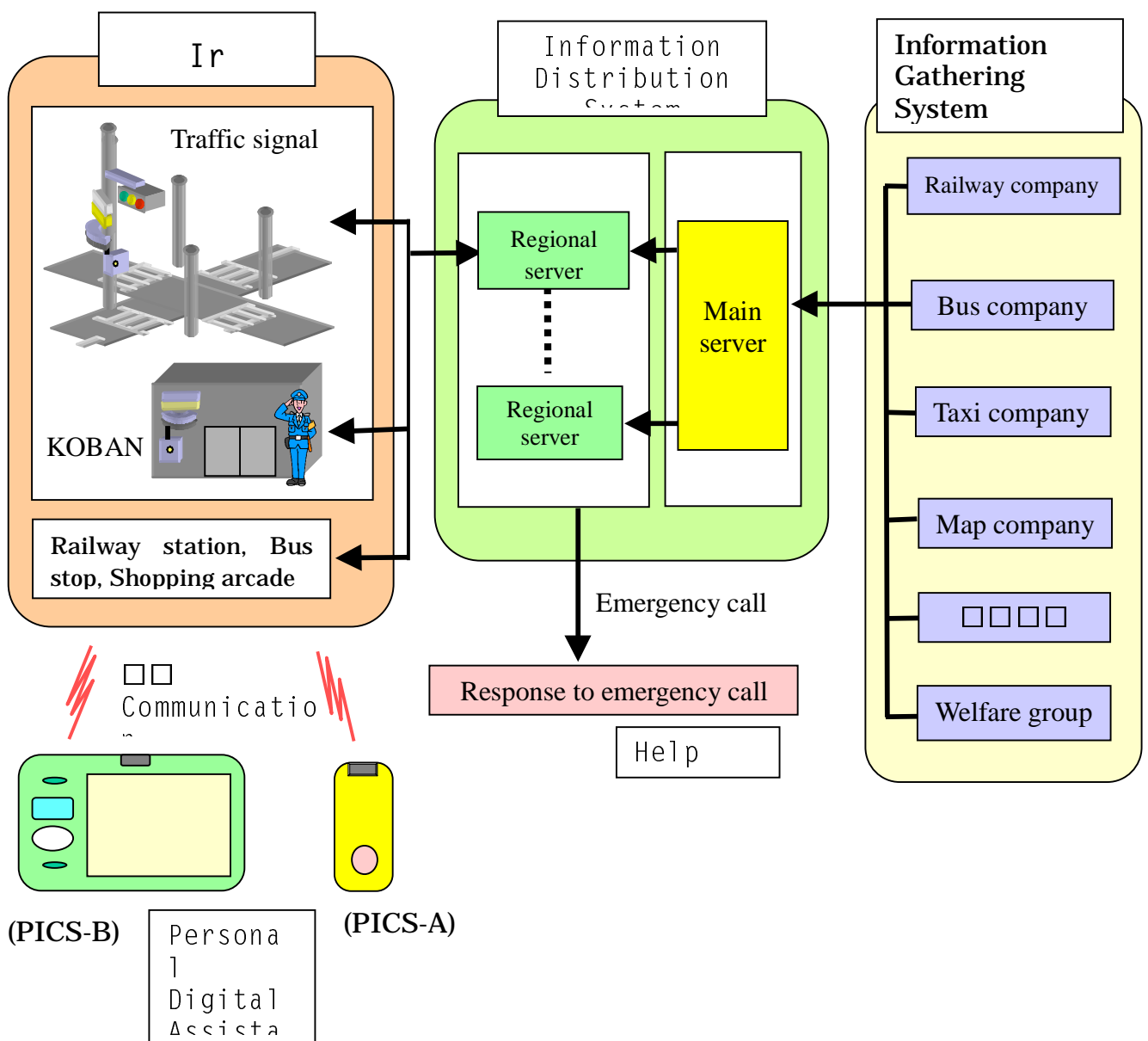


Figure-1 System Configuration

## **PICS-A**

This system is composed of infrared beacon transmitter and hand-held receiver. The transmitter sends the name of intersection, the direction to intersection, the status of pedestrian signal lights and other local information.

## **PICS-B**

This system is composed of information collection system, PICS server, help desk, infrared beacon device, network system, and hand-held PDA. The information collected is processed and transmitted with information of PICS server map data via infra-red beacon.

## **FIELD TEST**

We have made an experimental set of PICS-A and installed at the Hamatorihashi cross near Shin-Yokohama station and conducted field test during November and December, 1998.

## **SYSTEM CONFIGURATION**

The feature of PICS-A is that the information can be obtained personally and the direction of transmitter can be judged easily. Transmitter is installed closer to pedestrian signal lights and transmits the status of signal lights and information on intersection. Receiver receives the beacon and demodulates the signal and sends voice information via speaker. When visually impaired persons scan their hand-held receiver slowly toward the intersection, the voice message guiding the name of intersection and direction is transmitted through speaker of receiver. They can reach to the intersection walking toward the direction where they get the clearest voice message. After arrival at the intersection, they can get information about pedestrian signal lights like “walk” or “don’t walk”. Also they can get direction to cross the road, timing to start walking, knowing that their position is safely on the pedestrian crossing.

The voice message are as follows:

- Walking towards Hamatorihashi cross, the direction is to the east
- Walking towards Hamatorihashi cross, the direction is to the west
- Walking towards Hamatorihashi cross, the direction is to the north
- Walking towards Hamatorihashi cross, the direction is to the south
- The signal is red, don not walk
- The signal is turned to green
- Flashing

## **TEST PROCEDURE**

The route for the test is approaching to the cross from west side, crossing the road via east-west direction and crossing the road via north-south direction. The procedure for

the test is as follows. For making the mental map, a tester walks with a volunteer instructing shape of the cross and the position of transmitters. And then a volunteer walks the route twice with receiver independently. A tester records the track of volunteer's walking. After walking, testers make the verbal questionnaire and record answers. And testers discuss with volunteers and take note if there are some comments from them.

Total number of volunteers who kindly joined the test are 27. ( Totally blind=17, low vision=10. Male=16, female=11. Aged under 40=3, aged 40-49=7, aged 50-59=9, aged 60 ad over=8 )

The picture of field test is shown as figure-2.



Figure-2 Field Test at Hamatorihashi cross

## RESULTS AND CONCLUSION

### Results

As for system concept, the results are as follows.

- The direction to the cross is easy to judge ... 93%
- The name of the cross is easy to judge ... 96%
- The arrival to the cross is easy to judge ... 78%

- The direction to cross the road is easy to judge ... 96%
- The status of pedestrian signal lights is easy to judge ... 100%
- The timing to start walking to cross the road is easy to judge ... 96%
- The direction to the opposite side of the cross is easy to judge ... 89%
- The arrival to the opposite side of the cross is easy to judge ... 85%

As for walking track record, the results are as follows.

- Volunteers can stand straight to signal lights when waiting green signal.
- The track of volunteer's walking in the pedestrian crossing is almost straight.
- If they got out of the IR beacon width, they correct the walking direction towards the position of transmitter.

According to the questionnaire asked to the visually impaired persons who kindly attended this field test, following comments have been marked by them.

- It is easy to judge the direction to the intersection.
  - It is easy to recognize the name of intersection.
  - It is easy to judge the start timing of walk down, and it is clear to judge the status of pedestrian lights.
  - It is happy to get information personally.
- Consequently, they are relieved to walk if such a system is installed.

They also commented that the words for guidance on the receiver shall be much easier to understand and the receiver shall be more down-sized for easy handling.

## **CONCLUSIONS AND FUTURE PLAN**

### PICS-A

We evaluated that our system is effective to visually impaired people especially at intersection. We are working on following improvements:

- Messages shall be much easier to understand. Message on the status of signal lights shall be short within 5 to 6 seconds, but as for guidance of intersection 10 seconds or more will be allowed to provide enough information.
- Installing the transmitter shall be set to emit IR beacon downward as well as forward. At field test, some volunteer lost the beacon just before crossing over the zebra zone.
- Handheld receiver shall be smaller.

We are working on standardization of the system in function simplification and service formatting including message clarification.

### PICS-B

We are working on to identify what the fundamental functions of subsystems and the essential contents for services are required. And we are also planning to conduct field test for elderly, hearing and locomotory impaired persons.

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