Abstract: Kochi prefecture advocates “ITS for local pedestrians,” which is developed at low costs taking into account full deployment of the system. Kochi prefecture developed “pedestrian information system in the intermediate and mountainous area,” designed to ensure a safe traveling environment by reminding drivers that a pedestrian is around. As part of safety measures, our team deployed the system on the road in the intermediate and mountainous area within the prefecture where a sidewalk is not available since depopulation is accelerating merger and closure of elementary school and junior high school. Then, we conducted a survey to see how the perception of users changed. This paper presents “pedestrian information system in the intermediate and mountainous area” as a case of ITS for local pedestrians.

Key Words: pedestrians, intermediate and mountainous area, reminding

1. INTRODUCTION

Since Transportation Accessibility Improvement Law was enforced in 2000, creation of a barrier-free...
society has become a priority task in the field of social infrastructure development. Given this situation, elimination of physical barriers has been promoted by eliminating difference in level on the road, keeping sidewalk wide enough, and so on. Meanwhile, in order to ensure barrier-free walking space, ITS for pedestrians, intended to support safe, secure, and comfortable traveling by providing information with IT technology, has started to draw attention. A variety of pilot programs have been implemented across the country.

However, most existing pilot programs of ITS for pedestrians are:

- Applied to general public
- Feasible only with various equipments
- Focusing on seeds

Even if the people tested appreciate such program, they almost never see it officially implemented or put in operation in the current situation.

The followings are lessons learned from past ITS deployment in the case of Kochi.

1. Needs-oriented procedure is important instead of Seeds-oriented
2. Needs of ITS are quite different between Tokyo and Kochi
3. Advanced technologies are not always working well and not necessary depending on the situation.
4. Sustainability is essential and the cost, not only for initial but also for operating, is one of the key issue.

Considering those issues, authors started to develop ITS since 2003 and some systems are already deployed in the real fields of Kochi prefecture. We call “Grass-Roots ITS”

In Kochi, the prefectural office and Kochi University of Technology, collaborating with each other, clearly define targeted pedestrians and reduce users’ burden as far as possible to promote practical ITS for pedestrians (hereinafter called “ITS for local pedestrians”) (Hirota et al., 2007). ITS for local pedestrians is different from traditional ITS for pedestrians in the following points:

- Clear definition of targeted pedestrians
- Reduction of users’ burden as far as possible
- Implementation of measures for the local community with the official launch in mind

This paper discusses “pedestrian information system in the intermediate and mountainous area (Kitagawa et al., 2006)” newly developed in Kochi prefecture. After verification of its effects, the paper presents a proposal as to how ITS for local pedestrians should be.

2. OVERVIEW OF “PEDESTRIAN INFORMATION SYSTEM IN THE INTERMEDIATE AND MOUTAINOUS AREA”

2.1 Introduction

Kochi prefecture has been working on construction of sidewalk for the 1,410 km of roads specified under the first paragraph of article 3 of “Act concerning Promotion of Improvement Project of Traffic Safety Facility etc.” However, only 39% of the roads have proper sidewalk as of the end of 2004. Although 746 km out of 1,410 km are considered as school route, 198 km are still left untouched. Under
these circumstances, the local government has placed a high priority on the construction of sidewalk in such school route, but due to the recent severe fiscal situation, the government is in restraint of public investment such as infrastructure development etc.

Especially in the intermediate and mountainous area, the number of school children is decreasing influenced by declining birthrate and depopulation. In pursuit of cost effectiveness, the government puts a priority on urban area with regard to construction of sidewalk. In the future, the intermediate and mountainous area will presumably have more difficulties in construction of sidewalk. Nonetheless, increasing number of school children and others are forced to use the road without sidewalk in the intermediate and mountainous area because elementary school and junior high school are being either merged or closed in line with decreasing birthrate, aging society, and depopulation. That is why safety of users like school children must be assured urgently.

This situation has given rise to a need to think about measures using inexpensive software instead of sticking to traditional hardware improvement in order to assure the safety of pedestrians etc in the intermediate and mountainous area where users can be specified. Therefore, a team led by the local government and Kochi University of Technology developed a reminder system for the pedestrians in the intermediate and mountainous area as a measure to assure the safety of pedestrians etc at low cost. Then, the team deployed the system. Figure 1 gives a simple overview of the system.

2.2 Policy of System Development

Thinking about developing the system given in Figure 1, at first we conducted an inquiry survey for drivers, school children, and students etc who go through the relevant zone to see how they are aware of danger. Figure 2 summarizes how each driver and pedestrian/bike rider is aware of danger when passing by each other.
The results show that both drivers and bike riders feel more frightened at passing at night and that drivers are more aware of danger than bike riders. More than 80% of drivers are frightened at passing by a bike rider especially at night.

Thus, as a basic policy for the development of this system, we decided to place a priority on reminding drivers of an approaching bike rider at night. A majority (72.9%) of drivers going through the relevant zone requested a system which would allow them to know beforehand that a pedestrian or bike rider is around.

2.3 System Overview
As illustrated in Figure 1, this system consists of warning boards, push buttons, outdoor chassis, solar light-emitting marks, RFID reader and so on.

As for the device for the system to detect a pedestrian, we chose RFID tag (see Figure 3), which does not cost much, benefiting from the recent dramatic advancements in technology.

When a pedestrian or bike rider carrying a RFID tag goes through the relevant zone, the tag communicates with the reader installed on the warning board. In this way, the system detects the pedestrian/bike rider. Then, the system informs drivers of the approaching pedestrian/bike rider through the warning board. For the case where a pedestrian not carrying a RFID tag passes through the area, we made an arrangement so that pushing the button would activate the warning board, leaving it active long enough for the pedestrian to go through. We also prepared a supporting tool as seen in Figure 4 in order to hang the tag on a bike (Fujiwara et al., 2005).
Figure 4 RFID tag

Figure 5 and Figure 6 are pictures of the area in the day and night where the system has been deployed.

Figure 5 System in operation (day)
3. EFFECTS OF SYSTEM IMPLEMENTATION

3.1 Visibility of the System and Means of Advertisement

Launching a system like this, it is essential for the users to have proper understanding to take advantage of it. For this purpose, we advertised this system in various ways such as local cable TV, community newsletter and so forth, which ended up successfully raising the awareness among drivers and pedestrians to 73% and 78%, respectively.

Roughly half of the users learned about the system through the media such as local cable TV, newspaper, or community newsletter (see Figure 7) while as much as 41% of the users learned from the warning board. This suggests that activities collaborating with the local community greatly help to make a system more visible.

![Figure 7 Means of raising visibility of the system](image)
3.2 Perception Change
The pre-launch survey found out that drivers were particularly aware of the danger in passing a bike rider at night. Figure 8 and Figure 9 show how the awareness of danger changed among drivers and pedestrians after implementation of the system.

![Figure 8 Perception change among drivers](image1)

![Figure 9 Perception change among pedestrians](image2)

Figure 8 proves drivers became much less frightened at passing by a bike rider after this system was implemented. Figure 9 proves pedestrians/bike riders are also less frightened at being passed by a car.

These results demonstrate the fact that the system contributed to safe traveling in the relevant zone.

3.3 Continuous Operation and Expansion of the System
We conducted a questionnaire survey on drivers and pedestrians/bike riders going through the relevant zone about continuous operation of the system and its application to the areas facing a similar problem. Figure 10 and Figure 11 show the results.
These results found out that many users passing through the relevant zone demand continuous operation of this system. Moreover, more than 80% of them are in favor of the idea of expanding to other areas. Most comments against continuous operation were “because I don’t go through the area at night,” “because I have always been careful,” or something of this kind.
4. CONCLUSION

This paper discussed development of the security system by IT technology for the school children who use the road without sidewalk because of depopulation, aging society, and merger/closure of schools. Then, the effectiveness was verified. The results found out that implementation of the system enables to keep the area safe for bike riders and pedestrians.

Besides, we implemented the whole system in the relevant zone for 7 million yen while it would cost about 240 million yen if sidewalk was constructed as originally planned (Kochi Shimbun, 2006).

To take safety measures for pedestrians in mountainous area etc in the future, it will be necessary to think about efficient and cost effective measures by inexpensive solutions using IT technology rather than hardware solutions. We need to further improve our system to make sure pedestrians and drivers can enjoy more comfortable and safe traveling.

It will be necessary as well to consider penetration of community-oriented and practical ITS for pedestrians across the country based on their needs.

ACKNOWLEDGEMENTS

Mr. Kubo from Shimanto-cho office offered his valuable opinions from the beginning of the system development for us to write this paper. Mr. Ohta from Totoku Electric Co., Ltd. offered a great support in technical matters of RFID. We highly appreciate their cooperation.

REFERENCES


