Development of the Pedestrian Information System to Improve the Safety in the Intermediate and Mountainous Area

Hiromichi KUBO[1], Shuichi MATSUMOTO[2], Kenji OKAMURA[2], Hisashi KITAGAWA[3], Yasuhiko KUMAGAI[2]

1. Civil Engineering Division, Kochi prefectural government, Japan
1-2-20, Marunouchi, Kochi, 780-8570, Japan, TEL: +81-88-823-9832
E-mail: hirofumi_miyamoto@ken3.pref.kochi.jp
2. Regional ITS Infrastructure Research Center Research Institute Kochi University of Technology, Japan
3. Tyuonishi Civil Engineering Office, Kochi prefectural government, Japan

Abstract

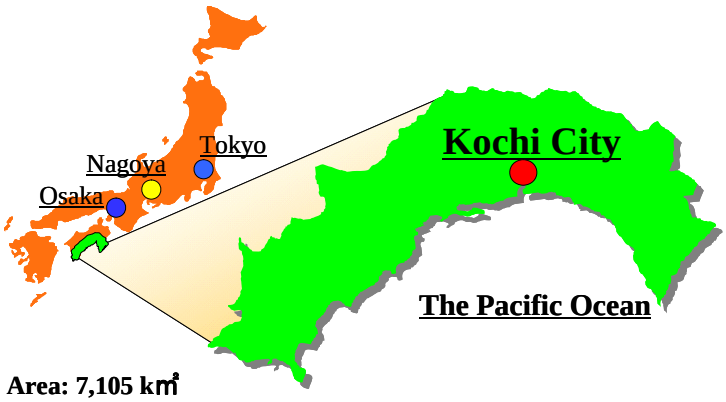
Many districts in the intermediate and mountainous area lack properly constructed sidewalks. With the aim of improving the safety of pedestrians, we developed an information delivery system that draws drivers' attention with a warning upon detecting a signal from the RFID tag carried by a pedestrian.

1 INTRODUCTION

With 83% of the land being forest, Kochi prefecture is characterized by its precipitous terrains. Many natural disasters such as typhoons and heavy rains hit the prefecture every year. Kochi Prefecture has not established a strong economic basis, and speaking of social capital, it is far behind other prefectures. The intermediate and mountainous area faces an aging population together with declining birthrate and depopulation. Most public investments tend to flow to the urban area in the current situation where priority is placed on cost effectiveness.

The local government controls 196 roads, equivalent to 2,788km, and 57% of them are ameliorated. Only 39% of the roads have proper sidewalks, and even in the school zone, about 200 km of them are left intact. The local government has placed a high priority on the construction of sidewalks in the school zone, but considering the recent severe fiscal situation, the promotion of construction in the intermediate and mountainous area is likely to be even more difficult in the years to come.

Nonetheless, assuring the safety of school children in the intermediate and mountainous area is an urgent necessity for road administrators. The road users have high expectations. Thus, we decided to take the second best measure to the traditional solution of infrastructure building: implementation of a software developed by the most appropriate electronic information technology.



Area: 7,105 km²
Population: 803,000
Population density: 113 /km²
Percentage of forested area: 83.3%
Length of coastline: 713km

Figure 1 Profile of Kochi Prefecture

2 UNDERSTANDING CURRENT SITUATION

We introduced the newly developed system to the Togawa district, Shimanto-cho located in western Kochi. In this district, the number of school-aged children decreased due to the declining birthrate and depopulation, which led to closure and merging of elementary schools. Consequently, the children who had attended to the closed school were forced to transfer to a distant elementary school. However, no sidewalks are provided in the school zone.

Prior to introduction of the system, we conducted a utilization survey to grasp the degree of road utilization and a hearing investigation to share users' views (see Table 1).

Type of survey	Period of survey	Survey method	Main survey items
Usage survey	2005/11/18 6:30AM to 9:00AM, 4:00PM to 9:00PM	Behavior survey	・user count ・utilization of sidewalk
Attitude survey	2005/12/16 6:00AM to 3:00PM	Hearing	・frequency of use ・purpose of use ・frightening experience ・sense of insecurity

Table 1 Survey schedule and survey items

Figure 2 geographic areas

The utilization survey found 4 pedestrians and 41 cars.

The hearing investigation was conducted on 149 drivers and 30 pedestrians/cyclists. As a result, we learned that nearly half of the road users had a frightening experience. We also found out the fact that about 60% of the drivers felt unsafe and anxious while passing by a pedestrian or a cyclist.

3 SYSTEM OVERVIEW

The challenge facing the traditional delivery system of pedestrian information was the detection of unspecified pedestrians.

We developed the system to be installed particularly in the school zone of the intermediate and mountainous area, so the pedestrians are specified to school children. Thus, we requested those who regularly walk or ride a bicycle in the school zone to carry a RFID tag. As soon as the reader installed on the roadside receives the signals from the RFID tag, the information board indicates pedestrian information to warn. Additionally, the light-emitting markers set up on the border with the traffic lane flash on and off to alert drivers.

Figure 3 is the overview of the whole system. The main devices that compose of the apparatus are outlined below.

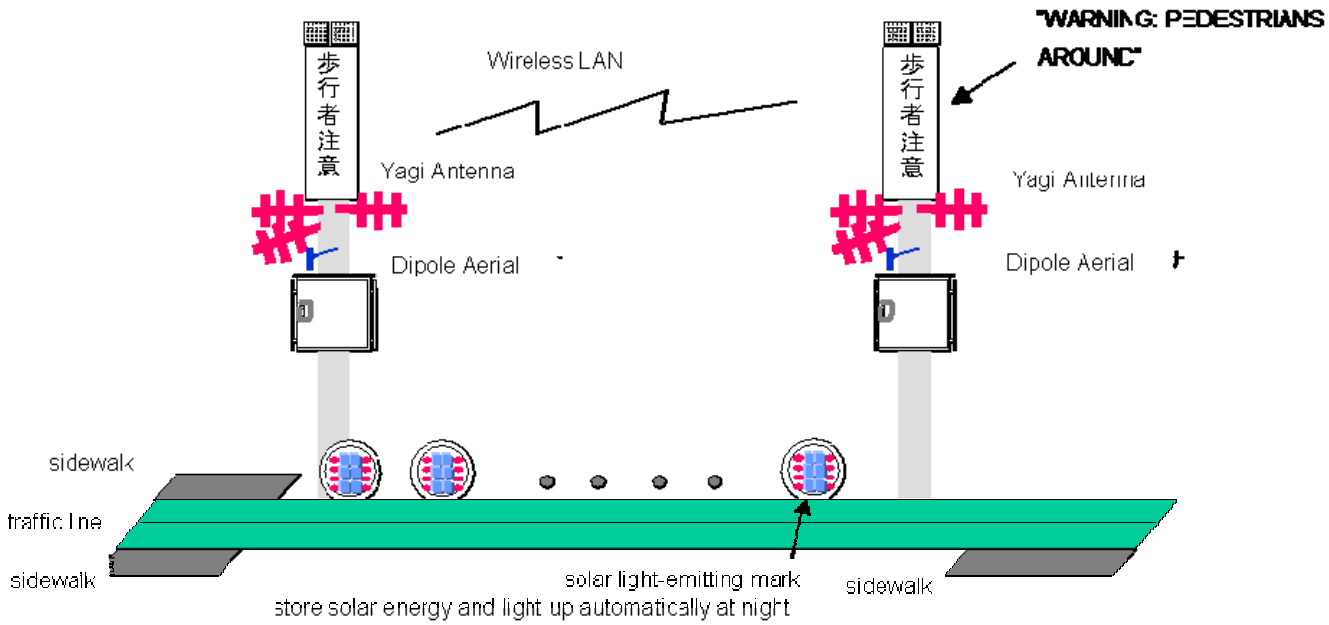


Figure 3 the overview of the whole system

3-1 RFID tag

Generally, imaging sensor is used to detect a pedestrian. However, the apparatus is expensive, and it needs some improvement in terms of accuracy. The pedestrians and cyclists to be detected are mostly specified to school children in the area where the system we developed is introduced. Thus, we chose the option of detecting the pedestrians/cyclists carrying a RFID tag.

Pedestrians carry a RFID tag of active type, and the reader installed on the roadside receives transmitted signals. The RFID tag carried by a pedestrian is shaped like a key ring, and it is compact. It incorporates a button battery inside. The signals from this RFID tag reach around 10m. Furthermore, 2 antennas covering different areas of detection are installed in order to improve accuracy of data the reader receives.

Figure 4 RFID tags and Reader

3-2 Information board

We can alert drivers either by sending information to the on-board unit via VICS and roadside radio, or by the information board set up on the roadside. Employment of VICS is not feasible because the prefecture does not meet a precondition for it: a car navigation system, which is not very common in the prefecture, has to be installed in each car. Utilizing roadside radio is not adequate, either for our purpose since it requires reception status of the radio. Hence, we found it most appropriate to choose the method of alerting drivers by indicating the existence of a pedestrian on the information board set up on the roadside.

It is desirable that the information board be easily understandable for drivers. On the other hand, the character size of a LED display board greatly affects its cost and visibility. After conducting a comprehensive deliberation with the current local situation in mind, we decided to choose the character height of 20cm which enables drivers to recognize the alert from 50m away when driving at 50km per hour. As for its color, we picked white, which is used as default standard in other regional ITS.

3-3 Light-emitting marks

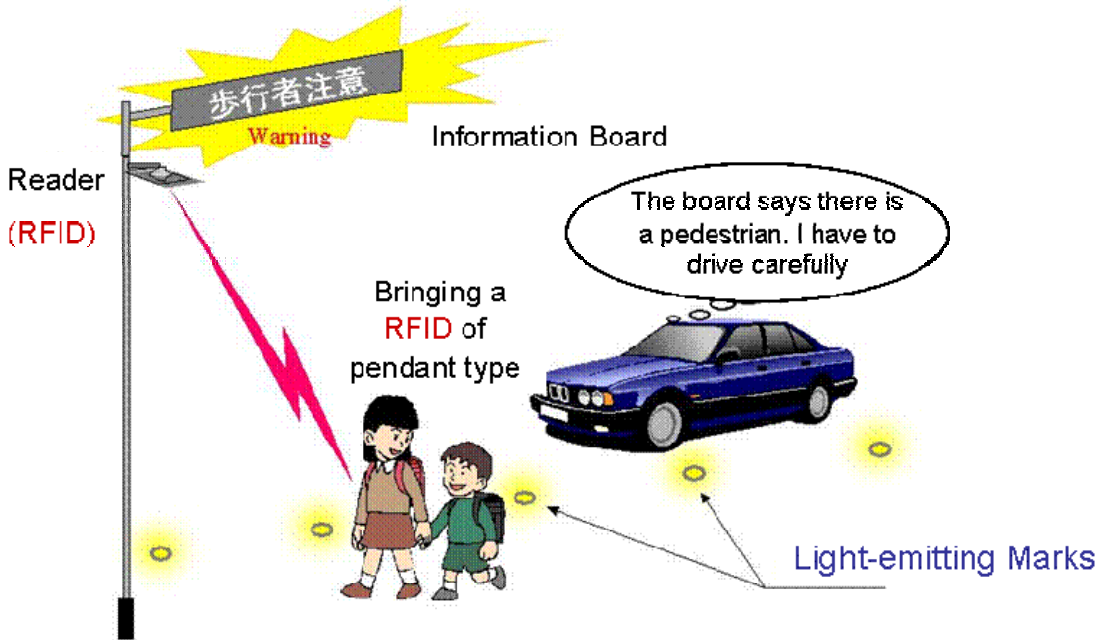
Light-emitting marks were implanted on the road along the lane edge for the purpose of showing drivers the border between the traffic lane and the sidewalk, and eventually assuring safe space for pedestrians. The light-emitting marks are of LED type, and they make themselves more visible by flashing rapidly. Moreover, the marks incorporate a sensor which doubles the speed of flashing upon detecting automotive headlights. As the emission color, a few options were considered such as red, yellow, or white. We chose white, the default standard in other regional ITS, on the grounds that Public Safety Commission has already been using red and yellow as the colors for regulatory signs.

4 CONCLUSION

Even in the intermediate and mountainous area, sidewalks have to be constructed in the school zone to ensure the safety of people like children. However, construction in the populous urban area takes precedence for the sake of cost effectiveness. This paper presents the system that provides drivers with pedestrian information as the second best measure to infrastructure building in the intermediate and mountainous area where pedestrians can be specified. As a next step, we would like to evaluate the effectiveness of the installed prototype and make the system even better.

Regional ITS is introduced for the purpose of assuring the safety of road users and improving convenience. Meeting the needs of community, regional ITS is a community-based effort. We believe that regional ITS provides “service of high quality at low cost” by effectively utilizing IT technology in order to face region-specific challenges in the field of road traffic.

Spreading and promoting of the system we developed will certainly be an effective way of assuring the safety of pedestrians in the intermediate and mountainous area. We, Kochi prefecture, would like to actively present the system to the local governments throughout Japan that face the similar road problem.



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