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Pedestrian's Signal Mechanism through Smart Traffic System centered on the vehicle

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Abstract

There is a trafficking weak who have difficulties with the normal traffic system. Because those people are slower than normal people, there is an issue that they have a hard time crossing the crosswalk safely with the normal pedestrian signal. Smart pedestrian traffic utilizes the IOT technology proposed in the previous paper to identify pedestrians that need more time via a smart device. This solves the problems that previously occurred with pedestrian signals by allocating more time for them. For the blind, it provides additional time plus sound guidance at the pedestrian signal by automatic recognition without the button operation. However, by increasing the walking time which is naturally increasing every year due to traffic demand, it is necessary to improve the connection with the existing traffic system, because it can influence the traffic flow. Local governments were introduced to the Intelligent Transportation Systems (ITS) in some cities in order to improve the speed of vehicular traffic, while decreasing delays and even air pollution. Although improvements in vehicle communication is achieved through ITS, traffic weak are not provided sufficient time to cross the crosswalk safely. In this paper, we researched improvement of the smart pedestrian signal system related to the Intelligent Transportation System centered on vehicles.

Keywords: *Smart crosswalk traffic light for handicapped; Simulation of the IOT Traffic Light;*

1. Introduction

Walking speed of Trafficking weak is slower than in the general population. Therefore, the safe crossing at the existing pedestrian signal that is set to 1 m/s is difficult. So the existing pedestrian signals are being operated to relieve the walking time to 0.8 m/s over a senior zone and child protection zone.

But it does not reflect well to the actual needs of trafficking weak. The result of calculating the average real speed of children walking is 0.63m/s, it also show 0.57m/s for elderly pedestrians. It is inadequate and does not ensure the safety even in the existing protected area [1]

Therefore, we proposed the smart pedestrian signal system which is centered on the trafficking weak. Smart pedestrian signal is the system that provides a personalized walking time by identifying trafficking weak for their safe crossing at the crosswalk. The system detects the signal of the Bluetooth devices and then, it identifies the trafficking weak. Pressing button is omitted to those who is blind. It provides a more customized walking time and the sound guidance signal by identifying a signal of the Bluetooth device of the blind [2].

This system identifies those trafficking weak by grafting IOT Technologies. And it allocates additional walking time for those in needs. This method is more efficient than the conventional method of specifying the senior zone, but may be confusing to an existing transport system.

The government introduced the Intelligent Transport Systems in domestic demand due to the issues of

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traffic. Through this, passage rate, delay, also, improved air quality, etc. [3]. Intelligent Transportation system operates to ensure a smooth flow of vehicle traffic. However, this system does not provide sufficient time for the trafficking weak to across the crosswalks safely.

In this paper, we study ways to improve the pedestrian walking system through the connection between the smart pedestrian signal which is applied IOT technologies and the Intelligent Transport Systems centered on vehicles.

The paper is organized as follows: Chapter 2 introduces the related research. Chapter 3 studies the improvement of relations between the smart pedestrian signal and transportation system centered in vehicles. Chapter 4 will mention the conclusions and future work.

2. Related Works

The vehicle-related research is related to the Intelligent Transport Systems. There is a major next-generation transportation system ITS (Intelligent Transportation Systems).ITS representative service is as follows:

ATMS (Advanced Traffic Management System) is the automation of tasks such as road traffic management and optimal signal system, and the recognition of both enforcement systems and traffic accidents. APTS (Advanced Public Transportation System) manages the public transport system based on the information received from the transit operating system. CVO (Commercial Vehicle Operation) recognizes the status of each vehicle and then manages the electronic customs systems and the loaded vehicle managing system [4,6,7].

3. Smart Crosswalk Traffic Light Mechanism

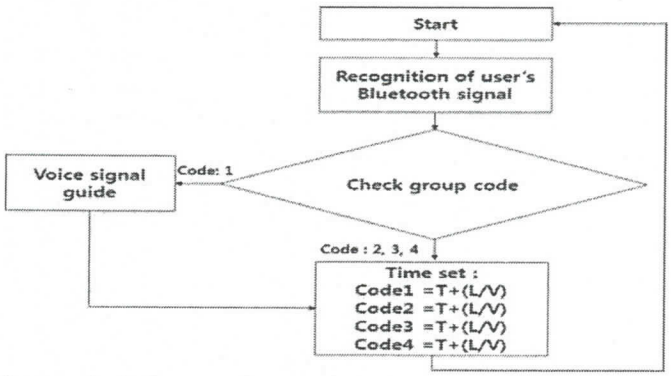

Figure 1. A Smart Crosswalk Traffic Light Diagram

Figure 1 shows the process of how the trafficking weak get additional walking time. This diagram consists of the three steps.

Step 1 – the trafficking weak install a private application on their smart device, it creates group code between 1 and 4.

Step 2 – The Bluetooth recognition devices installed in the traffic signal detects the Bluetooth signal from the pedestrian's smart device.

Step 3 – The traffic signal controller provides a signal to the smart pedestrian signals. It identifies the blue tooth signal and it changes the priority. After that, it gives those pedestrians additional walking time.

At this time, the walking time is set to T + (L / V). T is a pedestrian crossing entry time, L is the distance of crosswalk, V is the velocity of the pedestrian. V is set based on the average walking speed of each

trafficking weak. Then the walking speed is reflected in the time signal.

Smart pedestrian traffic light centered on the pedestrians has to be considered the effects of the traffic flow due to the adjustment of pedestrian's walking time according to whether pedestrians exist or not.

This is because various traffic status on the road will continue to change. The various devices installed in the roads collects traffic data. But we don't have a skill neither to control nor identify the traffic flow in real time. We need to develop the technology.

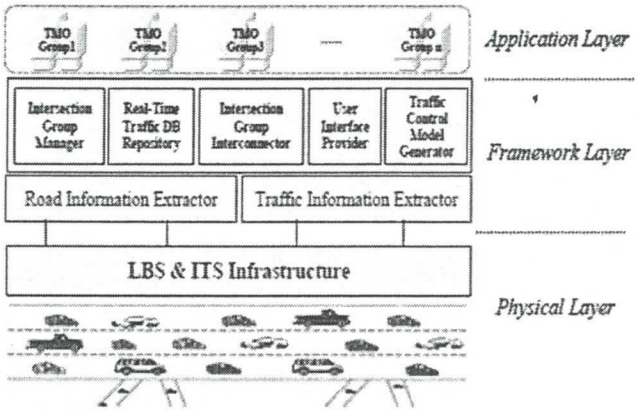

Figure 2. Intersection Simulation System Model

We would like to implement this with the virtual simulation. Figure 2 shows the intersection simulation system model. Traffic control at the intersection exerts influence over the entire traffic flow. Therefore, it is important to create an intersection network and manage it [5].

Figure 2 includes the application layer managing the grouping of each intersection. Framework layer in the middle of the intersection simulation system model is to dynamically control the traffic flow by collecting data from various devices which are installed on the road. The physical layer is present to provide the data to the upper layer through the physical data acquisition.

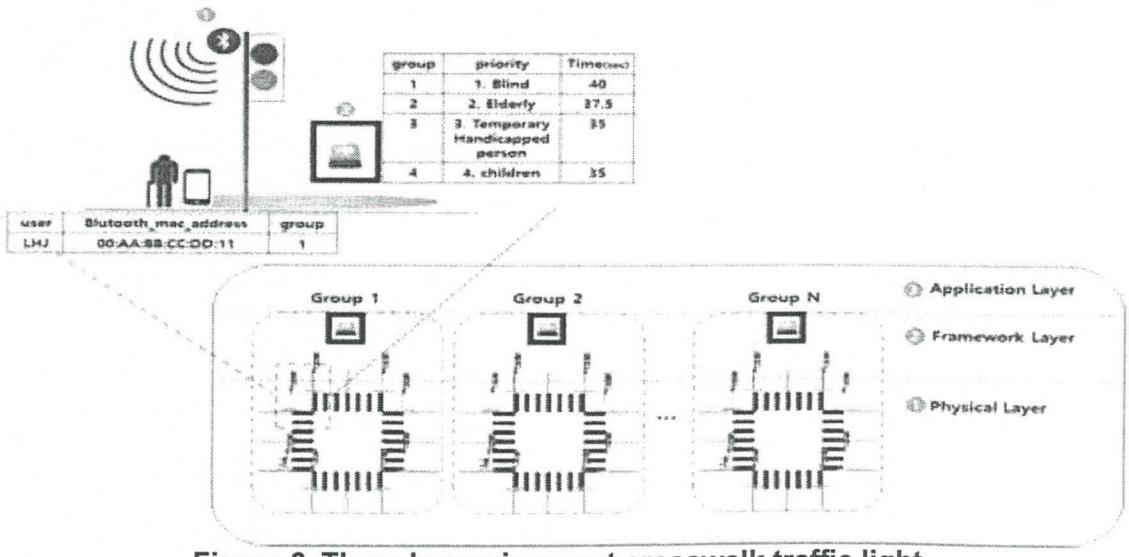

Figure 3. Three layers in smart crosswalk traffic light.

Figure 3 is a virtual simulation to visualize the structure. The physical layer in Figure 3 collects the data

from the traffic weak and transmits the data to the upper layer. The framework layer provides additional walking time for the trafficking weak. Application layer manages and grouping intersections

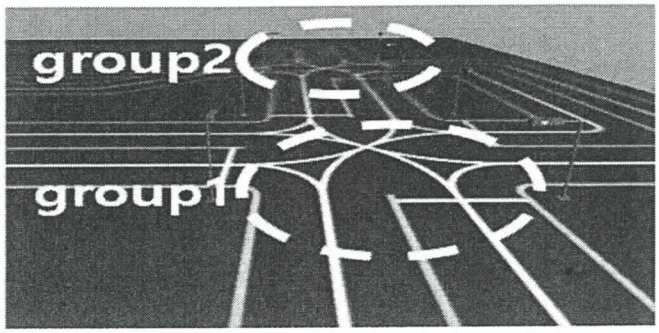

Figure 4. Intersection grouped in a virtual simulation

Figure 4 is a system which shows the intersection of simulation models. It also depicts the grouping of each intersection on the screen in the virtual simulation environment

The elderly[i] population is 12.7% of the total population, children[ii] are 14.3% of the total population, people with disabilities[iii] are 4.9% of the total population, which combined equals 31.9% of the total population of Korea in 2014.

This paper presents a virtual simulation based on this data. On the graph in Figure 5, the x-axis indicates the number of green lights that are off, they-axis represents the time the green signal is on. The results of the waiting time simulation are below:

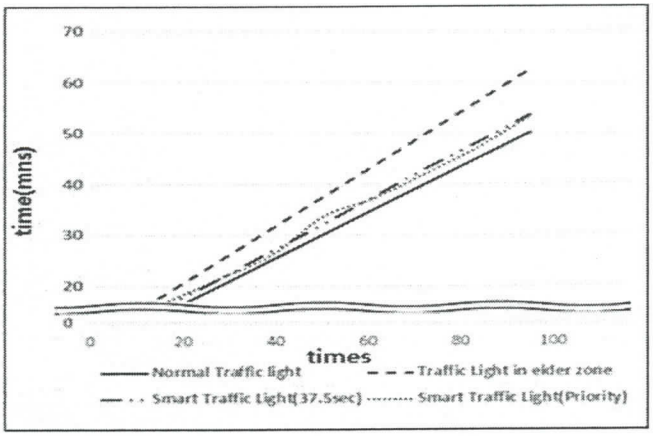

Figure 5. Compare traffic by waiting time

When the pedestrian traffic lights operates 100 times, the normal pedestrian signal takes 50 minutes, the smart pedestrian signal which applies priority takes 53.25 minutes. The smart pedestrian signal which does not apply the priority signal takes 53.63 minutes and the pedestrian signal in the senior zone takes 32.5 minutes. When we check the result of the smart pedestrian signal considered the priority increases 3.25 minutes than pedestrian signal is not applied. However, it is possible to minimize the interference by controlling the traffic flow through grouping the intersections.

4. Conclusion

Smart pedestrian signals centered on the pedestrians must be consider the effects of the traffic flow due to the adjustment of the walking time of pedestrians. This depends on if there is a pedestrian or not. Intelligent

Transportation Systems (ITS), which is centered on vehicles, can improve the vehicle traveling speed, minimize the degree of delay, and also, reduce air pollution. However, ITS does not provide enough time for traffic weak to cross the crosswalk safely.

In this paper, we seek to improve the connection between the intersection simulation based on the ITS and LBS for the traffic flow monitoring and control and smart pedestrian signals

The physical layer transmits the identified data of the traffic weak to the upper layer. Not only that but also the framework layer controls traffic flow through the added cross walking time and waiting time management based on the collected data. The application layer manages groups of intersections.

Considering traffic flows and added walking time due to the trafficking weak, the smart pedestrian is expected to be applied at the best time of the signal.

In this paper, only limited information due to ITS information privacy the authors studied the improvement of the smart pedestrian signals through the service applying real-time traffic flow. In future studies, we want to verify the actual implementation of the various possibilities for grafting to advanced smart pedestrian traffic signal system model

Acknowledgement

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[i] Estimated future population. Over 65 year old. Statistics Korea. 2014

[ii] Estimated future population. 0~14year old. Statistics Korea. 2014

[iii] Declared handicapped person. Ministry of Health & Welfare. 2014(included over 65year old people)

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