Development and Experimentation of Smartphone Application for Supporting Proper Cycling Speed

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***Abstract*— In this paper, we develop a smartphone application for supporting a proper cycling speed. In this application, there are two types of screens; normal screen and alert screen. On the normal screen, the current cycling speed and the proper cycling speed. The current speed is compared with the proper speed continuously. If the current speed exceeds the proper speed, the normal screen changes to the alert screen automatically. Moreover, this application sounds a warning tone for several seconds. We investigate experimentally how this application works. In the experimentation, we carry around with the smartphone where our application has been installed and collects several kinds of data. From the experimental results, we show the validity of this developed application.**

I. INTRODUCTION

Recently, cycling is one of the major sports and hobbies, and it has attracted much attention. The number of cyclists has increased over the last several years and some local governments recommend commuting and sightseeing by bicycle. This is because a bicycle is an eco-friendly, convenient, and healthy ways of transportation. Therefore, it is expected that cycling becomes more popular all over the world.

On the other hand, bicycle accidents are more serious than car accidents. Therefore, it is indispensable to avoid the bicycle accident, but it may not be easy to ride a bicycle safely. We consider that one of the reasons is because it is not easy to ride a bicycle at a proper speed. For example, the control of bicycle becomes unstable by riding a bicycle at a high speed, on the other hand, other drivers may be disturbed by a bicycle whose speed is much low. Hence, it is expected to ride a bicycle at a proper speed.

In this paper, we develop a smartphone application for supporting a proper cycling speed. In this application, there are two types of screens; normal screen and alert screen. On the normal screen, the current cycling speed and the proper cycling speed are displayed. This proper cycling speed changes according the position of smartphone. This application compares the current speed with the proper speed continuously. If the current speed exceeds the proper speed, the normal screen changes to the alert screen automatically. Moreover, this application sounds a warning tone for several seconds. After the current speed becomes smaller than the proper speed, the alert screen changes the normal screen.

We investigate how this application works experimentally. In the experimentation, we carry around with the smartphone where our application has been installed and collects several kinds of data. In order to evaluate the performance of the application carefully, we do not use the application on a bicycle in this paper.

The rest of this paper is organized as follows. Section II explains related work. Section III describes our developed smartphone application. Section IV shows some experimental examples, and finally we conclude this paper and explain our future work in Section V.

Fig. 1. How to use our developed smartphone application.

II. RELATED WORK

As a smartphone application for cycling, Runtastic Road Bike [1] and Speedometer 55 Pro. GPS kit. [2] have been developed and utilized. In this section, we introduce the two smartphone applications.

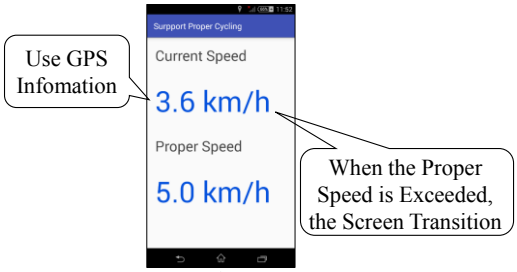
With Runtastic Road Bike, several kinds of data such as cycling speed, driving distance, and driving route can be displayed on a screen. These data can be shared with many users by social network services (SNS) though the Internet. The average speed on each route can also be displayed on the screen, and hence users guesses the proper speed on each route. However, it is not guaranteed that the average speed is proper on each point.

On the other hand, Speedometer 55 Pro. GPS kit. gives users an alert by both warning that is displayed on a screen and warning tone if the driving speed exceeds the limited speed. Therefore, with this application, users can ride a bicycle at a speed that is lower than the limited speed. In this application, the limiting speed is set by each user on each route. It is not easy for each user to set the proper speed on each point and it is not also guaranteed that the average speed is proper on each point.

III. SMARTPHONE APPLICATION FOR SUPPORTING CYCLING SPEED

In this section, we explain our developed smartphone application for supporting proper cycling speed. We assume that a user attaches the smartphone where our developed application on the steering wheel of bicycle (see Fig. 1).

In our developed smartphone application, there are two types of screens; normal screen and alert screen. Figure 2 (a) shows an example of the normal screen and Fig. 2 (b) shows an



(a) Normal screen.

(b) Alert screen.

Fig. 2. Two screen images for our developed application.

example of the alert screen. On the normal screen, the current cycling speed and the proper cycling speed are displayed. The current cycling speed is measured with the GPS information of the smartphone by using *getSpeed* method. Therefore, the accuracy of the current speed depends on *getSpeed* method. On the other hand, the proper cycling speed changes according to the position of smartphone. This proper speed for each position is set manually in this application in advance. This proper speed is supposed to set by a specific person such as administrator of this application. By riding a bicycle with this application, users are expected to change the cycling speed by checking the proper speed.

Moreover, this application compares the current speed with the proper speed continuously. If the current speed exceeds the proper speed during time interval T, the normal screen changes to the alert screen automatically. Moreover, this application sounds a warning tone for several seconds. After the current speed becomes smaller than the proper speed, the alert screen changes the normal screen. Therefore, users are also expected to avoid that the cycling speed exceeds the proper speed.

IV. EXPERIMENTAL RESULTS

We evaluate the performance of the developed application experimentally. In the experimentation, we carry around with the smartphone where our application has been installed (see Fig. 3) and we collect several kinds of data with a function of this application. In this experimentation, we set T to 3.0 [sec]. We do not use the application on a bicycle in order to check the performance of the application carefully.

Figure 4 shows the collected data in our experimentation. In this figure, the state of normal screen is denoted as 0 and the state of alert screen is denoted as 1. Moreover, the state of warning tone is denoted as 1, and the normal state is denoted as 0. Note that the data is collected with this application only when

Fig. 3. Experimental environment for our developed application.

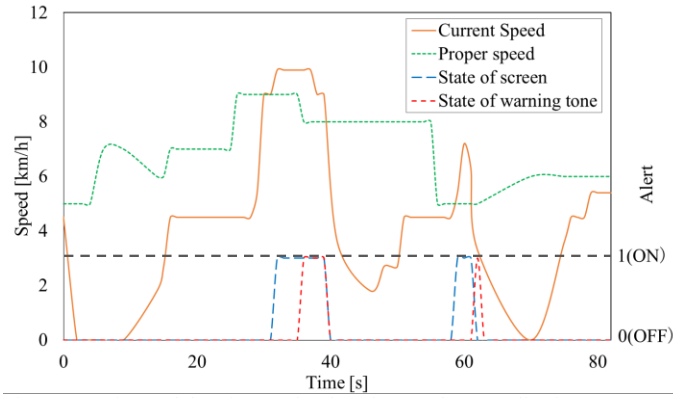


Fig. 4. Experimental data for our developed smartphone application.

an event occurs and that the time interval between two successive data is not constant.

From Fig. 4, we find that the normal screen changes to the alert screen just after the current speed exceeds the proper speed. Moreover, we found that the waring tone is sounded after about 3.0 seconds. Moreover, the alert screen changes to the normal screen just after the current speed becomes smaller than the proper speed. From these results, our developed application is expected to support the proper cycling speed.

V. CONCLUSION AND FUTURE WORK

In this paper, we developed a smartphone application for supporting proper cycling speed. In this application, the current speed is compared with the proper speed continuously. If the current speed exceeds the proper speed, the normal screen changes to the alert screen automatically. Moreover, this application sounds a warning tone for several seconds. We evaluated the validity of this application experimentally. From the experimental results, we found that the alert can be performed properly by comparing the current cycling speed with the proper speed.

In our future work, we investigate how cyclists can control the cycling speed by using our developed application properly and easily.

REFERENCE

[1] Runtastic Road Bike, https://www.runtastic.com/ja/apps/roadbike.
[2] Speedometer 55 Pro. GPS kit., http://www.blocoware.com/iphone-ipad-speedometer.htm.