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Development Design of Driver Safety Content for Mobile UI

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Abstract: Drowsiness driving is one of the causes of traffic accidents and it is known that the risk is higher than drunk driving. Therefore, there is a growing interest in developing a system that warns driver's drowsiness and research has shown that analyzing the driver's information records is effective in detecting driver fatigue and drowsiness. This research collects biometric data such as driver's biometric information, vehicle internal temperature and humidity information and current position display. Prior to the development of prototype App. which transfers the collected biometric data values to the smartphone application and detects the risk values of the drowsiness, environment, arrhythmia as another signal to the driver, we wanted to design the mobile driver safety content (Cockpit App.) UI. From this result, the proposed mobile driver safety content UI design confirmed that the driver was able to confirm the biometric information at a glance.

Key words: Drowsy driving, UI, Cockpit APP., information, biometric data, temperature

INTRODUCTION

The definition of drowsy or drowsy driving is still unclear. Drowsy driving can be viewed as a dispersion of attention in that the driver does not concentrate fully on driving behavior.

Most experienced drowsy drivers staying awake before an accident occurs but some drivers do not wake up from the moment they happen. In many studies, "accidents" or "accidents are likely to occur" associated with drowsiness driving is the most common type of the deviated road. Drowsiness driving is the most common cause of driving accident following driving after drinking (Anonymous, 1998). In the United States and Europe there has been a long history of trying to estimate the social cost of drowsy driving. In connection with dozing driving, social losses of about 100 billion won or more occur in the united states only every year.

According to a survey conducted by the Korea Traffic Authority in 1998, 95% of drivers experienced drowsiness (Anonymous, 2014). Since, then, Korea Traffic Authority's survey conducted in 2011 showed that 79.3% of them experienced drowsy driving. Of these, 15.7% experienced traffic accidents and 21.3% reported violations. Even though more than 10 years passed it can be seen that the drowsiness driving still cannot be solved (Anonymous, 2015). According to the national police agency statistics (2013-2015), about 2,500 traffic accidents are caused by drowsiness driving every year. The average death rate is about 120 for three years, about 5,000 injuries and 4.7% for fatalities appeared (Anonymous, 2016). Previous research on drowsiness detection of driver in drowsy driving has been mainly focused on vision-based drowsiness detection using image processing technology by photographing the driver's blinking, pupil size, gaze direction and facial expression (Choi *et al*., 2012; Joo *et al*., 2008). Also, a study on the detection of drowsiness through the correlation between stress and peripheral body temperature (Kataoka *et al*., 1998), heart rate change (Bunde *et al*., 2000) and skin impedance signal analysis (Lee and Lee, 2007) was also published. However, these studies have a disadvantage in that it is difficult to interpret drowsiness clearly and it is also difficult to actually apply it because of the sensitivity to ambient light and external brightness. In addition, the detection of drowsiness based on the movement of the pupil and the change of the muscles is a result obtained when the drowsiness has already been advanced. Therefore, a signal line gain and an analysis method are required for diagnosing the drowsiness state. In order to solve these problems, various bio-signal based researches have been conducted.

Previous research has proposed a method of analyzing brain features based on the AR (Autoregressive) model but this study uses a Linear Predictive Coding (LPC) coefficient that does not take input noise into account and the residual signal of the model (Han *et al*., 2011). The residual signal has stability in a noisy environment but still has a problem of threshold setting of residual signals of each feature.

This research collects biometric data such as driver's biometric information, vehicle internal temperature and

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humidity information and current position display. Prior to the development of prototype App. which transfers the collected biometric data values to the smartphone application and detects the risk values of the drowsiness, environment, arrhythmia as another signal to the driver, we wanted to design the mobile driver safety content (Cockpit App.) UI.

MATERIALS AND METHODS

Driver safety content (Cockpit App.) function configuration table for mobile: In order to develop a driver safety content prototype for mobile, a configuration table of driver safety content function for mobile was prepared as shown in Table 1.

Cockpit App. process flowchart using mobile: The following is a flowchart of the driver safety content process for mobile. Figure 1 shows the Bluetooth process. Figure 2 shows the location information process.

Driver safety content (Cockpit App.) for mobile UI design: The UI of Cockpit App. was focused on functional elements such as menu layout, screen layout for content

Table 1: Operator safety content configure APP. function

Menu/Function name	Detail of function
Login	
ID/PW	User ID and PW input function
Certification	User ID and PW value check processing
Main	
Average heart rate per week	Get heart rate information
	Average processing function of heart rate information
	Heart rate information graph display function
A weekly drowsiness change	Drowsiness index information retrieval function
	Drowsiness index information average processing function
	Drowsiness index information graph display function
Change in operating time per week	Get time information
	Average processing time information
	Display of running time information graph
Average information	Show the maximum heart rate during a week
	Minimum heart rate during a week
	Drowsy indicator
	Show running time
Today	
Heart rate	Heart rate information storage function
	Heart rate information graph display function
Stress	Stress information storage function
	Stress information graph display function
Driving information	Saving time information
	Display of traffic information graph
Current time information	Display maximum heart rate information
	Show stress status
	Display of running time information to present
Recording	
Heart rate comparison information	Get heart rate information
	2 weeks heart rate comparison graph
Stress Compare information	Ability to import stress information
	Two-week stress information comparison graph
Drowsiness comparison information	Get Drowsy Index information
	2 weeks drowsiness index information comparison graph
Location	
Map	Map display function to display position
My location	Ability to retrieve my location even if the map is moved to another location
My location information	My location information (road name)
Vehicle environment	
Internal temperature	Real-time internal temperature information collection
	Display internal temperature information
Internal humidity	Real-time internal humidity information collection
	Display of internal humidity information
Fine dust concentration	Real-time internal fine dust information collection
	Fine dust density status graph display
Set	
Collection module	Information gathering module search
	Information gathering module setting
Control module	Device control module search
	Device control module settings
User	Program user input
	Program user duplication check
	Program user registration

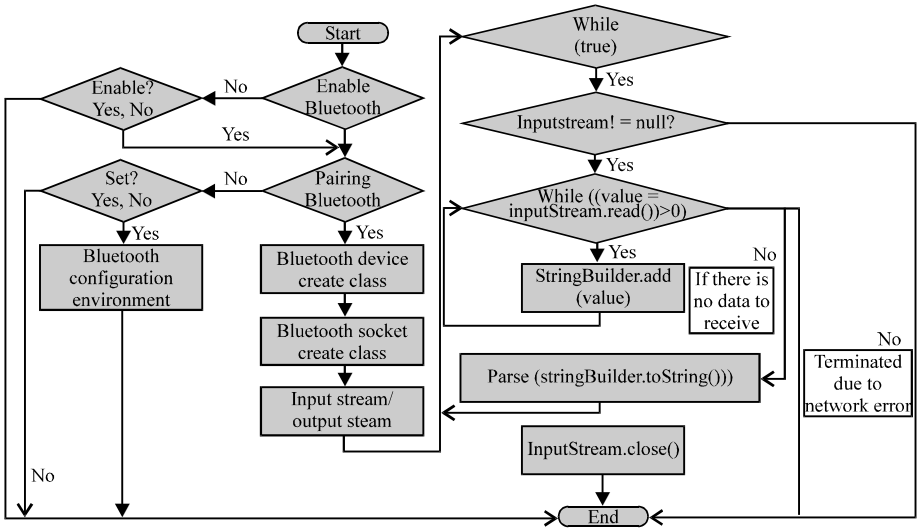

Fig. 1: Bluetooth process flow chart

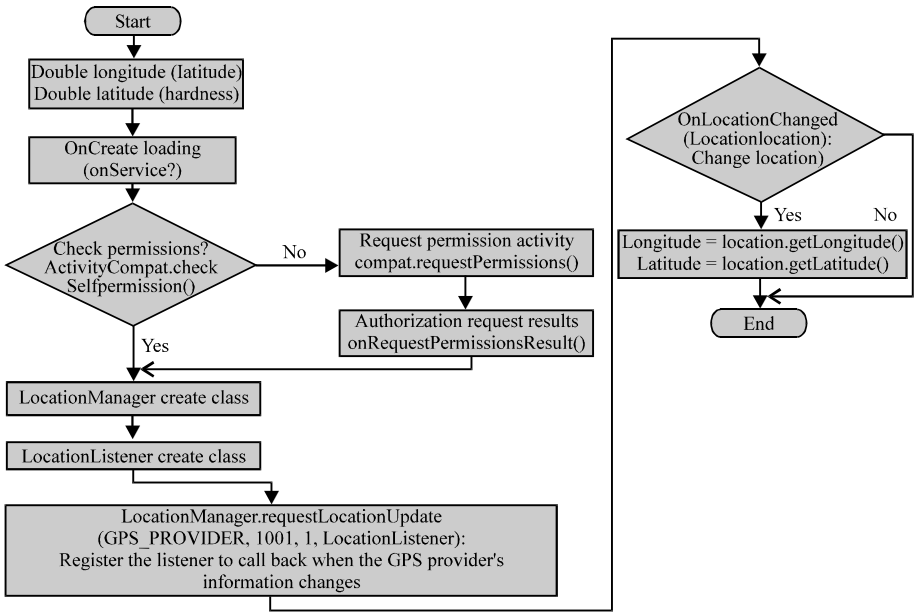

Fig. 2: Location information process flow chart

area and graph. For the user's visibility, design work was carried out in consideration of the latest trends, improvement of the user's cognitive ability and visual factors. The contents that can implement the function automatically are included even if the driver does not need to perform manual operation for the safety driving hazard item (emergency light, air conditioner control, driver emergency situation transmission, etc.).

Screen layout and design in the top line, the current menu name is displayed. In the content area which is the center of the screen, data such as the driver's heart rate, stress, sleepiness, driving information, vehicle environment and the like are displayed on the screen in the form of a graph. As an important content of the design, visibility is emphasized by applying an animation effect to the graph of the contents area when the screen is driven and a 'menu bar' button is arranged at the upper right of the screen to enable rapid menu movement. In addition, the design of the Cockpit App. was created using Adobe Photoshop CS6 and Adobe Illustrator 6 as shown in Fig. 3.

Fig. 3: Screenshot of Cockpit App's screen layout and actual screen: a) Login screen; b) Main screen; c) Today screen; d) Record screen; e) Location screen; f) In-car environment screen

RESULTS AND DISCUSSION

In the United States and Europe, there has been a long history of trying to estimate the social cost of drowsy driving. In connection with dozing driving, social losses of about 100 billion won or more occur in the united states only every year. This research collects biometric data such as driver's biometric information, vehicle internal temperature and humidity information and current position display. Prior to the development of prototype App. which transfers the collected biometric data values to the smartphone application and detects the risk values of the drowsiness, environment, arrhythmia as another signal to the driver, we wanted to design the mobile driver safety content (Cockpit App.) UI. Screen Layout and Design in the top line, the current menu name is displayed. In the content area which is the center of the screen, data such as the driver's heart rate, stress, sleepiness, driving information, vehicle environment and the like are displayed on the screen in the form of a graph.

CONCLUSION

As an important content of the design, visibility is emphasized by applying an animation effect to the graph of the contents area when the screen is driven and a 'menu bar' button is arranged at the upper right of the screen to enable rapid menu movement. In addition, the design of the Cockpit App. was created using Adobe Photo Shop CS6 and Adobe.

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