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Research paper

A study on bus safety operation system applying IoT technology

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Abstract

Background/Objectives: It is a bus safe operation system applying IoT (Internet of Thing) technology. It is the starting point of future economic activitiessuch as past simple transportation methods and various information such as health care, wearable, IoT, We want to change the paradigm into service exchange space. Vehicle infotainment technology utilizes a bi-directional head-up display (HUD) interface technology to detect the wheel state of the steering wheel operation, which is the driver's operation behavior, and the pupil watching forward, and warns if momentary carelessness or continuous carelessness occurs, Avoid.
Methods/Statistical analysis: Since the ratio of the eye area in the face area is very small, there is a possibility that the calculation time is greatly increased. In order to optimize the module, based on the analysis of the Korean face information, Thereby reducing the search time. Driver Monitoring System (DMS) developed by Toyota is an infrared camera module installed in front of the dashboard to monitor driver's eyelids and head movements during driving to determine driver's sleepiness.
Findings: Based on the know-how of wireless communication-based healthcare device manufacturing technology, we can develop user-oriented products that can differentiate from the existing IoT healthcare products and develop wireless communication-based healthcare for large- We will develop a care terminal to secure marketability.
Improvements/Applications: Developed commercial products focusing on the technology stabilization centered on the large transportation profession, obtained stable sensor information and obtained relatively accurate sensing information without inconvenience for long-term operation or work. Active braking assist is a fully automated control system that stops the vehicle when it detects the risk of a frontal collision. Using three radar beams installed in the vehicle, it detects up to 150m in front of the vehicle, helping to avoid the risk of a frontal collision.

Keywords: *Fabric Area Network; Internet of Things; Cloud Computing; Wearable; Augmented Reality.*

1. Introduction

By applying IoT technology, wearable and augmented reality technology evolves to detect the drowsiness by detecting and analyzing the eyes of the driver by inputting the images using the camera through eye recognition. Analysis of the time domain and frequency domain of heart rate variability (HRV) using ECG signals from R-peak detection analysis is used to compare and analyze differences between the driver's arousal state. Studies have shown that the respiration-based drowsiness sensor reduces the peak at about 75% of the normal person's sleep state when awake, and that the respiration rate at arousal is less than that at the drowsy state And a drowsy state is detected by comparing with the reference values. Augmented Reality (AR) is a field of virtual reality1. It is composed of virtual space and objects, such as computer graphics technique that synthesizes virtual objects in real environment and makes them look like objects in original environment. It is advantageous to synthesize virtual objects on the basis of the real world and to reinforce and provide additional information that is difficult to obtain only in the real world. One of the most basic problems that limit the application field of mixed reality system is the problem of image matching in which two images are exactly matched when real images and virtual graphics are overlapped. Such image synthesis techniques are relatively developed.

2. Related works

Vehicle infotainment technology utilizes a bi-directional head-up display (HUD)2 interface technology to detect the wheel state of the steering wheel operation, which is the driver's operation behavior, and the pupil watching forward, and warns if momentary carelessness or continuous carelessness occurs, Avoid. Figure 1 is a next-generation interface technology that enables real-time information distribution on a bus-based display and a mobile display for the purpose of bidirectional communication between an information transmitter and an information receiver, contributing to participation of information distribution and public information demand of a large number of citizens.

Fig. 1: Next Generation Interface.

2.1. Drowsy driving detection technology

Since the ratio of the eye area in the face area is very small, there is a possibility that the calculation time is greatly increased. In order to optimize the module, based on the analysis of the Korean face information, Thereby reducing the search time. Figure 2, shows the method used to detect eye flicker using the method of analysis of Multiple Gabor Wave Response, the method using pupil detection and pupil size, and the method using PCA. In order to increase the detection rate in various environments. the blinking is detected by blending the method using the color system and eye shape together with the PCA model.

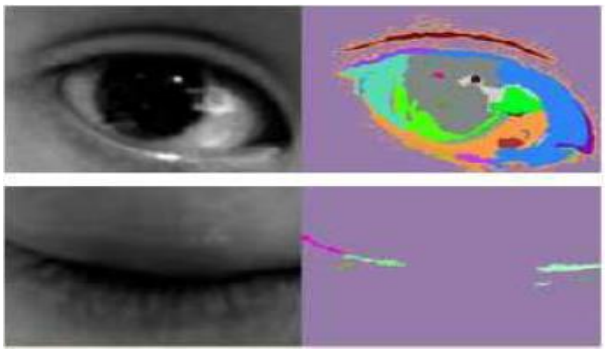


Fig. 2: Segmentation Result by Eye Opening / Closing Screen.

2.2. Drowsy detection technology for electrocardiogram measurement

Figure 3 below shows the frequency acquisition of HRV using electrocardiogram. (a) analyzing the time domain and frequency domain of heart rate variability (HRV) from the ECG signal by R-peak detection analysis and (b) detecting the drowsy state by comparing the difference with the driver's arousal state. The ECG signal is affected by the surrounding environment and noise so that it is difficult to detect an accurate signal in a bad environment such as an automobile.

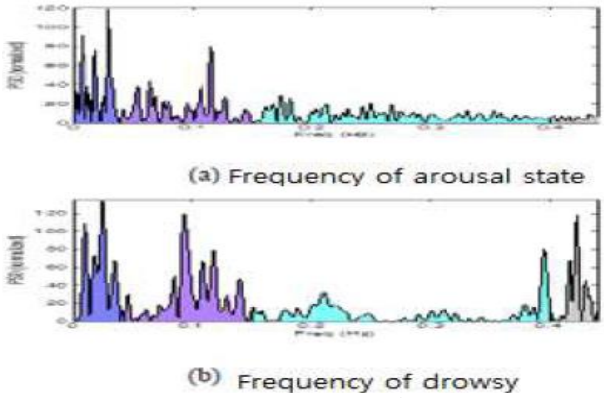
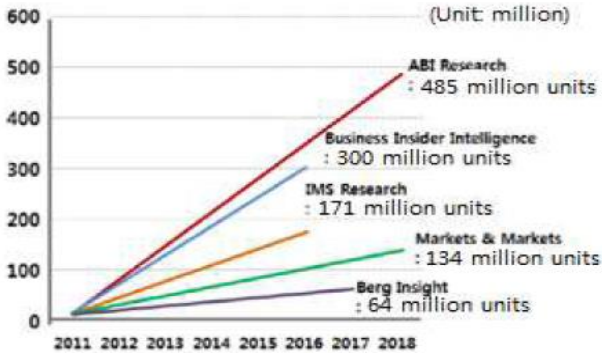


Fig. 3: Frequency Domain of HRV.

2.3. Wearable device technology

The focus of attention on wearable handsets is that the smartphone market has already matured due to the development of handsets and related technologies that will lead to the post smartphone era. And the growth rate is slowing down. By 2020, 5.6 billion people, about two-thirds of the total population, will have smartphones. ICT-related players, including handset operators, are increasingly investing in finding new sources of revenue after smartphones9. As the high-end premium smartphone market, which forms a high sales price, is entering its maturity period, wearable handsets are expected to generate new revenue sources As well. Table 1 shows that the market for wearable handsets continues to grow from 2012, with annual shipments of 385 million units until 2018, according to research from ABI Research, a market research agency. It accounts for about 28% of the total smartphone market size produced in the same period.

Table 1: Estimates of Annual Production of Wearable Handset Worldwide



3. Ways to design various types of wearables

3.1. Google glass

As a new end-user platform, Google is actively encouraging the development of Google Glass-specific apps around Google Glass, a funding program that helps Google Glass create its own ecosystem3, 4. Figure 4 shows that Google Glass-specific apps and services are built on Google's Mirror API. Google restricts external distribution of apps for Google Glass. Google restricts external distribution of apps for Google Glass. Google Glass is now available in a variety of apps, including Google's exclusive service apps like Gmail, Google+ and Google Now, as well as photo shoots and sharing, SNS, device security, augmented reality, games and healthcare5, 6.

Fig. 4: Google Glass.

3.2. Three terminal models with android wear OS

Wearable OS is one of the key factors to influence ecosystem as a field to pay attention to in smart wear and wearable terminal market. Recently, Google's Android Wear needs to pay attention. In March 2014, Google launched a demonstration video of the Android Wear5, 6 OS for wearable devices and a software development kit (SDK) for developers of Android Wear, and Android Wear released its Android OS as a smart watch And Table 2 shows the first application to Samsung Electronics 'Gear Live, LG Electronics' G Watch and Motorola's Moto 360 models7. It will be expanded to various terminal vendors and models.

Table 2: Melatonin Secretion Status According to Sleeping Time

Gear Live

G Watch

Moto 360

3.3. The future of wearable terminals: role of hub in specialized fields

Smartphones are the core of the ICT convergence industry and have served as hubs for various computing functions3. However, unlike smartphones, wearable handsets are more likely to develop into specific functions by linking with smart phones or building their own domains. Wearable handsets are expected to create new markets in areas where smartphones have not been able to take over or provide specialized functions. Figure 5 shows the value of using 3D augmented education, preventive medicine, personalized health care, lifestyle management, smart fashion and apparel through augmented reality 7, 8.

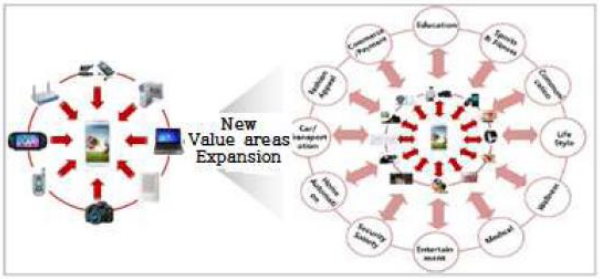


Fig. 5: Distributed Hub Wearable Terminal.

4. Implementation and performance evaluation

4.1. Drowsy driving detection technology

4.1.1. Lane maintenance subsystem (LKAS)

Figure 6 shows the Lane keeping Assist System (LKAS), which is installed on the windshield of the vehicle. It detects the lane in real time during driving and prevents the vehicle from escaping. When the driver leaves the lane without turning on the turn signal, The problem with LKAS is that it detects the ideal lane of the road. It is impossible to operate normally in the lane of the road or in severe fog13.

Fig. 6: Lane Maintenance Assist System.

4.2 Active brake assist (ABA)

Figure 7 shows the Active Brake Assist (ABA) automatic control system, which stops the vehicle when it detects the risk of frontal collision. It uses three radar beams installed in the vehicle to detect up to 150m ahead, Helps you get rid of accident risk.14.

Fig. 7: Operation of Active Brake Assist.

4.3. Attention aid

4.3.1. Attention assistive technology

Figure 8 shows a system for prevention of drowsiness by an Attention Assist (AA) system. After 20 minutes of driving, the system has 70 measurement factors (speed, acceleration, brake pedal usage, Measure the driver's driving style.After measuring this, it is a technique to notify the driver through a warning sound when a motion that is different from the average operation propensity is detected. When collecting the driver's driving pattern information, driving on a bad road surface or frequent lane change can cause a system error10, 11.

Fig. 8: Attention Each Technology.

4.3.2. Driver monitoring system: DMS

The Driver Monitoring System (DMS) is an infrared camera module mounted in front of the dashboard to monitor driver's eyelids

and head movement during driving to determine the driver's sleepiness. Figure 9 shows that although the face recognition rate of the driver is increased with six infrared LEDs, 9, 12 and infrared camera, the amount of light reflected on the driver's face in a very bright environment is large, or the activation of the system is delayed or not activated can be a disadvantage.

Fig. 9: Camera Module in Operator Surveillance System.

5. Conclusion

The purpose of this study is to study user - oriented products that have differentiated from existing IoT healthcare products with know - how of wireless communication - based healthcare device manufacturing technology. The purpose of this research is to acquire stable sensor information and to acquire relatively accurate sensing information without any inconvenience in long-term operation or work by studying commercial products focused on technology stabilization for large transportation profession. That is, the function of satisfying the heart rate within the error range and storing the ECG waveform at a constant interval simultaneously with the heart rate when the human heart rate is generated. Hardware, and algorithms, and to develop low-power devices accordingly. By controlling the sensing time according to sensor status information, we will contribute to customer satisfaction by solving the inconveniences related to target customers by introducing designing method considering power consumption and sensing circuit and MCU advantages. It is possible to provide relatively accurate information to occupational groups (bus drivers, large cargo drivers, train operators, large ship navigators) who are overworked or stressed due to their professional characteristics. We want to conduct product research that can continuously monitor health management.

Acknowledgments

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