Motivating Drivers to Change Their Habitual Driving Behavior by Comparing with Others

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Abstract—It is difficult for vehicle drivers to change their own driving behavior because they do not know what the perfect driving is and they do not notice why their habitual behavior are not good for safety or efficiency. Even though some latest automobiles are equipped with ambient lights to encourage drivers to accelerate or brake more efficiently, automobiles cannot distinguish whether the acceleration or braking is necessary or not because it depends on the contexts. In this paper, we propose a novel application that teaches safe and comfortable driving and motivates users to change their driving behavior by comparing with other users who drive on the same road. The application gathers various types of in-vehicle information and generates persuasive feedbacks to change users' behavior.

Keywords—Internet; road-vehicle electronics; visualization; persuasion; sustainability

I. INTRODUCTION

Latest automobiles have various types of features in safety and economic efficiency. For example, anti-lock braking system (ABS) prevents wheels from locking up while braking; airbag prevents passengers from striking interior objects like the window by inflating; engine stops idling silently while waiting at a red light or traffic congestion. In order to ensure these things, current automobiles are equipped with various types of sensors and computers. As well as engine speed and vehicle speed, computers in vehicle acquire information about steering column angle, each wheel speed, accel throttle position, braking position and so on. The computers silently decide how the vehicle should behave based on such information. This makes it possible for ordinary drivers to drive safely and efficiency without special techniques.

While such technological solutions are widely applied, drivers still need to change their driving behavior. For example, if drivers do not know how to drive efficiently, such technological solutions cannot persuade drivers not to press down the gas pedal more than necessary. To overcome the problem, latest cars including Toyota’s Prius and Honda’s Insight try to persuade drivers to drive more efficiently by using ambient lights for an efficient acceleration or braking. These lights are kinds of real time feedbacks. Such real time feedbacks change drivers’ behavior just for the occasion because the feedbacks do not tell the reason why the lights are blinking, and they cannot apply the knowledge at different locations and different contexts. In order to change behavior and to acquire better habitual driving techniques, drivers have to notice their own driving behavior and analyze how to improve them.

In this paper, we propose a novel application that teaches safe and comfortable driving techniques and motivates drivers to change their habitual driving behavior by using various types of in-vehicle information. The application stores every users’ driving data and makes users compare with other users who drive on the same road to notice their own driving behavior.

II. RELATED WORK

Meschtscherjakov et al. compared five persuasive user interfaces to reduce fuel consumption in terms of technology acceptance [1]. However all these five user interfaces offered only real time feedbacks.

Ecker et al. proposed a game-like application to encourage drivers to reduce fuel consumption [2]. This application makes it possible for users to compare among drivers in real time. Also they pointed out that the usual boring and annoying character of an ecological driving style is overcome by using game-like visualization. As Mankoff et al. mentioned in [3], social comparison motivates people to change their behavior. However, Ecker et al. reported that some participants tended not to press the brake pedal properly in order to beat their opponents. These types of feedbacks that trigger the traffic accident should be avoided.

III. APPLICATION DESIGN

Key idea of our application is to make drivers relive their own driving techniques and compare among other drivers after finishing drives. As we pointed above, real time feedback to compare with other drivers has one major drawback of enhancing unusual driving. In order to look back on driving in a calm manner, we adopted non real time feedbacks.

The application uses various types of vehicle information to produce minute visualization for reliving users’ own driving techniques. As shown in Figure 1, we use four components to acquire vehicle information. CAN data sniffer gathers all data in in-vehicle data network. CAN is an abbreviation for
Controller Area Network, which is a standard in-vehicle data bus to allow micro-computers and devices including many types of sensors in vehicle to communicate with each other. Many kinds of useful information for safety and efficient driving mentioned in Section I can be acquired by using this sniffer. Video camera records on-vehicle movie to recall visual image of their own driving. GPS acquires position data to locate the user on a road in order to compare with other drivers. Accelerometer acquires real time acceleration data to know how stable the vehicle is. An on-board computer in a vehicle stores these data and transmits them to the Internet. The application analyzes these data gathered from users and calculates optimized driving way on the road.

Users can see the differences between their own driving and optimized one / another users’ one after finishing their drives. They can compete with each other in terms of energy consumption, stability, and so on. As they can compare with other driving data on the same road, they notice how to improve their habitual driving behavior (e.g. braking and shifting gear timing was slower than others). Users can also watch playbacks with overlaid vehicle information to review their own behavior (see Figure 2.)

The prototype application was implemented in Java and Objective-C. CAN data were acquired by Lawicel’s CANUSB¹ device. Phidgets² accelerometers were used for detecting acceleration data. A Beagleboard³ was used for the on-board computer to gather and to transmit vehicle information.

IV. WRAP-UP AND FUTURE DIRECTION

In this paper, we introduced a novel application that motivates drivers to change their habitual driving behavior. Unlike existing works, our application persuades users to improve their own driving behavior without any danger of the traffic accident. Besides, our application keeps users from getting bored by using social comparison. However we have not conducted large scaled user study. So we are now planning to conduct a user study evaluation.

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REFERENCES


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