Column

Eco-Driving the Ultimate use of Intelligent Transport Systems

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Introduction

In recent years, automobiles have become essential to our life. They are the modes of transporting people and objects, and are part of our life. However, they also consume enormous amounts of fossil fuels at the same time. In concurrence with this, serious social problems such as air pollution and global warming (due to the effect of carbon dioxide) have occurred. How this consumption can be reduced has been a great challenge. Answers to this include infrastructure improvement involving intelligent transportation system (ITS[*1]) and electronic toll collection system (ETC). In addition, automotive manufacturers have been constantly improving the fuel efficiency and introducing hybrid vehicles and electric vehicles into the market to reduce the fossil fuel consumption. However, it is also necessary to draw our attention on things more familiar to us, in addition to depending on performance improvement in infrastructure and automobiles.

To reduce the consumption of fossil fuels, in other words, address energy saving, it is necessary to improve the driving skills of the drivers and improve the awareness for energy saving. To address this, we must quantitatively evaluate the concept of energy saving, which had been conventionally sensuous, and provide appropriate information to the driver successively. This article will focus on promotion of energy saving operation and describe the results of social experiments in the past.

*1: ITS: Intelligent Transport Systems

Background

To address prevention of global warming, emission reduction goals for greenhouse gases including carbon dioxide (CO_2) were specified in the 2002 Kyoto Protocol. The average emission of greenhouse gases for 5 years until Fiscal 2012 had increased by 1.4% from the total emission in Fiscal 1990. When 3.8% for forests as a source of absorption and 5.9% Kyoto Mechanism credit[*2] are subtracted, 8.3% needs to be reduced, indicating that the Kyoto Protocol goal will be addressed.

Of the carbon dioxide emission from Japan in Fiscal 2012, emission from the transportation sector comprised approximately 18%. Automobiles were responsible for a little less than 90% of this, thus indicating that approximately 16% is emitted from automobiles.
Based on this, it means that the overall carbon dioxide emission in Japan will

be reduced by 3.2% if, for example, the overall fuel efficiency of all vehicles can be improved by 20%. Incidentally, this 3.2% reduction is equivalent for approximately 60 billion yen as the Kyoto Mechanism credit.

*2: Kyoto Mechanism Credit: A system in which the emissions reduction by implementation of reduction projects in other countries can be gained as credits and count them in addressing the promised protocol goal for one's country.

Effects of being aware of energy saving

In general, the fuel efficiency of automobiles can be improved or made worse by the way they are driven. Therefore, fuel efficiency is improved if the drivers drive with awareness for energy saving. We thus measured the characteristics of various drivers, analyzed the results and developed a management system capable of inducing energy-saving driving via the internet. Its services have been provided mainly to business vehicles (Figure 1).
As a consequence, many users who introduced HORIBA driving management system have addressed energy saving and improvements in traffic safety (it is only natural for people driving for business to implement energy saving and safe driving according to the instruction of their companies, but it is different when they drive their own cars).

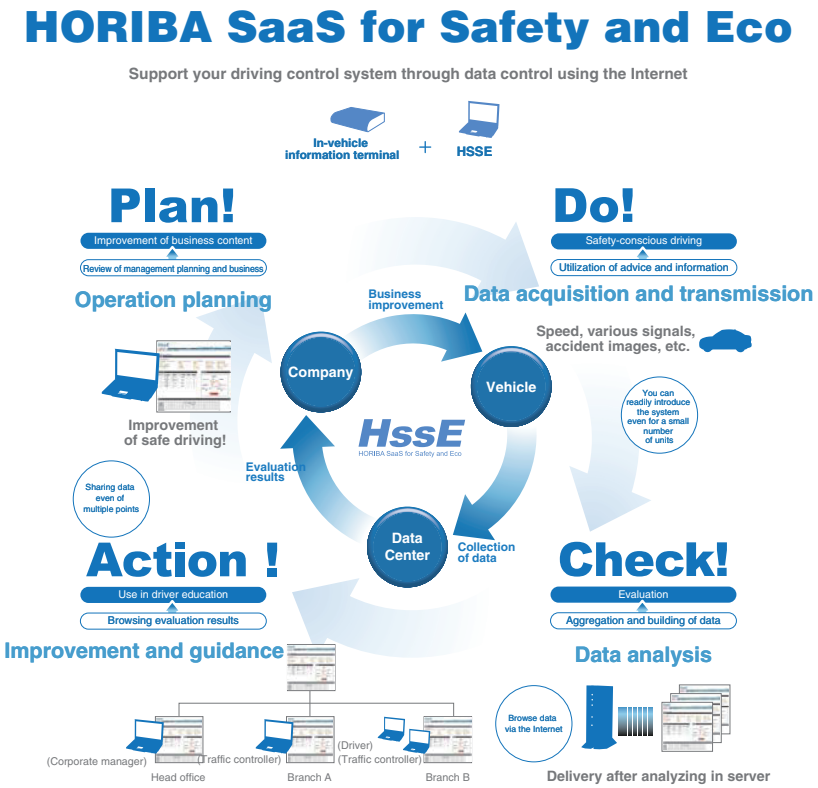

Figure 1

It has been impossible to quantitatively evaluate energy saving and safe driving in the past. For example, many people answer "Yes" when we ask, "Do you try to carry out energy-saving driving?" For the question "Do you drive safely?," everyone answers "Yes." However, there had been no standards for these questions. It was because of adoption of driving management system and the effect of automotive devices utilized in such systems that quantitative evaluation of such qualitative information has become possible in the recent years. Quantification is possible only by utilizing ITS a little, including paying attention in real time and making competition with relative evaluation, and the effects can be grasped, maintained and improved by turning the PDCA cycle for improvement.

Specific method

Normally, the only time we are aware of energy saving in automobiles is when we fill our cars at a gas station and calculate the fuel efficiency. We would think of driving to save energy if the fuel efficiency is low, but then completely forget it when we actually drive. To always focus on energy saving when we drive, the driver needs to be constantly reminded about anti-energy-saving and energy-saving actions. Social experiments in the past have delivered

Figure 2

results that it is possible to reduce idling and suppress sudden accelerations by providing cautionary information in audio and displaying the fuel consumption in cost at the same time (Figure 2). This is the same as worrying about the price on taximeter, which happens to everyone when we take taxis. Since drivers are human, we believe that they would improve by repeating to praise on the good things and warn about the bad things. The driving results are tabulated on cloud and distributed on the Web (Figure 3). As a consequence, fuel efficiency improvement of about 20% was addressed on average in monitor vehicles of more than 100 after 1 year. However, we must say that everything returns to before immediately once the above advice is stopped, although the improvement is maintained while the advice is repeated.

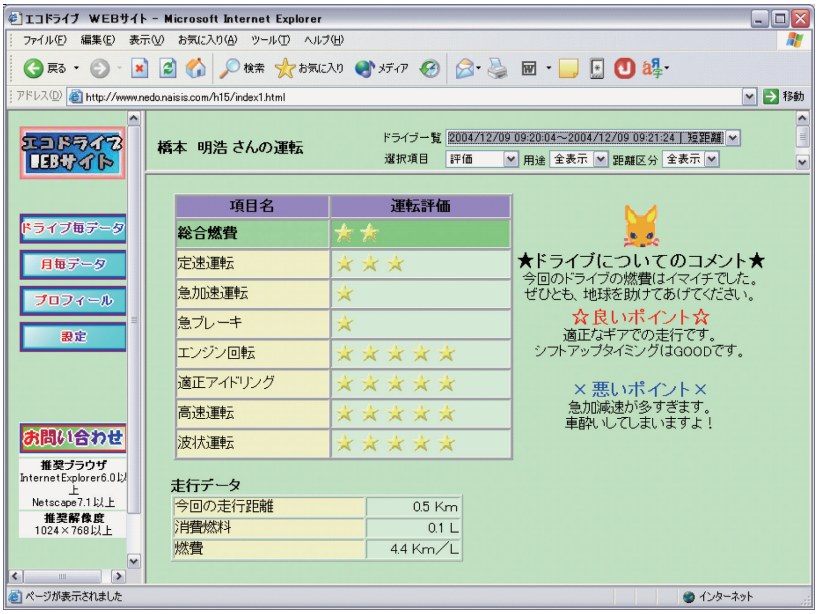

Figure 3

Future challenges

At present, a representative of ITS would be the automatic brake to prevent collisions. Practical application of automatic operation in the near future is becoming realistic. The first systems that become popularized among people in public after appearance of the word ITS are probably VICS and ETC. As ETC became popularized and smooth entry and exit to and from highways were addressed, fuel efficiency has been improved by changing the route based on the traffic information to the destination. In addition, it may become possible to drive without stopping even on roads with heavy traffic by driving at the speed specified by ITS instead of repeating starting and stopping. These require certain infrastructures and considered to take time until popularization. It is thus necessary to continue to improve the driving skills of the drivers and promote energy-saving awareness in the future. At HORIBA, “Horiba Fleet Linkage” (HFL[*3]) (Figure 4), the total driving management support system adopting an IT-utilizing automotive device and cloud system to process data addresses

Figure 4

this. This system not only improves the driver skills and fuel efficiency of the vehicle but also contributes to reduction of fossil fuel consumption through utilization in driving route optimization and vehicle optimization.

*3: HFL: HORIBA FLEET LINKAGE

Conclusion

In the near future, automobiles are expected to automatically drive under optimal conditions for time, distance, fuel consumption and so forth without stopping until they reach the destination. Although it is important to reduce the use of fuel regarding the current trend carbon footprint[*4], actions and selections to address reduction of total carbon dioxide emissions with consideration of emissions during automobile manufacture and disposal, fuel, tires and so forth are necessary. Similar systems have also addressed good results in improving traffic safety. We would like to introduce them in an another opportunity.

*4: Carbon footprint: Abbreviation of Carbon Footprint of Products, which is a mechanism to convert the greenhouse gases emitted throughout the lifecycle of a product or service from raw material purchasing to disposal or recycling into the amount of CO_2 and indicate it on the product or service in an easily understood manner

References

[1] Y. Nagasaka, M. Ishikura, A. Hashimoto, *Japan Logistics Society Magazine*, **12**, 41(2004)

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