Next-Generation Advanced Mobility System

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ABSTRACT

The next-generation advanced mobility and system which composed of integrating various technologies from Tohoku University has the purpose to propose a new concept. We manufactured EVs composed of integrating various technologies and executed demonstration experiments at our campus. As for the emergency such as the disaster occurrence, the social energy request changes from the normal time. The energy management system which is related with the mobility was executed by the traffic simulation.

1. Introduction

Tohoku University plays an important role in academic and educational fields in Sendai City, the center of politics, economics and culture in the Tohoku region. Since the foundation of the university, we have been putting "Research First", emphasizing "Practice-Oriented Research and Education", and creating the highest level of research and education in the world. After the Great East Japan Earthquake, Tohoku University has played a critical role in "Leading the Reconstruction of Tohoku and the Regeneration of Japan", as a member of the affected communities.

The next-generation advanced mobility and system which composed of integrating various technologies from Tohoku University has the purpose to propose a new concept. Our next-generation advanced mobility and system aims to solve various recent social problems such as environmental problems, energy problems, traffic jams, and the aging population, by utilizing our knowledge and cutting-edge technologies, and realizing a better place to live and safer more secure society for citizens.

2. Method

The next-generation advanced mobility was obtained fusing the various integrating technologies. Many laboratories and researchers concern the development of the mobility and the system. The EV is installed in the basis of the mobility. The manufactured EVs were composed of autonomous running technology, wireless charging technology, in-wheel motors and so on.

The energy management system which is related with the mobility was executed by the traffic simulation. By the traffic simulation in the virtual-space, it visualizes an energy analysis result, disaster information, traffic information at the normal time and so on. A driving simulator was used to do the investigation of the driving action which is effective in the energy consumption restraint which is peculiar to the EV.

Our major experiments are executed in driving around a new-campus in Tohoku University. As the developing experiment, it is arranging about the society proof in the earthquake disaster damaged area.

Figure 1 shows the concept of research and demonstration experiment of our mobility and system.

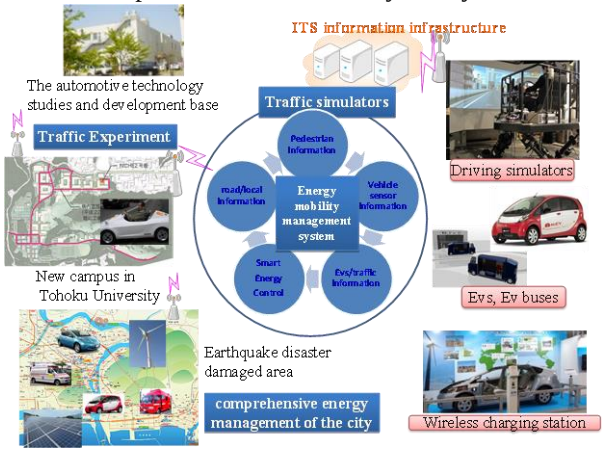

Fig. 1 Concept of research and demonstration experiment of our mobility and system

3. Demonstrations and Discussion

We manufactured EVs composed of integrating various technologies. Figure 2 shows the large EV which had technology such as in-wheel motor control, omnidirectional cameras, wireless charging. Figure 3 shows the small EV which had autonomous vehicle technologies. Moreover, we studied the peripheral technology of the mobility such as robotics, automatic steering control, torque sensing, active safety, tribology, head-up displays, power electronics, switched reluctance motor, vision analysis, battery analysis, traffic simulation.

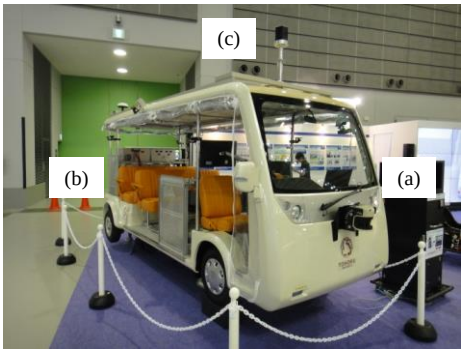

Fig. 2 (a) manufactured large EV, (b) in-wheel motor controller, (c) omnidirectional cameras. Coil for wireless charging is installed under the car.

Fig. 2 Manufactured autonomous vehicles

The energy which the mobility consumes accounts for the high rate in the society. To realize energy saving, the management which optimizes the energy consumption of the movement and the transportation is demanded. The insufficient mileage makes a driver choose the route which always goes via the charging station. The insufficient battery remaining makes a driver head for the charging station. For the energy management, we analyze a best way and predict it by the traffic simulation. Figure 3 shows analysis of electric vehicle users' behavior and desirable allocation of charging station.

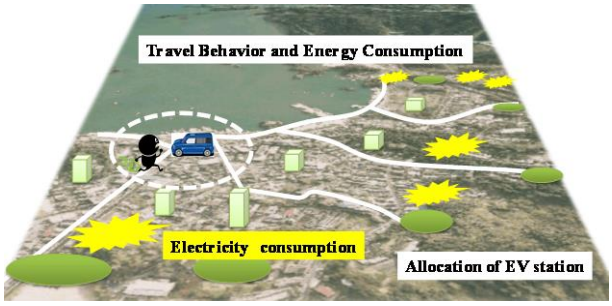

Fig. 3 Analysis of electric vehicle users' behavior and desirable allocation of charging station

As for the emergency such as the disaster occurrence, the social energy request changes from the normal time since rescue operation has higher priority than energy saving. For example, the consumption of the energy must be centered on the rescue support by the management such as the power transmission control. Figure 4 shows concept of the energy management system for the normal time and the emergency.

4. Concluding remarks

Tohoku University proposed new society conceptions after the Great East Japan Earthquake. Our proposal is next-generation advanced mobility. By integration of various technologies such as clean energy, support systems for times of disaster and emergencies, and communication networks, we aim to create smart mobility, a smart campus, and a smart town. We will research, develop and propose valuable things for

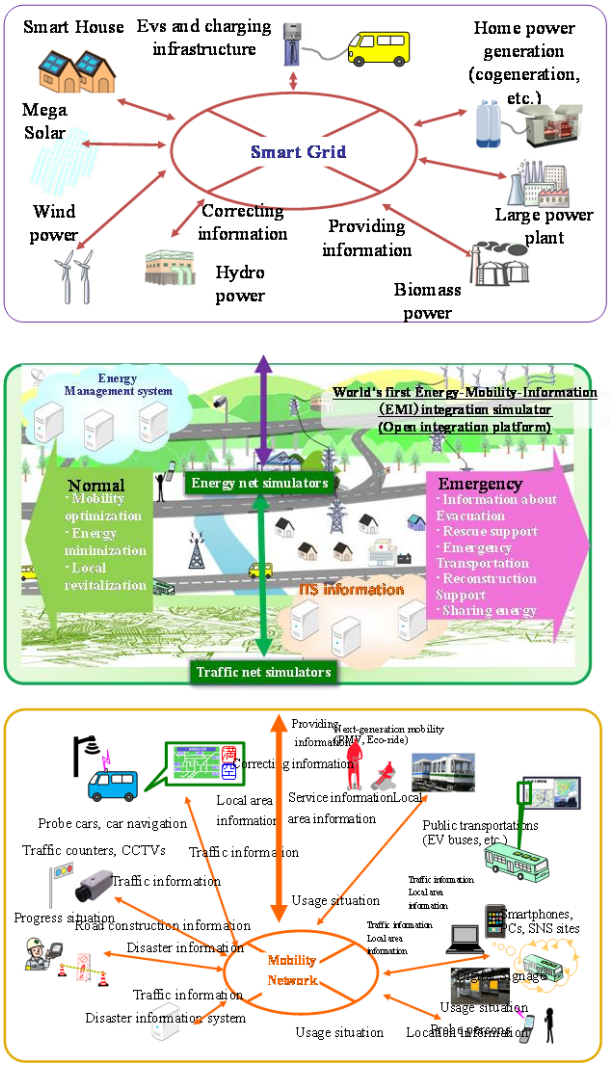

Fig. 4 Concept of the energy management system for the normal time and the emergency

society. In addition, we will carry over our enthusiasm to the next generation for further advancement. We will keep on improving our research for the next generation.