CS-66 Magnetically Levitated Moving Highway System

- A Basic Research on the Electric Powered Moving Highway System (No.2) -

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1. Introduction

In this article, the author presents a new concept about the ML-MHS(Magnetically Levitated Moving Highway System) which has a possibility to provide free control, high speed, safety, smooth mobility, energy efficiency, and eliminates most vibrations, noise and sound. In order to design the ML-MHS, the electro-magnetic absorption method for it's support system and the linear motor for the driving force are applied. The magnetic levitation system is installed on the fin, so that the fin becomes the EMFS(Electro-Magnetic Fin Module Supporting system) for the IPV and the vehicle. The basic concepts of the ML-MHS such as it is mechanisms, how it works and operates and basic architecture and structure examples are shown and discussed to the point of pre-evaluation in this paper. This ML-MHS doesn't require the magnetic superconductivity. The system of ML-MHS operates on ordinary conductivity. Also, it enables individual mobility by harmonizing all traffic condition and more accessibility in comparison with the piggy-back system, car train system at the mode-interchange from the ordinary highway system. This system has mechanical fail safe systems for keeping its lane. The ML-MHS will be one of the system-concept technologies that makes the levitated propulsion possible and non-contact support which offers a comfortable drive. In this report, feasible methods of magnetically levitated mechanisms are shown and the system itself is evaluated from the aspects of energy and its transportation specifications refer to the other transportation systems as well.

2. Breakthrough Core Technology of the ML-MHS

(1) High Speed Propulsion Technology

The linear induction motor system is applied to this system. Because the linear induction motor has more advantages such as easier control, smoother running, and more energy efficiency than the rotary motor.

(a) Historical Review of the Linear Motor

The basic mechanism of the linear motor was invented in 1841 in England. Because the power of magnet is developed linearly, the sliding friction rate is much less than the rotating motor. Therefore, the linear motor is very useful and effective to move something in linear.

(b)AGCL(Actively Gap Controlled LIM)

The linear motor system has been developed mainly in the railway or transportation and freight area. However, the AGCL is a completely new idea ,because the mechanism of the linear motor is supported by a rigid structure such as the iron wheel and shaft so as to keep the gap length between each plate of the linear motor. On the other hand, the AGCL is supported by very flexible suspension structure such and the gap length is automatically controlled by the actuator based the sensing data by the sensing the distance between the each plate and state. Therefor, AGCL mechanism generates more driving force to reach higher speeds. As a result, using the AGCL technology, the new transportation system can provide high speed of up to 150 to 200 km/h.

(2)Magnetic Levitation Technology

(a)Levitation Method

The basic mechanism of magnetically levitated MHS(ML-MHS) is shown in Figure1. The four of LDPF(lane deviation preventing fins) are utilized for the ML-MHS. And the electric control system will drive for the stability of ML-MHS as follows as below. The weight of automobile is usually about 1.0 tons to 2.0 tons and its length is approximately within 5 meters. On the other hand, magnetically levitated transportation system(maglev) has been developed such a HSST(High Speed Surface Transportation). For example, the HSST vehicle weights more than 1.5 ton/meter. Comparing these facts, levitation of the automobile would be no more than 1.0 ton/m. In addition , the 4LDPF can be utilized to install the maglev system as it is shown in Figure 2, to guarantee almost perfect safety of preventing deviation lane of the pallet, and the magnetic system can be installed in the LDPF system. As a result of adopting this built in magnetic levitation system in the LDPF, it enables quick merging and diverging on the road lane.

Earth Environmental Issues, Moving Highway, Linear Motor, Intelligent Transport Systems, Magnetic Levitation
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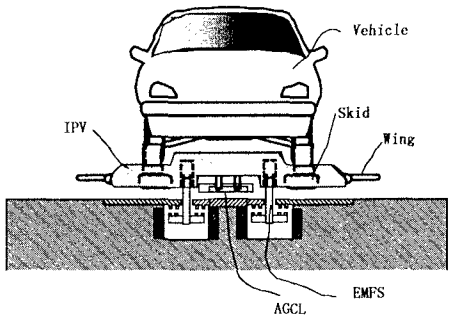

Figure 1 Cross Section of the ML-MHS

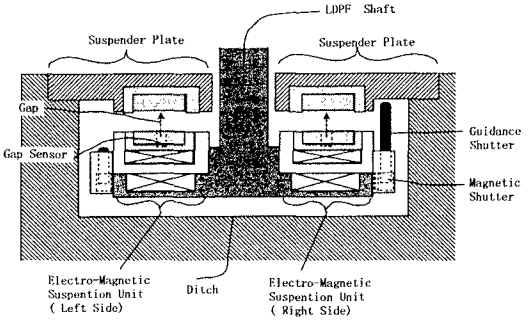

Figure 2 Detailed Cross Section of the EMFS

(3)Operation of the ML-MHS

The driver or the passengers of the automobile receive a communication device when the automobile gets into the automated mode-interchange. This device is linked to the system control center. The driving of the pallet vehicle is almost controlled by the center. The command signal is sent to the center, then the driving plan is optimized. After the plan is harmonized with the total highway system, the driving command signal is sent back to the pallet vehicle's computer to operate. However, the communication device will have to be developed to reflect the driver or passenger's intention for the system. Also when the person changes their mind, the system will follow it (Figure3)[1].

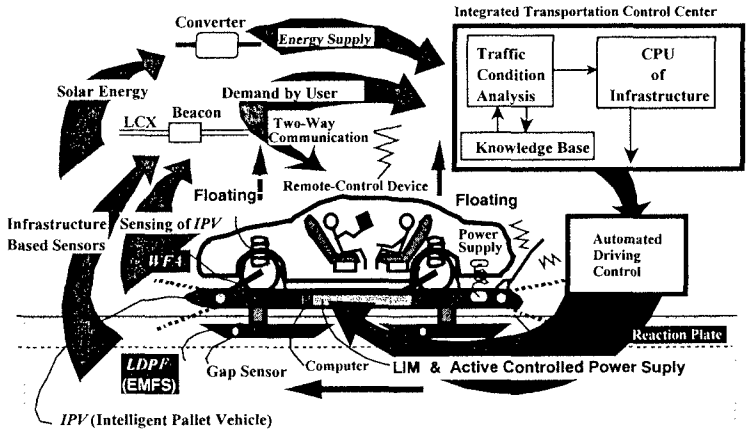

Figure 3 Operation Architecture of the ML-MHS

3. Conclusion

When the innovative core breakthrough concept is proposed, the conceptual study and each component of the detailed technology has to be evaluated properly. In such a case, it is better that the technologies have been provided by actual experiments, however, it also can be confirmed by checking these technologies whether it is based on practical technology or not. For example, referring to the case of HSST, the levitation of the pallet is practically possible, and the control and minimizing the gap would be less than 5 mm. In order to make the basic feasibility of specifications possible, the development of detail to be technology is necessary. Also, the organization and collaboration will help to expedite the development of the ML-MHS.

4.Future Vision

For realizing the ML-MHS, not only technology issues, but also there are some important matters to evaluate, for example, cost-benefit, public acceptance ,making consortium for new emerging system,etc.

5.Endnotes

1. Motoyuki MINAKAMI, "The Shuttle Highway System: A New Direction for System Architecture of the AHS", The Second ITS World Congress, 1995
2. Motoyuki MINAKAMI, "21st Century Strategy on the Intelligent Highway Systems in Developed Countries", Kaihatu,Japan, 1989
3.Taku KAJIWARA, Shouzou HIBINO, "Breakthrough" , 170 - 175, Koudansha, Japan, 1993