



A Study on the Utilization and Prospect of ICT-Based Movement Support for the Mobility Handicapped

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Abstract

Background/objectives: Due to the increase in mobility handicapped, related measures that reflect the needs of vulnerable people have been proposed in various fields. In particular, when entering an aging society, it is necessary to prepare for an overall social system. As the opportunities and demands for social participation of the elderly and the disabled are increasing, the need for research on the environment and mobility support for the mobility handicapped is increasing. **Method/Statistical analysis:** In the case of elderly people, the right to move has a close relationship with the economy when the guarantee for retirement life is insufficient. For the disabled, it is necessary to support movement to welfare facilities and medical support facilities, such as participation in rehabilitation and social education. System improvement and legislation are being made to guarantee the right to move for people with reduced mobility, but there are limitations in actual mobility support. Therefore, in this thesis, we intend to present a plan and a prospect of using ICT environment to support mobility of the mobility handicapped. **Findings:** By providing mobility support services in an ICT environment tailored to the types and characteristics of mobility handicapped, reflecting the mobility characteristics and requirements of mobility handicapped, we will improve the mobility autonomy of vulnerable people and provide welfare services and opportunities for social participation. **Improvements/Application:** Analyzing case studies on various mobility support using the ICT environment, we propose a plan to guarantee the right to move for the mobility handicapped.

Index Terms

ICT, Internet of thing, Mobility handicap, Transportation, Mobility support.

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I. INTRODUCTION

Currently, transportation demand between regions is increasing due to rapid growth in many cities. Also, due to urban expansion, the demand for mobility in the city center is increasing. The initial infrastructure construction for transportation demand is designed and built for the general public. Various mobility needs are increasing every year. It is a matter of basic rights, not a social welfare issue, to ensure mobility for the mobility handicapped. In addition, continuous improvement is needed in response to social changes [1]. The population of the mobility handicapped is 1 in 4 people, accounting for 25.7%. Among the mobility handicapped, the elderly accounted for 51.2%, children 17.7%, infants and children 17.1%, the disabled 10.7%, and pregnant women 3.3%. After entering the aging society in 2017, it is expected to reach an ultra-aged society in 2025. Therefore, the number of mobility handicapped is expected to increase continuously [2]. Legislation and improvement are being made due to the entry of an aging society and the increase of the mobility handicapped. Improving and expanding infrastructure and convenience facilities, such as transportation and pedestrian facilities, so that people with reduced mobility can move safely and conveniently. The expansion of transportation infrastructure and convenience facilities is focusing on quantitative expansion rather than qualitative improvement. In addition, support for mobility through legal and institutional improvements has limitations in the practical convenience of mobility handicapped. In other words, when establishing a plan for mobility handicapped, various demands, such as the characteristics of the traffic and the traffic environment, are reflected to provide support for movement centered on the vulnerable [3]. Recently, various industries are providing new services by converging with IT [4]. In particular, researches related to mobility support fields such as smart auto mobility, intelligent transportation systems, and smart walking are being actively conducted using ICT and IoT environments in developed countries [5-8]. There is a need for a study on mobility support services centered on the mobility handicapped through the ICT environment. In this paper, the introduction describes the background of the research and the necessity of moving support for the mobility handicapped. Next, Chapter 2 examines the outline of the mobility handicapped and service technology for the mobility handicapped, and Chapter 3 examines the traffic service based on ICT technology, and Chapter 4 describes the prospects and implications of ICT-based mobility support, and concludes.

II. RESEARCH BACKGROUND

A. Overview of the mobility handicapped

In general, people with reduced mobility are those who feel inconvenient to move in their lives, such as the elderly, the disabled, pregnant women, those with infants and young children, and children. Specifically, the disabled refers to users such as persons with physical disabilities, visually impaired persons, and hearing impaired persons. Senior citizens refer to users over 65 years of age. Temporary mobility handicapped refers to pregnant women, companions of infants and toddlers, people movement with heavy luggage, and children aged 5 to 9 [9]. The mobility handicapped can be classified into a narrow concept and a broad concept according to the range of mobility restrictions. The narrow concept of mobility handicapped who is restricted from movement due to physical reasons in using transportation. In the broad concept of mobility handicapped, in addition to the narrow concept mobility handicapped, it includes people who are restricted from mobility due to economic and social reasons, low income people, and even residents of underprivileged areas [10]. Figure 1 shows the classification of the mobility handicapped[11].

V u l n e r a b l e T r a f f i c	traffic vulnerable
	Disabled Person
	- Visually impaired - Hearing impaired - Speech impaired
	Elderly
	- Gait disturbance - Old age
	Temporary traffic vulnerable
	body factors
	- Patient - Injured - pregnant
	Physical factors
	- person with luggage - Accompanied by childrene
	Other factors
	- Foreigner

Fig. 1. Classification of vulnerable

B. Existing mobility handicapped service

There are sound signals, braille blocks, and advanced mobility handicapped protection systems to improve the mobility of the mobility handicapped. The sound signal is a service that is installed on the

crosswalk and delivers signal information through sound. It is difficult for the user to find the location of the button for the operation of the sound signal device, and it may cause a collision with a pedestrian, causing inconvenience in use [12]. Smart cane is a device that uses sensors and acceleration sensors to detect obstacles in the direction of travel and warn users. Figure 2 shows a smart cane using beacons [13].



Fig. 2. User alarm using beacon

Most of the existing services for the mobility handicapped are provided mainly for the visually impaired. Fig. 3 shows the mobility handicapped protection system being developed at home and abroad [14].

System	Mobility handicapped protection system	Laveno Mombello	Autonomous movement project
Type	RF wireless	RFID, smart cane	RFID, smart cane
Service contents	<ul style="list-style-type: none"> - Complementing the disadvantages of traffic lights and sound signals - Automatic operation of the sound signal - Guaranteed mobility for the visually impaired 	<ul style="list-style-type: none"> - RFID, smartphone - Provide information linking location information and tag number - Providing information using Bluetooth 	<ul style="list-style-type: none"> - RFID, PDA - Providing location information through mobile communication network - Voice information support

Fig. 3. Mobility handicapped protection system

III. TRANSPORTATION SERVICE BASED ON ICT TECHNOLOGY

A. Real-time mobile traffic information system

Traffic information collected from smart devices is transmitted to the integrated center server through WAVE, UTIS, DSRC, and mobile communication networks. Traffic information is processed in real time and provided for service or stored in a large-capacity storage device and then provided in various service types through big data technology. The real-time mobile traffic information system collects traffic environment information and vehicle-related information. The collected data is processed in real time and provided to drivers and pedestrians as information for safety and economic driving. Services provided include a collision prevention service between pedestrians and vehicles, and a real-time route guidance service. In addition, by applying big data technology, road traffic prediction service and vehicle failure prediction service can be provided [15]. Figure 4 shows the real-time mobile traffic information processing system structure.

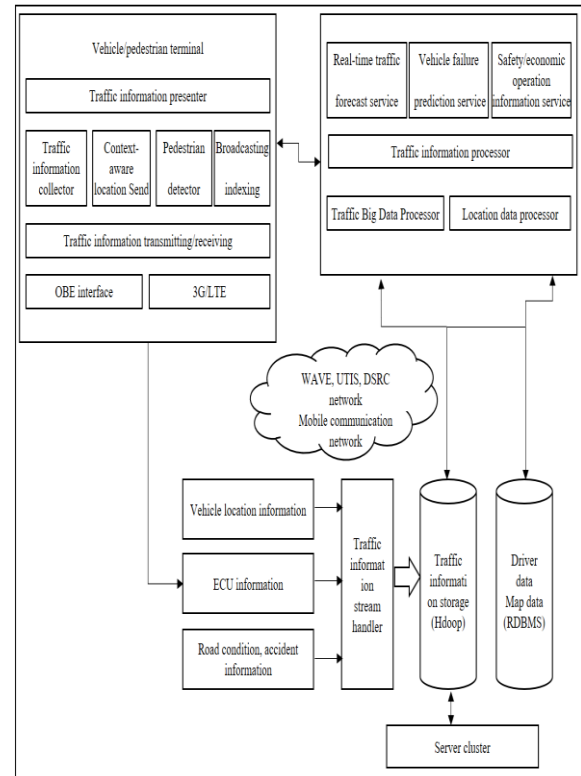


Fig. 4. Real-time mobile traffic information processing system structure

B. Cooperative-Intelligent Transport Systems (CITS)

With the establishment of an IoT environment, interest in transportation services using various sensors is increasing. It is necessary to invest in the

development of customized ICT technology suitable for the mobility handicapped with the advanced ITS technology linkage. The development of an ICT-linked service model for the technology of the mobility handicapped can bring about an increase in accessibility, mobility, convenience, and stability for traffic weak people [15]. C-ITS is an abstraction of the application process, taking into account all access technologies providing wireless connectivity and all networks transmitting information. ITS station means that an application can run on a platform to which various communication methods that are not limited to a specific access technology or a specific networking and transmission protocol can be applied. Figure 5 shows an example C-ITS architecture [16].

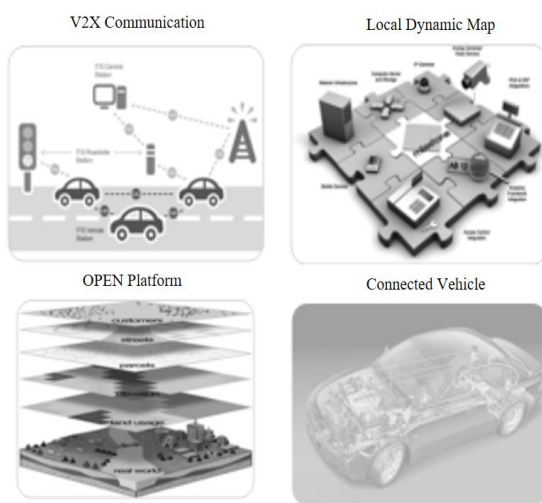


Fig. 5. Technologies of C-ITS

C. Advanced driver assistance system

The advanced driver assistance system is a technology that recognizes the vehicle itself and determines and controls the situation. Advanced driver assistance systems have been developed to complete autonomous driving technology. The system includes an automatic emergency braking system that reduces or stops the speed by itself when there is a risk of collision, a driving steering assist system that maintains the lane by adjusting the driving direction when a lane is departed, a smart cruise control that maintains an interval while maintaining a fixed speed, and a blind spot collision. It includes a collision avoidance assistance system that detects danger and helps to change lanes, and an around view monitoring function that shows the driving situation of the vehicle. The advanced driver assistance system provides customized driving assistance services through communication between the vehicle and the driver. Figure 6 shows the driver-customized situation recognition system [17].

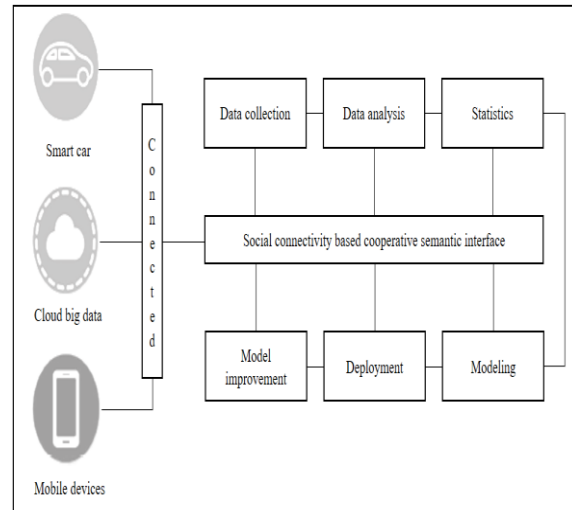


Fig. 6. Driver-specific situation awareness system

IV. ICT-BASED MOBILITY SUPPORT PROSPECTS AND IMPLICATIONS

A. Prospects

It is expected that investment and infrastructure in transportation means and convenience facilities for mobility support will increase due to the increase in the number of mobility handicapped. Although laws and systems for the mobility handicapped are being improved, there is a lack of mobility support systems or systematic systems for providing traffic information. In order to guarantee the right to move for the mobility handicapped, a mobility support method that considers the types and types of movement of the mobility handicapped is required. After entering an aging society, the number of people with reduced traffic is rapidly increasing. In other words, in order to increase social participation needs and opportunities of the elderly, the disabled, etc., and to maintain social relations, changes in the means of transportation and the environment are necessary. In order to provide transportation means and environment for each type of mobility handicapped, it is necessary to improve infrastructure by converging transportation provided based on the ICT environment can be divided into providing customized information, operating public transportation, and improving the environment for self-mobility. Support for the mobility of the mobility handicapped through IT technology convergence has already been implemented in developed countries, and industrialization is progressing in Europe. By expanding the spread of ICT devices, even the elderly and the disabled can easily access the mobility handicapped and the traffic information system. The convergence of the ICT environment and the transportation system is leading

to the development of a sustainable service model for the mobility handicapped. It is possible to guarantee the right to move for the mobility handicapped by establishing an ICT-based transportation environment.

B. Implications

Mobility handicapped people have fewer opportunities to use traffic environment and information than ordinary people. It is also difficult to actively adapt to rapidly changing means of transportation and infrastructure. In order to provide transportation and traffic information services identical to those of the general public, it is necessary to understand the characteristics of the traffic weak and provide service support for each type of mobility handicapped. New industries that converge with various fields and industries are developing due to the expansion of the ICT environment and the spread of devices. In the transportation field, it is applied in a variety of ways, such as pedestrian support service using IT-based technology, intelligent transportation system, smart auto mobility, and intelligent public transportation system. In order to guarantee the right to move for the increasing number of mobility handicapped, it is necessary to consider expanding transportation support services using ICT-based technology and establishing a support system. By grasping the characteristics and types of movement of each mobility handicapped, it is possible to present guidelines for supporting movement and providing information centered on the mobility handicapped. It is also necessary to prepare a system for securing professional manpower in the long term to build an infrastructure suitable for the environment of the mobility handicapped and strengthen software. ICT-based mobility support for the mobility handicapped and the establishment of an integrated information utilization system are required, and system maintenance and monitoring technology, security technology and awareness improvement according to the system construction must also be carried out. Movement support and information provision through the use of the ICT environment can improve the mobility autonomy of the mobility handicapped and provide transportation services at the same level as the general public, ultimately securing social equity. In other words, it can lay the foundation for realizing a welfare society. Side effects of changes in the means of transportation and transportation environment can have a huge impact on society as a whole. Therefore, a sufficient review of expected social side effects and discussion of supplementation should be preceded.

V. CONCLUSION

In many countries, the mobility handicapped due to aging is increasing. Various transportation convenience policies and systems are improving due to the increase in mobility handicapped. Although transportation support is being reinforced for the mobility handicapped through the establishment of transportation infrastructure and provision of traffic information, services are provided centering on the general transportation disadvantaged. These services are required to be supplemented because various types of mobility handicapped are not considered. The purpose of this study was to identify the problems related to the mobility support for the mobility handicapped and to find out about the convenience support for the mobility handicapped by using the ICT environment. Through this study, ICT-based technology was applied to improve the right to move for the mobility handicapped, infra, and use of transportation means and prospects for each type of transportation mobility handicapped. It is possible to guarantee the safe movement and autonomy and independence of traffic for the mobility handicapped through the provision of transportation and information using the ICT environment. In addition, it is possible to provide social equity such as various social welfare services, medical services, education, and participation in social communities without being isolated from society through the guarantee of mobility rights.

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