THE DESIGN OF BUS RESERVATION SYSTEM FOR THE TRANSPORTATION VULNERABLE

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ABSTRACT

This study suggests a bus reservation system for users vulnerable to transportation including wheelchair users, blind people, and senior citizens. For the study, first, we analyzed preceding studies and cases. Second, we conducted shadowing of wheelchair users, a visually impaired person, and a senior and derived problems and requirements for existing bus services. Third, personas and user scenarios were created based on previously investigated data. Fourth, through a co-creation workshop of stakeholders of bus service including a wheelchair user, a blind user, a bus driver and designers, design ideas were generated. Finally, from the design ideas generated in the workshop, design concepts and a prototype were produced. A device in the proposed bus reservation system installed at pillars of a bus shelter allows the transportation vulnerable to reserve bus ride to bus driver.

BACKGROUND & PURPOSE

Bus should be readily available to everyone, but it is still inconvenient for the transportation vulnerable. In response, Korean government has pushed for institutional improvement such as enforcement of the "Act on the Promotion of Transportation" and provision of Low-floor Bus, but the frequency of bus usage by the vulnerable is still low. This study aims at suggesting a bus reservation system allowing traffic vulnerable to make appointment of bus boarding to bus driver through a device installed on pillars of a bus shelter.

METHOD

For the research, first, we analyzed preceding studies and cases. Second, to identify problems and requirements on existing bus services we conducted shadowing of two wheelchair users, a visually impaired person and a senior citizen who were the most vulnerable to transportation. Third, based on shadowing result, we created a scenario of using the bus reservation system. Fourth, the co-creation workshop was held to clarify ideas presented in the scenario. Fifth, the design guidelines for the bus reservation system was derived by compiling the previous findings. Finally, a prototype was made based on the content presented in the guidelines.

Analysis of Preceding Study and Cases

Among applications developed to facilitate bus service in Korea and overseas, Seoul Bus App. is one that allows the transportation vulnerable to reserve a bus, send messages of boarding, and guide bus access. However, the

service is not well received from the transportation vulnerable due to lack of information such as guiding the visually impaired physical access to a bus shelter. Departures NYC, ' developed in the U.S., is an augmented reality based bus app that shows the nearest bus stop through augmented reality technology and provides bus and traffic information in real time as well as station information. However, the actual service to boarding is not provided, so it is not very helpful for the vulnerable.

Shadowing

The subjects observed in the shadowing were two wheelchair users, one elderly person and one blind person. The shadowing covered information exploration, waiting a bus, boarding it, moving by it, preparing to get off it, and exit from the bus stop.

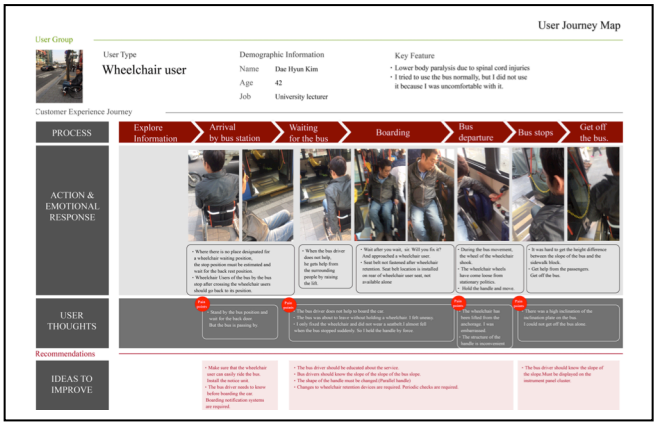

Figure 1: Customer journey map

The result visualized in a customer journey map showed problems in accessing to the bus stop, locating it, and recognizing voice guidance due to ambient noise near the bus stop, and finding the location of the bus boarding.

Table 1: Major findings from shadowing

Bus Users	Findings
Wheelchair users	· Delay in bus operation due to installation of ramp, concession of designated seat secured for wheelchairs etc. · Wheelchair users felt discomfort from the bus users when boarding the bus · Personnel support required to secure a wheelchair after riding the bus
Blind user	· Unable to recognize voice guidance from bus information system (BIS) due to ambient noise · Unable to recognize the location of the bus when buses arrive

New Service Scenario

Reflecting findings from shadowing, following new service scenario that includes from finding bus stops to boarding the bus was suggested.

Figure 2: Service scenario

1. Find a bus stop: GPS based voice information guides the visually impaired to get

to a bus stop where the reservation device is located.

2. Bus Reservation: Reserve the bus through the device installed at the bus stop.

3. Transfer reservation information: When boarding is reserved, the information is passed along to the bus driver.

4. Bus arrival information transmission : The bus stop access and arrival notification for the reserved bus are displayed on the bus information system (BIS) display installed within the bus stop and is also guided by voice.

5. Bus Arrival and Entry: When the bus arrives at the designated stop, the speaker attached to the outside of the bus guides transportation vulnerable to get on.

Co-Creation Workshop

To clarify ideas presented in the scenario, Co-creation workshop was held. Participants in the workshop included a blind, two wheelchair users, a bus driver, and designers. In the workshop, input method of push keypad rather than that of touch screen was suggested considering the use of the blind. Before the boarding of transportation vulnerable, the idea of announcing their boarding of the bus to the existing passengers and asking seat yield to them was proposed.

Design guidelines

Synthesizing the result of the workshop, followings were deducted.

1. The bus reservation device is installed on two columns on each side of the bus stop shelter considering the heights of wheelchair user and the blind (the device for the blind person is installed at 1,200 mm from the floor and the one for wheelchair users is installed at 800 mm from the floor.

2. The bus reservation device includes buttons of choosing the type of disability, bus number selection, confirmation and cancellation functions.

3. The device also includes buttons to select disability type, which allows transportation vulnerable to notify the bus driver of their type of disability in advance so that the driver can prepare bus boarding of them. These buttons have different shapes (Circle: wheelchair user. Triangle: the blind).

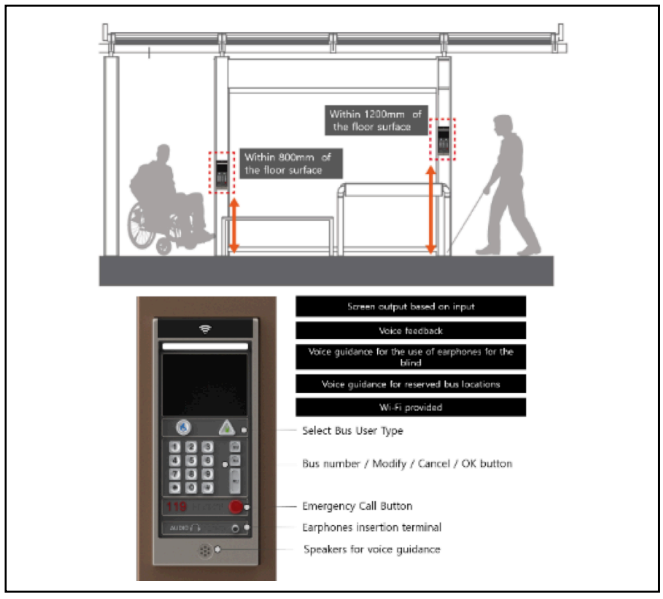

Figure 3: Bus reservation system components

5. After making a reservation, current location of the reserved bus is informed by

voice so that the person reserved the bus can estimate the waiting time and wait.

6. When the reserved bus approaches, the bus reservation device informs the number of approaching bus through a built-in speaker.

Prototype

Based on the design guidelines, a prototype was developed. To make a prototype, first, a CAD model was produced reflecting ergonomic measurements and user characteristics. Then, an actual scale mock-up was produced to check its usability and appearance.

Figure 4: The mock-up of a device installed on pillars of a bus shelter

CONCLUSION

This research suggested bus-ride reservation system design developed through user shadowing and co-creation workshop etc. Proposed bus reservation system enables the transportation vulnerable to reserve bus by passing along the information to the bus driver. It also makes it possible to give pre-notice to existing passengers in the bus before the transportation vulnerable user ride.

The device of the system installed on the pillar of a bus shelter includes a display, disability type selecting button, numeric buttons, a 119 button for emergency use, and a speaker informing the approaching of reserved bus.

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