TNC Transactions on Networks and Communications
SOCIETY FOR SCIENCE AND EDUCATION UNITED KINGDOM
VOLUME 2, ISSUE 1
ISSN: 2054 - 7420

A Planning of Campus Environment Identification System for Students with Visual Impairments

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ABSTRACT

Orientations and movements affect the ability of blind people to independently act and live in the environment. The purpose of this research is to develop the guiding facility in campus for blind people by the architecture plans. Through observations at site, interviews, and cognition sketch maps, we found the blind people are easily lost at intersection. When they are lost, they are disorientated in the environment. The constructed cognition maps suddenly lost the functions. According to documents, through RFID (Radio Frequency Identification Technology), the real-time message can be transmitted in the environment. In this paper, the configuration for the barrier free environment in campus is developed with RFID technology based on the requirements of users. This can provide references to the environmental designers for the configuration of facility for guiding blind people in the public spatial environment.

KEYWORDS: People with visual impairments; Orientation and mobility; Campus design; Barrier-free environment; RFID

1 INTRODUCTION

According to the data statistics of Ministry of Education, there are 90-100 college freshmen with visual impairments every year in Taiwan (Special Education Transmit Net, 2011). Schools must provide a humanistic, safe, convenient, continuous, escapable and protective barrier-free environment and facilities.

As those with visual impairments lack visual stimulation and experience of visual perception in environmental integration, their movements are usually restricted by orientation in the course of wayfinding (Long et al., 1997). The employment rate of those with visual impairments who can solve transportation and mobility problems by themselves is higher than that of those with visual impairments who cannot move without others' help (Wolffe, 1998). Apparently, the ability to identify orientation is important for those with visual impairments to act and live independently in the environment.

DOI: 10.14738/tnc.21.42
Publication Date:14th February 2014
URL: http://dx.doi.org/10.14738/tnc.21.42

The perceptive reaction or ability of individuals identifying orientation correctly in the environment is called spatial orientation. The non-visual spatial imagination of the blind is different from the visual spatial imagination of normal people. Normal designers are difficult to comprehend the mode of spatial orientation of the blind based on their own experience.

Therefore, the environment designers (or architects) should discuss and evaluate the interactive relationship between the blind and the environment before they design barrier-free environment and facilities, and formulate design plans to improve the efficiency of barrier-free facilities and equipment in public environment, in order to assist the visually impaired with spatial orientation.

2 BACKGROUND

Those with visual impairments must learn about various efficient and independent action skills in environment by professional orientation training, such as cognizing environment, problem solving, application of various perceptual messages, effective communication, body language, and asking for help (Bozeman, 2004). In addition, those with visual impairments can move safely in environment with the assistance of mobility aids according to personal needs.

The traditional mobility aids are classified into sound and electromagnetic wave according to the physical energy source; classified into passive feeling tool and active energy radiating system according to the physical energy transmit mode; classified into hand-held, head-held, chest-held, processed goods portable according to the carrying mode; classified into acoustic receiving, touching receiving, electric shock type, and visual type according to the information receiving position (Mao, 1973).

Lowenfeld, 1948Phillips(Center of Assistive Device, 2011)

Radio frequency identification (RFID) is an automatic wireless identification and data acquisition technology; it is extensively used in many domains. The auxiliary guiding devices for blind people developed by Industrial Technology Research Institute provide the real-time information of the environment by applying with Radio Frequency Identification Device (RFID) to assist and help the movements of blind people (Ministry of Economic Affairs, 2012).

This study explored the behavior of spatial orientation of the students with visual impairments in campus by means of field observation, and used RFID technology to develop campus environment identification system planning, so as to assist the visually impaired students with spatial orientation in campus, and to improve the efficiency of facilities and equipment in the barrier-free environment.

3 CASES OBSERVED

This study explored the orientation and mobility behavior of the students with visual impairments moving in environment from field observation and individual case interview, and

presented the observed results in behavior record chart. The functions of behavior record chart included describing phenomena, comparison, discussing space using mode (Ittelson *et al.* 1974). It is a tool for observation and recording, to record various behaviors occurring in man-made environment. In such a recording mode, the actor's action pattern can be clearly recorded, described and known, and can be actually reflected to real environment. This study has received consent from the respondent and was approved by the Academic Ethics Committee of College of Design, National Taipei University of Technology (IRB No: COD1000526).

Observation process:

1. Before observation: measure and record the average speed of straight walk of the subject.
2. Parting of the ways: observe and photograph the process of field test, make the orientation and mobility behavior record chart of the subject, record the measured values.
3. After observation: interview individual observed to remedy the defects of observation. Compare with the handmade cognitive map by the subject to know his mental feeling when he lost orientation.

4 OBSERVED RESULTS

The behavior record chart (Fig 1.) records the attribute of landmark when the subject is moving. The behavior performance of the subject moving in environment:

1. Determine relative position: the subject determines the relative position relation between the starting point and the destination first.
2. Construct landmark: the subject is accustomed to set up several various fixed landmarks on the path between the starting point (school entrance) and the destination (dormitory), so as to help himself identify direction, moving forward following continuous border stone by the road or the terrace pavement.
3. Getting lost: getting lost happens once at the parting of the ways (A) in the course of walking. When the subject gets lost, he keeps walking to look for familiar landmark, so as to identify his position and moving direction.

In terms of time, it is about 10 seconds for the subject to pass by each landmark, when he loses his way, he spends about 50 seconds searching for landmark during when he is upset and nervous, so that he draws badly in random direction when he makes cognitive map by hand (Fig 2.). Apparently, providing orientation or environment information at the parting of the ways or in proper regions will help the subject identify his position and moving direction.

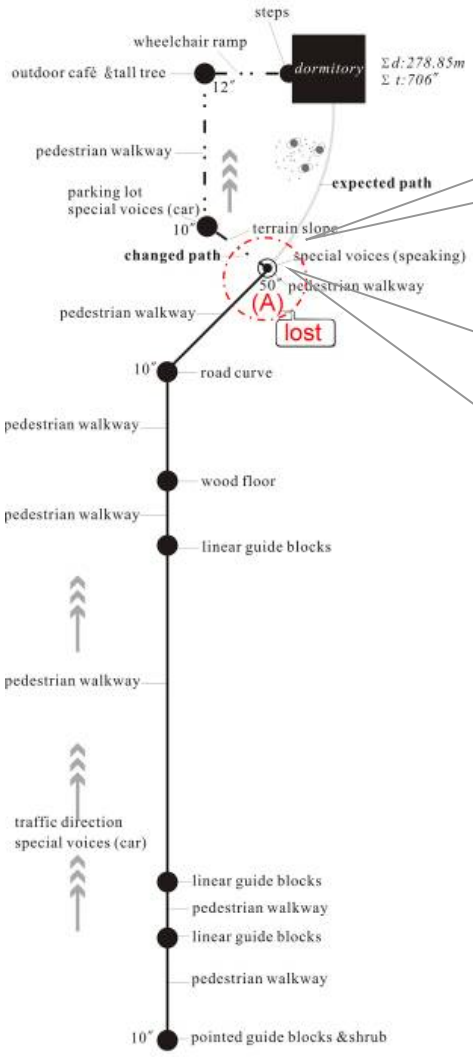
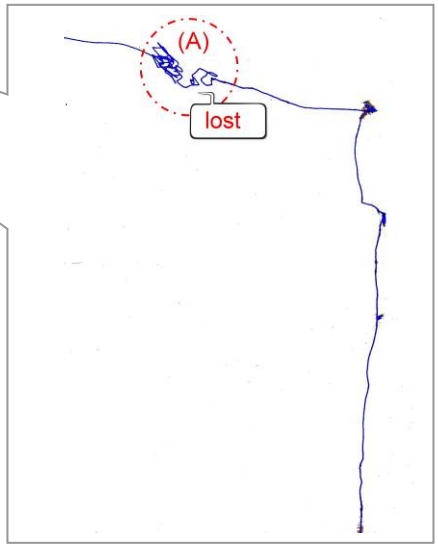


Fig 1 Observed behavior record (Made by the researcher)

The observed object lost at the intersection (A) continuously walks back and forth to look for familiar landmarks to identify the current location and working direction.



The observed object is lost at the intersection (A). When drawing the cognition map, graffiti due to disorientation is shown. It demonstrates disorientation. The constructed cognition map has lost its function.

Fig 2 Handmade cognitive map (Made by the subject)

5 PLANNING CONCEPT

The campus space configuration structure in Taiwan is mostly characterized by grid pattern or radial road system planning, where with cross roads will have a node in more than two directions. The node forms multi-directional space feature, it is the environment where the subject is likely to get lost. It is observed that those with visual impairments need relevant information for identifying their positions when they get lost. According to regulations, the design of the visually impaired guiding facilities shall provide "safe walk" and "position identification" (Jacobson, 1993; Jacobson, 1997; California State Government, 1991; Washington State Government, 1992).

Therefore, the spectacles, earphones and RFID are used, and tag information is provided at road junctions or the billboard of each building or classroom and exits in the campus (Fig 3-4.).

The students with visual impairments can use radio frequency to translate the information into voice information to receive, so as to identify their positions. The accuracy of mastering direction is increased by using spectacle radio frequency. This mobility aid is provided for the students with visual impairments when they just enter the school, and should be returned when they graduate, so as to help the students with visual impairments to act independently in campus environment.

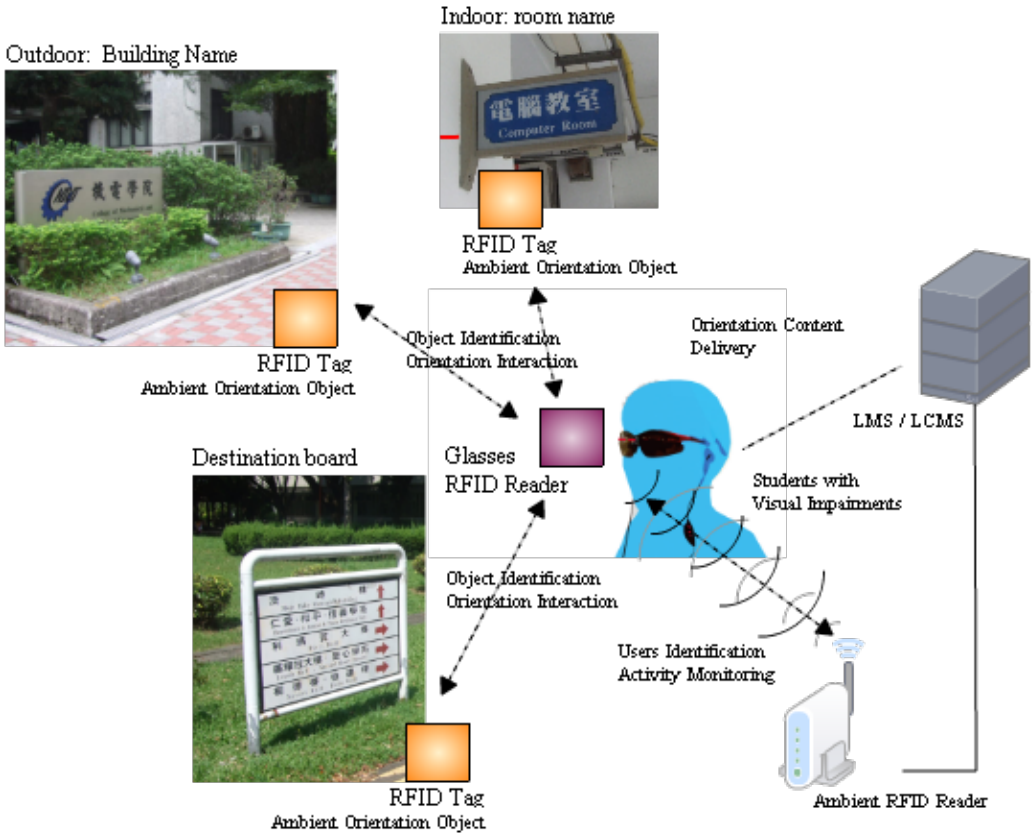


Fig 3. Campus environment identification system planning and design concept

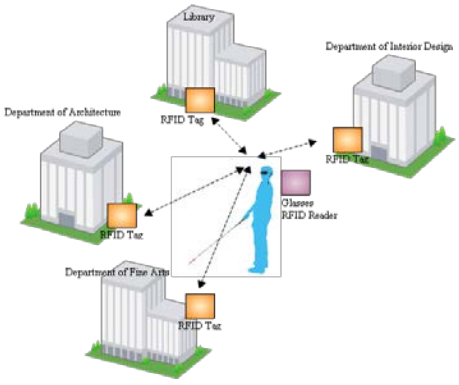


Fig 4. Campus environment identification system planning

6 SUMMARIES

Those with visual impairments need a lot of landmarks as reference information for orientation and mobility when they move in the environment. They are likely to get lost at road junctions for the spatial particularity. Therefore, the environment should provide relevant information to assist in spatial orientation and reduce the occurrence of being lost. Constructing the campus environment identification system is helpful to increase the efficiency of facilities and equipment in barrier-free environment, so as to enhance the willingness of the students with visual impairments to act independently in campus and to improve their quality of life.

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