An Economical Approach to Indoor Positioning and Navigation

Key Laboratory of Geographical Information Science,
East China Normal University, Shanghai, China
*Corresponding author, e-mail: xli@geo.ecnu.edu.cn

Keywords: indoor navigation; positioning; android;

Objective: To date, while the buildings are multifunctional, the indoor environment is becoming more and more complex. Developing indoor navigation service is necessary. Our goal is to provide an optimal presentation of the navigation information which would be helpful in finding the destination within a complex building.

Background and introduction: Geographic information system has been expanded to include web-based technologies like Google Maps, Bing Maps and the mobile version of ArcGIS [1]. Navigation and location-based services are becoming increasingly popular [2]. Commonly, mobile map services are considered as one of the best geographic information system with the advantage of both GIS and mobile technologies [3]. The wide-spread use of mobile map services in ubiquitous environment has drawn many scholars’ attention. Additionally, evolutions in three-dimensional modeling and computing technology have driven the geospatial research further [4-5]. Some researches show that flow state and processing speed affected users’ perceived ease of use and usefulness of the services, while perceived locational accuracy and display quality had notable effect on users’ attitude toward the services [6-7]. Some studies have been reported on the development of 3D models that can represent floor and apartment structure and the use of them in analysis related to navigation [8-10].

Navigation services have been a hot field of both industrial and academic research in recent years. Considering the user-related factors proposed by previous works, in indoor environment, people may have concerns about the limited accessibility of 3G or GPS for delivering locational coordinates. In this paper, we use existing approaches from outdoor navigation systems, and build up the display and communication of indoor routing instructions via digestible words instead of maps, given that reading map sometimes can be confusing while there are lack of reference objects.

Data: We get the CAD design drawing of a multi-story building, and then digitize it into lines and points, which are the representation of interior spaces. Lines represent accesses from one place to another, such as corridors, stairways and elevators. Points represent potential target sites, for example a classroom or a particular landmark. In this paper, we have the idea that making use of the exiting locale to locate the current point. If there is no existing distinguishable identity as the locational information in the field of view in physical surrounding environment, we can make a QR code which including the exclusive identity to represent the location.

Within this paper, we provide a customized format file as the indoor routing data source for a case study, which is the simplification the building. Currently available
data on floor footprints, points of interests, manmade landmarks are used to implement the service of providing a route from an origin to a destination point.

**Methodology:** In this paper, we adapt Dijkstra’s shortest path algorithm to find route in the indoor network. And then calculate the moving direction between two nodes. At last we show the route step by step in words and play information of every step using broadcast.

**Result and Discussion:** With the proposed method and application, we can navigate between any two locations in the building, and choose the way by giving the constraints like preferring elevator to stair as long as the digitization work is well done. In our experiments, we use the application to navigate in the building of Resources and Environmental Science, East China Normal University. We get the right information which is consistent with the empirical experience.

Experiences of digitizing and creating lines in 3D-dimension and target points especially QR code landmarks for simplifying the constitution for this particular indoor routing application can be transferred to other buildings and provide a basis for the digital content.

**Conclusion and Future Work:** The academic contribution of the study lies in its exploration of indoor navigation with an improved way with easy-to-understand statement and voice broadcast. In this paper, it demonstrates incorporate application of geographic information systems and mobile technologies to upcoming ubiquitous indoor environments. In addition, this work could provide a deeper and more comprehensive insight of how the indoor navigation of words and voice instead of maps could be. Thus future work should consider refining the words and making the broadcast more fluent. Finally future research will also pay attention to developing good processing speed and locational accuracy as well as providing a more acceptable route with other complex data from consistently changing environment.

REFERENCES


