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Landmark-based Navigation in Complex Buildings

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ABSTRACT

Mobile devices of all kinds penetrate our daily life and change it significantly. The build-in hardware becomes more complex and consequently, the range of application steadily grows.
Navigation is one of the many tasks that nowadays devices master. The satellite-based Global Positioning System (GPS) became the standard for outdoor positioning in recent time but reaches its limit at the entrance of a building.
Completely new navigation routines are often required to navigate a person inside unfamiliar buildings. For this task exist several hardware-based solutions as well as approaches working solely with logical constraints of the building and human perception.
This paper describes a new interactive approach for indoor navigation in complex buildings. We especially aim for a generally applicable solution, i.e., our system works in any building independent from compulsory hardware infrastructure (WiFi, RFID, etc.). This navigation system does not depend on precise geographical positioning of the navigation device in the building. We include the user into the navigation task by letting her subconsciously collect visual impressions about her surroundings. She then actively informs the system about her position in the building by selecting certain areas from a list of preselected positions. Using the physical constraints of the building and the human power of observation, we are able to design a generally applicable navigation system. However, we will include hardware-based positioning as a best-effort approach for existing infrastructures in buildings.
Usability and precise instructions are important goals of our system. The navigation steps need to be self-explanatory and the presented information has to be reduced to the required minimum. This way user's cognitive load can be significantly reduced.
The evaluation revealed that reliable indoor navigation can be accomplished by the provided implementation. The proposed solution improves indoor navigation compared to other solutions such as a building map and oral instructions.

KEYWORDS: landmarks, indoor navigation, perception, best-effort radio positioning, building-graph, user interaction