

## Investigation of indoor positioning technology focused on signboard in railway station

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The acquisition of the outdoor location information has become convenient and precise by the appearance and development of the satellite positioning technology. Recently, it has been more high precise positioning on a centimeter level by the launch of the quasi-zenith satellite in 2010. So, the various services utilizing the location information have been produced. In this way, the location information has become more important and essential as a kind of social infrastructures. Under such circumstances, the acquisition of location information in the indoor environment where the satellite radio wave cannot reach has been regarded important as a next step.

In this study, the authors are going to investigate an indoor positioning estimation technology focused on the railway station. In the railway station, the various needs, such as the advancement of amenities, the facilitation of pedestrian movement, the universal design associated with an aging society, the creation of a compact space appropriate for the population decline society and so on, have been required. In particular, the development of the railway station with multiple functions like business has been recently promoted in the metropolitan areas. So, the spatial structure of the railway station has been complicate because it has been required to play various daily roles for urban residents. And the precise acquisition of location information is more important in the indoor environment like the railway station which has much complexity in recent years. Therefore, the authors are going to investigate an indoor positioning estimation technology in the railway station space. Especially, the authors pay their attention to the signboards of important information indicating "positional relations of the space" in the railway station.

First of all, the authors built the database of the sign system and the floor maps to estimate the indoor location. The authors built it with three-dimensional information including the display height in addition to the plane information by extracting the signboard from the photograph. Also, they built the attribute information like the size and direction of sign boards, and the type and number of pictograms in the database. So, they tried to estimate an indoor location by using the photograph. Actually, they extracted signboards in the photograph by using the image processing technology. After that, the rough location where the signboards were taken in photos can be grasped by matching the attribute information. It is necessary to set an area in each signboard. In this study, the authors set up "the effective visual field range" of signboard, because they assumed to take a photograph when the signboard is confirmed. Finally, they are going to estimate a detailed indoor location by using photogrammetry technology. For the purpose, it is necessary to orient the already known three points with coordinates. Therefore, in this study, the detailed location is estimated by using three-dimensional coordinates on four corners of the signboard in the database. This study could obtain certain results as an indoor positioning technology through the investigation of "the extraction of a signboard from the photograph", "the estimation of the area from effective visual field range" and "the estimation of the point location by photogrammetry technology".

In future, it is necessary to make an effort for the improvement of accuracy related to the technology used in this study. In addition, the authors have to build the system that can automatically estimate an indoor position from the photograph.

Keywords: railway station space, railway signboards, indoor positioning, image processing