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Investigation of indoor positioning estimation technology by spatial structure modeling of railway signboards

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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 become more high-precise positioning on a centimeter level since 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 is widely regarded as the next important step.

In this study, the authors are going to investigate the indoor positioning estimation technology focused on the railway station.In the railway station, the various needs, such as the improvement of amenities, the smoothly 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 coped with various kinds of 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.In particular, the accurate acquisition of positional information is more important in the indoor environment such as the big railway station of today which does not increase only the complexity but also the worth as public property.

Therefore, the authors have been investigating an indoor positioning estimation technology in the railway station space.Especially, they paid their attention to the signboards of important information indicating ”positional relations of the space” in the railway station.This study has obtained a certain result as an indoor positioning technology through the previous investigation of ”the extraction of a signboard from the photograph”, ”the estimation of the area from effective visual field range”, ”the estimation of the point location by photogrammetry technology”.In particular, the authors revealed that it was effective to use the sign database, including the size and direction of signboards, the type and number of pictograms, three dimensional coordinates of pictograms’ center point and so on, for estimating a self-localization.

In this study, they are going to estimate an indoor position using continuously the sign database by modeling the spatial structure in the railway station.Specifically, they are going to set ”influence area of sign boards”, ”the relation of signboards” by using spatial tessellations analysis in computational geometry to estimate a self-localization in the indoor environment.First of all, they generated the Voronoi diagram and the Delaunay triangulation by using spatial tessellations analysis to express the spatial structure models of railway signboards.Moreover, they extracted a domain close to the real space by using GIS.

In future, it is necessary to improve the accuracy of the spatial structure modeling by taking the spatial components like pillars and walls other than the signboards into consideration. In addition, the authors have to develop the actual application system using ICT (information communication technology) that can automatically estimate an indoor position from the photograph.

Keywords: railway station space, railway signboards, indoor positioning, computational geometry