INTEGRITY IMPROVEMENT IN LOCALIZATION : GUARANTEE-ADDED LOCALIZATION METHODOLOGY USING SPATIOTEMPORAL CONTEXTS

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Abstract: Recently, location-based services and applications are becoming increasingly popular as wireless mobile networks and devices provide users access to information and communication anytime and anywhere. The services and applications depend on positioning techniques such as Global Navigation Satellite System (GNSS), Wi-Fi and indoor positioning systems. Moreover, an augmentation of GNSS, such as Satellite Based Augmentation System (SBAS), improves an attribute of the satellite-based navigation system through the integration of external information into the calculation process. The attribute includes accuracy, continuity, availability and integrity. However, position data taken from position data loggers are rewritable data. Thus, the position data have a possibility to be overwritten by a deliberate deception. For example, some spatial information crackers can replace recorded position data by false position data in image files with Exif format. As a result, a position data error damages a reliability of spatial services and contents. Thus, we can mention that the integrity in localization is required to protect various location services such as traffic controls and infrastructure maintenance.

Therefore, we focus on the integrity in the attribute of GNSS to guarantee position data against positioning deceptions and errors. Then, we propose an approach to achieve guarantee-added localization methodology using spatiotemporal contexts. The approach is as follows. First, position data are acquired using two or more devices simultaneously as reference data and secondary data. Next, we calculate relative distances between the reference and secondary data. Then, we estimate a dynamic threshold with a spatiotemporal cross-reference using the relative distances.

Moreover, we conducted an experiment to evaluate our approach. First, test data were prepared. A part of the reference data were randomly replaced by other position data as errors. Next, the spatiotemporal cross-reference was applied to the test data to detect error data. Detected error data were verified using true values.

In conclusion, we have confirmed that our proposed approach is possible to improve the integrity with some constraints for the guarantee-added localization.

Keyword : Location-based Service, Position data, GNSS, Security, Integrity