VICTOR KREBS

RESEARCH ON LOCALIZATION METHODS OF TRANSPORTATION NETWORKS OBJECTS USING SPATIAL DATABASES

intelligent transportation systems, cooperative localization, network localizability, Euclidean distance propagation, rigid graphs, graphs embedding, spatial queries

The thesis of Viktors Krebss (Victor Krebs) "Research on localization methods of transportation networks objects using spatial databases". The scientific supervisor is Dr.sc.ing., Boris Tsilker.

The main goal of the research is to explore the possibility of using alternative information resources in localization tasks, providing decision-making support for cooperative transportation systems, in cases when classical localization methods are not applicable.

Relevance of the topic is explained by the increasing need to improve the accuracy and availability of the wireless networks nodes localization methods in transportation, as well as the need for further integration of information systems of vehicles and road infrastructure.

The research considers existing localization methods, their characteristics, applicability and limitations imposed by the use of wireless networks in real traffic. Particular attention is paid to the scene analysis methods based on measured distances to various landmarks and knowledge of the measurement. Provided experimental data showing the influence of the different transportation situation scenarios on the resulting distribution of errors in the coordinates of the localized object. Especially noted situations where localization becomes very difficult or impossible at all.

Author formulates requirements for transport systems cooperative localization methods and shows a possible way to implement them, taking in account scenarios when the classical methods are not applicable.

As a result, author proposes a new original approach to object localization, relying on additional information resources. To accomplish this, new proposed localization method based on the embedding of the graph distance between the nodes of a wireless network on the plane with additional, alternative information resources as a set of constraints that exclude alternative graph realizations.

Proposed method has been realized both as "pure" algorithmic implementation, and as a compact, optimized implementation in the form of spatial queries to the Geographic Information System. A simulation-spatial analytical model has been developed to allow investigate and validate the proposed method. Implementation of the method is studied at different, close to the actual embedding scenarios. Data, collected within experiment cycles, has been processed,

analyzed and evaluated.

Main results of the thesis presented are universal in nature and shows that the proposed method can be widely used as a source of missing information for other localization methods, or as the source of information for the period of time when the classical methods of localization are unavailable.

The basic concepts and findings were reported and discussed at scientific conferences and seminars. The author has 9 publications on the subject of the thesis including indexed at peer reviewed scientific literature citation databases such as Index Copernicus, Google Scholar, EBSCO, SCOPUS, ERA, DOAJ and ProQuest Index. The research results have been used in the project COST IC0906 "Improving the accuracy of real-time positioning of moving objects in mines".

The thesis consists of an introduction, five chapters, conclusion, bibliography, and three appendixes. The paper contains 120 pages, and includes figure 52 and 15 tables. Bibliography includes 151 references.