

OPINION

by Prof. Irina Aleksandrovna Radeva, PhD – Institute of Information and Communication Technologies,
Bulgarian Academy of Sciences
on a dissertation submitted for the award of the educational and scientific degree “Doctor”

Field of higher education: **4. Natural Sciences, Mathematics and Informatics**

Professional field: **4.6. Informatics and Computer Science**

Doctoral programme: **Informatics**

Author: **Georgi Kostadinov Kostadinov**

Title: **Research on the Development of an Ambient-Oriented Route Generator**

Scientific supervisor: **Prof. Asya Georgieva Stoyanova-Doycheva, PhD**

1. General presentation of the procedure and of the doctoral student

By Order No. RD-22-1309/29.06.2026 of the Rector of Paisii Hilendarski University of Plovdiv, Prof. Rumen Mladenov, PhD, in connection with the open procedure for the defence of a dissertation on the topic “Research on the Development of an Ambient-Oriented Route Generator” for the award of the educational and scientific degree “Doctor” in field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Science, doctoral programme Informatics, by Georgi Kostadinov Kostadinov – a full-time doctoral student at the Department of Computer Systems, with scientific supervisor Prof. Asya Georgieva Stoyanova-Doycheva, PhD, on report No. RD-21-1310/25.06.2026 by Prof. Angel Atanasov Golev, PhD – Dean of the Faculty of Mathematics and Informatics, and in accordance with Art. 4 of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), Art. 2(2) and Art. 30(3) of the Regulations for the Application of the LDASRB, and Art. 37(1) of the Regulations on the Development of the Academic Staff of Paisii Hilendarski University of Plovdiv, I have been appointed a member of the scientific jury.

As a member of the scientific jury I have received a complete set of documents: an application to the Rector; a curriculum vitae in the European format; the dissertation; the author’s abstract in Bulgarian; an abstract in English; a list and full-text copies of the publications; a list of the publications cited in the dissertation; a declaration of originality and authenticity; a declaration on the incorporation of previously published work; a statement of compliance with the minimum national requirements; and an extract from Minutes No. 11-25/26 of 12.06.2026 of the Department of Computer Systems. The documentation complies with Art. 36(1) of the Regulations on the Development of the Academic Staff of the University.

Georgi Kostadinov Kostadinov is a graduate of Paisii Hilendarski University of Plovdiv. He holds a Bachelor’s degree in Informatics (2008–2012) and a Master’s degree in Software Technologies (2012–2014). Since 2019 he has been a full-time doctoral student at the Department of Computer Systems of the Faculty of Mathematics and Informatics. He has more than thirteen years of experience in the software industry, currently as a senior software engineer and technical lead of back-end teams. This experience is evident in the engineering quality of the prototype.

2. Relevance of the topic

The topic is relevant in both scientific and scientific-applied terms. Smart tourism is an established research area. It brings together recommender systems, context-aware mobile applications and the semantic modelling of cultural and historical heritage. Classical electronic tourist guides provide reference information. They leave the tourist to combine thematic interest, available time, location, personal constraints and environmental conditions unaided. This deficit of contextual intelligence is formulated as the scientific-applied problem of the dissertation.

It is valuable that accessibility is treated as a structural factor and not as a descriptive attribute. A dynamic weather context and explainability of the recommendation are added to it. Accessible tourism and the transparency of algorithmic decisions are topics of growing public and regulatory importance.

3. Knowledge of the problem

The doctoral student demonstrates a very good command of the state of the art. Chapter One organises the literature into four strands: recommender systems in tourism; interactive tourist guides; ontological and context modelling; accessibility and explainability under incomplete data. The bibliography comprises 83 sources and combines classical works with recent publications.

The review in Chapter 1 is not compilative. It ends with a comparative analysis along five clearly argued axes: semantic description, multidimensional accessibility, dynamic weather context, controlled completion of missing data, and explainability. A sixth axis is added – global route optimisation – on which the author correctly acknowledges the advantage of existing solutions. The five research opportunities identified determine the architecture in Chapter 2 and the implementation in Chapter 3.

4. Research methodology

In the introduction to the dissertation (p. 11) the author formulates the main objective as follows: “The main objective of the dissertation is to design, implement and substantiate a two-stage model of an ambient-oriented intelligent tourist guide, in which a semantic retrieval of candidates based on ontological knowledge is followed by an ambient re-ranking that takes into account the user profile and the dynamic external context, with the aim of generating practically feasible and explainable routes (in the sense defined above) to cultural and historical sites.”

To achieve this objective, three sub-objectives are formulated, elaborated in six research tasks (pp. 11–12):

“Objective 1. To develop a theoretical and architectural framework for an ambient-oriented intelligent tourist guide, in which the semantic description of tourist sites is combined with a multidimensional model of the ambient factors.” – Task 1.1 (analysis of the state of the art and identification of the research niche) and Task 1.2 (a formal model of the tourist site and a multi-layered architecture).

“Objective 2. To implement a prototype system that materializes the two-stage model in a working software project with support for semantic search, ambient re-ranking, explainability and uncertainty management.” – Tasks 2.1–2.4 (prototype modules and meteorological context; accessibility as a real constraint; completion of missing characteristics through a language model; explainability and uncertainty management).

“Objective 3. To formulate and apply a methodology for experimental validation of the proposed model.”

The validation setup is described in Section 4.1 (p. 80). Three strategies are compared (proximity only, ambient ranking without weather context, and the full model) for five user profiles. An ablation analysis of the four factors and a scenario-based validation were carried out. Two corpora were used: a synthetic one of 100 sites in Plovdiv and a real one of 143 sites, with Gabrovo as the centre of the experiment. The metrics are Precision@5, Precision@10 and nDCG@10, supplemented by the “Feasibility” metric introduced by the author. The benchmarks are automated tests with cached AI inferences and run without external API calls.

The objective is formulated in concrete terms, and the tasks are derived from it and cover the main stages of the work. The chosen methodology makes it possible to attain the objective set and to answer the tasks addressed.

5. Characterisation and assessment of the dissertation and of the contributions

The dissertation is 157 pages long. It comprises an introduction, four chapters, a conclusion, 10 figures, 21 tables, 6 appendices and a bibliography of 83 sources. The structure complies with Art. 27(2) of the Regulations for the Application of the LDASRB. The exposition follows a natural progression from a

theoretical foundation (Chapter 1), through the architectural framework (Chapter 2) and the engineering implementation (Chapter 3), to experimental validation (Chapter 4).

The research approach is two-stage. Candidate sites are first retrieved on the basis of ontological knowledge. They are then re-ranked against the user profile and the external context through four ambient characteristics. Location and working hours act as filters. Accessibility eliminates a site in the event of explicit incompatibility. Exposure adjusts the rank according to the current weather conditions. The approach is developed in Chapters 2, 3 and 4.

The material on which the contributions rest is reliable. A working server-side prototype has been implemented in Java 21, Spring Boot 3.5 and MySQL 8.0, with a REST interface, an ontology layer, a polymorphic ambient layer, integration with an external weather service and an isolated AI service with resilience patterns. The quantitative results are obtained through executable benchmarks and are verifiable.

The results declared by the author are presented in the conclusion (pp. 110–111) in three groups – conceptual and scientific-applied, applied, and methodological. On this basis, and on the basis of my analysis of the dissertation, I accept the following contributions, regrouped into two categories.

Scientific-applied contributions

A two-stage architectural framework for an ambient-oriented intelligent tourist guide is proposed and substantiated. The semantic retrieval of candidates is separated from the ambient re-ranking. The ambient characteristics are differentiated by semantic function (spatial, temporal, personal and contextual).

A multidimensional model of accessibility (motor, visual and auditory) is developed. It is formalised as a hard constraint on the ranking rather than as a descriptive attribute, and it is integrated with a dynamic weather context through an exposure adjustment factor.

A cautious mechanism is proposed for the controlled completion of missing ambient characteristics through a language model with structured outputs and domain rules. Inferred values remain distinguishable from observed ones, and unresolved fields receive a neutral rank. The value of the contribution lies in the controlled, rather than automatic, use of artificial intelligence.

Applied contributions

A modular software prototype with explainability by construction has been implemented. For each factor it provides an explicit classification of the effect, the provenance of the value and the reason for elimination.

A validation methodology has been formulated and applied, based on comparative baseline strategies, ablation analysis and scenario-based profile checking. It is applicable without modification to both a synthetic and a real corpus.

I accept that these contributions are realistic, that they correspond to the scope of the dissertation and that they meet the requirements for the award of the educational and scientific degree “Doctor”.

6. Assessment of the publications and of the personal contribution of the doctoral student

Four publications on the topic of the dissertation have been submitted. All are in English and co-authored. Two are conference papers from Automatics and Informatics (ICAI 2020, Varna), refereed and indexed in IEEE Xplore and Scopus. One publication is in Digital Presentation and Preservation of Cultural and Scientific Heritage (DiPP 2022), refereed in Web of Science and Scopus. One article is in the journal Cultural and Historical Heritage (KIN Journal, 2021).

The doctoral student is first author of two of the four publications. These are precisely the publications containing the core of the algorithmic solution – the algorithm for generating and visualising routes (ICAI 2020) and the application of ambient characteristics, personalisation and ontology concepts (DiPP 2022). They are included in the bibliography of the dissertation, as items 25 and 26, and are cited in the text. The other two publications are listed only in the “Publications on the topic” list on p. 114.

According to the statement submitted, the author meets the minimum national requirements for the educational and scientific degree “Doctor” in field 4. Natural Sciences, Mathematics and Informatics – Group A (50 points) and Group G (54 points against a required 30), 104 points in total. The conditions of

the Regulations for the Application of the LDASRB and of the Regulations on the Development of the Academic Staff of Paisii Hilendarski University of Plovdiv are met.

No data on recorded citations have been submitted.

I am convinced of the personal involvement of the doctoral student in the research carried out. The results in Chapters 2, 3 and 4 are his own achievement.

I have no evidence of plagiarism or of unreliability of the scientific data presented in the dissertation.

7. Author's abstract

The author's abstract is 32 pages long and is presented in Bulgarian and in English. Its structure follows the chapters of the dissertation. The abstract gives a faithful picture of the content and quality of the dissertation.

8. Critical remarks and recommendations for future use of the results

I assess the dissertation highly. The remarks below do not call its principal results into question.

The summary of the ablation analysis is stronger than the data. In Tables 4.3 and 4.7, 28 of a total of 40 measurements show no change when a factor is removed; location, for example, has no effect in any profile of the synthetic corpus, and working hours none in any profile of the real corpus. The claim on p. 108 that every factor has its own measurable contribution, and that the effect is not due to a single dominant component, is not supported by these tables.

The prototype contains functionality that is implemented but unused. User ratings are collected and stored but do not affect the ranking (p. 111). The data-provenance and confidence layer is announced but not implemented.

The appendices serve mainly the technical reproducibility of the prototype. Part of the material in them, however, is of a contributory nature and belongs in the main text. The "Feasibility" metric is introduced by the author, yet its justification is left in the glossary (E.6) instead of in Section 4.1.2. The risk of misinterpreting accessibility and the argument for a human verification cycle (G.3 and G.6) are precisely the reasoning that is missing from the main text, where the mechanism is announced but not implemented. Table B.1 reproduces Table 4.3 from Chapter 4 without change.

The bibliography is technically sound in structure, but the entries are incomplete: DOIs and ISBN/ISSN are absent, and about twenty articles lack volume, issue and pages. The inconsistency is clearest in the author's own publications, items 25 and 26, which appear in the bibliography without DOI or pages, while the list of publications gives them in full.

I recommend that the results of Chapter 4 be prepared as a separate publication in a journal with an impact factor. The validation should be extended with independent expert annotation, stronger baseline models and testing with real users.

The contributions have potential for practical application. The prototype and the validation methodology can be used in tourist information systems and in projects for the digitisation of cultural and historical heritage. The ambient model deserves to be tested in adjacent domains as well – municipal services and accessible routes for people with disabilities. A natural next direction is multi-criteria route planning, in which the proposed model is used as an evaluation layer.

CONCLUSION

The dissertation contains scientific-applied and applied results that constitute an original contribution to science and meet all the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB), the Regulations for its Application, the relevant Regulations of Paisii Hilendarski University of Plovdiv and the additional faculty requirements of the Faculty of Mathematics and Informatics under those Regulations.

The dissertation shows that the doctoral student Georgi Kostadinov Kostadinov possesses in-depth theoretical knowledge and professional skills in professional field 4.6. Informatics and Computer Science, and demonstrates the qualities and skills required to carry out independent research.

In view of the above, I confidently give my positive assessment of the dissertation, the author's abstract and the results achieved, and I propose that the esteemed scientific jury award the educational and scientific degree "Doctor" to Georgi Kostadinov Kostadinov in field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Science, doctoral programme Informatics.

07.09.2026

Opinion prepared by: _____

Prof. Irina Radeva, PhD