REVIEW

by Assoc. Prof. Veneta Veselinova Tabakova-Komsalova

Faculty of Mathematics and Informatics, Plovdiv University "Paisii Hilendarski"

of a dissertation for the award of the educational and scientific degree **of "Doctor"**

in the field of higher education: *4. Natural Sciences, Mathematics and Informatics*,

professional field: *4.6. Informatics and Computer Sciences*

Doctoral programme: *Informatics*

Author: ***Ilia Iliev Nedelchev***

Topic: ***Development of intelligent tools for working with virtualised cultural and historical objects***

Scientific supervisor: ***Prof. Stanimir Nedyalkov Stoyanov, Faculty of Mathematics and Informatics, Plovdiv University "Paisii Hilendarski".***

1. General description of the presented materials

By Order No. RD-22-2527 of 15 December 2025 of the Rector of Plovdiv University "Paisii Hilendarski" (PU), I was appointed a member of the scientific jury to ensure the procedure for the defence of a dissertation on the topic "**Development of intelligent tools for working with virtualised cultural and historical sites"** for the acquisition of the educational and scientific degree "Doctor" in the field of higher education 4. Natural Sciences, Mathematics and Informatics, professional field 4.6. Informatics and Computer Sciences, doctoral programme in Informatics. The author of the dissertation is **Ilia Iliev Nedelchev** – a full-time doctoral student at the Department of Computer Systems with scientific supervisors Prof. Stanimir Nedyalkov Stoyanov, PhD, from the Faculty of Mathematics and Informatics at Plovdiv University "Paisii Hilendarski", Plovdiv. The set of materials on electronic media presented to me by Ilia **Iliev** Nedelchev is in accordance with Art. 36 (1) of the Regulations for the Development of Academic Staff at Plovdiv University "Paisii Hilendarski".

The set of materials on electronic media presented to me by Ilia Iliev Nedelchev is in accordance

with Art. 36 (1) of the Regulations for the Development of Academic Staff at Plovdiv University and includes the following documents:

- a request to the Rector of Plovdiv University to initiate the procedure for the defence of a doctoral thesis;
- a list of publications;
- minutes from the preliminary discussion in the department and an opinion from the academic supervisor regarding readiness for preliminary discussion;
- abstract – in Bulgarian and English;
- declaration of originality and authenticity of the attached documents;
- certificate of compliance with the minimum national requirements for obtaining a PhD degree;
- list of scientific publications on the topic of the dissertation;
- dissertation;
- copies of scientific publications on the topic of the dissertation.

2. Brief biographical information about the doctoral student

Iliya Iliev Nedelchev completed a master's degree in "Computer Systems and Technologies" at the Technical University of Gabrovo in 2014-2016. From 2014 to 2017, he completed a second master's degree in Fundamentals of Psychology at the St. St. Cyril and Methodius University of Veliko Tarnovo in Veliko Tarnovo. From 2023 to 2025, he was a full-time doctoral student at Paisii Hilendarski University of Plovdiv in the Department of Computer Systems at the Faculty of Mathematics and Informatics.

His professional career began in 2022 and continues to this day at ZigZag Global in Varna as Director of Information Systems.

Comments: The attached CV does not indicate what his bachelor's degree is in and where it was completed. Furthermore, the scanned documents (CV) do not clearly show the completed master's degree in Computer Systems and Technologies at the Technical University of Gabrovo.

3. Relevance of the topic and appropriateness of the objectives and tasks set

The topic of the dissertation is undoubtedly relevant and significant in both scientific and applied terms. The digitisation of cultural and historical heritage, the use of intelligent agents, multi-agent systems and semantic technologies are among the priority areas in contemporary computer science. Their application in the field of tourism and cultural heritage is particularly relevant, where

there is a growing need for personalised, adaptive, context-aware and interactive information systems.

The main objective – to develop a platform for the digitisation of cultural and historical heritage with a focus on personal tourist guides – is clearly formulated and logically justified. The tasks formulated are adequate, consistent and fully in line with the objective set, ensuring its achievement through analysis, modelling, design and experimental implementation.

4. Knowledge of the problem

The doctoral student demonstrates a very good understanding of the subject matter. The first chapter provides an in-depth analysis of the current state of tourism, virtual tourist guides, intelligent agents and the application of artificial intelligence. Both theoretical concepts and current technological trends are presented.

The literature review is comprehensive and demonstrates an ability to critically analyse and synthesise a significant number of scientific sources. The existing limitations of the available solutions are correctly highlighted, which justifies the need for the proposed research.

All these factors show that Ilia Nedelchev has in-depth knowledge of the field of research, uses established methodological approaches and works on a current and significant problem.

5. Research methodology

The research methodology is consistent with the stated objective. The author applies a combination of:

- analytical methods for researching existing architectures and technologies;
- methods for conceptual and semantic modelling;
- an agent-oriented approach to design;
- experimental methods for validating the developed prototypes.

The research approach is adequate for the objectives of the dissertation and allows for the achievement of reliable and reproducible results.

6. Characteristics and evaluation of the dissertation

Iliya Nedelchev's dissertation is structured logically and consistently.

The dissertation has a total volume of 144 pages, including referenced literature, which contains

116 literary sources in Bulgarian and English. The structure of the thesis is logically consistent and includes: Introduction, four main chapters, Conclusion, list of publications, glossary of terms used and references.

The introduction justifies the relevance of the problem and defines the goals and tasks that the author sets for the software development.

The first chapter of the dissertation provides a brief overview of topics related to the subject of the dissertation. The specific aspects of modern tourists are examined. The features of the virtual tourist guide are presented. The specifics of artificial intelligence and intelligent agents are analysed.

The second chapter presents the model and architecture of the personal tour guide.

The third chapter is devoted to the prototype implementation of the virtual tourist guide.

The fourth chapter presents the possibilities for applying an adapted version of the tourist guide in a different application area, namely monitoring air quality in the Plovdiv area.

The conclusion provides a brief summary of the results of the research conducted within the framework of the dissertation. Some future directions for continuing work on the topic are also discussed. Iliya Nedelchev's dissertation is written in a scientific style, with good structure, consistency of presentation and precise terminology. There is a good connection between theory and practice, with the results achieved having real value for the development of intelligent systems in the field of tourism and cultural heritage.

The volume and content meet the requirements for a doctoral dissertation. The main results are presented clearly and with good reasoning.

The following make a particularly positive impression:

- the developed model and architecture of the personal tourist guide;
- the multi-agent approach and integration with the ViPS reference architecture;
- the demonstrated ability to adapt the developed solution to different application areas (air quality monitoring).

In summary, I would like to emphasise that the dissertation has been prepared very thoroughly. The style of the dissertation is very good, clear and easy to read, which aids in the correct understanding of the text. The models, algorithms and methods are illustrated with very well-designed diagrams and charts. I am impressed by the business functionality of the tourist guide.

7. Contributions and significance of the study for science and practice

The main contributions of Ilia Nedelchev's dissertation are both scientific-applied and practical. Within the scope of the study, four main results are defined, which correspond to the tasks set and the aim of the study:

- an improved model and architecture for an intelligent personalised tourist guide has been proposed;
- an ontological network for presenting cultural and historical heritage, compatible with the CCO standard, has been developed;
- a prototype of a multi-agent platform with context-aware behaviour has been implemented;
- the universality of the approach has been proven through application in different domains.

Each of these tasks corresponds to the developments in the individual chapters of the dissertation, which shows that the set goal has been achieved.

The development has the potential for real implementation and can be used both in tourism practice and in other areas related to intelligent information systems.

I believe that the results achieved meet the regulatory requirement to represent an "original contribution to science" (Article 27(1) of the PP ZRASARB).

8. Assessment of publications related to the dissertation

The author has submitted a list of seven papers in collections from national and international conferences. Four papers are in English, two of which are co-authored. One of the publications is referenced in Web of Sciences **Q2**, and the other in SCOPUS. This satisfies the minimum national requirements of the Regulations for the Implementation of the Law on the Development of Academic Staff in the Republic of Bulgaria for a minimum of 30 points in indicator group G, where the doctoral student has 78 points. All tasks and respective results of the dissertation are reflected in the two publications. The publications on the topic of the dissertation are relevant, sufficient in number and reflect the main scientific results of the research. They have been published in appropriate scientific journals and conferences and demonstrate the doctoral student's active scientific research activity.

9. Personal participation of the doctoral student

The content of the dissertation and the abstract clearly demonstrate the doctoral student's significant personal participation in the implementation of the research. The doctoral student

independently analysed existing solutions and technologies, formulated the research goals and objectives, and developed the concept, model and architecture of the personal tourist guide.

The doctoral student actively participated in:

- conceptual modelling;
- architectural design;
- the implementation of prototypes;
- the integration of different technologies;
- experimental testing and analysis of results.

All these activities testify to the doctoral student's high degree of independence and scientific maturity. I have no doubts about Ilia Nedelchev's personal contribution to the dissertation research and to the achievement of the relevant scientific-applied and applied results. I have not found any plagiarism in the dissertation according to the established legal procedure.

10. Abstract

The abstract is attached in accordance with the requirements in Bulgarian and English, and is 32 pages long. It is clearly structured, contains the main objectives, tasks, methodology and contributions, and fully meets the requirements for this type of scientific document. Its volume and content meet the requirements for an accurate, complete and concise reflection of the dissertation. It presents the relevance of the topic, the aim and objectives of the research, the methodology used, the structure of the dissertation, and the main scientific and applied results.

The presentation is logically structured and allows the reader to quickly orientate themselves in the essence of the research. The main contributions are clearly formulated, and the description of the prototype implementation and experiments is sufficiently informative. The abstract fully meets the requirements for this type of scientific document and adequately presents the dissertation.

11. Questions and recommendations

Along with the indisputable merits, some comments can also be noted. In places, the presentation is too detailed and could be more compact. There is a lack of in-depth quantitative analysis of the results of the experiments. It would be useful to make a clearer distinction between existing developments and the author's personal contribution in some sections. These comments are not significant and do not diminish the scientific value of the work.

In connection with the presented dissertation, the following questions and recommendations can be formulated:

Questions:

1. What are the possibilities for scaling the developed system when using it on a national or international scale?

2. What are the limitations of the multi-agent approach used when working in a highly dynamic environment with a large number of users?

3. How is the reliability and quality of the data used in the adaptation of the air quality monitoring system ensured?

Recommendations:

- In future studies, the experimental part should be expanded with a more in-depth quantitative analysis and comparative assessment with similar systems.

- Consider opportunities for integration with additional external data sources and other smart tourism service platforms.

- The applicability of the developed architecture should be explored in other domains related to smart cities and services.

Despite the comments made, which do not affect the quality of the presented dissertation, I must note that the topic of the dissertation is relevant and the results achieved deserve high praise. The doctoral student has demonstrated in his research in-depth knowledge in the field and an ability for independent scientific research.

CONCLUSION

The dissertation is a complete, independent and scientifically applied study with clearly formulated objectives, correct methodology and significant results. The author demonstrates in-depth knowledge, analytical thinking and skills in the development of modern intelligent software systems.

The dissertation contains **scientific-applied and applied results** that represent an original contribution to science and meet all the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria (ZRASRB), the Regulations for the Implementation of the ADSRA, and the relevant Regulations of Plovdiv University "Paisii Hilendarski". The presented materials and dissertation results fully comply with the minimum national requirements in the Regulations for the

Implementation of the ADSRA of the Republic of Bulgaria.

In view of the above, I am confident in giving my **positive** assessment of the research presented in the above-reviewed dissertation, abstract, results and contributions, and I propose that the honourable scientific jury award the educational and scientific degree of "Doctor" to Ilia Iliev Nedelchev in the field of higher education: 4. Natural Sciences, Mathematics and Informatics, professional field: 4.6. Informatics and Computer Sciences, doctoral programme: Informatics.

20 January 2026

Reviewer: .....

(signature)

Assoc. Prof. Veneta Tabakova-Komsalova