OPINION

BY PROF. ASYA STOYANOVA-DOYCHEVA, PHD

Faculty of Mathematics and Informatics at the University of Plovdiv "Paisii Hilendarski"

of a dissertation for awarding 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 program Informatics

Author: Ilia Iliev Nedelchev

Topic: Development of intelligent tools for working with virtualized cultural and historical sites.

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

1. General presentation of the submitted materials

By order № RD-22-2527 /15.12.2025 of the Rector of the University of Plovdiv "Paisii Hilendarski" (PU), I have been appointed as a member of the scientific jury to participate in a procedure for the defence of a dissertation on the topic of *"Development of intelligent tools for working with virtualized cultural and historical sites"* for acquiring 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 program Informatics. The author of the dissertation is Ilia Iliev Nedelchev – a full-time doctoral student at the Department of Computer systems, with scientific supervisor Prof. Stanimir Nedyalkov Stoyanov, PhD from FMI at the University of Plovdiv "Paisii Hilendarski".

The set of materials presented to me by Ilia Iliev Nedelchev on electronic media is in accordance with Article 36 (1) of the Law on the Development of the Academic Staff of the University of Plovdiv.

Ilia Iliev Nedelchev holds a master's degree in Computer Systems and Technologies at the Technical University – Gabrovo and a master's degree in Psychology from the University of Veliko Tarnovo "St. St.Cyril and Methodius". Since 2023, he has been a regular doctoral student at the Department of Computer Systems at the Faculty of Mathematics and Informatics at Plovdiv University. Since 2023, he has been a full-time doctoral student at the Department of Computer Systems at the Faculty of Mathematics and Informatics at Plovdiv University. He has been working as Director of Information Systems at ZigZag Global, Varna since 2022.

2. Relevance of the topic

The main objective of the dissertation is to continue the work on implementing a platform for digitizing cultural and historical heritage. A key component of this platform is a personal tourist guide.

The digitization and preservation of Bulgaria's cultural and historical heritage is included in the "National Development Program BULGARIA 2030." Promoting and providing access to various

cultural and historical sites is a key task of tourism development strategies. In this regard, the development of a tourist guide that assists tourists in their experiences, developed with modern technologies and solutions such as artificial intelligence methods, is undoubtedly relevant.

3. Knowledge of the research problem

The well-defined goals and objectives in the dissertation on page 19 and the motivation presented demonstrate the doctoral student's knowledge in the field. The knowledge of previous research in the field, studied at the Department of Computer Systems, also makes a good impression. From the dissertation and its bibliography, containing 116 literary and Internet references, it can be concluded that the doctoral student has thoroughly and carefully studied the state of scientific research in the field of cultural and historical heritage.

4. Research methodology

I consider that the chosen research methodology follows the usual trends in this field. A concept and architecture for a tourist guide for the city of Gabrovo has been developed and presented. The specifics of the region are presented, which are included as the basis for the model of the developed prototype. A prototype assistant has been implemented to monitor air pollution in the city of Plovdiv in order to demonstrate the possibility of adapting the proposed architecture of the tourist guide to other areas of application. The methodology and results of the research are presented in detail in the dissertation.

5. Characteristics and evaluation of the dissertation work

The dissertation is 144 pages long and consists of an introduction, four chapters, a conclusion, a complete list of the doctoral student's publications, and a bibliography. The research work is structured into several logical components, which are discussed in the individual chapters of the dissertation.

The introduction presents the main objective of the dissertation (p. 19): "... to continue the work on implementing a platform for digitizing our cultural and historical heritage. A key component of this platform will be a personal tourist guide." Four tasks have been defined to achieve this goal (p. 19). The introduction motivates the goal of the study by presenting previous developments in the field. Some of them are related to the development of ontologies in the field of cultural and historical heritage, the processing of ontologies with intelligent components, and the development of catalogs of cultural and historical sites.

Chapter One presents the state of the problem area. It is divided into three parts: specific aspects of tourist services and tourism, characteristics of tourist guides, and specifics of intelligent agents. The conclusions drawn by the doctoral student are that tourists are increasingly turning to individual tourist experiences. To this end, he proposes the development of a tourist guide that adapts to the tourist's wishes and takes into account the conditions of the environment by offering information on

combined services. The doctoral student proposes that the tourist guide be specialized for a specific area, in this case the city of Gabrovo.

The second chapter of the dissertation describes the architecture of the tourist guide. The choice of Gabrovo as the region for the developed prototype of the tourist guide is justified. The model and architecture of the prototype are presented. The virtual tourist guide is a multi-layered system that includes a multi-agent environment implemented with the Jason framework. The client part consists of a mobile application developed with Flutter and a web application developed with ASP.NET Core. The web application consists of a website and a REST API, with the REST API processing requests sent from the mobile application. The database is developed with PostgreSQL. Two types of BDI agents have been implemented: Planner Agents, which manage the Guide agents, and Guide Agent, which takes care of the individual plan of the tourist. Guide Agents react proactively to changes in the environment. The agents have access to the implemented services – Attraction Store Service, Chat Service, Tourist Service, Map Service, and Weather Service through the REST API.

The third chapter of the dissertation describes the implementation of the prototype. It includes parts of the code for implementing the agents in a Jason environment and implementing chat. Two types of chat have been implemented: Rasa with predefined scenarios and ChatGpt API, which uses LLM to process more general requests.

Chapter 4 describes a prototype environment for reporting air pollution. The idea is to show how the architecture of the tourist guide can be adapted for other areas of application. The developed prototype has a multi-agent architecture, with one of the agents using ontologies with threshold values for air pollutants and the other using information from various sources on the Internet through a large language model. The first agent uses specialized knowledge and rules to make its conclusions, while the other uses a large language model trained with a large set of different information and sources. The combination of the two types of artificial intelligence leads to a more secure and reliable approach to determining air purity in the Plovdiv area.

The conclusion presents the main results of the dissertation.

6. Evaluation of the dissertation publications and personal contribution of the PhD student

Ilia Iliev Nedelchev has submitted a total list of seven publications, all on the topic of his dissertation. The articles are co-authored. Two of the publications are included in the report on minimum national requirements – sixth and seventh on the list of publications. Two of the publications are indexed in Web of Science, one with an impact factor and quartile Q2, while the other publications are in international conferences and journals. I accept that the results of the dissertation are well presented to the scientific community. I have no doubt that the dissertation and

the results obtained are the personal work of the doctoral student. I have not noticed or found any plagiarism.

The minimum national requirements of the Rules for the Implementation of the Act for the Development of the Academic Staff in the Republic of Bulgaria are satisfied for a minimum of 30 points under group G indicators, where the doctoral student has 78 points.

7. Abstract

The abstract complies with the requirements of the ZRASRB and the Regulations of Paisii Hilendarski University in terms of volume and content.

8. Critical remarks and recommendations

I recommend that the doctoral student continue the research he has begun, as the topic has a high degree of applicability and broad prospects for development.

I have some comments on the dissertation:

• Printing errors are found in the work.;

• There are many inaccuracies in the administrative documents – for example, the autobiography is not well formatted, which makes it difficult to read and understand, and the list of publications lacks information about conferences and ISBN or ISSN numbers.

Questions for the doctoral student:

• Is specific training provided on the Rasa model that you use in the tourist guide chat service?

The recommendations made to the doctoral student do not diminish the significance of the results achieved.

CONCLUSION

The dissertation contains scientific-applied and applied results, which represent an original contribution to science and meet all the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for the Implementation of the Act for the Development of the Academic Staff in the Republic of Bulgaria (ADASRB), and the relevant Rules of the University of Plovdiv "Paisii Hilendarski". The presented materials and dissertation results fully correspond to the minimum national requirements in the Rules for the implementation of the ADASRB.

Due to the above, I confidently give my positive assessment of the conducted research, presented by the above-reviewed dissertation work, abstract, achieved results, and contributions, and I propose to the honorable scientific jury to award the educational and scientific degree "doctor" to Ilia Iliev Nedelchev in field of higher education: 4. Natural sciences, Mathematics, and Informatics, professional field: 4.6. Informatics and Computer Science, doctoral program: Informatics.

11.01.2026 Signature:

Plovdiv / Prof. Asya Stoyanova-Doycheva/