

OPINION

by **Associate Professor Vanya Angelova Ivanova, PhD,**
University of Plovdiv “Paisii Hilendarski”, Plovdiv

of a dissertation for awarding 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 program: Informatics

Author of the dissertation: Irina Krasimirova Krasteva

Topic: Blockchain-based synchronization of personal assistants

Scientific supervisor: Prof. Stanimir Nedyalkov Stoyanov, PhD

1. General presentation of the procedure and the doctoral student

By order № RD-21-236 of 29 January 2024 of the Rector of the University of Plovdiv “Paisii Hilendarski”, I have been appointed as a member of the scientific jury to participate in a procedure for the defense of a dissertation on the topic of “Blockchain-based synchronization of personal assistants” 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 Irina Krasimirova Krasteva – a full-time doctoral student at the Department of Computer Systems, with scientific supervisor Prof. Stanimir Nedyalkov Stoyanov, PhD, from the University of Plovdiv “Paisii Hilendarski”.

The set of materials presented by the doctoral student is in accordance with Article 36 (1) of the Law on the Development of the Academic Staff of the University of Plovdiv and includes the following documents on electronic media:

- An application form to the Rector for initiating a procedure;
- CV in European format;
- A protocol of the preliminary discussion in the department;
- An abstract in Bulgarian and in English;
- A declaration of originality and authenticity of the attached documents;
- A certificate of compliance with the minimum national requirements;

- A list of publications;
- A dissertation;
- Copies of the publications on the topic of the dissertation;
- A certificate № 561 of 18 December 2023 for participation in projects from the Department for Scientific Research;
- A statement by the scientific supervisor.

The doctoral student has submitted 4 publications, 3 of which are in English and 1 in Bulgarian; two of the publications are referenced in Scopus.

This set of documents complies with the requirements of the Act for the Development of the Academic Staff in the Republic of Bulgaria, the Rules for its implementation, and the Law on the Development of the Academic Staff of the University of Plovdiv “Paisii Hilendarski”. The dissertation was discussed and approved for defense at a department meeting on 15 December 2023 at the Department of Computer Systems at the Faculty of Mathematics and Informatics of the University of Plovdiv. The procedure for the defense of the educational and scientific degree “doctor” is organized according to the law. The dissertation and the author’s abstract correspond to the requirements of the Rules on the Conditions and Procedure for Acquiring Science Degrees and Holding Academic Positions at the University of Plovdiv.

The doctoral student Irina Krasimirova Krasteva received her bachelor’s degree in 2010 majoring in Informatics at the University of Plovdiv “Paisii Hilendarski” and she acquired the qualification of informatician (computer scientist). Irina Krasteva received a master’s degree in “Financial Management” from the University of Plovdiv “Paisii Hilendarski” in 2015. From 2018 to 2021, she participated in a doctoral program in informatics at the University of Plovdiv “Paisii Hilendarski”, Faculty of Mathematics and Informatics, Department of Computer Systems, and was awarded the right of defense. Since January 2019, the doctoral student has been working as an assistant professor at the Faculty of Mathematics and Informatics of the University of Plovdiv.

2. Relevance of the topic

Irina Krasteva's dissertation is in-depth innovative research work dedicated to a current problem related to data security and, accordingly, to the use of blockchain technologies to minimize the risk of manipulation of already stored data. The dissertation includes main and auxiliary goals, namely analyzing and conducting experiments on matching intelligent personal assistants with blockchains and developing and testing blockchain-based models synchronized with personal assistants and their application to various adaptations of the Virtual Physical Space ViPS.

The goals are clearly defined and supported by the following specific sub-goals: development and testing of an “Electronic School Diary” model built based on synchronization between intelligent agents and the use of blockchain technologies within the framework of adaptation of the reference architecture in the field of secondary education, as well as development and testing of a technology application model in adapting the ViPS architecture to smart agriculture.

3. Knowledge of the research problem

The topic implies in-depth studies of the problem area. The doctoral student convincingly demonstrates a high level of knowledge of the issues under consideration, evidence of which is the appropriately composed structure of the dissertation and the formulated main and auxiliary goals and sub-goals. The doctoral student very successfully uses and correctly cites literary sources on the issue. The dissertation contains good illustrative material. The content of the work has a logical connection between individual chapters and paragraphs.

4. Characterization and evaluation of the dissertation work and contributions

The dissertation has a volume of 139 pages and the bibliography includes 150 sources. The dissertation consists of an introduction, four chapters, a conclusion, results of the scientific research, participation in projects, reports at scientific conferences, declaration by the doctoral student, a list of 4 publications, and references.

The introduction is the foundation of the topic and scope of the dissertation work. It presents the problem under consideration, the main goals and tasks of the dissertation, and describes the general approach and methodology of the scientific research.

Chapter 1 justifies the need to conduct the study and introduces and summarizes the main features of blockchain technology, including its advantages and disadvantages. This chapter describes the features of Cyber-Physical and Cyber-Physical-Social Systems as well as the reference architecture of the Virtual Physical Space ViPS through which target systems such as education and smart agriculture adaptations are modelled.

Chapter 2 describes the software architecture, models the BLISS educational multi-agent environment for secondary schools, and presents blockchain-based synchronization with personal assistants in building the electronic diary. The second chapter of the dissertation also presents a model application that manages and coordinates the use of factory-numbered documents in a secondary school.

Chapter 3 presents the application of the considered concept when creating a system for intelligent agriculture in the following two areas: implementation of a validator of new seed samples in the national GenBank and a store for the sale or exchange of seed samples and their use in real

production.

Chapter 4 presents conceptual models for the application of the proposed concept in system development in the field of agricultural supply chain and tourism, and defines directions for future research.

The concluding part summarizes the results obtained in the dissertation research.

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

The main results of the research have been published in journals and conference proceedings.

In total, there are four publications on the topic of the dissertation. One of the publications is in Bulgarian and the other 3 in English, which makes them accessible to a wide range of readers. Two of the publications are referenced in Scopus and all of the doctoral student's publications are co-authored.

The submitted publications are proof of the good promotion of the results of the dissertation work and of the doctoral student's ability to work in a team, assume responsibilities, and be accountable. The doctoral student's contribution to the publications is indisputable.

The number and quality of the publications meet the requirements of the Rules on the Conditions and Procedure for Acquiring Science Degrees and Holding Academic Positions at the University of Plovdiv and their content reflects basic results that are sufficiently presented to a specialized scientific audience.

6. Abstract

The abstract reflects the content and contributions of the dissertation and meets the requirements. Here, as in the dissertation work, the clear position of the author and the consistency and completeness in the realization of the set goals are evident.

7. Critical remarks and recommendations

I have no substantive critical remarks on the presented documents and works. Some inaccuracies can be noted, such as different spellings in Bulgarian of the term "multi-agent" (as one word and with a hyphen); blockchain, oracle (used both in Bulgarian and in English); some grammatical errors such as the use of definite articles in Bulgarian, incorrectly placed commas, etc. I would like to emphasize that the remarks of a technical nature in no way affect the scientific value of the work. As a recommendation, I would encourage the doctoral student to consider publishing individual scientific papers as well.

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 (ADASRB), the Rules for the Implementation of the ADASRB, and the Rules on the Conditions and Procedure for Acquiring Science Degrees and Holding Academic Positions at the University of Plovdiv “Paisii Hilendarski”.

The dissertation work shows that the doctoral student Irina Krasimirova Krasteva has in-depth theoretical knowledge and professional skills, demonstrating qualities and skills for independent conduct of scientific research.

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 Irina Krasimirova Krasteva in field of higher education: 4. Natural sciences, Mathematics, and Informatics, professional field: 4.6 Informatics and Computer Science, doctoral program “Informatics”.

13.02.2024

Reviewer:

Assoc. Prof. Vanya Ivanova, PhD