O P I N I O N

By Prof. Asen Kanchev Pahnev, PhD

on a dissertation on the topic of

„Research on Creating a Virtual Operator in a Smart Agriculture Infrastructure"

author of the dissertation: Ivan Stanimirov Stoyanov
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

By order № RD-21-1093/19.05.2023 of the Rector of the University of Plovdiv "Paisii Hilendarski" (PU), I have been appointed a member of the Scientific Jury to participate in a procedure for the defense of a dissertation on the topic of "Research on Creating a Virtual Operator in a Smart Agriculture Infrastructure" 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, by Ivan Stanimirov Stoyanov – a full-time doctoral student at the Department of Computer Systems at the Faculty of Mathematics and Informatics of the University of Plovdiv "Paisii Hilendarski", with scientific supervisor Prof. Asya Stoyanova-Doycheva, PhD.

In my capacity as a member of the scientific jury, I have received the full set of materials on electronic media from Ivan Stanimirov Stoyanov in accordance with Art. 36 (1) from the Law on the Development of the Academic Staff of PU.

The dissertation "Research on Creating a Virtual Operator in a Smart Agriculture Infrastructure" developed by Ivan Stanimirov Stoyanov presents in a finished form the results of an in-depth study on a current field for the creation of personal assistants for intelligent agriculture. The dissertation consists of 120 pages, containing: an introduction, five chapters, a conclusion, a declaration of originality of the results, a list of participations in projects, and a bibliography including 164 sources.

The purpose of the research is clearly formulated: "to develop a personal assistant (PA) supporting farmers and agricultural specialists working in the conditions of intelligent

agriculture" (p.10), and the specific tasks correspond to it. The research methodology is described on page 11 of the dissertation. First of all, the doctoral student has made a critical analysis of the created platform for intelligent agriculture ZEMELA and its theoretical model. A new version of an event model has been developed as the theoretical basis along with a computational model of the ZEMELA smart agriculture platform. An updated version of the architecture of the ZEMELA smart agriculture platform is considered, which satisfies and makes possible the implementation of the proposed event model. A reference architecture and prototype of a personal assistant for farmers has been developed as the core of the ZEMELA platform and the usability of the personal assistant for a specific scenario of the operation of the ZEMELA platform has been demonstrated.

Chapter I reviews the status of the research problem. The second chapter presents the development of a new event model in which the existing model is refined and detailed. A new concept of an abstract event engine is introduced, now as part of the event model. It is proposed to formalize it as a cellular automaton. The third chapter introduces the ZEMELA smart agriculture platform. The architecture of the platform is discussed, comments are made regarding the architecture and its implementation, and a new platform architecture is proposed based on the idea of its practical application. The fourth chapter presents the reference architecture of a personal assistant for the needs of the ZEMELA platform. The life cycle of the personal assistant is presented, which consists of initialization, anomaly identification, and execution of a selected event-based action plan. The fifth chapter of the dissertation describes the implementation of a prototype of the personal assistant with the JaCaMo technology for the development of intelligent agents with BDI architecture. A demonstration is made of the use of the personal assistant prototype for tomato vegetation. In the conclusion, the main results of the dissertation are summarized and opportunities for continuing research on the topic are presented.

The doctoral student has submitted a list of 2 of his dissertation publications. Both publications are referenced in SCOPUS, which satisfies the minimum national requirements for the educational and scientific degree "Doctor". The publications are in English.

I accept the contributions of the dissertation formulated in the conclusion and consider them to be the personal work of the doctoral student. I have not detected any plagiarism in Ivan Stoyanov's dissertation.

The abstract of the dissertation is submitted according to the requirements in Bulgarian and

English, in the amount of 32 pages, and in terms of volume and content it meets the requirements for an accurate, complete, and concise reflection of the dissertation thesis.

I have no critical remarks for the doctoral student. I recommend that he continue his research and implement the future research presented on pp. 96-98.

Conclusion: My assessment of Ivan Stanimirov Stoyanov's dissertation thesis, abstract, scientific publications, and scientific contributions is positive.

The presented dissertation fully complies with 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, the Law on the Development of the Academic Staff of the University of Plovdiv, and the additional faculty requirements of the Faculty of Mathematics and Informatics at the University of Plovdiv "Paisii Hilendarski" for the acquisition of the educational and scientific degree "Doctor".

The achieved results give me a reason to confidently propose to award the educational and scientific degree "Doctor" to **Ivan Stanimirov Stoyanov** in field of higher education: 4. Natural sciences, Mathematics, and Informatics; professional field: 4.6 Informatics and Computer Science, doctoral program: Informatics.

27.05.2023 Reviewer:
Plovdiv /Prof. Asen Rahnev, PhD/