

OPINION

by Assoc. Prof. Dr. Alexander Ivanov Shikalanov – ULSIT
Member of the Scientific Jury, appointed by the Council of Commands to
the Director of the ICT-BAN
№ 252/02.10.2023

SUBJECT: Dissertation by **Victor Kanchev Danev** on "DESIGN OF
"SMART HOUSES" UNDER OPEN SYSTEM OPENHAB", presented
for acquiring educational and scientific degree "Doctor" under the
doctoral program "Informatics", professional field 4.6. Informatics and
Computer Science, headed by Prof. Daniela Ivanova Borisova, DSc.

1. General description

At the first meeting of the Scientific Jury I was selected to prepare an opinion and
I received the following documents:

- thesis
- auto abstract in Bulgarian and auto abstract in English,
- publications on the topic of the dissertation in full text,
- other documents supporting the procedure.

2. Topicality, purpose and tasks

The topic of the dissertation is in the field of application of Internet of Things (IoT) technologies and techniques applicable to the design of systems with IoT. Changing living conditions, as well as rapid technological advances in all areas of human activity require change and development of new approaches, methods and tools for designing the smart home using open source software systems. This underlines the undoubted relevance of the dissertation presented.

The aim of this dissertation is to propose a project for building a smart home using an open source software platform.

In order to achieve the aim of the dissertation, the following research tasks have been formulated:

1. to analyze the challenges in the field of IoT and the techniques applicable to the design of systems using IoT;
2. to propose a multicriteria decision model for choosing an open source platform for smart home design;
3. to propose a model for determining the competences of IoT specialists for the design and implementation of a smart home;
4. to propose an approach for building a smart home environment using open source software systems;
5. to conduct the numerical experiments to validate the proposed models and approaches.

3. General characteristics of dissertation

The dissertation consists of 130 pages, structured in an introduction, three chapters, conclusion, contributions, directions for future research, a list of publications on the

dissertation, a list of notable citations, a declaration of originality of the results and a bibliography. It contains 23 figures, 9 tables and 177 literature sources. A list of terms and abbreviations used is presented.

Chapter **one** provides an overview of IoT technologies, standards and applications. The various aspects of the smart home as part of the IoT paradigm are discussed. The advantages and disadvantages of commercial software and open source software platforms for use in home automation are analyzed. A review of methods of multicriteria decision-making in the selection of suitable alternatives for dealing with contradictory criteria is made, accompanying decision-making of complex problems.

In the **second chapter**, an application of the multi-criteria approach to modeling and designing smart houses is outlined. Multicriteria models are proposed for ranking open source home automation platforms and for assessing competences of IoT professionals. Models for evaluating possible decision-making alternatives for a smart home project have been developed with MCDM techniques, which allow informed decision making, prioritisation of alternatives and optimisation of different aspects in the context of smart homes.

In **chapter three**, a numerical testing of the proposed models for the realization of a smart home is made. A heating automation scenario is discussed, a software solution is presented in detail, and a numerical simulation of the proposed smart heating design by means of open source home automation software. I note developing a digital twin of the apartment that is used to simulate the effect of digital infrastructure on heating loads.

4. Offerings

I accept and appreciate positively the scientific and applied contributions formulated in the dissertation. In aggregate form they can be referred to as:

1. An analysis of the challenges in the field of Internet of Things and the techniques applicable to the design of home automation systems using the Internet of Things is made.
2. Proposed multicriteria decision model for choosing an open source platform for smart home design.
3. A hardware solution is proposed as well as a corresponding architecture for the realization of effective control of the automation of smart home heating.
4. A model of a digital twin of an apartment is proposed, which was used to conduct theoretical simulations of heating, taking into account various factors.
5. A model for determining the competences of IoT specialists is proposed on the basis of two groups of key indicators related to the acquired knowledge and skills for teamwork.

5. Abstract

The two versions of the autoabstract presented in Bulgarian and English faithfully reflect the content of the dissertation and comply with the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria and the relevant Rules for its implementation.

6. Assessment of compliance with minimum national requirements

The PhD student Victor Kanchev Danev has probed parts of his dissertation in five scientific publications, all in English. Four of the publications are indexed in Scopus, three of them with SJR. There are also 4 noticed independent citations, which shows the necessary publicity of the results achieved in the scientific community.

According to the minimum national requirements for obtaining NSA "Doctor" in professional field 4.6 Informatics and Computer Science, defined in the Law on Educational Research, at least 30 points under Group D indicators are required. The same number of points is required by the Regulations on the terms and conditions for acquiring scientific degrees and for occupying academic positions at the Bulgarian Academy of Sciences and the Regulations for the specific conditions for acquiring scientific degrees and for occupying academic positions in IICT-BAS. The dissertation publications presented form a total of the points for the Group D indicators equal to 108 points, which significantly exceeds the required minimum of 30 points.

The reference in Scopus shows that Victor Danev has five publications indexed in this scientific database, and so far six independent citations have been noted, and h-index = 2, which convincingly proves the doctoral student's abilities to carry out research.

7. Notes and recommendations

The dissertation works make a good impression with its interdisciplinary scope. The results achieved are original and correspond to the topic posed. I have no comments on the substance of the dissertation. The topic is very extensive and all aspects of its consideration benefit the scientific community.

8. Final complex assessment

I believe that the submitted dissertation meets the requirements of the Law on the Development of Academic Staff in the Republic of Bulgaria and the relevant Regulations for its implementation. The achieved results give me grounds to give a positive **assessment with full conviction and** I recommend to the honorable Scientific Jury to award the educational and scientific degree "Doctor" to **Victor Kanchev Danev** in professional field 4.6 Informatics and Computer Science, PhD program "Informatics".

Oct 27, 2023 Sofia

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