

REVIEW

by Prof. Vassil Guliashki, PhD
Institute of Information and Communication Technologies - BAS
on a dissertation thesis for acquiring the educational and scientific degree "**Doctor**"
in professional direction 4.6 "**Informatics and Computer Sciences**", doctoral program:
"Informatics"

titled: "Design of "Smart Homes" under open-source system OpenHAB"

by **VICTOR DANEV**

By order № 252/22.10.2023 of the Director of the Institute of Information and Communication Technologies – Corr. Member D.Sc. Svetozar Margenov, in connection with the procedure for acquiring the educational and scientific degree "Doctor" in the professional field 4.6 **Informatics and Computer Sciences**, doctoral program „Informatics“, by Victor Kanchev Danev with a dissertation thesis titled "*Design of "Smart Homes" under open-source system OpenHAB*", I have been included in the Scientific Jury.

As a member of the scientific jury, I received:

1. Dissertation thesis for acquiring the educational and scientific degree „Doctor“ in Bulgarian.
2. Abstract of Dissertation thesis in Bulgarian.
3. Abstract of Dissertation thesis in English.
4. List of publications on the PhD student's dissertation.
5. Copies of the publications.

When evaluating the dissertation, the terms of the Law for development of the academic staff in the Republic of Bulgaria (LDASRB), the Regulations for Implementation of LDASRB (Decree No. 26 of February 13, 2019) and the Regulations of the Institute of Information and Communication Technologies for application of the Law for the development of the academic staff in the Republic of Bulgaria are decisive.

1. According to Art. 27 (1) of LDASRB "the dissertation work shall contain scientific or applied research results that represent an original contribution to science. The dissertation shall show that the candidate has profound theoretical knowledge in the respective subject, as well as their abilities of independent scientific research."
2. According to Art. 27 (2) of LDASRB the dissertation work should be presented in a form and volume corresponding to the specific requirements of the primary unit. The dissertation work should contain: title page; contents; introduction; presentation; conclusion – summary of the obtained results, accompanied by declaration of originality; bibliography.

The scientific supervisor of the dissertation thesis is Prof. D.Sc. Daniela Borissova.

ACTUALITY

In connection to the pollution of the planet and the increasingly felt climate changes (Global Climate Warming), the green transformation related to the implementation of new technologies such as the Internet of Things (IoT) and Artificial Intelligence (AI) in the so-called "smart cities" and "smart homes" becomes extremely relevant and necessary. A smart home is a connected network of devices in a home that work together to provide a seamless, intuitive and convenient lifestyle. Smart homes are energy efficient because they can automatically adjust lighting, heating and cooling, as well as other appliances. They not only save energy and reduce costs, but also help to reduce the carbon footprint and protect the environment. The design of smart homes requires the integration of various technologies and systems in order to create a comfortable, efficient and automated living environment.

GENERAL CHARACTERISTICS OF THE DISSERTATION THESIS

The dissertation is in a volume of 130 pages with 24 figures, 9 tables and includes: Used terms and abbreviations, Introduction, 3 chapters, Conclusion, Contributions, Directions for future research, List of publications, List of noted citations, Declaration of results originality, and Bibliography (177 sources).

The goal of the dissertation work is to propose a project to build a smart home using an open-source software platform.

To realize the set goal, the following tasks for completing are formulated:

- 1) to analyze the challenges in the field of IoT and the techniques applicable in the design of systems using IoT,
- 2) to propose a multi-criteria decision-making 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 to building a smart home environment using open-source software systems.
- 5) to conduct the numerical experiments to validate the proposed models and approaches.

The formulated goals and tasks have a scientific and scientific-applied potential for research and applications.

PUBLICATIONS

Five (5) publications were presented on the dissertation work - 2 from 2021 and 3 from 2022, respectively. One of them is indexed in ACM Digital Library, two are indexed in Scopus, and one is indexed in Web of Science. Three of the publications are in SJR-journals. The submitted publications are sufficient to cover the national minimum requirements for obtaining the degree "Doctor" in professional direction 4.6 "Informatics and computer sciences".

The publications presented are indicative of the quality of the research in the dissertation work and give reason to assume that the research has the necessary publicity. 4 citations are noted.

CONTRIBUTIONS

The **results** obtained can be summarized in the following **scientific and scientific-applied contributions**:

1. An analysis of the challenges in the field of the Internet of Things and the techniques applicable to the design of home automation systems using the Internet of Things is made.

2. A multi-criteria decision-making model for choosing an open source platform for smart home design is proposed.

3. A hardware solution as well as a corresponding architecture is proposed for the realization of an effective control of the heating automation of a smart home.

4. A digital twin model of an apartment was proposed, which was used to conduct theoretical simulations of heating, taking into account various factors.

5. A model is proposed for determining the competencies of IoT specialists based on two groups of key indicators related to the acquired knowledge and teamwork skills.

It can be assumed that the presented results sufficiently cover the scope of the set goal and tasks.

The Abstract in Bulgarian is 33 pages. The Abstract in English is 33 pages. Both abstracts present correctly and accurately the dissertation.

CRITICAL REMARKS

1) Some spelling errors have been noticed in the text of the dissertation, which should be corrected.

2) In the abstracts it is stated that "the dissertation is in a total volume of 123 pages, 30 figures and 16 tables, 126 cited literary sources". In fact, the dissertation has a volume of 130 pages, includes 24 figures and 9 tables, as well as 177 cited literary sources.

3) The optimization of consumed energy and the management of devices in the smart/intelligent home requires the consideration of the dynamics of the environment, the collection and processing of a large amount of data in real time, feedback in real time. This is related to a large amount of memory and computing resources. An appropriate software platform is also required to be installed. For example, subsection 2.2.1 discusses 8 open-source platforms. Choosing a platform involves certain trade-offs. Maintaining servers and maintaining the installed software platform is also required. All this is associated with additional costs. It should be calculated how long the costs of the energy management and device control system will pay off from the possible savings achieved and how

cost-effective it is to implement such a system in the praxis. Also, the implementation of the "smart home" project requires reaching consensus on numerous compromise decisions on the part of the users.

COMMENT

The obtained results have scientific and practical value for the construction and automation of a smart/intelligent home. They make it possible to prepare a series of publications. In this regard, I recommend that the PhD student expand his research in the area of the dissertation and publish his results.

FINAL COMPLEX ASSESSMENT

The critical remarks made do not belittle the scientific and scientific-applied contributions achieved by the doctoral student. I believe that the submitted dissertation **meets** the requirements of the Law on the Development of the Academic Staff in the Republic of Bulgaria. The achieved results give me reason to confidently propose to the respected Scientific Jury to award **Victor Danev** the educational and scientific degree "Doctor" (PhD) in the professional direction - 4.6 "Informatics and Computer Sciences", doctoral program: "Informatics".

20.11.2023.
Sofia city

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