REVIEW

by Assoc. Prof. Dr. Eng. Radoslava Nikolova Gabrova,
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of dissertation for awarding the educational and scientific degree **"Doctor"**

in the field of higher education *5 Technical sciences* professional field *5.3. Communication and computer technology* doctoral program *"Automation of areas of the intangible field (medicine, education, science, administrative activities, etc.)*

Author: Mag. Veselin Zdravkov Mengov

Topic: "System for remote access to training resources in the field of telecommunication and information systems"

Supervisor: Assoc. Prof. Dr. Sotir Sotirov - Paisii Hilendarski University of Plovdiv

1. General description of the submitted materials

With order № P33- 3478 from 19.07.2021. of the Rector of Plovdiv University "Paisii Hilendarski" (PU), I am appointed a member of the scientific jury on the procedure for defense of the dissertation of Mag. Veselin Zdravkov Mengov on "System for remote access to training resources in the field of telecommunication and information systems", presented for acquiring educational and scientific degree " doctor " in the field of higher education 5 Technical sciences, professional field 5.3. Communication and computer engineering, doctoral program "Automation of areas of non-material sphere (medicine, education, science, administrative activity, etc.) doctoral training Mag. Veselin Zdravkov Mengov took place in regular form to the department "Electronics, communications and information technologies" (ECIT) at Plovdiv University “Paisii Hilendarsi” and supervisor Assoc. Prof. Dr. Sotir Sotirov, member of the academic staff of the cited primary unit.

Presented by Mag. Veselin Zdravkov Mengov set of materials on paper is in accordance with Art. 36 (1) of the Regulations for the development of the academic staff of PU and includes the following documents:

- Application to the Rector of PU for opening the procedure for defense of dissertation;
- Autobiography in European format;
- Minutes of the Department Council, related to reporting the readiness for the opening of the procedure and the preliminary discussion of the dissertation;
- Dissertation work;
- A second abstract;
- List and copies of scientific publications on the dissertation topic;
- List of noticed citations;
- Declaration of originality and authenticity of the attached documents.

2. Brief biographical data about the doctoral student

I don't know the Ph. student personally and I got the biographical information from the presented autobiography. Mag. Vesselin Zdravkov Mengov has graduated from secondary special education with qualification "Electrical Networks and Power Plants" at the Technical School of Electrical Engineering and Electro-Ronics, Sofia, Bulgaria. In 2010 he obtained the qualification "Bachelor of Information" from Paisii Hilendarski University, and in 2015 he obtained the qualification "Master of Software Technologies" from the same university.

His work activity began in Luxor AD in 2000. Since 2007 he has been working as an "Expert-Information Department" at the Agrarian University, Sofia. Since 2007 he has been working as an assistant professor at the Faculty of Physics and Technology, Paisii Hilendarski University of Plovdiv, Department of ECIT.

He has competences in programming - languages C#, Java, Python and SQL and in configuration, construction and maintenance of communication networks.

I do not have information on the training in the PhD program, but given the enrollment with the right to defense by Order No. RD-21-434 of 28.02.2022 of the Rector of Plovdiv University "Paisii Hilendarski" (PU), I believe that the set study procedures have been fulfilled and given the review of the CV I can conclude that the PhD student Mag. Veselin Zdravkov Mengov has the necessary educational and practical background.

3. Relevance of the topic and expediency of the set goals and objectives

For the development of humanity, the main importance and priority should be the education of the society in terms of its quality provision. In recent years, with the development of information and communication techniques and technologies, there has been an increased interest in providing opportunities for distance learning, so-called e-learning or distance education, which allows the use of non-traditional approaches compared to the classical classroom system. A particular challenge is this kind of learning in specialised courses in higher engineering education. In this sense, the topic and issues of the presented dissertation "Remote access system for training resources in the field of telecommunication and information systems" are relevant, since the development is target at solving problems in practical training of engineers at a distance by providing a remote laboratory with remote access for conducting realized real exercises.

The aim and objectives are formulated in two places in the thesis - in the introduction and at the end of chapter one, which I consider as a remark. The two formulations are different in textual form and detail, but identical in meaning. In my opinion, the first version is better and I accept it for review. The main objective of the research formulated in the thesis is "to create a system for remote access to training resources in the field of telecommunication and information systems", and to solve it methodologically correctly six tasks are set, corresponding to the main four stages in any scientific research:

- Stage 1 Problem Analysis - first and second tasks of the dissertation;
- Stage 2 Proposing a solution - third, fourth and fifth tasks;

- Stage 3 Experimental justification - sixth task;
- Stage 4 Feasibility analysis of proposed solutions - sixth task.

4. Knowledge of the problem

In the literature review, the PhD student has examined the current state of e-learning issues, exploring its nature and applicable standards. He has explored the main results in the field of distance learning systems and has paid more detailed attention to online laboratories, examining their classifications, advantages and disadvantages, reviewing some of them and presenting a critical and analytical view of the problem. Based on this, he has summarized the requirements for remote labs, which are also presented in two places - in 1.3 Requirements for remote access systems for learning resources and in 1.7 Conclusions. In my opinion, these requirements have been formulated by the PhD student as a result of the detailed study of the problem and systems considered and should be at the end of Chapter One. It would be good if they were linked to the goal of implementing a system fulfilling these requirements and their derivation was distinguished as a scientific and applied contribution.

This gives me reason to believe that from the literature study done, the PhD student has identified issues related to distance learning systems and distance laboratories for engineering disciplines and has defined the need to develop a new one.

The doctoral student's literature review consists of 99 sources, most of which are in English, indicating that he is familiar with trends in distance learning systems.

5. Research methodology

In relation to the fulfilment of the formulated aim of the dissertation, the doctoral candidate used different theoretical and practical approaches and methodologies to solve the set tasks. The object of the research is a system for remote access to learning resources, in particular a remote laboratory for training in engineering disciplines, and the subject of the research is its effectiveness in implementation in the educational process.

I think that the PhD student Mag. Vesselin Zdravkov Mengov has structured his work methodically correctly, following the stages of any scientific research - he has studied the problem, proposed a solution, which he implemented, tested and analyzed.

The developed remote laboratory is a complex system requiring a connection between a teacher, user interface, laboratory equipment, hardware, software, databases and student. The PhD student has correctly used a systems approach and has decomposed the process into component processes, analysing, proposing and implementing a solution for each and then integrating these solutions into a complete system. From a methodological point of view, in his work the PhD student has demonstrated scientific culture and professional skills and has shown the ability to deal with broad and complex tasks, given the different nature of the modules of the system and the need for

their joint work. The methodology of work has been properly selected in accordance with solving the given tasks and achieving the aim.

6. Characteristics and evaluation of the dissertation

The dissertation submitted for review has a total volume of 147 pages and contains 91 figures (photos, schemes, graphs), 19 tables and 15 formulas excluding those in the appendix. The dissertation consists of an introduction, six chapters, a conclusion with the contributions of the dissertation, a list of scientific works related to the development, a declaration of the originality of the material, literature used and appendices.

The dissertation research was conducted within the framework of a PhD programme at the Department of ECIT of PU, on the basis of which the main research, design and experimental activities were carried out.

In the first chapter with a volume of 25 pages, a literature review of the issues of providing remote access to learning resources for laboratory exercises in engineering disciplines is made and on this basis the aim and objectives are formulated.

In relation to the stated goal "to create a system for remote access to training resources in the field of telecommunication and information systems" and the formulated tasks, in the second and third chapters approaches are proposed and hardware and/or software provision of the individual modules of the developed system are implemented. Coherence of operation between the modules is also ensured.

Remote laboratories are a form of remote access laboratories (online laboratories) and should essentially be made up of two modules - a remote laboratory access system and a laboratory workflow system, each of which includes separate sub-modules. The second chapter, "Design and Development of a Remote Access System for Learning Resources", with a length of 19 pages, is devoted specifically to the first module - the web-based remote access system for learning resources. A cascade model for its creation is selected, functional requirements and models are defined, a prototype of the system is proposed, the selected technologies for the implementation of the individual submodules are presented - user interface - client-side environment with open source Bootstrap; software - PHP, HTML, JavaScript; database - MySQL; web server of the system - XAMPP and the proposed developments are described. Similarly, the third chapter "Design and development of the remote laboratory" with a volume of 30 pages is devoted to the second module - the action system of the laboratory, including multiple submodules.

The fourth and fifth chapters, both 19 pages in length, present theoretical statements on the topics of the two developed laboratory exercises and the developments themselves, including theoretical materials for students, experimental setup, hardware implementation and manuals.

The analysis of the results of the application of the implemented remote laboratory in the educational process is presented in the sixth chapter in the volume of 14 pp.

The dissertation was developed at the Plovdiv University “Paisii Hilendarsi” and has been implemented in the teaching process at the Faculty of Physics and Technology. Mag. Vesselin

Zdravkov Mengov has carried out development and research work, has conducted experimental studies and has made generalizations and conclusions, the results are presented through appropriate photographic, tabular and graphical material.

7. Contributions and significance of development for science and practice

In the presented dissertation there is a correspondence between the aim, the set tasks for its realization and the presented results of the conducted theoretical and experimental developments and essentially the work contains results that can be defined as scientific and applied contributions with a predominance of the applied ones.

In the conclusion of the dissertation, the PhD student has presented his view of the contributions of the development, and they are divided into two categories – scientific-applied and applied:

Scientific-applied contributions:

➢ An approach for the implementation of a web-based system for access to training resources is proposed.

➢ An architecture of a system for remote access to learning resources is presented.

Applied contributions:

➢ The software of the system for access to learning resources is implemented.

➢ The software and hardware to the remote laboratories integrated in the system is implemented.

➢ Designed and implemented a method for remote access to laboratory equipment via a web interface.

➢ An analysis of users' (students and faculty) opinions was made and results of the system usage were presented.

I consider that the claims presented by the PhD student with a classification of the contributions correspond and detail the results obtained, according to the specifics of their significance.

In my opinion, one more scientific-applied contribution could be formulated, that generalized requirements for the functionalities of a remote laboratory are proposed.

The value of the development should be highly evaluated, given that the developed remote laboratory is implemented in the educational process at the PU. In connection with the growing need to provide the opportunity for distance learning and practical exercises for engineering majors, I believe that the contributions received can be defined as essential for practice.

8. Evaluation of the publications on the dissertation

The doctoral student Mag. Veselin Zdravkov Mengov has presented a list of 6 works, all of which are in English. There is one independent publication, and the other five are with two co-authors, and in four of them one is the scientific supervisor. Four publications are directly related to the dissertation, and two to its topic.

Five of the publications are in scientific publications, referenced and indexed in the world-famous databases Web of Science, and one in Scopus. Four of the publications were presented

at the International Technology, Education and Development Conference (two in 2021 and two in 2022), one – at the International Conference on Education, Research and Innovation 2021, one – at the International Scientific Conference Electronics' 2020.

According to the citation report presented, four of the publications have one citation each, and one has two, but five of the citations are from groups from the same university.

Through the presented scientific publications related to the dissertation work, the doctoral student mag. Vesselin Zdravkov Mengov has secured 73.3 points in relation to the minimum national requirements for the publication activity with the required 30 points, i.e. crosses the threshold more than twice.

The data presented in this way give me reason to conclude that the necessary publicity of the research in the dissertation has been ensured.

9. Personal participation of the doctoral student

Of the six publications presented on the dissertation work and essentially reflecting the results obtained from the development, in five the PhD student is in the first place, and in one he is an independent author. This testifies to the essential contribution of the doctoral student to the obtained results.

10. Abstract

The abstract has a volume of 33 pages and faithfully reflects the content of the dissertation work in a summarized form, containing an introduction, purpose and tasks of the dissertation work, results of the literature research in the first chapter, the main highlights of the doctoral student's work, presented in the remaining five of the six chapters, conclusion, main contributions and research papers of the dissertation work.

11. Critical remarks and recommendations

The presented dissertation can be considered from two sides - as a substantive work and as an exposition. To begin with, I would like to comment on the first part - the development of a remote laboratory for engineering disciplines is a complex task, as the system itself is composed of multiple hardware and software subsystems that need to work seamlessly and in sync. And in this sense, a large amount of work has been done in all aspects of the development of the presented remote lab in the proposed dissertation. This leads me to believe that the PhD student has demonstrated scientific and professional skills and has the capabilities to deal with interdisciplinary and complex tasks.

With regard to the second part, the textual exposition and layout, which is no less important, I have a number of criticisms related to the style of the whole work, the most important of which are:

1. There are many repetitions in the text - directly of whole fragments one to one or the same things in meaning presented with other words, such as the previously noted in the review presence of the goal and objectives in two places - different in text, but the same in

meaning; repetition of a whole fragment on the requirements for the systems for remote access to learning resources - in 1.3 and 1.7, and there are others;

2. In some places, there is a lack of uniformity in the use of terminology, for example, mixing the terms "remote access system", "online lab" and "remote lab" - section 1.3, 1.4 and 1.5 refer to "remote access systems for learning resources" according to the titles, while section 1.3 discusses requirements for remote labs only; section 1.1. .4 reviews the types of online laboratories - virtual, remote and hybrid; in section 1.5 two of the three types of online laboratories - remote and virtual - are analysed, the hybrid is missing, and yet this section ends with the conclusion "Because of the advantages and disadvantages mentioned, I will use a remote laboratory to develop a system for remote access to learning resources.";
3. There are inaccurate in meaning and incorrect texts, perhaps as a result of translation from a foreign language, such as: the text to formula (10), representing Fourier series - "... harmonics with frequencies that are an odd number, ..."; the explanation of the aliasing effect, which is related to the appearance of pseudo-frequency components at an incorrectly chosen sampling frequency; the incorrect term "quantum error" is used instead of "quantization error", etc.;
4. The structuring of the fourth and fifth chapters are not good- the essence of the dissertation is the development of a remote laboratory in engineering disciplines, which implies to emphasize the presentation of the development, including hardware and software as a start, while the experimental setup is described in the materials presented to the students and after a description of the tasks.
5. My main remark is on the two developed exercises presented in chapters four and five - there are numerous technical errors and inaccuracies, which I have discussed with the PhD student and accordingly I make a recommendation to him to revise, refine and correct.

The remarks made do not diminish the significant amount of research work carried out, but can only be taken as recommendations, especially for the future scientific and teaching activities of the PhD student.

The dissertation shows that the goal has been achieved and that the candidate possesses in-depth theoretical knowledge of the relevant specialty and the capacity for independent research.

12. Recommendations for future use of dissertation contributions and results

I allow myself to make a recommendation to the doctoral student to continue with the "enrichment" of the developed remote laboratory with more exercises, considering that with small additions to the available element base and software provision, other practical topics in the same academic discipline could be implemented.

CONCLUSION

The dissertation work is a valuable development and the doctoral student mag. Veselin Zdravkov Mengov has fulfilled the set aim and tasks.

The dissertation **contains original scientific-applied and applied results** and **meets the** requirements of the Law for development of the academic staff in the Republic of Bulgaria (LDASRB), the Regulations for application of LDASRB and the respective Regulations of PU "Paisii Hilendarski" for awarding ESD "Doctor".

The dissertation shows that the doctoral student Mag. Veselin Zdravkov Mengov **has a** profound theoretical knowledge and professional skills in the scientific field 5.3 Communication and computer equipment, as **demonstrated** qualities and skills to independently conduct research.

I definitely give my positive assessment of the peer-reviewed dissertation, presenting a study with original results and contributions, and I suggest that the esteemed scientific jury award the ESD "Doctor" to Mag. Veselin Zdravkov Mengov in the field of higher education: 5 Technical sciences, professional field 5.3 Communication and computer technology, doctoral program "Automation of areas of the intangible field (medicine, education, science, administrative activities, etc.)".

31.01.2024 Reviewer:.....

(Assoc. Prof. Dr. Eng. Radoslava Gabrova)