

REVIEW

By PhD Eng. Atanaska Dimitrova Bosakova-Ardenska, Professor at the University of Food Technologies - Plovdiv

of a dissertation on the award of the educational and scientific degree "**Doctor**"

by: field of higher education 5. Technical sciences

professional field 5.3. *Communication and computer engineering*

doctoral program *Automation of areas of the intangible sphere (medicine, education, science, administrative activities, etc.)*

Author: *Anatoliy Rosenov Parushev*

Topic: *AUTOMATION OF A LABORATORY FOR ECO-ENERGY TECHNOLOGIES*

Scientific supervisor: *Prof. PhD Eng. Rumen Kostadinov Popov*

1. General description of the presented materials

Based on an order of the Rector of Plovdiv University "Paisii Hilendarski" (PU) RD-22-2023 of 22.10.2025 I have been appointed as a member of the scientific jury to provide a procedure for the defence of a dissertation on "Automation of a laboratory for eco-energy technologies" for acquiring the educational and scientific degree "Doctor" in the field of higher education 5. Technical sciences, professional field 5.3. Communication and Computer Engineering, PhD Program "Automation of areas of the intangible sphere (Medicine, Education, Science, Administrative Activities, etc.)". The author of the dissertation is Anatoliy Rosenov Parushev – full-time PhD student at the Department of ECIT (Electronics, Communications and Information Technologies) with scientific supervisor Prof. PhD Eng. Rumen Kostadinov Popov from Plovdiv University "Paisii Hilendarski".

The set of materials presented by the PhD student is in accordance with Article 36 (1) of the Regulations for the Development of the Academic Staff of Plovdiv University and includes the following documents:

- application to the Rector of Plovdiv University for disclosure of the dissertation defence procedure;
- CV in European format;
- protocol of the Department Council related to reporting readiness for opening the procedure and preliminary discussion of the dissertation;

- dissertation (PhD thesis);
- abstract of the PhD thesis;
- a list of scientific publications on the topic of the dissertation;
- copies of scientific publications;
- a declaration of originality and authenticity of the attached documents;
- reference for the fulfilment of the minimum national requirements set out in the Regulations for Implementation of The Law on The Development of The Academic Staff in The Republic of Bulgaria for acquiring the educational and scientific degree "Doctor".

The PhD student has submitted 6 publications on the topic of the dissertation.

2. Brief biographical data about the PhD student

The PhD student Anatoliy Parushev graduated from the Karl Marx Professional School of Economics in Smolyan with a degree in Financier in 2016, in 2020 he obtained a Bachelor's degree in Computer and Communication Systems at the Paisii Hilendarski University, and in 2021 he obtained a Master's degree in Information Security at the same university, and in 2021 he was enrolled as a full-time PhD student at the Department of ECIT at the Paisii Hilendarski University. From 2017 to 2020, Anatoliy Parushev worked as a technical manager at Digital Systems Ltd., Varna, where he was involved in the construction of optical networks. From October 2020 to November 2021, he holds the position of "Key Account Manager" in "Eco-Spa-Agarti", Devin, whose subject of activity is the trade in mobile devices and accessories, after which he was appointed as an assistant at the Faculty of Physics and Technology of the University of Plovdiv. Anatoliy Parushev is an author of 30 reports presented at national and international scientific forums in the country and abroad. As an assistant at the University of Plovdiv "Paisiy Hilendarski", the PhD student has taught classes in the disciplines "Programming in C++", "Web-based systems", "Object-oriented programming with C#", "Programming in Java", "Sensor and executive mechanisms", "LabView Practicum", "Computer Periphery" and others.

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

The dissertation presents the development of a system allowing remote access and remote conduct of experiments using a laboratory stand allowing the measurement of air flow parameters. The system is based on an existing laboratory stand, which has been modernized in order to adapt it

to modern trends in providing opportunities for remote work both in conducting scientific research and in providing an educational process with an engineering focus. The trends of globalization in the field of production automation, scientific research, and education determine the growing need to build systems allowing remote access and control of a wide range of physical and technological processes, as a result of which there is a rapid development both in terms of hardware components and in terms of software tools that support protocols allowing remote access. In this context, the goal of the present dissertation, as well as the tasks set therein, are undoubtedly of a current nature, since as a result of their implementation, the material and technical base of the Faculty of Physics and Technology of the University of Plovdiv is modernized and a wide range of opportunities for remote conducting of practical classes for future engineers is provided.

4. Knowledge of the problem

A total of 139 literary sources were used in the dissertation, of which 30 are Internet addresses. The majority of the literary sources included in the bibliography are from the last ten years, which also confirms the relevance of the topic. The list of literary sources used includes both articles and reports from international conferences, as well as practical guides related to the use of network technologies, which speaks of the necessary practical knowledge allowing the actual construction of the target system. The dissertation also includes a list of abbreviations used, containing mainly abbreviations from the field of communication technologies, thanks to which the readability of the material is improved. All this indicates a sufficiently good knowledge of the subject area and potential for real solving of existing problems.

5. Methodology of the study

The structural scheme of the system designed in the dissertation includes modern modules and components allowing network connectivity, the choice of which is determined by a comparative analysis of their technical parameters. Principles and concepts established in the practice such as "Master-Slave" and "Client-Server" have been used, which allow the construction of effective solutions in the field of communication and information technologies. As a methodological apparatus for processing the data received from the sensors, physical dependencies established in science and practice between quantities such as temperature, speed and pressure are used. The overall design of the system is based on the principle of scalability, which is a prerequisite for future development and implementation in the modernization of other experimental setups. Given the above, I believe that the choice of design and implementation methods is adequate to the set goal and allows the actual

construction and experimental validation of an automated laboratory stand with remote control capabilities, intended for training and research of heat transfer processes.

6. Characterization and evaluation of the dissertation

The dissertation work contains 4 chapters, a list of literature sources, abbreviations and used notations, as well as appendices. In Chapter 1 "Overview of laboratory automation tools in the field of eco-energy technologies", a review of literature data of popular hardware, software tools and system architectures with application in remote monitoring and control of various devices is carried out. Special attention is paid to existing solutions in the field of building laboratories for conducting remote research based on real equipment and/or software models. Based on the review and systematization of available information, the need to modernize training laboratories through automation and remote access capabilities, as well as the need to develop an automated laboratory platform with capabilities for experimental verification of physical processes related to energy transformation, has been identified. Chapter 2 "Research Methodology" presents the structure of the SR1162E laboratory stand designed for measuring airflow parameters, and analyzes the possibilities for its adaptation in order to automate measurements and provide remote access and process control. Based on the analysis, a scheme for controlling the power supply of the stand and its operation is proposed. A set of additional components is proposed to replace and/or supplement the functionalities of the existing ones in order to provide the possibility of remote operation of the stand. The basic methodological apparatus is also presented, which allows the correct interpretation of the data recorded by the sensors related to the temperature and pressure of the airflow. Chapter 3 "Development of an automated stand with remote access" examines the process of developing and implementing an automated stand with remote access capabilities when conducting experiments related to analyzing airflow parameters. The hardware structure, communication scheme and software integration of the individual modules in the system, which can be used for both scientific and educational purposes, are discussed. Specific block and principle electrical diagrams are presented, as well as a justification for the choice of specific components. Chapter 4 "Experimental Studies" describes the procedure for performing remote measurements using the modernized SR1162E stand. The results of experiments conducted to determine the dependencies between temperature, speed and air flow rate are presented and discussed. The obtained results confirm known theoretical dependencies, thus confirming the operability of the built system.

7. Contributions and significance of the development for science and practice

The dissertation work formulates a total of eight contributions presented in the categories "Scientifically Applied" and "Applied". I accept the content and the classification of the contributions in essence. However, I believe that they can be formulated in a shorter form, which would contribute to their better understanding. For example, the first scientifically applied contribution would be sufficient to formulate as follows: Developed and adapted for remote work, is a methodology for measuring the air flow velocity profile, based on a Pitot tube, a differential pressure sensor and the division of a square cross-section into five separate zones. The second scientifically applied contribution could be formulated as follows: Developed and adapted for the specifics of remote research is a methodology for measuring the specific heat capacity of air at constant pressure using the mass flow rate of air in a pipe channel, the heat transfer rate from the heating element and the temperature difference in the flow before and after the heater. The third scientific and applied contribution can be formulated as follows: An approach for remote switching on and control of stands and servers has been developed and tested, based on the Modbus protocol for TCP/IP protocol and remote access to a computer system by the teacher and granting access rights to the student. The presented five applied contributions contain a detailed description and motivation for the use of the relevant components, which complicates the presentation and hinders the perception of information. The recommendations made regarding the formulation of the contributions are of an editorial nature and do not relate to their essence. The built system for remote research related to energy efficiency in heating an air flow can be used both for scientific work and in the educational process. One of its advantages is the possibility of upgrading by including additional automated laboratory installations for conducting research with a different focus. Overall, the contributions of the dissertation work confirm the applicability of modern communication and information technologies in the implementation of remote access to laboratory equipment and are related to the implementation of such technologies in the educational process.

8. Assessment of dissertation publications

The PhD student has submitted a list of six publications related to the dissertation, as well as copies of them. One of the publications is indexed in the world-famous and well-established in scientific area database for scientific information Scopus. Three of the publications were presented at the international scientific forum "International Technology Education and Development Conference". With regard to the author teams, it can be noted that of the publications submitted, 3 have author teams of five people, 2 have author teams of four and 1 has author teams of three. In 3 of

the publications, the doctoral student is the first author in the author team, in 2 of them he is the second author and in one he is the 4th in a row in the list of authors. It can be summarized that in 83.33% of the publications submitted for participation in the procedure for acquiring the scientific and educational degree "doctor" the PhD student occupies a leading position (1st or 2nd), which undoubtedly speaks of his significant personal contribution to the implementation of the researches.

9. Personal participation of the PhD student

In all six publications related to the dissertation, the PhD student's supervisor is a co-author, which demonstrates the PhD student's participation in the research conducted under the supervision of the supervisor. The PhD student's classes in the field of information and communication technologies, as well as his professional experience in the same field, confirm his ability to participate in the design and development of the remote access system discussed in the dissertation and the conduct of research in the field of eco-energy technologies.

10. Abstract of the PhD thesis

The abstract submitted under the procedure is 32 pages long and is presented in Bulgarian and English. The materials presented in the abstract show in a summarized form the most significant results achieved by the dissertation candidate, which corresponds to the main purpose of an abstract.

11. Critical remarks and recommendations

Regarding the presentation of information in the dissertation, I can note the presence of a large number of technical errors, some of which are:

- on page 39 there is a literary source, the citation of which is not specified (it is written [??]);
- the names of some foreign authors in the text of the dissertation are written in English, and others in Bulgarian;
- inaccurate (incomprehensible) statement "Чрез оптимизиране на енергийните процеси организациите могат да постигнат значителни икономии и да намалят околната си отпечатък." (page 58);
- the title of Fig. 2.1 B and the text information in it are oppositely oriented;

- in formulae (2.2) and (2.6) the same symbol is used to denote different quantities (pressure and density);

- in formulae (2.9), (2.10) and (2.13) an error is made by writing that the corresponding areas of square frames are calculated as a product, and not as a difference of the squares of the sides of the outer and inner squares, and in addition, it is incorrectly written that 117 to the second power is equal to 13685 (calculations in formula 2.9) /the same incorrect value appears in the following chapters and appendices/;

- in formula (2.12) an error is made, by writing A1 instead of A5;

- in the text describing formula (2.21) the quantities T1 and T2 are commented on, and in the formula itself the quantities T3 and T4 are used;

- on page 82 the non-existent formula (3.2) is mentioned;

- on page 85 in the description of formula (2.41) the concepts of density and pressure are mixed up, as well as their units of measurement;

- on page 97 the sentence " В някои системи, управлението на тези времена, които може да бъде много кратък при най-високите скорости на комуникация, може да бъде тежък за обработка и проблемен." does not have a sense;

- on page 133 (Fig. 3.20) in the pressure information visualization panel, an appropriate name for the graph is not set (the title CHART 1 is displayed);

- on page 139 (Fig. 3.26) a block diagram is contained in which no value is set for the outputs of a block for checking a logical condition;

- in chapter 3 (page 140) a fragment of program code is presented, for which regardless of whether the logical condition is fulfilled or not, the same program code is executed (txbuffer[5] = 0x01;). However, in appendix 2.2 the code in the if and else parts is different;

- some of literary sources are not described according to the rules for bibliographic description (for example, 1st and 2nd);

- it is not clear how the source of information about the current atmospheric pressure was chosen and why the data provided by the NIMH are not used.

In this regard, I recommend that the PhD student in the future be more precise and demanding of himself regarding the technical layout of scientific and research materials.

12. Personal impressions

I don't know the PhD student personally and I can't share my impressions.

13. Recommendations for future use of the dissertation contributions and results

The automated system for analyzing airflow parameters presented in the dissertation clearly shows their interrelationships, which could undoubtedly be used to enrich the practical classes of students studying disciplines in the field of modern eco-energy technologies. As guidelines for future work, I would recommend real implementation of the developed system in the educational process and upgrading it to expand the scope of the conducted research.

CONCLUSION

The dissertation contains contributions of a scientifically applied and applied nature that meet the requirements of the Law on The Development of The Academic Staff in The Republic Of Bulgaria, Regulations for Implementation of The Law on The Development of The Academic Staff in The Republic of Bulgaria and the relevant Regulations of Plovdiv University "Paisii Hilendarski". The presented dissertation shows that the PhD student Anatoliy Rosenov Parushev has theoretical knowledge and professional skills in the scientific specialty "Automation of areas of the intangible sphere (Medicine, Education, Science, Administrative Activities, etc.)”

As a result of the above, I give my **positive assessment** of the conducted research, presented by the above-reviewed dissertation, abstract, achieved results and contributions, and ***I propose to the honourable scientific jury to award the educational and scientific degree "Doctor" to Anatoliy Rosenov Parushev in field of higher education: 5. Technical sciences, professional field 5.3. Communication and Computer Engineering doctoral program "Automation of areas of the intangible sphere (Medicine, Education, Science, Administrative Activities, etc.)"***.

17.11.2025

Author of the review:

/ Prof. PhD Eng. Atanaska Bosakova-Ardenska /