

OPINION

by Dr. Eng. NIKOLAY ATANASOV SHOPOV,
Associate Professor at the Department of Computer Systems and Technologies
of the Technical Faculty,
UNIVERSITY OF FOOD TECHNOLOGIES - PLOVDIV

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 non-material field (*medicine, edu-
cation, science, administration, etc.*). " .

Author: MEng. Stanislav Mitkov Assenov

Topic: "Design, research and optimization of wireless sensor nodes with low power consumption."

Supervisor: Assoc. Prof. Dr. Dimitar Mihailov Tokmakov - PU "Paisii Hilendarski ".

1. General presentation of the procedure and the doctoral student

With order № P33-3478 from 19.07.2021. of the Rector of the University of Plovdiv "Paisii Hilendarski" I have been appointed a member of the scientific jury in the procedure for defense of a dissertation on "Design, research and optimization of wireless sensor nodes with low power consumption" to obtain the 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 the intangible field (medicine, education, science, administrative activity, etc.) with the author of the dissertation asst. Stanislav Mitkov Assenov. The set of materials presented by the doctoral student on paper is in accordance with Art. 36 (1) of the Regulations for development of the academic staff of the University of Plovdiv and the University of Bulgaria in the Republic of Bulgaria. The doctoral student has attached 8 publications on the topic of the dissertation and 6 citations.

MEng. Stanislav Assenov graduated from high school in 2006, at Professional high-school "Hristo Botev" – Smolyan in specialty "Electronic computing".

During the period 2006 - 2010 he studied at TU-Sofia - Plovdiv branch with a bachelor's program in "Computer Systems and Technologies".

I know Eng. Stanislav Mitkov Assenov from his training in the master's program of the same name at UFT - Plovdiv in the period 2013-2014. Under my scientific guidance, on 28.02. 2014, Eng. Stanislav Assenov successfully defended his thesis on "Touch screens using infrared (IR) technology." With Eng. St. Assenov we have a joint scientific publication.

2. Relevance of the topic

The theme of the presented dissertation is related to the search for innovative solutions to reduce the energy consumption of wireless sensors. The problem can be considered both from the point of view of power sources and from the point of view of consumers. In the presented work the attention is paid to the consumers (wireless sensors) and the minimization of their energy consumption. I believe that the problem at hand is relevant.

3. Knowledge of the problem

PhD student Eng. Stanislav Assenov cited 165 literary source Latin. The main part of the cited works has been published in the last 10 years.

From the list of cited literature sources, it can be concluded that the doctoral student has a deep insight into the current world situation and trends in the problems solved in the dissertation.

4. Research methodology

The dissertation is 165 pages. It is formed in four chapters, introduction, conclusion (general conclusions), description of the contributions, list of the doctoral student's publications and bibliography (used literature).

In Chapter I of the dissertation a classification is made and the main trends in the architecture and technologies for data transmission in wireless sensor modules are considered. An analysis of the power sources is made. Indicators for energy efficiency and consumption are defined.

An analysis of the state of the problem has been performed, and the purpose and tasks of the dissertation have been defined.

Chapter II presents a model of wireless sensor nodes in terms reducing energy costs. An algorithm has been developed, experimental results have been presented and conclusions have been drawn.

Chapter III, PhD student Assenov, has devoted to the tasks related to the design and research of wireless sensor nodes with low power consumption based on ATMEGA 328 microcontroller with wireless sensor node with LoRaWAN transceiver and Wi-Fi sensor node with low power consumption. They are presented with experimental results and conclusions.

In Chapter IV "Optimization of wireless sensor nodes with low power consumption through harvester systems" an analysis is made and a model of LoRaWAN sensor unit without battery is developed. Experimental results are presented, and conclusions are formulated.

5. Characteristics and evaluation of the dissertation and contributions

After a thorough acquaintance with the dissertation and the publications of Eng. Stanislav Assenov, I am convinced that the achieved results of the research and development were obtained entirely with his participation. With the presented work the doctoral student demonstrates his knowledge and skills for in-depth research and solving scientific problems of scientifically applied and applied nature.

After getting acquainted with the applied scientific works of Eng. Assenov, I believe that the developed ideas and the obtained results have become available to the scientific community in our country through the publications and reports presented at conferences.

In the self-assessment of the contributions presented by the doctoral student, a total of 10 pieces are formulated, which are classified as scientific applied (4 pcs.) And applied (6 pcs.). I believe that the presented contributions accurately reflect the results obtained by Eng. Assenov. Scientific and applied contributions are in the field of computer communications and networks, creation of microprocessor devices, software, and computer modelling.

In my opinion, the contributions refer to the adaptation of known methods and algorithms and the creation of new constructions, technologies, software, models in a new and dynamically developing field.

6. Evaluation of the publications and personal contribution of the doctoral student

The results obtained in the development of the dissertation are presented in eight publications. In seven of them doctoral student Eng. St. Assenov is the first author. I believe that the doctoral student's dissertation publications reflect the main contributions he claims.

7. Abstract

The presented abstract corresponds to the requirements for its preparation. It correctly reflects the main results and contributions of the dissertation.

8. Recommendations for future use of dissertation contributions and results

Basically, my recommendations are in the direction - considering the joint work of power supplies and their characteristics and consumers (sensors).

These recommendations do not relate to the nature of the contributions, and therefore do not affect my personal positive impression of the scientific output and other merits of the doctoral student.

CONCLUSION

After a thorough acquaintance with the dissertation and the publications of Eng. Stanislav Assenov, I am convinced that the results of the research were obtained entirely with his participation. With the presented work, the doctoral student demonstrates his / her abilities for research activity and solving scientific problems of scientifically applied and applied character.

The dissertation contains **scientific-applied and applied results, which represent an original contribution to science and meet all 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 Paisii Hilendarski University.

Based on the analysis I give a **positive** assessment of the developed dissertation and I consider it reasonable to propose Eng. Stanislav Mitkov Assenov to acquire the educational and scientific degree "Doctor" in scientific field 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.)"

30.08.2021

Prepared the opinion.....
(Assoc. Prof. Dr. Eng. Nikolay Atanasov Shopov)