

TECHNICAL UNIVERSITY – VARNA

OPINION

from **Assoc. Prof. Dr. Eng. Diyan Zhelev Dinev**

regarding a dissertation for the award of the educational and scientific degree “Doctor”
in the PhD program “**Computer Systems, Complexes and Networks**”
professional field 5.3 “**Communication and Computer Technology**”

Author of the dissertation: **Marieta Metodieva Haka**

Dissertation title: “**Approaches to increasing the security of IoT networks**”

1. Relevance of the Problem Addressed in the Dissertation

The development and widespread deployment of the Internet of Things (IoT) in industry, urban environments, and critical infrastructures make information security issues particularly significant. IoT networks comprise a large number of resource-constrained devices, which often operate in a wireless environment and are vulnerable to eavesdropping, key compromise, node impersonation and replacement, and attacks at the communication level. This necessitates effective and practically applicable protection approaches, aligned with the limited computing resources, memory, and energy budget of end devices.

The chosen focus on ZigBee/IEEE 802.15.4 is well justified, since the technology is widely used in IoT/WSN solutions, and its security mechanisms are based on symmetric cryptography (AES) and centralized key management functions (Trust Center). In this context, the dissertation addresses a relevant engineering and scientific problem and proposes solutions with potential for practical application.

The objective of the dissertation is to develop and investigate approaches to improving the security of IoT networks implemented with ZigBee, including a quantitative security assessment, the development of a simulation environment, and experimental validation in a prototype network.

2. Contributions of the Dissertation

I accept the contributions presented in the dissertation as follows:

Contributions of a scientific nature:

- An adaptive approach has been proposed to improve the security level in ZigBee networks.

Contributions of a scientific-applied nature:

- A system of indicators has been defined for evaluating simulation products for security research in ZigBee networks.
- An analytical expression has been proposed for calculating the security level in ZigBee networks, along with a scale for determining the degrees of the security level.

Contributions of an applied nature:

- A simulator has been developed for studying security processes in ZigBee networks.
- A prototype ZigBee IoT network has been developed, in which security has been experimentally investigated and the proposed scale for determining security level degrees has been applied.

I acknowledge the above contributions as merits of the PhD candidate, achieved during the dissertation research.

I consider the personal involvement in the dissertation contributions to be indisputable. The PhD candidate presents 5 publications on the topic of the dissertation, 4 of which are indexed in the international database “Scopus”. I believe that the volume and quality of the presented publications satisfy the requirements of the Academic Staff Development Act in the Republic of Bulgaria for the award of the educational and scientific degree “Doctor”.

3. Opinion, Recommendations, and Remarks

The formulation of an indicator and a scale for the quantitative assessment of the “security level” represents a useful contribution. Although in the abstract it is presented as a scientific contribution, in essence it functions as an assessment methodology/indicator, which is why it is more appropriate to classify it as a scientific-applied contribution. This remark does not diminish the value of the result but aims at its more accurate positioning in line with commonly accepted classifications of contributions.

The above critical remarks do not diminish the overall work of the PhD candidate.

4. Conclusion

I consider that the developed dissertation meets the requirements of the Academic Staff Development Act in the Republic of Bulgaria and its implementing regulations. Regardless of the critical remarks and recommendations stated above, considering the relevance of the issues discussed and the achieved results, I express my final positive opinion regarding the overall content, the conclusions and findings. In this regard, I propose to the respected scientific jury to award **Eng. Marieta Metodieva Haka** the educational and scientific degree “Doctor” in the PhD program “**Computer Systems, Complexes and Networks**” within professional field 5.3 “**Communication and Computer Technology**”.

Date: 12.01.2026

Jury member:
/ Assoc. Prof. Dr. Eng. Diyan Zhelev Dinev/