OPINION

on a dissertation for the award of the educational and scientific degree *"PhD"*
in area *5. "Technical Sciences"*, professional direction *5.2. Electrical Engineering, Electronics and Automation*,
scientific specialty – *"Application of the principles and methods of cybernetics in various fields of science"*

Author of the dissertation: *M.Eng. Svetoslav Emilov Kremenski*

Topic of the dissertation: *"Integration of brain-machine interface and social robots with application in various object domains"*

Member of the scientific jury: *Prof. Dr. Eng. Georgi Ilinchev Popov – Technical University of Sofia*

1. Relevance of the problem developed in the dissertation work in scientific and applied terms. The brain-machine interface (BMI) provides a direct communication link between the human brain and computer systems or external devices without muscle stimulation. Combined with the concept of the Internet of Things (IoT) and modern social robotics, this technology opens up extremely innovative and intuitive horizons for control and natural human-robot interaction. The topic is highly relevant in view of the forecasts for the large-scale penetration of conversational robots with artificial intelligence and non-invasive MBI devices in areas such as healthcare, education, smart homes and customer service. The specific tasks set successfully address the existing technological challenges related to the transformation of social robots into IoT objects and overcoming the lack of compatibility between different hardware and software platforms.

2. Degree of knowledge of the state of the problem and creative interpretation of the literature. The PhD student demonstrates in-depth knowledge of the state of the research problem in the world and in our country. A detailed and comprehensive overview analysis of the historical development of MMI, the essence and characteristics of EEG signals (alpha, beta, theta, delta waves), as well as existing portable non-invasive devices (such as Emotiv EPOC+ and OpenBCI) has been made. The contemporary experience in the field of social robotics (robots such as Pepper, NAO, Furhat, Misty, QTrobot) has been creatively interpreted and analyzed. The conclusions drawn from the overview analysis clearly define the existing scientific and applied problems, which has served as a solid basis for formulating the goal and objectives of the dissertation.

3. Compliance of the selected research methodology and the set goal and tasks of the dissertation work with the achieved contributions. The selected methodology and research approaches fully correspond to the set goal and tasks. The work successfully combines software platforms and environments (NodeRED, Python, Kotlin, MQTT), machine learning methods and modern statistical methods (Pearson correlation, Cohen's coefficient, etc.) for characterization and classification of EEG data. The designed author's innovative model for transmission, analysis and processing of EEG signals and their conversion into commands for interaction with social robots in

IoT has been successfully verified through real experiments in the field of intelligent neuromarketing using OpenBCI and the Furhat robot.

4. Contributions of the dissertation. The contributions presented in the dissertation are original in nature and have a scientifically applied and applied nature, fully meeting the requirements for the educational and scientific degree "PhD"

5. Assessment of the publications on the dissertation work. The results of the dissertation work have received the necessary publicity among the scientific community through 3 publications with co-authors and 5 citations from foreign authors. The topic and its contributions correspond to the presented publications and the noted citations. The publications adequately reflect the content of the individual chapters and the experimental results obtained, demonstrating work in a multidisciplinary context.

6. Opinions, recommendations and notes. The dissertation is structured and formatted in accordance with academic standards, showing logical consistency and completeness. The following recommendations and notes may be addressed to the author:

1. In Chapter 2, subsection 2.1, a significant amount of space is devoted to a detailed description of well-known platforms such as Apache NiFi, Home Assistant, OpenHAB, Huginn, n8n, Zapier, FlowFuse and ThingsBoard, and in the end only the Node-RED platform was chosen.
2. Technical error in numbering: sub-item 4.4.1 is followed directly by sub-item 4.4.3.

The remarks made are minor and do not affect the quality of the scientific work.

Conclusion

The dissertation presented by M.Eng. Svetoslav Emilov Kremenski on the topic "Integration of brain-machine interface and social robots with application in various object areas" represents a completed and original scientific work. The results obtained have a clear scientific-applied and applied nature and fully cover the legal requirements for acquiring the sought-after degree.

All this gives me reason to give my **positive assessment** of the dissertation work and to propose to the esteemed scientific jury **to award the educational and scientific degree "Philosophiae Doctor"** to M.Eng. Svetoslav Emilov Kremenski in field 5. "Technical Sciences", professional direction *5.2. "Electrical Engineering, Electronics and Automation"* , scientific specialty *"Application of the Principles and Methods of Cybernetics in Various Fields of Science"* .

Date: 12 .07.2026

JURY MEMBER:

/Prof. Dr. Eng. Georgi Popov/