SCIENTIFIC OPINION

on a dissertation

awarding of educational and scientific degree PhD in field 5. "Technical sciences", professional direction 5.2. Electrical engineering, electronics and automation with a scientific specialty - "Application of the principles and methods of cybernetics in various fields of science"

Author of the dissertation: *mag. Eng. Adelina Georgieva Kremenska*

Dissertation topic: *" **Designing a Brain-Machine Interface to various devices and services in the Internet of Things** "*

Member of the scientific jury: *Prof. Georgi Ilinchev Popov, PhD - Technical University - Sofia*

1. **Actuality of the problem developed in the dissertation work in scientific and scientific applied terms. Degree and levels of relevance of the problem and specific tasks developed in the dissertation.**

   A brain-machine interface (BMI) enables direct communication between the human brain and computer systems or devices. Combined with the IoT, this would allow people to control devices and services with just their thoughts, without the need for physical interaction. This opens up new horizons for more intuitive and natural ways to control technology.

2. **Degree of knowledge of the state of the problem and creative interpretation of the literary material.**

   Based on the review of 101 literature sources, problem areas in science were found, successfully solved in consequence, which is the essence of scientific contributions.

3. **Correspondence of the chosen research methodology and the set goal and tasks of the dissertation with the contributions achieved.**

   APIs to be integrated across devices and transformed into the IoT. Node-RED provides a web browser-based stream editor that can be used to create JavaScript functions. App items can be saved or shared for reuse. The runtime is built on top of Node.js. Streams created in Node-RED are stored using JSON.

An author's innovative model for transmission, analysis and processing of EEG signals and their conversion into commands for controlling devices and services in IoT is proposed, and author's methods and algorithms for integration of EEG-based BMI are developed.

4. Scientific and/or applied scientific contributions of the dissertation work: formulation and justification of a new scientific problem (area); formulation and justification of a new theory (hypothesis);

In essence, the significance of the contributions made are quite sufficient for a small doctoral dissertation. I acknowledge claims for 5 author contributions. Contribution 1 – scientific, Contribution 2 has a scientific-applied nature (concerns design), Contribution 3 – scientific-applied and Contributions 4,5 – applied.

5. Assessment of dissertation publications: number, nature of editions in which they are printed. Reflection in science - use and citation by other authors, in other laboratories, countries, etc.

In connection with the dissertation, the candidate participated in 5 nos. publications, as there is no independent one. In Google Scholar, the publications have 3 citations, one of which is in Scopus.

2 pcs. are publications indexed in Scopus.

The average number of authors per publication is 4.

6. Opinions, recommendations and notes.

The submitted dissertation fully complies with the requirements for engineering work, such as structure, content, research and contributions.

As remarks, I can point out:
1. the incorrect numbering of mathematical formulas that appear to be widely known to the scientific community (1);
2. taken figures [4,5] etc. from the Internet, which are not cited correctly (the address of the Internet source must be under the name of the figure, in principle, such figures can be cited and not embedded in the thesis);

I recommend the PhD student to publish in reputable international journals with an impact factor.

7. Conclusion

Presented by *Mag. Eng. Adelina Georgieva Kremenska* dissertation work ***"Designing a Brain-Machine Interface to various devices and***

services in the Internet of Things" represents a completed scientific development. The obtained results have *a scientific* and *scientific-applied character* and fully cover the requirements for obtaining the educational and scientific degree PhD.

I give my *positive assessment* of the dissertation work and propose to the respected scientific jury *to award* the educational and scientific degree *Philosophy Doctor* to M.Sc. *Adelina Georgieva Kremenska* by 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: **JURY MEMBER:**
14.09.2024

/Prof. Georgi Popov, PhD/