REVIEW

by Prof. Ph.D. Daniela Ivanova Borissova, IICT – BAS
on the scientific works for participation in a competition for the academic position
of "Associate Professor", by professional direction 5.2. Electrical engineering, electronics
and automation, scientific specialty: "Automated systems for information processing and
control (integration of data from sensor networks)" for the needs of the "Unmanned
Robotic Systems" laboratory, announced in SG no. 85 of 10.10.2023,
with a single candidate
Chief Assistant Dr. Alexander Kirilov Alexandrov

According to Order No. 153/13.12.2023 of the Director of IR-BAN, I am determined to be a member of the scientific jury under the announced procedure, and according to the protocol of the first meeting held on 18.12.2023, I am elected to prepare a review.

1. Brief biographical data about the candidate

Ch. Assistant Dr. Alexander Kirilov Alexandrov was born on 07.09.1960. He completed his master's degree at VMEI – Varna with a major in "Electroenergetics" in 1986. In 2017, he obtained the educational and scientific degree "Doctor" in "Informatics" at IICT-BAS, and in 2018 he was elected Chief Assistant also at IICT-BAS.

2. Assessment of compliance with the minimum national requirements and the requirements of IR-BAS

According to Art. 57a of the Regulations for the Implementation of the Academic Staff in the Republic of Bulgaria (respectively, Article 24 of the Law on the Development of the Academic Staff in the Republic of Bulgaria (LDASRB) and in accordance with Articles 2 and 3 of the Regulations on the Terms and Procedures for Acquiring Scientific Degrees and Holding academic positions at the Institute of Robotics at the BAS, the members of the scientific jury evaluate the candidates for the academic position "Associate Professor" according to the fulfillment of the conditions under Article 53 and in accordance with the results of the inquiries under Article 54, Paragraph 1 of the Implementing Regulations of LDASRB.

The fulfillment of these conditions is shown in the following table:

Applicants for the academic position of "Associate Professor" must meet the following conditions:	Presented documents
Art. 53, para. 1 to have acquired an educational and scientific degree "Doctor"	Diploma No 897 of 06.06.2017 for educational and scientific degree "Doctor" from IICT-BAS
Art. 53, para. 2 not less than two years: a) to have held the academic position of "Assistant", "Chief Assistant", or ….	Certificate for occupying the academic position of Chief Assistant No 1226/16.03.2018 from IICT-BAS
Art. 53, para. 3 to have submitted a published monographic work or equivalent publications in specialized scientific publications or evidence of relevant artistic achievements in the field of arts, which do not repeat the submitted for the acquisition of educational and scientific degree "Doctor" and for the acquisition of scientific degree of Science ".	A published monographic work "Wireless sensor systems. Architecture and Communication Protocols"
Art. 53, para 4. to meet the relevant minimum national requirements and the requirements of Art. 1a, para. 2	Reference for the fulfillment of the minimum requirements of IR-BAS
Art. 53, para 5. not to have legally proven plagiarism in scientific works	-----
Art. 54. para.1. The candidates shall submit a reference for fulfillment of the minimum national requirements and of the requirements under art. 1a, para. 2, as well as a reference for the original scientific contributions, to which the respective evidences are attached.	Reference of fulfillment of the minimum national requirements and certificate of original scientific and scientific-applied contributions

From the submitted scientific works for participation in the competition, the fulfillment of Art. 53, para. 5.

Therefore, the verification of the fulfillment of the conditions under Art. 53 in accordance with the results of the inquiries under Art. 54, para. 1 of the Regulations for the Implementation of the LDASRB established that the candidate Ch. Assistant Dr. Alexander Kirilov Alexandrov meets the conditions for holding the academic position of "Associate Professor".

The fulfillment of the minimum points for the groups of indicators for the academic position "Associate Professor", in accordance with the specific requirements of IR-BAS, is shown in the following table:

Area 5. Technical sciences, 5.2. Electrical engineering, electronics and automation

Group of indicators	Contents	Associate Professor (min. points)	Presented by the candidate in the competition
A	Indicator 1	50	50
B	Indicator 2	--	
C	Indicators 3 or 4	100	100
D	Sum of indicators from 5 to 11	200	223.8
E	Sum of indicators from 12 to 15	50	63
F	Sum of indicators from 16 to the end	---	---

From the above table, it is easy to see that both the points for publication activity (Group D of indicators) and the points for citation (Group E of indicators) exceed the required minimum.

3. Research activity and results

To satisfy the indicators of group **C**, the candidate Ch. Assistant Dr. Alexander Alexandrov, presents a published monograph that was not presented as the main habilitation thesis. The monograph "Wireless sensor systems. Architecture and Communication Protocols" was published by the academic publishing house "Za Bukvite", has 2 scientific reviewers, has an ISBN and is 270 pages long. For the indicators from group **D**, a total of 7 publications are presented, 6 of which are with the SJR index. For group **E** – the candidate has shown data for 2 publications that have been cited a total of 7 times, with 6 of the citations being in scientific publications referenced and indexed in world-renowned databases.

From the analysis made in this way regarding the scientometric indicators presented by the candidate, it is established that Ch. Assistant Dr. Alexander Alexandrov fully satisfies both the defined minimum national requirements and the specific requirements of the Institute of Robotics at the BAS.

4. Scientific and scientific-applied contributions

The main scientific and scientific-applied contributions, which can be determined on the basis of the works submitted for review, including the applicant's reference for the scientific and scientific-applied contributions, are reduced to:

1. A model of parallel data processing of LWSN sensor nodes with cluster topology based on generalized networks is proposed. The model considers all aspects of sensor data integration between nodes and the cluster-based parallel processes specific to large amounts of sensor data operations.

2. An approach based on the Weighted Clustering Algorithm is proposed by modifying an ad-hoc clustering method in wireless sensor networks to reduce the risk of failure of cluster coordinators in wireless sensor networks and to improve the energy optimization of the implemented protocols for routing.

3. A new mathematical model and multi-criteria optimization approaches are presented, considering different performance and shelf-life objectives. This model aims to improve energy-efficient communication between sensor nodes and cluster heads in wireless sensor networks.

4. An adaptive control method of a wireless sensor node is proposed by using machine learning modeled on the basis of multilayer perceptron using State-Action-Reward-State-Action algorithm. The method results in solutions that maximize the use of resources and extend the lifetime of battery-powered wireless sensor modules part of a network. A new Q-Learning-based machine learning method and algorithm is also proposed to optimize the transmission power control process of a node.

5. A new hybrid method is proposed to improve the accuracy of the indoor positioning approach for Bluetooth Low Energy mobile devices based on an optimized combination of arrival angle and received signal strength. This indoor positioning-enhancing hybrid method is implemented through a two-step data fusion process using an extended Kalman filter and the Fraser-Potter equation.

6. A new technique based on Quality of Service is proposed for energy optimization of the existing ZigBee communication protocol. The proposed technique is based on the combination of the ZigBee wireless modules' built-in link quality indicator and received signal strength indicator as critical parameters.

5. Critical notes and recommendations

I personally know Ch. Assistant Dr. Al. Alexandrov as a motivated and active scientist in the field of information processing systems and control of wireless sensor systems. I have no critical comments on the materials presented by candidate Ch. Assistant Dr. Alexander Kirilov Alexandrov, as they meet all the scientometric indicators required by the Regulations for the implementation of the LDASRB and the specific requirements of IR-BAS. My recommendations to the candidate are related to increasing the publication activity and initiative in the training of future doctoral students.

6. Conclusion

The documents presented by the candidate fully satisfy all the requirements for holding the academic position of "Associate Professor", according to the LDASRB, the Rules for its implementation, as well as the Rules for the conditions and procedures for acquiring scientific degrees and for holding academic positions at the Institute of Robotics at the BAS. **All this gives me a reason to give a positive assessment and I suggest that the scientific jury vote on a proposal to the Scientific Council of the Institute of Robotics at the BAS to elect Ch. Assistant Dr. Alexander Kirilov Alexandrov for the academic position "Associate Professor" in professional field 5.2 "Electrical engineering, electronics and automation", specialty "Automated systems for information processing and control (integration of data from sensor networks)".**

23 January 2024

Signature