

REVIEW

for the competition for the academic position of "**professor**" in scientific field 5: Technical Sciences, professional field 5.2. Electrical engineering, electronics and automation, specialty "Robots and manipulators", published in State Gazette № 21/15.03.2022 for the needs of the Cyber-Physical Systems Section, with the only candidate Assoc. Prof. Dr. Eng. Nayden Shivarov

Reviewer: Prof. Dr. Lubomir Dimitrov, Technical University of Sofia,

Review is made on bases on the Order of the Director of ICT-BAS № 133/13.5.2022

1. General information and biographical data

Assoc. Prof. Dr. Naiden Shivarov was born on October 27, 1973. He graduated with a degree in Mechanization of Forest Industry "Master's Degree" at the Higher Institute of Forestry - Sofia in 1997. In 2001 he successfully defended his PhD degree in "Institute of Robotics" at the Technical University of Vienna (Austria). From 01.08.2007 to 30.06.2010 he worked as a research associate at the Central Laboratory of Mechatronics and Instrumentation at the Bulgarian Academy of Sciences. From 01.07.2010 to 30.09.2014 he works at ISIR - BAS. From 15.06.2015 - 30.07.2017 he works as an expert and director of a directorate in the Ministry of Health. Since 20.10.2015 he has been an associate professor at the European Polytechnic University - Pernik, and since 01.03.2019 he has been working at ICT – BAS. Since 16.10.2019 he is associate professor in ICT – BAS.

The candidate has submitted for review 34 documents: 33 publications, 1 monograph, as well as 6 research projects and 1 patent. I accept for review all submitted scientific papers, patents and research projects, which can be divided into the following groups:

- 23 publications included in indexed and referenced publications in world databases of scientific information;
- a monograph, which is not presented as a major habilitation thesis;
- 0 Scientific publications in unreferred journals with scientific review or in edited collective volumes;
- 1 patent;
- 6 research projects.

According to the place of the author in the published scientific papers:

- 1st place - 14
- 2nd place - 9
- 3rd place - 5
- 4th place - 5

I would say that a large part of the papers accepted for review are focused on the competition specialty "Robots and Manipulators".

Assoc. Prof. Dr. Naiden Shivarov has 38 publications in the Scopus database and h-index 6, which speaks well of his publishing activities.

The reference shows that the national minimum requirements have been met, as well as the minimum requirements of the ICT for holding the academic position of "professor". The attached table shows that the national minimum requirements for all criteria have been met, with 58% of the total and 32% of the ICTs being exceeded.

Table 1: Requirements for professor and indicators of Assoc. Prof. Naiden Shivarov

| Criterion | National requirements | IICT requirements | Naiden Shivarov's points |
|-----------|-----------------------|-------------------|--------------------------|
| A | 50 | 50 | 50 |
| B | 100 | 100 | 178.5 |
| Г | 200 | 220 | 279,58 |
| Д | 100 | 120 | 170 |
| E | 150 | 150 | 270 |

2. General characteristics of the research, scientific-applied and pedagogical activity of the candidate.

The research and applied activities of the candidate are focused on problems and specific tasks in the field of the announced competition. The candidate has shown that in the field of robots, and manipulators and cyber-physical systems is very well informed, is familiar with current developments and is aware of existing problems.

The candidate defended his doctoral dissertation in 2001 in the scientific specialty "Robots and Manipulators" on the topic: "A set of Robo-tools for modular intelligent mobile robots" at the "Institute of Robotics" at the Technical University of Vienna, and in 2019 held the academic position of associate professor in IICT-BAS.

He has also been an associate professor at the European Polytechnic University since 2015, where he lectures and exercises in the discipline: "Intelligent Robotic Systems". Currently, Assoc. Prof. Shivarov is the head of 3 full-time and 2 part-time doctoral students at IICT-BAS in the specialty "Robots and Manipulators" and "Cyber-Physical Systems".

The presented scientific papers show the further development of the problems covered in the dissertation and the papers presented for the acquisition of the academic position of associate professor.

The problems that Assoc. Prof. Naiden Shivarov is working on are relevant for the industry both at home and abroad. He has participated in 6 research projects. He is known among the scientific community as a highly qualified and respected specialist, actively working in the field of mobile service robotics and cyber-physical systems, which is confirmed by his research and development activities, with a list of 17 citations in Scopus, much of which are abroad (170 points in total).

3. Basic scientific, scientific-applied and applied contributions

The main scientific and applied contributions contained in the scientific papers relate to service robots and cyber-physical systems.

The scientific and applied contributions contained in the scientific works of the candidate can be referred to the following groups:

- **It is developed, prototyped and researched a training mobile robot for STEM education in Bulgarian schools. It is developed a software for line tracking, to solve a maze, for obstacle avoidance and for remote control via joystick and a virtual joystick and IR remote control for training robot as well.**
- **It is developed a Cyber-Physical System (CFS) for intelligent management of animal husbandry complexes. A prototype of a Cyber-physical system for intelligent management of an animal husbandry complex (including openHAB-based management software, user interfaces, IoT devices and sensor systems) is created. It is developed a graphical interface for management and analysis of data for CFS of the animal husbandry complex, with the possibility of remote control via the Internet, based on openHAB.**
- **It is developed, prototyped and tested a service robot for storage and delivery of finished products. It is developed a semi-autonomous control of a service robot under the meta-operating system Robot Operating System (ROS). A system for localization and navigation of a service robot under the meta-operating system Robot Operating System (ROS) is created. A system for control, navigation and localization of a prototype of a tele-controlled service robot is developed. A graphical interface under the Robot Operating System (ROS) meta-operating system for controlling a service robot is done. A web-based graphical management interface and prototype of a tele-controlled service robot is created.**
- **A Cyber-Physical System (CFS) for remote monitoring and tele-medical examinations in hospital care is developed. It is created a mobile robotic assistant. Researched and developed IoT technologies, sensor systems and actuators for incorporation in CFS. Research and development control center for CFS management. Researched and developed prioritized management of the Cyber-physical system.**
- **Algorithms using artificial intelligence for automatic recognition of faces and objects are implemented: implemented system for real-time recognition and classification of objects "YOLO (You Only Look Once); implemented system for recognition and classification of objects using the neural network "SSD (Single Shot Multibox Detector)"**

- **It is created a manipulator type SCARA for rehabilitation of upper extremities; researched and developed the mechanical system, hardware and software, providing the necessary functions and properties for rehabilitation procedures. It is developed graphical user interface for easy control of the rehabilitation manipulator, allowing both manual and automated user control and configuration.**
- **It is designed, developed and 3D prototyped specialized gripper-dispenser for dosing a laboratory mill with grinding bodies. Eliminate the possibility of incorrect dosing of grinding bodies, eliminate possible human error and ensure proper reading of data. Conducted experiments for reliability and proper operation of the dispenser gripper.**
- **It is developed and researched robot companion to improve the quality of life of people with disabilities: developed tele-control for service robot using joystick, gestures and voice commands. Developed human-robot interfaces designed to provide user-friendly interaction between people with disabilities and the robot, presenting four possible methods of robot control: joystick control, gesture control, voice control and remote control via web user interface. Developed software for robot control. The usability of the tele-controlled service robot has been studied by performing real tests of the robot with disadvantaged people,**

All contributions are in the field of competition. The contributions are formulated on the basis of what the author has done and accurately reflect what has been achieved.

I accept all the contributions presented in the applicant's report and evaluate them positively.

4. Significance of contributions to science and practice

The importance of the contributions in the scientific works of the candidate is expressed in the enrichment of the theory and practice in the field of robotics and cyber-physical systems. In this field, Assoc. Prof. Dr. N. Shivarov has received recognition not only in Bulgaria but also abroad. This is confirmed both by the received annual award of Plovdiv Tech Park for his contribution to the development of Information Technology and Robotics for the benefit of society, and by citations of his scientific works, as in the attached list of 17 citations in Scopus, he is the first author of all cited articles. Also, Assoc. Prof. Shivarov has the necessary skills and experience to work with modern tools for design, creation and research of mobile service robots and cyber-physical systems in various fields of human activity for industrial and social activities. His participation as a leader and participant in international and Bulgarian projects under H2020, Erasmus +, EBRD, NSF

and NNP "Intejivo" proves the importance of the developed research contributions and respectively published scientific papers.

The evaluated works have a high degree of applicability in practice.

5. Critical remarks

I did not find any fundamental inaccuracies or errors in the scientific works. Nevertheless, there are some shortcomings, omissions, incompleteness, etc., the most common of which are:

- Not all publications clearly disclose scientific and applied contributions.
- In the auto-report for the contributions they are presented in a very generalized form, as one contribution must be defined in one complex sentence.
- There are publications where there is an overlap of texts.
- I recommend in the future more independent publications in SCOPUS refereed publications and protection of research papers with patents.

6. Personal impressions

I know the candidate personally from our joint contacts and participation in scientific conferences on robotics, mechatronics and automation. The materials presented in the competition are well formed and significant in content.

In general, the following summaries can be made based on the materials submitted by the candidate Assoc. Prof. Dr. N. Shivarov for participation in the competition:

- Research and implementation activities are focused and in-depth with a very high potential for implementation in a number of companies and organizations, with significant participation in international projects.
- Much of the scientific work is devoted to current issues in the field of design, creation and research of service mobile robots and cyber-physical systems.
- The scientific and scientific-applied contributions of the candidate are significant and indisputable.
- Assoc. Prof. Naiden Shivarov is an established specialist in the design, research and application of mobile and service robots in the production and social sphere, who is respected among the guild of robotics and automation.

Conclusion

Based on my acquaintance with the materials presented at the competition, my personal impressions, relevance and significance of the scientific and applied contributions contained in the works, the achieved implementation in engineering practice, I strongly recommend the esteemed scientific jury to positively evaluate the scientific works of the competition and propose of the Scientific Council of the Institute of Information and Communication Technologies to elect Assoc. Prof. Dr. Eng. Nayden Shivarov to hold the academic position PROFESSOR in the professional field 5.2

Electrical Engineering, Electronics and Automation, specialty "Robots and Manipulators".

Sofia, June 14, 2022.

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