



## REVIEW

by competition for the academic position of professor in the field of higher education 5. Technical sciences, professional field 5.2. Electrical engineering, electronics and automatics, scientific specialty "Robots and manipulators", to the section "Cyber-physical systems" of the Institute of Information and Communication Technologies (IICT) - BAS, Sofia, published in the State Gazette issue № 21 / 15.03.2022 with a single candidate: **Assoc. Prof. Dr. Eng. Nayden Nedkov Shivarov** was found

Reviewer: Prof. DSc. Eng. Chavdar Ivanov Damyanov, UFT - Plovdiv (retired)

Elected as a reviewer on 23.05.2022 at a meeting of the scientific jury, approved by the National Assembly of IICT-BAS on 27.04.2022 (Minutes № 4).

As a reviewer, I declare that I do not have common publications and joint participation in research and projects with the candidate Assoc. Prof. Dr. Eng. Nayden Nedkov Shivarov, as well as other reasons that would affect my assessments.

### 1. General provisions and biographical data

In the announced in SG no. 21 / 15.03.2022 and on the website of IICT-BAS competition for a professor in a professional field 5.2. "Electrical Engineering, Electronics and Automation", specialty "Robots and Manipulators", the only candidate for participation in the competition is Assoc. Prof. Dr. Eng. Nayden Nedkov Shivarov from the section "Cyber-physical systems" at IICT - BAS, for the needs of which section the competition has been announced.

From the presented CV can be traced the professional development of the candidate - Nayden Shivarov. He was born on October 27, 1973 in the city of Sofia. He received his higher education at the University of Forestry - Sofia in 1997 with a master's degree in mechanization of the forest industry. In the same year he was appointed a research associate at the Institute of Robotics at the Technical University of Vienna, Austria, where in 2001 he defended his doctoral dissertation on "A set of tools for modular intelligent mobile robots." Dr. Nayden Shivarov's academic career began in 2007 at the Bulgarian Academy of Sciences, where he worked successively at the CLMP-BAS (2007-2010) and at ISIR-BAS (2010-2014). He received his habilitation as an associate professor in the scientific specialty "Robots and Manipulators" in 2012 at ISIR-BAS. At the same time he holds the academic position of associate professor at the European Polytechnic University-Pernik, where he is head of the Robotics Laboratory. Since 2019 and currently, Assoc. Prof. Dr. Nayden Shivarov is an associate professor and head of the Rilab Laboratory at IICT. Since 2020 he has been the head of the Cyber-Physical Systems Section of IICT-BAS.

Assoc. Prof. Dr. Nayden Shivarov speaks German and English. All the facts from the professional profile and development of the candidate as an expert, lecturer and researcher are directly related to the professional direction of the competition procedure.

The copies of the documents for the competition for a professor provided to me contain:

1. Request from Assoc. Prof. Dr. Nayden Shivarov to the Director of IICT;
2. Curriculum vitae (CV) according to the European model;
3. Copy of the diploma for the educational and scientific degree "Doctor";
4. Copy of associate professor's certificate;
5. Certificate of internship in the specialty;
6. List of the scientific publications with which the candidate participates in the competition, which should not repeat the presented for acquisition of the educational and scientific degree "doctor" and for holding the academic position "associate professor";
7. List of inventions and other scientific and applied results;
8. List of citations;

9. Summaries of the scientific publications with which the candidate participates in the competition - in Bulgarian and English;
10. Copies of all scientific publications with which the candidate participates in the competition;
11. Information for fulfillment of the minimum national requirements under art. 2b, para. 2 and 3 and the requirements of IICT under Art. 2b, para. 5;
12. Information about the original scientific and scientific-applied contributions;
13. Declaration that there is no legally proven plagiarism in scientific works.
14. Set of other documents on electronic carrier, certifying scientific, pedagogical, popularizing and administrative activity of the candidate: awards, certificates and certificates.

According to the necessary documents for participation in the competition and their content, according to the normative base of the Law for development of the academic staff of the Republic of Bulgaria (ZRASRB), the Regulations for its implementation and the Internal regulations of IICT, I have no objections. All materials are properly shaped and arranged.

The procedural requirements for the announcement and participation of the candidate in the competition are met.

According to ZRASRB, the candidates for the academic position of "professor" must meet the requirements of Art. 29 (1):

1. To have acquired the educational and scientific degree "Doctor";
2. To have held the academic position of "associate professor" in the same or in another higher school or scientific organization for not less than two academic years or ...;
3. To have submitted a published monographic work or equivalent publications in specialized scientific journals..., which should not repeat the ones presented for acquiring the educational and scientific degree "Doctor"... and for holding the academic position "Associate Professor";
4. To have presented other original research works, publications, inventions and other scientific and scientific-applied developments, which are evaluated as a whole.
5. To meet the minimum national requirements under Art. 2b, para. 2 and 3, respectively to the requirements under Art. 2b, para. 5;
6. Not to have plagiarism in the scientific works proven according to the statutory order.

It definitely follows that the requirements of Art. 29 (1) are fully fulfilled, as with a certificate № 287 / 01.03.2007 the Higher Attestation Commission approves the educational and scientific degree "Doctor" given to Nayden Shivarov for successfully defended dissertation in TU-Vienna, Austria in the scientific specialty "Robots and Manipulators".

The candidate meets the requirements of Art. 29 (1) item 2, as with a decision of the National Assembly of IICT-BAS from 25.09.2019. holds the academic position of "Associate Professor" and according to the submitted documents, has held this position for 2 years and 7 months in IICT.

Assoc. Prof. Dr. Nayden Shivarov fulfills the requirement of Art. 29 (1) item 3, as he has presented 10 publications, equivalent to a monographic work (the works from group B.4), as well as a list of publications, for acquiring the educational and scientific degree "doctor" and for holding the academic position "Associate Professor", whose analysis shows that none of the candidate's publications are duplicated.

Assoc. Prof. Dr. Nayden Shivarov meets the requirements of Art. 29 (1) item 4, as he has presented other original research papers and publications, a total of 24, which are evaluated as a whole. The applicant has submitted a Certificate for implementation of the national minimum requirements / Art. 29 (1) item 5 /, supplemented with a list of its scientific production.

Group	Contents	For professor	For N. Shivarov
A	Indicator 1		
	1. Dissertation work for awarding the "Doctor" degree	50	50
		50	50
B	Indicators 3 or 4		
	3. Habilitation work - monograph	100	178.5
	4. Habilitation work - scientific publications in publications that are referenced and indexed in world-famous databases with scientific information	100	-
		60/n for each post	$1 \times 8,5 + 2 \times 10 + 5 \times 12 + 1 \times 30 + 1 \times 60 = 178,5$
Г	Sum of points in indicators from 5 to 10	200 (220)*	279.58
	5. Published monograph, which is not presented as a main habilitation thesis	30	30
	7. Scientific publication in publications that are referenced and indexed in world-famous databases	40/n or distributed in a ratio based on a contribution protocol	$1 \times 6,66 + 9 \times 10 + 2 \times 13,3 + 1 \times 20 = 143,26$
	8. Scientific publication in unrefereed journals with scientific review	20/n or distributed in a ratio based on a contribution protocol	$2 \times 4 + 1 \times 5 + 2 \times 6,66 + 2 \times 10 + 3 \times 20 = 106,32$
Д	Sum of points in indicators 12 and 14	100 (120)	170
	12. Citations or reviews in scientific journals, referenced and indexed in world-famous databases with scientific information.	10	$17 \times 10 = 170$
	14. Citation in unrefereed journals with scientific review	2	-
E	Sum of points in indicators from 17 to 26	150	227
	18. Participation in the nat. scientific project	10	$2 \times 10 = 20$
	19. Participation in the int. scientific project	20	$1 \times 20 = 20$
	20. Manag. of nat. scientific project	20	$1 \times 20 = 20$
	21. Management of in int. project	40	$2 \times 40 = 80$
	22. Raised funds for projects	1 point for every BGN 5,000.	237426 лв. = 47
	26. Recognized patent	40	$1 \times 40 = 40$
	<b>TOTAL:</b>	minimum 600 (640)	905.08

\* The figures in brackets are the required increased values, according to the Regulations for the specific conditions for acquiring scientific degrees and for holding academic positions in IICT - BAS.

In accordance with Art. 80. (4) NJ should also take into account additional requirements of the respective scientific organization. In its Regulations for the specific conditions for acquiring scientific degrees and for holding academic positions in IICT - BAS, the above requirements of IICT are duly taken into account.

With regard to the requirement of Art. 29 (1) item 6, I am not aware of any received signals under Art. 4 para. 11 of the Law on Plagiarism and no plagiarism has been established in the submitted scientific

papers of the candidate. There is also a declaration signed by Nayden Shivarov that the results and contributions in his scientific production are original and not borrowed.

Many of Nayden Shivarov's research developments have a specific practical focus and are the result of his many years of work almost 20 years of experience (exactly 19 years and 11 months), starting from research associate to associate professor currently at IICT-BAS.

## **2. General description of the submitted materials**

Assoc. Prof. Nayden Shivarov presented for his participation in the competition a well-selected excerpt from his works, namely 34 publications, including 10 publications from group B4, 1 monograph in group G5 and 13 works in groups G7 and G8, as follows:

- Scientific papers submitted for participation in the competition for "professor" as equivalent to a monograph, in accordance with the minimum national requirements - 10 papers [B4 - 1÷10] with a monograph in publications that are referenced and indexed in the world-famous database with scientific information - Scopus and / or Web of Science. No unifying title specified. The works are in the field of "Service robots for the support of the disabled, for storage and delivery of goods and products, training robots and Cyber-physical systems for intelligent control and monitoring". Scientific papers in group G on indicators G5 - 11; G7 - 12÷24 and G8 - 25÷34 - a total of 24 issues, including 1 monograph, which is not presented as the main habilitation work.

English was used as the main language for publication - 5 papers were written in Bulgarian and 29 - in English.

I accept that all works from the production of the candidate are entirely in the problems of the competition. Of the 34 publications on the topic of the competition, 24 are referred to SCOPUS and / or Web of Science, one with an impact factor and 10 with an impact rank.

The works with which the candidate participates in the competition are the product of active and consistent research work mainly in the period 2019 ÷ 2021, which is also a confirmation that the submitted publications are outside those included in the procedures for obtaining a "doctor" and "associate professor".

As explained before, the candidate fulfills and re-fulfills all conditions and normative quantitative requirements of the IICT-BAS Regulations. This gives me reason to confirm with conviction that Assoc. Prof. Nayden Shivarov meets the requirements of IICT-BAS for holding the academic position of "professor".

## **3. Reflection of the candidate's scientific publications in the scientific community (known citations)**

A brief reference in the scientific databases Scopus, Google Scholar and Researchgate.net (as of June 26, 2022) on the degree of citation of the candidate's publications gives over 100 citations of a limited number of his works. In the report on compliance with the minimum national requirements, the candidate presented data on 17 citations of his works noticed by him. The citations show that the candidate's scientific results have become widely known.

## **4. Overview of the content and results in the presented works**

The scientific production of Assoc. Prof. Dr. Nayden Shivarov is oriented mainly towards the creation of Cyber-physical systems. It is not superfluous to emphasize how important this issue is for the theory and practice of PF 5.2. Electrical engineering, electronics and automatics, where the quality of any technical solution is usually determined by its functional efficiency.

The most significant scientific results and contributions are contained in the works of group B4, presented as equivalent to a monographic work. The publications in group B on indicator B4 consider the theoretical basis, methods and means for studying the properties and operational characteristics of a relatively wide range of cyber-physical systems, and in the presented 10 articles the results of specific experimental and simulation studies are considered and analyzed. of different types of robotic systems. Nayden Shivarov's publications in this group are on issues that can be broadly reduced to

"Methods and tools for development, prototyping and research of robotic systems systems." I accept that the 10 publications in group B are equivalent to a monograph.

I will note that a certain interest is the participation of Assoc. Prof. Nayden Shivarov in joint works of teams with 5 to 6 co-authors, in particular works [B4 - 1, 2, 8÷10 and G7 - 16], as probably the aspiration and purpose of the authors were to present to the interested reader a more complete idea and strategy regarding the possibilities and main problems in the synthesis and analysis of the developed robotic systems. This goal has been largely achieved.

Although almost entirely the works of the candidate are co-authored, I believe that his role in the submitted works is indisputable. This is largely due to his long-standing interest in this still inexhaustible scientifically applied problem of an interdisciplinary nature.

## **5. General characteristics of the candidate's activity**

### **5.1. Educational and pedagogical activity**

The candidate has conducted classes at 2 universities: TU-Vienna and EPU-Pernik. He has conducted 5 years of seminars and laboratory exercises in the discipline "Service Robotics" at the Technical University of Vienna and 7 years is a titular lecturer in the discipline "Robotics" in EPU-Pernik. In the presented materials there is no data about the developed curricula and characteristics of these disciplines. It is necessary to note the scientific guidance of Assoc. Prof. Nayden Shivarov of 3 full-time and 2 part-time doctoral students in the field of higher education 5. Technical sciences. The pedagogical training and activity is without special weight in the academic institutes of BAS, where the main activity is of research and applied nature, but in this case, the candidate has 12 years of experience as a university lecturer and undoubtedly his pedagogical activity in all its aspects can be assessed high. Both in terms of quality and volume, it is completely sufficient for the purposes of the competition.

### **5.2. Scientific and scientific-applied activity**

The applicant has certified his participation in 7 research projects, of which four are European (under EU programs) and 3 are national, funded by the NSF at the MES:

- Project Coordinator N: 2020-1-BG01-KA202-079200, "Network of ICT Robotics Clubs", ERASMUS +, Key Activity 2, Vocational Education and Training, 2020 - current
- Participant in a project of the DIH<sup>2</sup> (Digital Innovation Hub for Agile robotics) network, funded by the European Union's Horizon 2020 research and innovation program, under a grant agreement № 824964. 2020 - current
- Participant in the project COST Action CA16116 - Wearable Robots for Augmentation, Assistance or Substitution of Human Motor Functions, 2017 - 2021
- Project Manager № DN 07 / 23-15.12.2016 "Tele-controlled Service Robots Improving the Quality of Life of the Elderly and Disabled" funded by the NSF, 2016-2020
- Deputy Head of the project "Multifunctional shadow robot, supporting the independent living of the elderly" № 247772 under the 7th Framework Program of the European Commission, 2010 - 2013.
- Project Manager DMU 03/16 "Intelligent modular service mobile robot controlled via the Internet" - NSF, 2012-2014.
- Project Manager BG051PO001-3.3.06-0002: Increasing the efficiency and quality of training and the scientific potential in the field of systems engineering and robotics - ESF, 2012-2014.

I find participation in projects a significant contribution to the research activity shown by the candidate.

### **5.3. Implementation activity**

The applicant has a registered patent for "Autonomous personal service mobile robot" № BG 66853B1 from 2014. Despite the allegations in some of the applicant's publications for tested and implemented

developments, the submitted materials do not contain data on such (official notes, certificates, etc. ), as documents of an evidentiary nature.

## 6. Yields

The research interests of Assoc. Prof. Nayden Shivarov are mainly in intensively studied areas of robotic systems with different areas of purpose (warehouses, telemedicine, hospital care, face recognition, STEM training, etc.). The candidate has submitted his / her own self-assessment of his / her contributions on the basis of the publications in groups B and Г. I accept the scientific, scientific-applied and applied contributions in the form edited by the candidate (according to the reference for contributions). of the results obtained by him. The main contributions to the candidate's work can generally be characterized as the enrichment of existing knowledge of classical and more modern areas of methods and tools for studying the properties, performance and control of training, service and mobile robots. The contributions to the works submitted for the competition (assuming that the participation of all co-authors is equal) can be summarized briefly as follows:

### Scientific contributions:

- An algorithm and the line tracking software implementing it have been developed; to solve a maze; for obstacle avoidance and for remote control via joystick, virtual joystick and IR remote control for training robot. [B4 - 6, 8; G5 - 11];
- A system for localization and navigation of a service robot under the Robot Operating System (ROS) meta-operating system has been proposed and tested [B4 - 9; G7 - 11 ÷ 15].
- Human-robot interfaces have been developed to provide user-friendly interaction between people with disabilities and the robot, presenting four possible robot control methods: joystick control, gesture control, voice control and remote control via a web user interface. . [B4 - 1, 3; G7 - 17.22 and G8 - 29.33].

### Scientific applications:

- Cyber-physical system for intelligent management of animal husbandry complexes has been developed: [G7 - 20,24];
- Cyber-physical system for remote monitoring and tele-medical examinations in hospital care has been developed [B4 - 7.10; G7 - 23; G8 - 30];
- Algorithms using artificial intelligence for automatic recognition of faces and objects have been developed and studied [G7 - 19].

### Applied contributions:

- A SCARA type manipulator for rehabilitation of upper extremities was designed, developed and studied [B4 - 4; G8 - 34].
- Designed, developed and 3D prototyped is a specialized gripper-dispenser for dosing [B4 - 5; G7 - 18].

A number of other results with engineering-applied and educational-methodical character have been achieved, which the candidate has not presented in the author's reference for contributions. It should be noted that Assoc. Prof. Nayden Shivarov is a laureate of the Annual Award of Plovdiv Tech Park AD for 2021 for his "contribution to the development of Information Technology and Robotics for the benefit of society."

The overall content analysis of the scientific production of Nayden Shivarov gives me reason to consider that the authenticity of the contributions is undoubted and they are definitely his personal work.

## 7. Assessment of the personal contribution of the candidate

Assoc. Prof. Dr. Nayden Shivarov carries out effective research and uses the name of a respected and qualified expert in the professional field of the competition. Summarizing this part of my review, I believe that the presented publications have obtained original results in the creation of methodologies and tools for the creation of cyber-physical systems, their testing and research in virtual and in-situ natural environment. In accordance with the generally accepted differentiation of the contributions,

with Assoc. Prof. Nayden Shivarov, they cover the range of scientific and applied scientific contributions, consisting in: proving with new means of existing scientific problems and theories, obtaining new facts and confirmatory ones and creating new methodologies for calculations, simulation and application of scientific achievements in practice. I find it a certain advantage that the application of individual fragments are practically feasible and implemented in training stands and training robots, supporting STEM training and others.

Regarding the contribution moments in the works of Assoc. Prof. Nayden Shivarov, I have indicated only those which, in my opinion, deserve special attention. I think that they completely satisfactorily cover the results achieved in his scientific production. The works are written at a high professional level. From the publications it can be concluded that Assoc. Prof. Nayden Shivarov has been actively involved in several scientific problems, one of which he summarized in the works of group B, as equivalent to a habilitation / monograph work, as well as in the monograph published in English. Family of Educational Robots 'ROBCO' », 2020. As far as I know the literature in this field, I have no doubt that all the contributions in the scientific production of Assoc. Prof. Nayden Shivarov are his personal work. The analysis of the presented self-assessment of the candidate's contributions also gives me reason to assume that they are his merit.

Nayden Shivarov's participation in 7 research contracts / projects is a convincing proof that he has established cooperation and contacts with scientists and teams directly related to the issues of the competition.

The candidate has presented as an independent author 5 works [works - 6,11,32 ÷ 34]. The other publications are collective, as in 9 of them [works - 1 ÷ 5, 7 ÷ 9,25] Nayden Shivarov is the first author, and in 11 publications he is the second author [works - 10,12,13,19,21,22, 24,26,27,29,31]. As there is no separation protocol in the materials, I accept the participation of each of the co-authors in conducting the research and writing the publications as equivalent.

The research qualification of Assoc. Prof. Nayden Shivarov is unquestionable. The candidate in the competition has presented a significant number of scientific papers published after the defense of ONS "Doctor" and the first habilitation ("Associate Professor"). In the works of the candidate there are scientific, scientific-applied and applied contributions, which have received international and national recognition, and have been published in journals and scientific collections. Theoretical developments have practical applicability, and most of them are directly oriented to engineering practice. The scientometric data on the results achieved by Assoc. Prof. Dr. Nayden Shivarov in the research activity fully comply with the requirements of IICT-BAS for holding the academic position "Professor".

## **8. Critical remarks and recommendations**

I have no critical remarks of a significant nature to the materials of the competition. They are properly presented and structured. In some of the articles, the style of the exhibition could have been improved. In this line of thought, my following remarks are of a recommendatory nature:

- In the presented author's reference for the contributions there are no well-formulated summarizing claims, but statements and results from individual publications or groups of publications are presented. It is difficult to distinguish his personal contribution to collective publications.
- There is no separation protocol for the share participation of the co-authors in the collective developments.
- Repeatability, such as figures, individual text passages or inferences, is observed in some of the publications. Some of the copies of the publications [9,12,17,18,26,28] do not have their pages marked.
- Only one individual publication in group B, their total number is small (five). Undoubtedly, the areas of scientific interest in which the candidate works require the involvement of more specialists, but I would recommend him in the future to summarize some of his results in separate publications.

The above remarks are of a formal nature and do not detract from the results of the research carried out, nor do they affect the very good general impression that the candidate's production creates.

## 9. Personal impressions and opinion of the reviewer

My personal impressions of Assoc. Prof. Nayden Shivarov are from the time when he was a lecturer at EPU-Pernik and are based on my visits there, as well as some of his scientific achievements and results of his research. I also have indirect impressions from his work in IICT, as well as from his regular participation in the International Scientific Conference "Artificial Intelligence and E-Leadership". They are all entirely positive. He is always very precise, constructive and accurate. This, by the way, has been reflected in his scientific work, which is characterized by depth and accuracy. After my detailed acquaintance with the scientific production of the candidate, I believe that his participation in the current competition for professor is also a proof of the positive development of his potential as a researcher and researcher.

The claims for scientific contributions are substantiated and correspond to the results actually achieved. The candidate has serious scientific publications on the issues of the competition, they have been tested at Bulgarian and international scientific forums and published in authoritative publications. From the presented production, obtained results and achievements it is evident that Assoc. Prof. Nayden Shivarov has made a name for himself as a highly erudite and respected scientist in the field of competition. His participation in the competition presents him as a very well-prepared and actively working researcher, which confirmed my positive personal impressions of Assoc. Prof. Nayden Shivarov. It should be noted that behind the quantitative indicators and contributions of Assoc. Prof. Nayden Shivarov in its development as a researcher and expert in the field of competition, stands a person dedicated to his profession, who throughout his conscious life has worked systematically, continuously and persistently. to build as a specialist. In this light, the path of professional development, the accumulated academic experience and scientific production by Assoc. Prof. Nayden Shivarov make him the most suitable candidate in the current competition for professor.

## CONCLUSION

Given the above, assessing the overall research output of Assoc. Prof. Dr. Nayden Shivarov, I believe that it fully satisfies the conditions, criteria and requirements for election to the academic position of "professor". On this basis, I give my positive vote and invite the members of the esteemed scientific jury to vote positively for the selection of the candidate. From the presented materials it can be seen that sufficient scientific and applied contributions have been received.

After getting acquainted with them, my assessment of their importance and the contribution results contained in them, I find it reasonable to recommend to the esteemed members of the National Assembly at IICT-BAS Assoc. Prof. Dr. Eng. Nayden Nedkov Shivarov to take the academic position "PROFESSOR". in the professional field 5.2. "Electrical engineering, electronics and automatics" in the specialty "Robots and manipulators".

June 28, 2022.  
Plovdiv

НА ОСНОВАНИЕ

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