

REVIEW

by Prof. Stoyan Nedkov Kapralov, D.Sc.
Technical University of Gabrovo
on the materials submitted for participation
in a competition for the academic position of "Professor"
at the Technical University of Gabrovo
Field of Higher Education: 5. Technical Sciences
Professional Field: 5.3. Communication and Computer Technology
Specialty: "Automated Information Processing and Control Systems"

In the competition for the academic position of "Professor", announced in the State Gazette, issue no. 61/03.07.2026, and on the website of the Technical University of Gabrovo for the needs of the Department of Computer Systems and Technologies at the Faculty of Electrical Engineering and Electronics, there is a single candidate: Associate Professor Rosen Stefanov Ivanov, Ph.D, Eng. from the Technical University of Gabrovo.

1. Brief Biographical Data

Rosen Ivanov was born in 1967 in the town of Karnobat. In 1985, he completed his secondary education at the "Hristo Botev" Secondary School in his hometown with honors.

In 1990, Rosen Ivanov graduated from the Higher Institute of Mechanical and Electrical Engineering (VMEI) - Gabrovo with a Master's degree in Electronic Engineering and Microelectronics (specialty ETME). His grade point average from the course examinations was Excellent (5.76), and his grade from the diploma thesis defense and state examination was Excellent (6.00).

From 1992 to 2004, Eng. Rosen Ivanov consecutively served as an Assistant Professor, Senior Assistant Professor, and Chief Assistant Professor in the Department of Computer Systems and Technologies at the Technical University of Gabrovo.

In 2001, Rosen Ivanov obtained the educational and scientific degree of "Doctor" (Ph.D.) in the scientific specialty "Automated Information Processing and Control Systems". The topic of his dissertation was "*Methods and Algorithms for Increasing the Noise Immunity of Distributed Speech Recognition Systems*".

In 2005, Dr. Rosen Ivanov became an Associate Professor in the Department of Computer Systems and Technologies at the Technical University of Gabrovo, once again in the scientific specialty "Automated Information Processing and Control Systems".

2. General Description of the Submitted Materials

According to the general reference sheet for participation in the competition, the candidate has submitted 35 scientific publications (articles and papers), 1 monograph, and 6 textbooks and teaching manuals. None of these works have been used for the acquisition of the educational and scientific degree "Doctor" (Ph.D.) or for the academic position of "Associate Professor". The distribution by indicator groups is as follows:

Group	Type of Work	Count
B.4	Habilitation work - scientific publications in editions that are refereed and indexed in world-renowned databases (6 of them with an impact factor)	12
G.5	Published monograph, which is not submitted as a main habilitation work	1
G.7	Scientific publications in refereed and indexed editions	6
G.8	Publications in non-refereed journals with scientific peer-review or in edited collective volumes	17
E.23	University textbooks	5
E.24	University teaching manual	1

The monograph "*Methods and Algorithms for Intelligent Localization and Navigation in Indoor and Outdoor Environments*" (Vasil Aprilov University Publishing House, 2026, 260 pages, ISBN 978-954-683-736-3) is a sole-authored work of the candidate.

Out of the 35 publications, 18 are refereed and indexed in Scopus and/or Web of Science (12 from group B.4 and 6 from group G.7), 6 of which have an impact factor; 24 (68.57%) are sole-authored, and the candidate is the first author in 31 (88.57%). According to the general reference sheet, 14 of the publications are articles in scientific journals, and 21 are papers presented at scientific conferences. The verification against the attached bibliographic descriptions and the author's reference sheet confirms the number of refereed (18), sole-authored (24), and first-authored (31) works. For the 11 co-authored publications, the personal contribution is declared to be equally distributed among the co-authors (50% each for two authors, 33.3% each for three, and 25% each for four authors).

The twelve publications from group B.4 span the period 2010–2023 and are all sole-authored. Six of them are published in journals with an impact factor: *Journal of Network and Computer Applications* (Elsevier, IF 1.065), *Journal on Multimodal User Interfaces* (Springer, IF 0.797), *Journal of Ambient Intelligence and Smart Environments* (IOS Press, IF 0.878 and 2.759), *International Journal of Geographical Information Science* (Taylor & Francis, IF 3.545), and *ISPRS International Journal of Geo-Information* (MDPI, IF 2.800). The remaining six include four papers from CompSysTech (ACM; 2010, 2012, 2016, and 2017), one paper from ICAI (IEEE; 2021), and one paper in *Digital Presentation and Preservation of Cultural and Scientific Heritage* (2019; Scopus, WoS).

The reference sheet for compliance with the minimum national and institutional requirements compares the candidate's achievements with the criteria for the position of "Professor" in professional field 5.3:

Indicator	Requirement Achieved	
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Table 26.1 - Points by groups (National Requirements)

Group A (Dissertation thesis)	50	50
Group B (Habilitation work - publications)	100	720
Group G (Indicators 5-11)	200	428.33
Group D (Citations and reviews)	100	1610
Group E (Indicators from 16 to the end)	150	410
Total Points	600	3218.33

Table 26.2 - Requirements of TU-Gabrovo

Total number of publications (articles and papers)	30	35
- thereof sole-authored	at least 5	24
- thereof with IF (WoS)	at least 3	6
Known citations by other authors + reviews	20	161
Published textbooks/books	2	5
Published teaching manuals	-	1
Successfully defended Ph.D. students	1	1
Leadership of projects and/or contracts for attracted funds	3	5

3. Reflection of the Candidate's Scientific Publications in the Scientific Community (Known Citations)

The citation reference sheet (Indicator D12) was compiled with an access date of June 13, 2026, based on the candidate's profiles in Google Scholar, ORCID (0000-0002-8695-3085), Web of Science (ResearcherID A-3265-2017), and Scopus (Author ID 55781888700). Six publications are presented with a total of 127 citations in editions indexed in Scopus and/or Web of Science; citations used for the academic position of "Associate Professor" are excluded. The distribution is as follows:

Cited Publication	Citations
B4.6 Indoor navigation system for visually impaired (<i>CompSysTech</i> '10, 2010)	41
B4.3 BIM approach for indoor navigation systems (<i>JAISE</i> , 2017)	27
Ivanov & Velkova (2025). Analyzing visitor behavior to enhance personalized experiences in smart museums: a systematic literature review (<i>Computers</i> , 14(5), 191)	17
B4.7 RSNAVI (<i>CompSysTech</i> '12, 2012)	16
B4.12 ExhibitXplorer (<i>ISPRS IJGI</i> , 2023)	13
B4.1 Real-time GPS track simplification algorithm (<i>JNCA</i> , 2012)	13
Total	127

The citing works were published between 2011 and 2026. Citations for B4.6, B4.1, and B4.7 are primarily in works concerning assistive technologies, navigation for visually impaired people, and NFC/RFID systems (e.g., *Information Sciences*, *Sensors*, *Applied Sciences*, *IEEE Access*, *ACM CHI*, and *ASSETS*). B4.3 is cited in journals such as *Automation in Construction*, *ACM Transactions on Accessible Computing*, *Developments in the Built Environment*, and *Disability and Rehabilitation: Assistive Technology*, including works on BIM-based navigation for fire evacuation. All 13 citations of ExhibitXplorer are from 2024–2026 and appear in works on artificial intelligence in museums, virtual exhibitions, and geofencing (e.g., *Technovation*, *Scientific Reports*, *npj Heritage Science*, *Heritage*).

According to the Google Scholar profile as of June 13, 2026, the candidate has 509 citations (256 since 2021), an h-index of 11, and an i10-index of 13; the most cited are B4.6 (126 citations) and ExhibitXplorer (46 citations). As an additional indicator of impact, 18 out of the 35 publications are in editions indexed in Scopus/WoS, and six of them are in journals with an impact factor.

The second part of the reference sheet (source: Web of Science ResearcherID, accessed on June 13, 2026) presents 34 reviews written by Associate Professor Rosen Ivanov, Ph.D. for 19 journals with an impact factor: *Sensors* (11), *ISPRS International Journal of Geo-Information* (3), *Computers*, *Journal on Computing and Cultural Heritage*, and *Applied Sciences* (2 each), and 14 other journals with one review each, including *Journal of Ambient Intelligence and Smart Environments*, *IEEE Transactions on Mobile Computing*, *IEEE Internet of Things Journal*, *IEEE Transactions on Intelligent Transportation Systems*, and *IEEE Transactions on Consumer Electronics*. The impact factors range from 2.0 to 10.9, with an average value of 4.74 for the 19 journals. The reviewed manuscripts date from the period 2015–2026, with 18 of them from 2025–2026. Thematically, a portion of the publications lies within the field of BLE/Wi-Fi localization and indoor navigation (e.g., nos. 4, 13, 14, 15, 26, 30, 33) and personalized services in museums, which aligns directly with the candidate's own research focus.

4. Review of the Content and Results in the Submitted Works

The submitted works fall into three main thematic areas: (I) outdoor navigation and positioning systems — 7 works; (II) indoor navigation and positioning systems — 11 works; and (III) contextual, IoT-based, and personalized systems and services — 12 works. Six publications (G8.1, G8.3, G8.4, G8.5, G8.13, and G8.16) are not assigned to any specific area. Chronologically, the research evolves from NFC/RFID solutions (2010–2012) through BIM-based modeling and route algorithms (2012–2018) and BLE-localization (2017–2021) to IoT, geofencing, microservices, and generative artificial intelligence (2019–2024).

Area I — Outdoor Navigation. The research began with a vehicle tracking system using GPS, GSM, and the Internet (G8.2, 2003). This was followed by a mobile application for GPS navigation for visually impaired individuals featuring Bulgarian voice menus and an SOS mode (G8.6), and a voice navigation algorithm utilizing an adaptive Kalman filter and adaptation to HDOP (G8.7). In G8.8, an online algorithm for GPS track simplification was proposed, achieving a data point reduction of 3 to 15 times with a maximum error of about 6–8 meters. In B4.1 (*JNCA*, 2012), the RSTS algorithm was introduced, which achieves over 90% point reduction and reduces file size by over 30 times, demonstrating efficiency comparable to the Douglas-Peucker algorithm. This group also includes publication G8.11 — a MATLAB toolbox for processing and visualizing NMEA 0183 data.

Area II — Indoor Navigation and Localization. The starting point is a comprehensive review of existing indoor navigation systems for visually impaired individuals, grouped by technological principles, which formulates requirements for future systems (G8.12). The initial solutions consist of a low-cost system using NFC/RFID tags with map storage in WBXML format and audio messages in AMR format (B4.6, G8.9). When tested in a hospital environment with 20 visually impaired users, all participants reached their destination with an average time of 140 seconds, while the cost of the passive tags ranged between 0.3 and 0.8 euros. RSNAVI (B4.7) incorporates 4D building modeling, semantically rich models, and multi-parameter route optimization with automatic recalculation. The Building Information Model (BIM) for navigation is presented in B4.3; macroscopic pathfinding is complemented by microscopic physical search and obstacle avoidance (B4.8). In B4.4 (*IJGIS*, IF 3.545), a K-shortest paths algorithm in multi-storey buildings is proposed using hierarchical directed multigraphs. In all test scenarios, it performed faster and was more memory-efficient than the fast version of Yen's algorithm, allowing real-time graph expansion.

In the localization segment, publication B4.9 proposes micro-localization using BLE beacons, NFC tags, and BIM, coupled with an adaptive Kalman filter, ring intersection, and ANN clustering with an entropy metric. This approach requires no prior data collection and achieves an error rate below 1.5 meters. B4.5 analyzes five BLE-localization algorithms depending on beacon density, deployment, and channel noise, proposing an adaptive signal preprocessing method that achieves sub-meter accuracy on low-computational-power platforms. Publication B4.11 introduces adaptive beacon selection through fuzzy logic quality evaluation of combinations of k beacons, while G8.10 focuses on automatic beacon deployment. The results indicate that a configuration with 21 beacons achieves an average error of 0.55 meters (standard deviation of 0.27 meters), which is comparable to an expert deployment utilizing 24 beacons.

Area III — Contextual, IoT-based, and Personalized Services. Publication B4.2 (JMUI, 2014) presents a mobile NFC service for the interaction of visually impaired users with voice-enriched objects without buttons or menus. In a test with 12 users aged 31–84, 58% rated it as very easy and 33% as easy to use. B4.10 proposes a platform-independent, open-source IoT architecture for personalized museum content (mobile app, sensor network, edge computing gateway) that operates without requiring constant internet access. This architecture is further developed in a series of joint works with co-author V. Velkova: an open-air museum service featuring geofencing and push notifications with visitor segmentation into five categories (G7.1); a web application with a tangible interface (NFC, BLE, geofences) and automatic profiling (G7.2); a multi-institutional BLE system for multimedia content (G7.3); and an application and microservice for geofence creation with export to MongoDB/GeoJSON and geohashes (G7.6, G8.15).

The pinnacle of this research is ExhibitXplorer (B4.12, IJGI 2023) — a distributed architecture incorporating contextual geofencing, microservices, and the GPT API for content generation, featuring implicit and explicit segmentation (researchers, students, casual visitors, children). In an open-air ethnographic museum, 55% of the participants were satisfied and 45% were very satisfied with the development. G7.4 describes a microservice interface to ChatGPT via an AMQP broker with a REST layer.

A portion of Dr. Rosen Ivanov's research applies to the healthcare sector: a web service supporting medication prescription with incompatibility checks and generic substitute searches built on Google App Engine (G8.14); a pregnancy tracking and monitoring service using microservices, an AMQP broker, and MongoDB in Azure, tested on a simulated wireless sensor network (G7.5); and a low-cost IoT system based on ESP32 with MAX30100, MAX30205, and BME688/BME680 sensors (G8.17).

Monograph and Other Scientific Works. The monograph (G5.1) synthesizes GPS processing (RSTS, MATLAB toolbox), the BIM model, algorithms for K-shortest paths and obstacle avoidance, RFID/NFC, and BLE systems (beacon deployment and selection, micro-localization), as well as a dementia prevention system using navigation technologies with ESP32-S3-BOX3 (Wi-Fi, BLE scanner, MQTT). A review of future trends is also provided.

The six publications outside the main thematic areas date from 2002–2008: an Internet-programmable SC12 controller for remote control of technological processes (G8.1); an automatic VoIP call billing system for Cisco ATA (G8.3); a web controller for monitoring yogurt fermentation (G8.16); a J2ME color recognition algorithm with 93% accuracy (G8.4); an image database application for mobile face recognition (G8.5); and a mobile learning and testing system (G8.13).

The books, textbooks, and teaching manuals (groups E23 and E24) are: *"Network Programming"* (Abagar, Veliko Tarnovo, 2007, 432 pp.); *"JavaScript - Introduction to Programming"* (Faber, 2018, 200 pp.); *"Data Mining"* (Vasil Aprilov University Publishing House, Gabrovo, 2023, 274 pp.); *"Mobile Device Programming"* (2023); *"Programming for Distributed Systems"* (2023, 224 pp.); and the teaching manual *"Non-Relational Databases: Laboratory Practicum Guide"* (2023, 176 pp.). All publications possess ISBN and COBISS-ID identifiers.

5. General Characteristics of the Candidate's Activity

The candidate's activity encompasses teaching courses in the fields of web, mobile, and distributed systems, computer organization, and databases; research across three interconnected thematic areas; and participation in 10 scientific projects, serving as the principal investigator (project leader) for 5 of them. Details are provided in sections 5.1–5.3.

5.1. Teaching and Pedagogical Activity (Work with Students and Ph.D. Students)

According to the official certificate of taught courses, the candidate lectures on the following subjects:

No.	Degree	Course	Specialty	Lecture Hours
1	Bachelor	Internet Programming	KST, SKI	30
2	Bachelor	Computer Organization	KST, SKI	30
3	Bachelor	Non-Relational Databases	SKI	30
4	Bachelor	Mobile Device Programming	SKI	30
5	Bachelor	Programming for Distributed Environments	SKI	30
6	Master	Mobile Internet Systems	KST	24
7	Master	Data Mining	SKI	24
8	Master	Computer Organization (Preparatory training)	KST, SKI	30
9	Master	Internet Programming (Preparatory training)	KST, SKI	30

The candidate has successfully supervised one Ph.D. student, Dr. Viktoria Tsvetanova Velkova. According to the attached diploma issued by the Technical University of Gabrovo (Department of Computer Systems and Technologies, Reg. No. 0114, issued on 21.10.2025), she defended her dissertation on October 14, 2025, on the topic “*Development and Investigation of a Service for Delivering Personalized Content to Open-Air Museum Visitors*” under the Ph.D. program “Automated Information Processing and Control Systems” (professional field 5.3). The topic directly aligns with the candidate’s thematic Area III. V. Velkova is a co-author with an equal share in six of the submitted publications (G7.1, G7.2, G7.3, G7.4, G7.6, and G8.15).

The candidate is the author of 5 textbooks and 1 teaching manual. Thematically, four of the publications correspond to the courses he teaches: “*Data Mining*”, “*Mobile Device Programming*”, “*Programming for Distributed Systems*”, and “*Non-Relational Databases*” (laboratory guide). These were published by the Vasil Aprilov University Publishing House – Gabrovo, while “*Network Programming*” (2007) and “*JavaScript – Introduction to Programming*” (2018) were published by Abagar and Faber, respectively.

Rosen Ivanov is a Senior Member of the IEEE – the world's largest engineering association.

Associate Professor Rosen Ivanov, Ph.D. has served several times as the team leader for the Technical University of Gabrovo in the National Student Olympiad in Programming. In 2026, TU-Gabrovo hosted the Olympiad, and Rosen Ivanov was responsible for the software installations on the competitive computers.

5.2. Scientific and Applied Research Activity

The scientific activity is focused on three areas: outdoor navigation and positioning, indoor navigation and localization, and contextual, IoT-based, and personalized services. The candidate has published 35 papers and one monograph; the scientific propositions are accompanied by implemented prototypes (mobile and web applications, microservices, IoT devices) and validated in simulated and real environments (tests with 12 and 20 visually impaired users, tests in an open-air museum). Project participation is detailed below:

Period	Contract	Topic	Role
2009	E917	Mobile Augmented Reality Systems – Indoor Tracking Algorithms	Leader
2012-2013	E1209	RFID-based Navigation System for Visually Impaired People in Unfamiliar Buildings	Leader
2016	D16177E	Cloud-Based Service for Automated Medication Intake Monitoring	Leader
2017-2018	1710E	Development of a Smart Medication Dispenser with a Privacy-Preserving Architecture	Leader
2020-2021	2006E	IoT-Based Service for Personalized Content Delivery and Automatic Customer Profiling	Leader
2014-2015	E1407	Digital Presentation of Ethnographic Materials (PI: Assoc. Prof. E. Zaharieva)	Team Member
15.12.2016 – 15.12.2018	DN 07/10 (BNSF)	Research on Architectures, Models, and Methods for Autonomous Management in the Future Internet (PI: Prof. E. Pencheva, D.Sc., TU-Sofia)	Team Member
2022-2023	2209E	Virtual Laboratory for Training in Digital Hardware Design (PI: Chief Asst. Prof. P. Minev, Ph.D.)	Team Member
2024	E2409	Application of Modern IT Technologies for the Presentation, Preservation, and Storage of Cultural and Historical Heritage (PI: Assoc. Prof. E. Zaharieva)	Team Member
2025	NIP2025-15	Application of Modern IT Technologies for the Presentation, Preservation, and Storage of Cultural and Historical Heritage. Phase II (PI: Assoc. Prof. E. Zaharieva)	Team Member

The five contracts led by the candidate were funded by the state budget for scientific research (certificate issued by UCNIT at TU-Gabrovo, 17.06.2026) and are accounted for under Indicator 20 (100 points); participation in the five projects as a team member is accounted for under Indicator 18 (50 points). Participation in the Bulgarian National Science Fund (BNSF) project DN 07/10 is certified by the National Science Fund (14.07.2026). The topics of the managed contracts correspond to the thematic fields of the publications — navigation for visually impaired individuals, IoT services for personalized content, and cloud services for healthcare.

Scientific activity also includes reviewing manuscripts for journals with an impact factor (34 reviews for 19 journals). The candidate maintains active profiles in Google Scholar, ORCID, Web of Science, and Scopus.

5.3. Implementation Activity

The submitted materials do not include certificates or acts for the commercial implementation of the candidate's developments, nor patent applications or utility models (Indicators 25-26). According to the candidate's data, ExhibitXplorer has been tested at the "Etar" Open-Air Museum (Gabrovo) but has not yet been formally implemented. The applied nature of the activity is evident from the implementations described in the reports and their testing in real-world environments: the Internet-programmable controller tested at TU-Gabrovo (G8.1); the web controller for yogurt fermentation tested in laboratory settings and at the "ELVI" dairy plant (G8.16); the indoor navigation system tested in a hospital environment with 20 visually impaired users (G8.9); ExhibitXplorer tested at the "Etar" museum (B4.12); and the database of geofences for buildings and open spaces at TU-Gabrovo (G8.15).

6. Contributions (Scientific, Scientific-Applied, Applied)

In the habilitation reference sheet, the candidate has identified 12 contributions — one for each work in group B4. The personal contribution is beyond doubt, as all 12 works are sole-authored. I accept the contributions as defined by the candidate.

Scientific Contributions. The most well-substantiated contribution is the algorithm for finding the K-shortest paths in multi-storey buildings (B4.4). It was published in a journal with an IF of 3.545 and, in all test scenarios, performed faster and with lower memory overhead than the fast version of Yen's algorithm. The RSTS algorithm (B4.1), which simplifies GPS routes in real time by removing over 90% of data points and reducing file size by more than 30 times, is equally convincing. The third group consists of localization algorithms using BLE beacons. Micro-localization (B4.9, error under 1.5 m) and the analysis of five algorithms (B4.5, error under 1 m, in simulated and real environments) are well-supported. The fuzzy logic beacon selection method (B4.11) has been tested only in a simulated environment.

Scientific-Applied Contributions. The Building Information Model (BIM) for navigation (B4.3) has been cited 27 times, including in *Automation in Construction* (IF 2025 = 12.6), demonstrating that it has been recognized in the field. The microscopic pathfinding (B4.8) and RSNAVI (B4.7) represent solid engineering design solutions, and I accept them as conceptual contributions. B4.2 was tested with 12 users with various visual impairments, and 20 users tested the system from G8.9 in a hospital setting.

ExhibitXplorer (B4.12) should be evaluated as an architectural contribution, given that GPT was utilized as a pre-trained model.

Applied Contributions. The candidate has designed and tested numerous working prototypes: mobile navigation applications, a MATLAB toolbox, geofencing services, a ChatGPT interface, and IoT systems for health monitoring. These have been validated in simulated and/or real environments.

7. Evaluation of the Candidate's Personal Contribution

For participation in the competition for the academic position of "Professor", a list of 12 publications is presented (articles in reputable scientific journals and papers from prestigious conferences from the period 2010–2023), in which Associate Professor Rosen Ivanov, Ph.D. is the sole author, making his personal contribution indisputable.

8. Critical Remarks and Recommendations

The candidate's materials are perfectly organized and presented. I have no critical remarks or recommendations.

9. Personal Impressions

I have long-standing, excellent personal impressions of Rosen Ivanov both as a fellow faculty member and as an individual. Student feedback characterizes Associate Professor Rosen Ivanov, Ph.D. as a highly erudite and principled educator.

10. Conclusion

In view of the above, I propose that **Associate Professor Rosen Stefanov Ivanov, Ph.D, Eng.** be elected to the academic position of "**Professor**" at the Technical University of Gabrovo, in the Field of Higher Education: 5. Technical Sciences, Professional Field: 5.3. Communication and Computer Technology, Specialty: "Automated Information Processing and Control Systems".

Date: 15.10.2026
Gabrovo

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(Prof. Stoyan Kapralov, D.Sc.)