

OPINION

on a dissertation for awarding a scientific degree "Doctor "

Field of higher education: 5. Technical sciences

Research area: 5.3. Communication and computer systems and technologies
(Automated information processing and management systems)

Dissertation theme: "DEVELOPMENT AND RESEARCH OF A SERVICE FOR
DELIVERING PERSONALIZED CONTENT TO VISITORS OF OPEN-AIR MUSEUMS"

Author of the dissertation: MSc. Eng. Victoria Tsvetanova Velkova

Scientific jury member: Prof. DSc. Evelina Pencheva

1. Topic and relevance of the dissertation

The digitization of museums has become increasingly popular in recent years, transforming the way visitors engage with exhibits and open spaces, offering convenience, information, and interactive experiences. Digitalization provides an easy and accessible way for visitors to explore content at their own pace. Real-time personalization of delivered content involves instantly adapting experiences, content, or offers to individual users based on their current behavior, demographics, and preferences. This dynamic approach ensures that users receive appropriate information and engagement, ensuring that the visitor experience is relevant and engaging. By focusing on what interests them, visitors are more likely to absorb information and enjoy their visit, leading to a more fulfilling and educational experience.

The scientific research presented in the dissertation is aimed at solving the problems related to the implementation of systems for delivering personalized content to visitors to open-air museums, namely: lack of financial and technical resources of museums to implement complex personalized systems; protection of personal information when collecting data about visitors; need for constant maintenance and updating of content; and protection of copyright and cultural heritage in an online environment.

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

The first chapter of the dissertation provides a comprehensive and in-depth review of the digitization of museums. The critical attitude of the doctoral student towards the research and solutions related to the problems considered is evident. The analysis focuses on technologies used in smart museums, the personalization of content delivery and the specificity of delivering personalized content in open-air museums. A total of 158 works by other authors are adequately cited and analyzed in the dissertation. After the conclusion, the goal of the research in the dissertation and the scientific tasks arising from it are clearly and precisely formulated.

3. Compliance of the chosen research methodology and the set goal and objectives of the dissertation with the achieved results

The correspondence of the chosen research methodology and the set goal and tasks with the achieved contributions is well justified and it should be emphasized that the set goal and tasks are closely related to the achieved results and contributions in the dissertation work. A correct approach has been applied, in which M.Eng. Victoria Velkova has synthesized and formulated precisely both the goal and the tasks in her dissertation work.

For the implementation of the service, the microservices architecture has been chosen, as a modern approach to software design and development, which focuses on the separation of complex applications into smaller, independent services. The chosen microservices architecture solves problems related to scalability, modularity, technological independence, error isolation, rapid development and improved resilience. Near Field Communications (NFC), geofencing (Global Positioning System (GPS)/Bluetooth Low Energy (BLE)) technologies for precise positioning of museum visitors and artificial intelligence (GTP application programming interfaces) for dynamic content generation are integrated. Explicit (via surveys), pseudo-explicit (OAuth) and implicit (GPS/BLE) methods are used to segment visitors to outdoor museums.

4. Contributions of the dissertation

As a result of the research conducted, the results achieved are summarized as scientific, applied science and applied contributions. They relate to the creation of new and improvement of existing models, methods and approaches in the scientific field under consideration, as well as the expansion of existing knowledge.

An innovative architecture based on microservices and an original algorithm for providing personalized content to visitors to open-air museums have been developed. A methodology for segmenting visitors and a methodology for experimentally determining the signal strength attenuation exponent when using BLE beacons have been developed. A database in GeoJSON for objects of the Ethnographic Open-Air Museum "Etar" has been developed. Test mobile applications have been created with innovative functionality for visitor localization, delivery of personalized content, intelligent management of the phone's energy mode and a personalized user interface adapted to different types of users.

The formulated contributions are justified correctly and reflect the research work carried out by the doctoral student. They are relevant and applicable in the development of services and applications for personalized content delivery to open-air museum visitors.

5. Authorship of the obtained results

The scientific and applied contributions described above are included in the doctoral student's publication activity, which is sufficient in volume and content. They have been popularized in appropriate and established forums in the field of dissertation work. This means that the results of the dissertation have gained the corresponding popularity and recognition in scientific circles. In this regard, the personal participation of M.Eng. Victoria Velkova is indisputable and confirmed by the presence of 2 independent publications and 6 publications in co-authorship with the scientific supervisor, in 2 of which she is leading author.

6. Publications and citations of publications on the dissertation

All 8 publications are of theoretical and applied importance, are related to the dissertation and the professional direction 5.3 Communication and Computer Engineering. Of the 8 publications attached, 7 were presented at international conferences in Bulgaria and 1 at an international conference abroad. 5 of the publications are referenced in the SCOPUS database, and 4 - in Web of Science. It is important to note that at the time of preparing the opinion, a total of 10 citations were found.

7. Opinions, recommendations and remarks on the dissertation

The dissertation is well structured with a focus on the technologies used. I have no comments on its content, theoretical and applied content of the publications.

I would recommend that M.Eng. Victoria Velkova continue her scientific activities in the chosen research direction and publish the results of her research in international journals.

8. Conclusion

Based on the above, a general positive assessment of the theoretical and practical results achieved in the development of this dissertation can be given. The defined scientific and applied contributions, reflected in a sufficient number of publications and in appropriate international forums, are quite sufficient grounds for a clear positive conclusion regarding the qualification of the doctoral candidate and her confirmed in the dissertation qualities of a scientist in her chosen field.

Therefore, I propose to the esteemed Scientific Jury to award the educational and scientific degree "Doctor" to MSc. Eng. Viktoria Tsvetanova Velkova in the field of higher education 5. Technical sciences, professional field 5.3. Communication and computer technology.

31.07.2025

Sofia

Scientific jury member:

/Prof. DSc. Evelina Pencheva/