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Doctoral Dissertation Review
Mostafa Abotaleb

Analysis and Assessment of The Quality of Wireless Information Transmission in Shipboard Measurement and Control Systems – Collaborative Perspective

The review was prepared in response to the letter from the Dean of the Faculty of Electrical Engineering at the Gdynia Maritime University, Dr. hab. Eng. Piotr Jankowski, Professor of GMU, dated September 26, 2025. The review concerns the procedure conducted in the field of engineering and technical sciences, within the discipline of automation, electronics, electrical engineering, and space technologies, in accordance with the Act on Higher Education and Science of July 20, 2018 (Journal of Laws of 2024, item 1571, as amended).

1. The basis for preparing a review

According to Article 187 of the Act, the opinion concerning the doctoral dissertation includes an assessment of the following elements:

– the candidate's general theoretical knowledge in the discipline,

– the ability to conduct independent scientific research,

– the originality of the solution to the scientific problem and the application of the candidate's own research results in the economic or social sphere.

The review concludes with a final statement on the fulfillment of the statutory requirements. The review has been prepared in both Polish and English, while the dissertation itself is written in English. Both language versions are to be regarded as equivalent; in the event of any discrepancies, the English version shall take precedence.

2. Bibliographic data of the doctoral dissertation

The reviewed doctoral dissertation M.Sc. Eng. **Mostafa Abotaleb** entitled "*Analysis and Assessment of the Quality of Wireless Information Transmission in Shipboard Measurement and Control Systems – Collaborative Perspective*" is written in English. It comprises 135 pages, four chapters with subchapters, a list of abbreviations, and a bibliography containing 113 references, including online sources.

3. Evaluation of the topic of the doctoral dissertation

The subject of the dissertation has been formulated appropriately and provides an accurate representation of its overall content. The topic is precisely defined and demonstrates a clear alignment with the research aims and scope of the work. The subject matter is timely and of considerable scientific relevance, contributing to the advancement of research in innovative approaches to measurement and control systems employing wireless communication technologies, particularly the Wi-Fi standard and the WirelessHART protocol.

4. Brief description of the dissertation

The dissertation consists of four chapters. The first part is the Introduction, which presents the rationale for undertaking the described research work. The main component of this section is the formulation of the objective and the thesis of the dissertation. The thesis is divided into four points, all of which are of a technical nature and directly related to the stated objective of the work. The defined scope of the dissertation clearly indicates the activities undertaken to verify the thesis. Finally, the elements of originality are identified and further discussed in Chapter 1, which is devoted to wired systems used for real-time data transmission. This chapter discusses the adverse effects on data transmission resulting from the challenging environmental conditions affecting ship installations. Subsequently, basic communication models and the results of simulation studies concerning the discussed issues are presented,

employing models of selected sensors. The conclusions derived from the simulation results are predominantly of a technical character. It is expected that during the defense, the doctoral candidate will provide a concise and synthetic summary of these findings.

Chapter 2 focuses on the WirelessHART protocol in wireless communication technology applied in automation systems, with particular emphasis on shipboard applications. The most important and original elements of this chapter are the mathematical models, their presentation, and the analysis supported by relevant literature references. During the defense, it is expected that the doctoral candidate will clarify whether Table 2.7 and the subsequent figures are, in the author's opinion, correct.

Chapter 3 is devoted to the application of Wi-Fi as a universal wireless technology in marine engineering applications. To conduct the laboratory experiments described later in the work, the author utilized Arduino MEGA 2560 and ESP32 development systems, which served as testing platforms. The conducted tests and experiments are described in detail, with ESP32 acting as the communication component. Finally, a system intended for shipboard operation is proposed and comprehensively described, with particular emphasis on its architecture and functional relationships.

Chapter 4 – The Discussion section serves as a concluding part of the dissertation, summarizing the main findings and reflections. In the reviewer's opinion, it effectively highlights the original contribution of the doctoral candidate, which possesses significant scientific and practical value. However, the dissertation lacks a discussion of the reliability of wireless techniques compared to traditional wired systems for measurement data transmission and control.

5. Assessment of the doctoral student's general theoretical knowledge

The doctoral candidate presents the theoretical background relevant to the dissertation topic in Chapters 1 and 2, and partially in Chapter 3. The bibliography is extensive and impressive, comprising 113 references. Even a cursory review of this collection confirms the candidate's thorough knowledge of the subject matter.

The main focus of the dissertation is the use of Wi-Fi communication between the nodes of the measurement and control system. The experiment described in Section 3.4 demonstrates that the candidate's expertise is also applicable to land-based systems. In the reviewer's opinion, the doctoral candidate can be regarded as a specialist in the field of communication systems for measurement sensors and control solutions intended for shipboard operation.

6. Assessment of the ability to conduct independent scientific work

The aspect of independently conducting scientific research related to the doctoral dissertation is of the utmost importance, particularly the application of the scientific method to acquire knowledge and solve the stated problem. In the technical field, this also includes applying the acquired knowledge to develop a practical application. The doctoral candidate has clearly fulfilled these requirements.

His research focused on the problem of measurement data transmission in measurement and control systems on ships — that is, under challenging environmental conditions as well as within the structural constraints of ships. The candidate developed an original methodology for designing and constructing wireless data transmission systems on ships. The results of his work have been published in professional and scientific journals.

The doctoral candidate demonstrates the ability to conduct independent scientific research.

7. Evaluation of the originality of the solution to a scientific problem

The doctoral candidate developed an original methodology for designing a Wi-Fi communication system on ships. The dissertation contributes value through experimental measurements conducted in the ship environment and by providing concrete recommendations. Literature in this field often remains at the conceptual or simulation level. This work offers a highly practical approach to solving wireless communication problems by addressing specific hardware limitations and demonstrating effective coping methods. This is a strong point compared to existing literature, which often leaves scalability as a challenge for future research.

The identification of directions for further research also provides a new perspective on the modern design of industrial measurement and control systems.

8. Debatable issues

To indicate that the dissertation meets the appropriate academic level, I kindly ask for responses or comments on the remarks included in the review text, which I quote again:

1. I expect that during the defense, the doctoral candidate will provide, in a concise form, a general summary of the findings derived from the simulation studies.
2. Justification for the selection of the ESP32.

3. There is a lack of information regarding the reliability of using wireless techniques compared to wired data transmission and control. Could specific examples be provided?

9. Final reviewer opinion

In accordance with Article 187 of the Act, three elements listed in point 1 of the review were evaluated by the reviewer. These elements are assessed positively. It is worth noting that the subject of the evaluation is not the quality of the doctoral dissertation itself, but rather the scientific work — the entire scholarly output of the Doctoral Candidate. I consider the research methodology presented in the dissertation to represent an original scientific contribution.

In conclusion, I state that the dissertation of M.Sc. Eng. **Mostafa Abotaleb**, titled "*Analysis and Assessment of the Quality of Wireless Information Transmission in Shipboard Measurement and Control Systems – Collaborative Perspective*", meets all the requirements set for doctoral dissertations as defined in Article 187 of the Act of 20 July 2018 — Law on Higher Education and Science (Journal of Laws of 2023, item 742, as amended), in the field of engineering and technical sciences, in the discipline of automation, electronics, electrical engineering, and space technologies.

I recommend that the dissertation be admitted to public defense.