

O P I N I O N

From: Prof. Dr. Lubomir Dimitrov, Technical University - Sofia,
For dissertation for the award of educational and scientific degree "Doctor"
Scientific area 5. "Technical sciences",
Professional field 5.2. "Electrical Engineering, Electronics and Automation",
Doctoral program "Automated systems for information processing and control"

Author of the dissertation: Milena Filipova Grueva

Topic of the dissertation:

"Group control of robotized vehicles for transport of goods"

Ground: Order № 111 / 9.6.2020 of the Director of IICT – BAS

The dissertation has a volume of 154 pages and consists of four chapters, literature, conclusion, declaration of originality and a list of the author's publications.

The aim of the dissertation is to study the types of group control of mobile robots and to propose innovative approaches for group control of non-holonomic mobile robots with application in robotized tools of transport of goods.

To achieve this goal, the following tasks are solved:

1. Overview, analysis and systematization of types of mobile robots and methods and tools for group control.
2. Study of known approaches for group control of non-holonomic mobile robots in a formation "following the leader" and in a distributed formation.
3. Offering for structure, organization and composition of a system for group control of non-holonomic mobile robots.
5. Offering for innovative approaches for construction of robotized tools for transport of goods with group control.
6. Conducting experiments for group control of robotized tools for transport of goods in different modes. The results will be analyzed.

The declared goal and the formulated tasks reflect the actuality of the dissertation. The results of group control of mobile robots allow application in tasks not only for transport of goods, but also for transport of materials in hospitals, nursing homes and others.

The author presents 9 publications - 1 at an International Conference Abroad (Rome), published in an International Journal, 1 in an English Journal in Bulgaria, 7 at National Conferences in Bulgaria. I personally noticed another post in Scopus from 2019 on the topic of the dissertation (An intelligent control system for service robots).

No data on citations or intellectual property protection are provided.

The dissertation is structured in 4 chapters and conclusion as follows:

An overview, analysis and systematization of types of mobile robots for different purposes has been made. Types of group control of non-holonomic mobile robots in the formation "following the leader" and in a distributed formation are presented. An innovative approach for group control of mobile robots in a centralized and distributed control structure is proposed. Modeling of mobile robots in Webots simulation environment is presented. Experimental results are given in the simulation environment Webots in three variants - with 3 and with 7 robots in the formation "following the leader". The third type of experiments is with 7 robots and a formation following 3 leaders. In conclusion, the expected areas of application of robotic cargo carriers with group control such as airports, hotels and resorts, hospitals, homes for the elderly and people with disabilities, warehouses and shops, industrial enterprises are discussed.

I accept the contributions formulated by the PhD student.

The contributions are scientifically-applied and applied. The indicated scientific-applied and applied contributions can be referred to the groups: proving with new means of essential new aspects of already existing scientific fields, problems, theories, hypotheses; creating new classifications, methods, constructions, technologies and obtaining confirmatory facts, constructions and methods and enriching the existing knowledge with practical application.

The abstract has a volume of 30 pages. It reflects the essence and content of the dissertation, including the purpose and tasks of the dissertation, the ways of their achievement and the obtained results.

The dissertation and its contributions are the personal work of the PhD student. The PhD student did a lot of research work and showed depth in entering this current field.

The dissertation is characterized by thoroughness, precision, striving to study the problem from different points of view and finding a working practical solution. The studied area is relevant with prospects for further development. I have remarks and recommendations to the PhD student, mainly related to the technical design of the dissertation, the preparation of the bibliographic reference, etc.

As a recommendation for future work, it would be good to focus more publications in prestigious international journals, as well as the protection of intellectual property.

Conclusion

The requirements of the Law for the Development of the Academic Staff in the Republic of Bulgaria and the Regulations for its implementation have been met. I give my positive assessment and recommend to the esteemed Scientific Jury to award the educational and

scientific degree "Doctor" to Milena Filipova Grueva, in the professional field 5.2. "Electrical Engineering, Electronics and Automation", doctoral program "Automated information processing and management systems".

6/24/2020
Sofia

Compiled by: ..

/ prof. Dr. Lubomir Dimitrov /

**NOT FOR
PUBLIC RELEASE**