

## OPINION

by Prof. Dr. Kostadin Kostadinov

of the dissertation work of mag. Eng. Stanislav Yovchev Yovkov  
on the subject: "MULTI-FUNCTIONAL LEARNING MOBILE  
ROBOTIZED PLATFORM",

submitted for the acquisition of the educational and scientific degree "doctor"  
in the doctoral program " Automated systems for information processing and  
management"

by scientific field: 5. Technical sciences

and professional direction: 5.2 Electrical Engineering, Electronics and  
Automation

### **1. Relevance of the problem developed in the dissertation work.**

The topic of the dissertation "Multifunctional Educational Mobile Robotic Platform" is in the field of educational robotics.

Robotics, and educational robotics in particular, is multidisciplinary, allowing learners to acquire integrated knowledge of mechanics, sensors, programming, artificial intelligence, physics and mathematics. Thus, theoretical knowledge leads to solving real practical problems.

Solving the tasks arising in the implementation of algorithms for navigation and localization of robots, as well as their programming, affect several fundamental problems of educational robotics.

Mobile educational robotics is already being studied in vocational high schools and universities, as well as in various schools and courses.

The relevance of the dissertation is determined by the specialties studied at the Universities such as: robotics, automation, artificial intelligence and ICT.

### **2. Evaluation of the scientific results and contributions of the dissertation.**

In the introduction, a brief justification of the topicality of the problem considered in the dissertation is made, and the purpose of the dissertation and the tasks arising from it are formulated on this.

In the first chapter, an overview of the development of robotics is made. The classification of robots and a forecast for the development of educational robotics are described. Three tasks are presented that the learning robots must be able to perform – obstacle avoidance, maze solving, and line following.



In the second chapter, algorithms for implementing the management of learning robots are analyzed. A training mobile Nitrobot differential platform was developed, including: sensors, power supply, drive electric motors with reducers, control controller, etc. Algorithms have been developed for: obstacle avoidance, maze solving and line following.

Experiments and comparative analysis of the results when moving from one point to another in the absence and presence of previously undefined obstacles of a robot with a differential drive and a robot with mecanum wheels were performed.

Algorithms have been developed to control a mobile robotic platform using a Huskylens machine vision camera.

In the third chapter, the algorithms for remote control of a robot with an infrared remote control and a joystick are developed. Based on the MIT App Inventor application, software with an interface for Android-based mobile devices has been developed for remote control of a learning mobile robot via Bluetooth communication.

In the fourth chapter, the experiments carried out with the developed robots using the synthesized algorithms are described. The results of the experiments show that for the same tasks, the robot with mecanum wheels performs the tasks with greater accuracy.

I accept and positively evaluate the scientific-applied and applied contributions in the dissertation, reformulated by me as follows:

- methods and algorithms are systematized for the control and navigation of learning robots when overcoming obstacles, searching for an exit from a maze, an exit from a closed space, following a line and remote control of learning robots;
- synthesis of algorithms for control and navigation of teaching robots with differential drive and with mecanum wheels, using the results of a comparative analysis of the work of robots with different navigation and drive.
- A learning robot was developed and the algorithms developed for line tracking and object tracking were applied to a robot navigating using a Huskylens smart camera;
- developed an interface for Android mobile devices based on the MIT App Inventor application, designed for remote control of an educational mobile robot by means of Bluetooth communication.

### **3. Opinion, recommendations and remarks**

The dissertation has been developed in the necessary volume and is a completed scientific research work. The doctoral student has carried out a thorough and systematic study of the problem and has proposed original solutions with scientific and applied results that fully meet the formulated goals and tasks of the dissertation work.

I have no critical comments on the substance of the dissertation and the presented results, but I have comments on the layout, style and use of some terms literally translated from English without using the already accepted terminology in Bulgaria.

My main comments are on the formatting of the dissertation, the notations in the block diagrams and algorithms in the English dissertation, the wrong citation of figures in the text of the dissertation and some spelling mistakes.

These remarks are not of the essence of the work and do not diminish the value of the contributions in the dissertation work.

My recommendations to the PhD student are to deepen his work in the field of robotics by expanding research in the field of Industrial and Service Robotics and to pursue the creation of a utility model or patent.

### CONCLUSION

I positively assess the work done and the results obtained in the dissertation. The dissertation meets the requirements of the LADRB and the Regulations for its implementation, as well as the specific conditions for acquiring scientific degrees and occupying academic positions at IIKT. I propose to the respected Scientific Jury to award the M.Sc. Eng. Stanislav Yovchev Yovkov the educational and scientific degree "doctor" in the field of higher education: 5. Technical sciences, professional direction: 5.2. Electrical engineering, electronics and automation, specialty in the doctoral program "Automated systems for information processing and management".

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