

OPPONENT'S EVALUATION OF THE BACHELOR'S THESIS

Student: Muhammad Rashid Zia

Opponent: Ing. Petr Dostálek, Ph.D.

Study program: Applied Informatics in Industrial Automation

Specialization: Intelligent Systems with Robots

Academic year: 2024/2025

Bachelor's Thesis topic: Autonomous Mobile Robot with Remote Control

Evaluation of the thesis:

The presented bachelor's thesis addresses the topic of controlling autonomous mobile robots, including the possibility of remote operation. The objective was to describe the fundamental types of autonomous robots, conduct a survey of available platforms suitable for educational purposes, and based on the findings, select an appropriate robotic platform for the practical implementation. In the practical part, the student was tasked with developing control algorithms for trajectory tracking and obstacle avoidance, as well as implementing remote control functionality via a smartphone.

The topic of the thesis is timely and relevant, and the scope and complexity of the assignment are in line with the requirements for a bachelor's thesis.

The theoretical part of the thesis is well-structured and provides a detailed examination of various architectures of autonomous robots and the algorithms used for their control. It also includes a comprehensive overview of the most commonly used educational robotic platforms, along with a comparison of their features and current applications in research.

For the practical part, the mBot Ranger robotic kit was selected. The student assembled an off-road tank-style robot and implemented software algorithms for trajectory tracking, obstacle avoidance, and hand tracking.

The following comments and observations pertain to the practical implementation:

- Pages 59, 60: It would be more appropriate to present the control algorithms for the individual autonomous modes using flowcharts rather than bullet-pointed text.
- The program lacks sensor data filtering, which may result in jerky robot movement or brief decision-making issues.
- In hand-tracking mode, the robot's speed could be dynamically adjusted based on the measured distance from the hand.
- The program does not periodically verify the connection status with the remote control, which could lead to a loss of control over the robot.
- The implemented remote control could be enhanced by adding manual control of the robot's movement with adjustable speed, which would improve its practical usability.

From a formal standpoint, the thesis is well-prepared. Only minor formatting issues were identified in the image captions on pages 44 and 53, as well as a completely blank page 48.

In conclusion, the bachelor's thesis meets the required scope and its outcomes are practically applicable in educational robotics laboratories.

Questions for defence:

1. What is the maximum distance at which the robot can be controlled using the smartphone-based remote control?
2. How would you enhance the robot's software to include monitoring of the remote control connection status?

Overall evaluation of the thesis:

The Opponent shall grant a mark according to the ECTS classification scale:

A – Excellent, B – Very Good, C – Good, D – Satisfactory, E – Sufficient, F – Insufficient

An "F" grade also means "I do not recommend the thesis for defence."

I recommend this thesis to be defended and suggest the following evaluation:

B - Very Good

In the case of an evaluation grade of "F – Insufficient", please supply the main shortages and reasons for this assessment.

Date: 2.6.2025

Thesis Opponent's Signature: