THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	Automated Detection and Closing of Holes in Point Clouds Using Unmanned Aerial Vehicles
Author's name:	Ernée Jan
Type of thesis :	bachelor
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Karel Zimmermann
Reviewer's department:	Department of Cybernetics

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	**ordinarily challenging**
How demanding was the assigned project?	
Please insert your comments here.	

Fulfilment of assignment	**fulfilled**
How well does the thesis fulfil the assigned task? Have the primary goals been achieved? Which assigned tasks have been incompletely covered, and which parts of the thesis are overextended? Justify your answer.	

Methodology	**correct**
Comment on the correctness of the approach and/or the solution methods.	
Please insert your comments here.	

Technical level	**A - excellent.**
Is the thesis technically sound? How well did the student employ expertise in the field of his/her field of study? Does the student explain clearly what he/she has done?	
Please insert your comments here.	

Formal and language level, scope of thesis	**A - excellent.**
Are formalisms and notations used properly? Is the thesis organized in a logical way? Is the thesis sufficiently extensive? Is the thesis well-presented? Is the language clear and understandable? Is the English satisfactory?	
Please insert your comments here.	

Selection of sources, citation correctness	**A - excellent.**
Does the thesis make adequate reference to earlier work on the topic? Was the selection of sources adequate? Is the student's original work clearly distinguished from earlier work in the field? Do the bibliographic citations meet the standards?	
Please insert your comments here.	

Additional commentary and evaluation (optional)
Comment on the overall quality of the thesis, its novelty and its impact on the field, its strengths and weaknesses, the utility of the solution that is presented, the theoretical/formal level, the student's skillfulness, etc.
Please insert your comments here.

III. OVERALL EVALUATION, QUESTIONS FOR THE PRESENTATION AND DEFENSE OF THE THESIS, SUGGESTED GRADE

Student fulfilled the assignment of the bachelor thesis. The thesis is clearly written, the only unclear part is the explicit definition of the optimization problem from the boundary extraction method, see question below for details. The main contribution stems from re-implementing the hole extraction algorithm from [1] and proposing the algorithm for estimating the viewpoints from which the missing data can be captured. The problem of estimating the capturing trajectory (the Generalized-TSP planning) has been solved via running an existing implementation used in MRS. Nevertheless, the student demonstrated the ability to perform independent engineering work and opened the space for an interesting future research.

The grade that I award for the thesis is **A - excellent.**

Question to be discussed during the defense:

1. There are two types of holes in the initial pointcloud:
   a. True holes that correspond to places, where no real-world surface is present and the lidar beam went through them. For example, open door or windows.
   b. Virtual holes that emerges in the pointcloud due to insufficient coverage of the real-world surface by sensory measurements due to occlusions.
   Do you explicitly distinguish between these two cases?
2. What is the explicit form of the optimization problem being minimized in the boundary extraction algorithm? Given a labeling of a pointcloud, what is the value of the criterion function and what are the constraints on the cycles that the labeling should satisfy?
3. What happens when multiple holes are tightly connected to each other making some points to be part of multiple boundaries? Is it allowed that a point is shared among multiple boundaries? If not, the optimization may suffer from combinatorial explosion, are you able to find the global optimum in such cases?
4. Is the outcome of boundary extraction always deterministic or does it dependent e.g. on initialization of BFS? What are the typical failure cases?

Date: **31.5.2023**   Signature: