THESIS REVIEWER'S REPORT

I. IDENTIFICATION DATA

Thesis title:	**Position Estimation of a Flying Target from a Camera Onboard a UAV Using Visual Tracking**
Author's name:	**Mykola Morhunenko**
Type of thesis :	master
Faculty/Institute:	Faculty of Electrical Engineering (FEE)
Department:	Department of Cybernetics
Thesis reviewer:	Ing. Tomáš Pivoňka
Reviewer's department:	Intelligent and Mobile Robotics Group, CIIRC, CTU

II. EVALUATION OF INDIVIDUAL CRITERIA

Assignment	ordinarily challenging

How demanding was the assigned project?

The assignment is adequate for a diploma thesis. The main goal was to implement an object visual tracker and use it to compare selected pose estimation methods. This localization system was evaluated for accuracy in relation to the tracking position and uncertainty.

Fulfilment of assignment	fulfilled with minor objections

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.

The author reimplemented several 3D position estimation methods, and in addition, he introduces one new approach – the degenerate Kalman filter extended with a subtended angle. All these methods were tested in several simulated scenarios, and the best-performing methods were also tested on data from experiments with a real UAV. My first objection is that the thesis focuses especially on general position tracking but neglects the visual tracking itself. The presented system uses only a standard OpenCV tracker; however, it was not used in any presented experiment except the presentation of several example images. The second objection is that each experimental scenario was tested only once despite a random noise influencing the results.

Methodology	correct

Comment on the correctness of the approach and/or the solution methods.

The overall approach was correct. In addition to the objections mentioned in the previous section, some technical details should be described in more detail. For example, how were the noise covariance matrices tuned?

Technical level	C - good.

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?

All the presented methods are sufficiently and clearly described in Section 3; however, the thesis lacks some important details related to the experiments (e.g., camera resolution and view angle) and motivation (why and how the particular methods were selected).

Formal and language level, scope of thesis	E - sufficient.

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?

The language is clear and easy to understand, but it is too informal in some parts.
The formal level of the thesis and its structure are the weakest points of the thesis. The first mistake is that the first letters of words in the main caption should be capitalized equally to the assignment. Further, I have serious objections to the introduction and its subsections. Instead of unnecessary general information about UAVs, the aim of the thesis in relation to other similar methods should be clearly declared. Its definition in the problem statement subsection is insufficient. The related work subsection should be more detailed and systematic, focusing particularly on the systems related to the

presented work. In addition, the mathematical notation should be outside the main text or in the particular section where it is used, not in the introduction. The introduction also misses a brief description of the thesis structure.

Since the second chapter is relatively short and describes only the standard Kalman filter, I would prefer to merge it with the Methods chapter, which describes some other adopted techniques. The method section itself sufficiently describes all the used methods. As mentioned, despite the methodology and experiments being mostly correct, their description misses some important details. In the last section, the achievements should be emphasized more, and the section could include more information about future development and potential applications instead of a brief summary of work done only.

The thesis also misses some standard parts, such as lists of figures and tables, and mainly the description of the attached code. Especially when the code and scripts are not documented in the attachment. Therefore, it was not possible to evaluate this attachment.

Selection of sources, citation correctness	C - good.
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?	
The cited sources were selected correctly; however, the related work should be elaborated more systematically. Moreover, it would be more convenient to sort the references according to their order in the text instead of the publication year.	

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

Summarize your opinion on the thesis and explain your final grading. Pose questions that should be answered during the presentation and defense of the student's work.

The author mostly fulfills the assignment, and I appreciate his work on the implementation of individual methods and their experimental evaluation, to which I have only some minor objectives mentioned above. Nevertheless, these results are devalued by the formal quality of the thesis, which I have to include in the final grade.

The grade that I award for the thesis is **D - satisfactory.**

Date: **3.6.2024**   Signature: