Department of Control Engineering
Faculty of Electrical Engineering
Czech Technical University in Prague
Technicka 2, Prague 6
Czech Republic

Master thesis review: "Robotic Lawn Mower" by Lukáš Bauer

To the master theses committee.

The presented master thesis describes a design and implementation of hardware and software for an automated robotic lawn mower, that, unlike recent commercially available solutions, utilizes an onboard camera image for the mower navigation – where to perform the mowing. The presented text fulfills the formal requirements for a master thesis and in 50 pages presents a review of existing solutions, choice of the experimental platform, design and experiments with the proposed AI techniques for solving the problems that are natural to such an uneasy robotic task. It is clear that the student devoted a lot of hours to the practical solution of the problem and therefore, while obviously running out of time, the text still could have been extended and improved at many places. Some of the sections are unnecessarily brief. Here are my main concerns:

- The text is missing analysis of the assignment, from which it would be clear what problems will have to be solved. This is then reflected by the thesis structure, in which some of the sub-problems appear to be *out of a blue sky* (e.g. SLAM in section 3.3).

- I miss a schematic drawing of the complete solution design. It would be very helpful if presented in the thesis introduction where it would serve as a reference for further sections since the complete system is composed from many functional modules. (e.g. in 3.4, why one needs a ground truth, why is the localization needed, what are the sub-problems?)

- The thesis needs to describe the achieved solution design, not the path towards it. It is clear that many dead ends were explored during the work. It is important to mention them such that further continuation of the project does not have to reiterate them, but it is important to mark them so in the final thesis write up (e.g. the tilted camera mounting should be the main focus because if brings the better results, the not-tilted mounting should be mentioned only).

- Some figures need a better formatting/labeling, e.g. figure 8.17 in which all the labels are *true*. The image contains two classes (grass/not grass) that could be split into two groups visually.

I would like the student to address the following questions during the thesis defense:

1. Why not get the orientation from the camera image (and not just from the odometry)?
2. How is the camera mounted on the vehicle (schematic figure missing)?
3. Is this a viable approach / would you recommend further development of a vision-based navigation for a lawn mower?

Finally, I recommend the presented master thesis to be defended before the committee and I suggest the following classification:

B – very good

In Lugano, June 15, 2020

Sincerely,

_____

Ing. Jan Koutnik, PhD
(reviewer)
jan@nnaisense.com
Director of Intelligent Automation & Co-Founder
NNAISENSE SA