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# Review of the thesis supervisor

## Title: Autonomous car driving with LIDAR

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The goals of the bachelor thesis were the following:

1) Review sensors suitable for a small autonomous car model
2) Prepare software for data processing of data from LIDAR. The software will run on an Arduino and control the car movement.
3) Design at least 2 test tracks for algorithm testing
4) Prove experimentally the functionality of your algorithms, including theirs limitations

The student started to work on the topic in autumn 2019, approximately in November. We had regular meetings, once per week. The initial task was to get acquainted with the area of sensors used to automate the movement of a small car model to make it autonomous. He should focus especially on LIDAR as a promising technology. In this time period he came to our regular meetings and he was able to work on the sensors review. For this period of time I evaluate his performance as good. He is able to do a review study.

However after the faculty closure in March 2020, he practically disappeared. He was not in contact with me for several months. The original submission date for the thesis was in June 2020, however the faculty has extended the deadline until August. The student contacted me about 1 week before the deadline saying that he would like to defend the thesis. Without any results, which I have refused. He was given a modified assignment for his second thesis attempt. After the first failed attempt his communication got better. We had online meetings, approximately one every two weeks.

In the practical part of the thesis the student has made effort. That is undeniable. However his performance in practical tasks was poor. It took him around 1 to 2 months to get the serial line between an Arduino and the LIDAR working. His understanding of mathematics or geometry required to detect and successfully avoid an obstacle is bad. His algorithm works just by detecting the maximal free distance and guiding the car in that direction. Without any consideration for the non-zero dimensions of the car. The result of this is that the car is doing “something”, sometimes reacts to the obstacle, sometimes not. Despite the fact that I have tried to explain several times how the detection should work he was not able to implement a successful obstacle avoidance algorithm. Based on the video he showed me, I would estimate the success of obstacle detection to about 75 percent. So the movement is not completely random, one can see that it detects something but a successful collision avoidance is not very probable.

My evaluation of the thesis will be influenced by the following:

- The student has shown me the thesis text about **4 hours** (!) before his deadline when he had to submit the final version **in print** and deliver it to the faculty. He had not shown me the thesis before. So there was not a chance for me to even guide him how the thesis should look like.
- The presented results in chapter 3 do not show that the car is able to avoid an obstacle. For example what should I see on figure 24? I see that the car is changing the angle of the front wheels. But I don´t see any relation at all with the obstacle detected. Where is the obstacle? Why did the algorithm choose such an angle? The LIDAR max angle vs. time – the blue curves in figure 24 – where in that chart can I see the obstacle and the reaction to it? How does the measured data correspond to the definition of the test tracks in figures 17 and 18. From the measured charts it is not visible, I don´t see any relation. The measured "max angle vs. time" looks like a random signal and the servo angle looks like a random walk. The same for all other presented experiments in figures 25 to 34. From the data the student presents I cannot conclude if he has created a functional algorithm to avoid the obstacle. Therefore I can´t confirm that he has fulfilled goal 4) of the thesis.
- For example figure 19 and 20 – the colors in the legend show 19 different variables. Why so many variable and where are they in the chart?
- The student has been working on the thesis topic for 1,5 years (from approx. November 2019 to February 2021). In this quite a long time he was able to make a software that is **slightly** better that a random movement. I find this to be a very poor result for such a spend time.
- The thesis results, if there are hardly any, are unusable for the future. I believe the only usable result are the few lines of code that read the measured data from the LIDAR and display them in a chart.

With respect to the above mentioned I grade the thesis with **„E - sufficient".**

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