Master's thesis review

Thesis title: Indoor navigation based on fusion of positioning signals
Author: Bc. Nikolai Garmayev
Reviewer: Dr.-techn. Ing. Jan Přikryl

The master's thesis presented by Nikolai Garmayev deals with an interesting issue in object localisation and navigation, namely indoor navigation. While providing an accurate outdoor navigation can be now considered as a mere technical problem, the thesis clearly demonstrates that in the area of indoor navigation we still have a number of problems to address before we would be able to provide object coordinates with sufficient accuracy.

The thesis structure follows that of the thesis assignment: The author starts with an overview of different indoor positioning techniques and attempts to classify them. This, in my opinion quite brief chapter is followed by a detailed survey of available positioning techniques, which should have included method principles, technical parameters and availability, and optionally SWOT analysis – but in many cases the author limited himself to citations extracted from numerous references. The rest of the thesis describes the theoretical background of the proposed measurement method, proposes the method for data fusion and presents an experimental evaluation of the proposed technique.

After reading the thesis, my main concerns are twofold:

- First, my impression is that the thesis structure has not been chosen ideally (many valuable pieces of information are spread over the whole text) and the author did not pay enough attention to formal issues (sometimes he uses footnotes instead of citations, some papers in the list of references are not cited in the text, he uses different abbreviations for the same methods – e.g. kNN, KNN, k-nearest; AoA, AOA – and sometimes he uses abbreviations that are not explained anywhere).
- Second, I am very surprised by the results of the fusion process: It is hard to believe that a properly implemented data fusion may make things worse; I am afraid that there is a methodological error somewhere in Mr. Garmayev fusion algorithm – on of the crucial points before merging information from FM and WiFi together should be an assessment of reliability of both signals and this is something I have not found in the proposed method.

Despite my formal and factual objections, the thesis presented here is acceptable and I recommend it for defence. My grading is **C – good**.

Questions for the defendant

1. I am curious about the fusion: my expectation would be that by fusing (or "merging") information from two information sources I would never make things worse, provided that I have appropriate models for both information sources. Do you have any, even preliminary, idea, how to address this problem? My guess would be that deciding which information is reliable and which is less so should be a quite common problem in data fusion.

2. How does the indoor localisation using a single GSM/GPRS station work? What other indicators besides signal strength (which will give you just a radial distance from the source) may be used in such a scenario?

Prague, January 9, 2015 Dr.-techn. Ing. Jan Přikryl