1 Background and problem statement

The topic of the project is related to the problem of indoor navigation. The context of the problem states that no GPS data are available at hand, which makes the use of usual navigation services impossible.

Most existing systems of indoor navigation require special mapping stage. Novel indoor navigation systems utilize the data recorded from users. This is what is called the crowdsource approach.

For realtime indoor navigation, in conditions where is no initial data is available, we have to pass stages of localization and mapping, which can be done simultaneously in SLAM approach. We aim to combine both SLAM and crowdsource approach for the best performance of positioning system.

The innovation of this research is in ability to provide same navigation services with less information and in more natural way, which means also the reduced cost of the system overall.

2 Objectives

We perform this research to create an indoor positioning system with special features. The objective of this research is to develop all algorithms needed to obtain these features.

We can write the criteria for the positioning system we develop.

Criteria for the proposed system:

1. no prior map is available: the system can work as SLAM system (realtime navigation with no prior map)

2. no special hardware for operation except smartphones: positioning accuracy enough for operation (1-2m is the usual accuracy in this conditions)

3. the system aggregate data from many sources (crowd-source) and improves the localization accuracy

We formulate several hypotheses we evaluate during research:

Hypotheses: The technology of magnetic field navigation can be implemented and fine-tuned for indoor croudsource SLAM

The data from magnetic field and inertial sensors is enough for running SLAM

The croudsource system satisfies the system optimality conditions and improve the accuracy

The hypothese 2 was not proved in existing systems. For most system, additional prior knowledge is needed. This is more the scientific interest to prove this hypotese.

Two other hypoteses are more the engineering questions. We have to compare performance and robustness of our algorithm and systems to other state of the art approaches. However for our problem statement, there is no much systems that have achieved any reasonable accuracy (1-2m). So we aim to achieve the accuracy that can be compared to other methods only.