Navigation to a human in motion by using points of interest

P4 + P5 reflection – Tim Nagelkerke – Geomatics for the build environment

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This thesis proposes the SEA* method that uses the iterative A* algorithm and improves this algorithm with using semantics, in the form of points of interest for the target, to deal with the following behavior of the iterative A* algorithm. In this way the generated path, that the user has to take to meet a target in motion, provides shortcuts to reach the target faster and is always able to reach the target. The limitation of the SEA* method, in contrast to the iterative A* method, is that if the target is heading to a point of interest and suddenly turns around, this method gives the same path or a longer path to reach the target.

Due to the lack of knowledge about programming in the languages Android and IOS and creating mobile applications, it was not possible to finally create a real-time working mobile application that uses the GPS sensor to get an accurate positioning in the outdoor environment. Therefore, this method is not tested in a real-time situation, which would be interesting to do in future work. However, real GPS data, obtained around the campus of the Technical University of Delft, is used to test the SEA* method. Also the method is tested within the indoor environment. Logical scenarios based on real situations within the faculty of Architecture are used to simulate the positions of both the user and the target to test this method.

This thesis research stimulated me to acquire in-depth knowledge about the concept of moving target search. Because this is widely applied in robotics, a robotics course was followed to get understanding of the robotics domain. This knowledge was necessary to bridge the gap between the Robotics domain and the Geomatics domain.

This research is formed and performed individually. The topic is chosen by my own interests and with the help of Sisi Zlatanova and Pieter Jonker (Biomechanical Engineering). Because of the lack of feedback and time from Pieter Jonker, he could not attend the P2 presentation and does not gave any feedback on my deliverables, Abdoulaye Diakité replaced him.

This research is a first step to provide a method that a person could use to navigate to another person in motion within the build environment. To my knowledge, there are no existing applications that use the concept of moving towards a person in motion. This research provides a concept to find people you need as efficient as possible. The main societal contribution of this thesis is to support navigation of a person to another person that they lost or need. In this way, children, elderly, family, coworkers and friends can be found more quickly. Especially the user could benefit from this concept if the person you need cannot communicate with the user, like small children or people suffering from dementia. Also in emergency situations, this method could help emergency responders to quickly navigate to their coworkers, without having to verbally communicate with their coworkers and could therefore completely focus on their primary task.

The SEA* method depends on the accuracy of the positioning techniques. The method could benefit from the growing markets of indoor localization, indoor navigation and outdoor navigation. The scenarios used in this thesis could also be understood as an application in the field of Geomatics. This research also uses an iterative A* method to validate the findings. The advantages and disadvantages of this method also provides knowledge for future implementations.

The fusion between concepts in the robotics domain and concepts in the Geomatics domain provided the developed method. However, the main focus lies on concepts in the Geomatics domain. This research uses the geographical data to provide a navigable model, adds semantics to the model to predict where the target is moving towards, uses knowledge about positioning techniques and navigation algorithms, which is all learned in the core courses of the master Geomatics. Especially the core courses GIS, Python programming, and 3D modelling form the basis of this thesis. The focus lies on the build environment, by using an example of navigating within a building and within the outdoor build environment. The master Geomatics focusses on analyzing, acquisition, management, processing and visualization of geographical data. This research covers each of these topics.