A Location-Based Educational Game for Understanding the Traveling Salesman Problem - A Case Study

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Motivation

The combination of mobile devices with location-based technologies allows new options and possibilities for the development of educational games which integrate learners' environment with real world examples.

In this paper, we present a mobile educational game which uses the Global Positioning System (GPS) technology to support learners in understanding concepts related to the Travelling Salesman Problem (TSP).

What is the shortest possible route ?
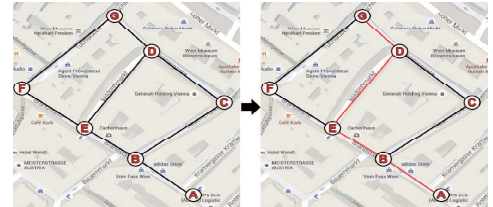
AB = 66, BC = 100, BE = 53, CD = 83, DE = 100, DG = 50, EF = 71, and FG = 110

The Game

The game idea is to combine the identification of routes between predefined locations in the real world with a quiz.

Problem-solving tasks

The player has to find routes between predefined locations in the real world. The locations on the map are represented by red markers. A blue icon represents the position of the player. The location that the player visits first is defined as start location and the tracking of the player's movements starts. The player's movements are visualized as lines.

Quiz
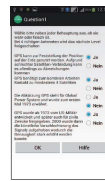
After each level, the players have to play a quiz in order to unlock the next level. The goal is that players reflect on what they have learned in the previous level and that they are able to answer a set of questions on their newly acquired knowledge.

Four Levels + One Extra Level for Personalized Routes

Level 1   Level 2   Level 3   Level 4
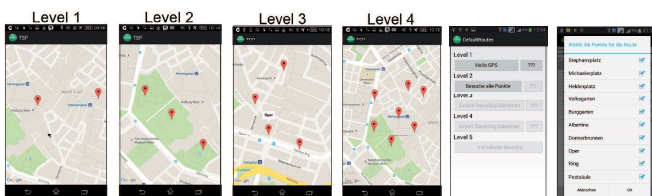
High-Score Table + Comparison Visualization of Routes
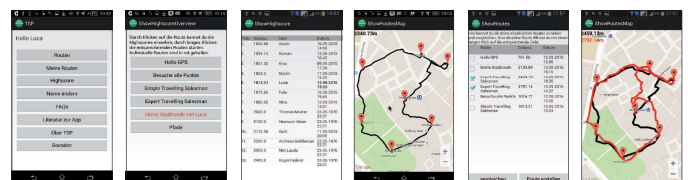
Evaluation

The game was evaluated with eight participants (4 female and 4 male) between 14 and 60 years. All participants had only little previous knowledge about route problems and route optimization.

The participants played the game for approximately one week. To assess the learning process, they had to solve tasks related to the optimal path, the Hamiltonian Path/Cycle, and the TSP before and after they played the game. Furthermore, semi-structured interviews were conducted.

Results

- 👍 The game was well received by the particpants.
- 👍 Evaluation indicates that the game can help learners to understand the concept of the TSP.
- 👍 Participants got the impression that they know more about route finding after having played the game.
- 👎 The routes were too long.
- 👎 Because of tracking inaccuracy, the game may present impossible routes (e.g., routes can lead through the middle of a house).
- 👎 Another consequence of the tracking inaccuracy is that it is difficult to compare several different routes.

(a)   (b)   (c)