

## Location-based Learning with Diverse Maps Applying Gamification Strategies

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### 1. Location-based learning and gamification

Location-based Learning is a type of knowledge transfer enabled by sensors responding to the actions of a user at a specific location in space and time to create a situated learning experience. Its quick development is based on the global proliferation of location-aware devices like smartphones and LBS. The learning is in a highly mobile context, and its content is highly contextual and immediately relevant to user's physical location. As some products already appear, reports show that the global market is growing quickly.

In designing such kind of applications, gamification strategy is often applied. Gamification is using game-based mechanics, aesthetics and game thinking to engage people, motivate actions, promote learning, and solve problems. It is the idea of thinking about an everyday experience like jogging or running and converting it into an activity that has elements of competition, cooperation, exploration and storytelling. So that an attractive system can be created, in which people want to invest brain share, time and energy. Stamp rally can be considered as a close example in daily life.

We insist that learning is not only in the progress of browsing content or "playing games", but also should be in creating content or "making games" by the users themselves.

### 2. Using diverse maps instead of commercial web mappings

Current location-based learning applications usually use commercial Web mappings as base map. Those maps are accurate, convenient and globally available, but they are designed for generic and multiple purposes, but without emphasis and diversities. On the other hand, there are rich resources of existing diverse maps in printed medias, such as illustrated maps in textbooks, guide books, magazines, pamphlets and so on. These maps are well designed for specific themes and are more attractive, therefore more suitable for knowledge acquisition. However, they are often distorted, as a result of exaggeration, simplification and decoration, which will bring difficulty for positioning.

Our proposed approach is called POI-based inter-georeference. We simply use points of interest (POI) as reference points. If we have got the coordinates of POIs both in the real world and in the map images, then we can locate our current position obtained from GPS to the map images by making a similarity transform with the nearest 2 POIs. Some analysis has been made on the error of the method. The results show that, the error become larger when the current position is far from the POIs or the line of POIs; and the error is acceptable when the current position is near the POIs or along the line of POIs.

### 3. Design of framework and development of experimental system "Manpo"

The approach above enables the design of structure of the framework. It uses multiple geo-referenced illustrated maps for particular areas, on which multiple POIs are located, and link to multimedia content. Location of user is considered to be the input to invoke content.

We have developed an experimental system on Apple Inc.'s iOS platform with the name Manpo. It has both browsing and editing functions. With Manpo, illustrated map can be imported by image or camera, POIs and medias can be added and edited by simple steps. Users can appreciate the created content in the real world, with the assistant of GPS to show their locations and trajectories on the maps. Maps and POIs are interactive both by users' operations and their actions in the real world.

We have made content and experiments for walking tours in many places, including Kashiwa, Kawagoe and Kesenuma in Japan, and also Columbus, Ohio in the USA and Munich in Germany. An iPhone App "UT Kashiwa Rally" using the same approach was made for the Open Campus event of the Kashiwa Campus of the University of Tokyo in October 2012.

We hope our approach can contribute as one solution to enable diverse maps in our latest mobile devices and innovate location-based services.

Keywords: Location-based Learning, Gamification, Illustrated Map, Ubiquitous Mapping