

# Mobile Treasure Hunt Games for Outdoor Learning

D. Kohen-Vacs, M. Ronen, S. Cohen

**Abstract**—We present an effort to provide teachers with a dedicated environment for designing location based games conducted via mobile phones. Treasure-HIT allows teachers to define a set of locations (using Google Maps and Google Street APIs), to attach clues that direct the players to the locations and to offer specific activities for each location. The system is primarily aimed to support the outdoor learning activities of the subject My Village as part of the national curriculum for elementary schools.

**Index Terms**—Treasure Hunt, Mobile Learning, Location Based Games

## I. INTRODUCTION

The recent vast availability of advanced mobile technology offers new opportunities for extending learning activities beyond the traditional boundaries of the classroom [1]. These technologies facilitate seamless learning across learning contexts [2, 3]. Learning applications supported by mobile technology could be adapted to different kind of spaces like museums [4], urban areas [5] and outdoor archeological sites [6].

One of the approaches of combining the outdoor space in learning is by Treasure Hunt type games. In such games, participants are challenged to identify specific sites according to clues and to reach these sites. An additional activity could be assigned at the sites as a condition to advance in the game. The game could be played by individuals or by teams.

Treasure hunt activities represent an old game based pedagogical approach that was traditionally enacted without any technological means [7]. Mobile technology can provide direct support for such games by: tracking participants' locations in real time, presenting the game clues in various multimedia formats, enactment of pre-planned interactive activities related to the sites, collecting and sharing digital information contributed by the participants, communication between participants and with the game's instructor and

controlling the activity by the game manager.

Various types of mobile treasure hunt environments were recently developed enabling the authoring and enactment of such games for different purposes.

GeoCoaching [8] is based on GPS enabled mobile devices that also provides constant online communication between participants. The communication component allows participants to share different resources during the game like clues, pictures or general text. Scavenger [9, 10] was developed to create treasure hunt activities aimed for intra-organizational training. Skattjat (treasure hunt in Swedish) [11] was designed to support collaborative problem solving. fAR-Play [12] serves as a framework that supports augmented/alternate reality games, in a treasure-hunt style, using space as the context for communicating information. These environments are not necessarily designed for pedagogical use by school teachers and do not provide cross culture support.

We aim to provide teachers with a dedicated environment for designing location games conducted via mobile phones. Our efforts are specifically directed towards adapting the technological capabilities to the teachers' needs while involving teachers in the design process.

## II. THE TREASURE-HIT

Treasure-HIT represents our ongoing efforts to develop a treasure hunt game authoring environment that supports learning across spaces [13]. The system includes two components: an authoring web environment used by the teacher to create and control activities and the player's application used by the participants (students) during the game enactment.

### A. The Authoring Environment

The authoring environment enables teachers to create and share activities. The activity definition includes the location setting for each station, the sequencing of the stations, the clues and activities related to each station and the feedbacks provided to players during the game. A created activity is stored in the activity repository and can be viewed by other teachers then duplicated and changed in order to adapt it to different needs.

The location of a station is set by a simple web interface that embeds Google Maps API, by positioning the marker anywhere on the map. The teacher can also control the

Dan Kohen-Vacs is with the Instructional Technologies department at Holon Institute of Technology, 52 Golomb st., Holon, Israel 58102 (mrkohen@hit.ac.il).

Miky Ronen is with the Instructional Technologies department at Holon Institute of Technology, 52 Golomb st., Holon, Israel 58102 (ronen@hit.ac.il).

Shavit Cohen is with the Instructional Technologies department at Holon Institute of Technology, 52 Golomb st., Holon, Israel 58102 (Dan Kohen is with the Instructional Technologies department at Holon Institute of Technology, 52 Golomb st., Holon, Israel 58102 (shavitc@hit.ac.il).

minimal required distance from the site (Tolerance), within the limitations of the GPS technology.

Fig. 1 presents an example of defining a station in the game

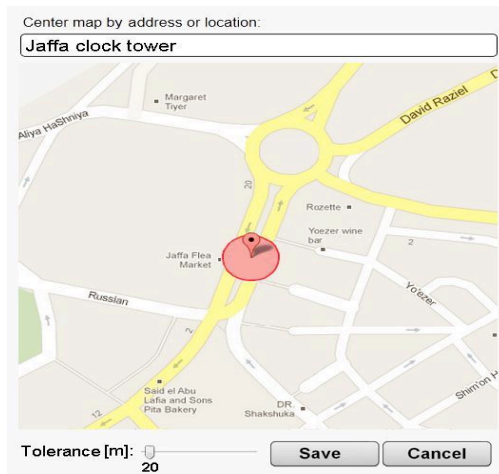


Fig. 1. Using Google Maps by author to mark treasure hunt stations

and the allowed tolerance.

Since the game may require exact sites of interest that may be difficult to pinpoint in a regular two dimensional map, further position refinement could be achieved using an additional interface that incorporates Google Street View API. Fig. 2 presents an example of fine positioning of the marker (symbolizing the station) on a real picture of the environment.

When defining a station the author is required to attach clues that would direct the players to each station. These clues



Fig. 2. Using Google Street view by author to refine stations' position

can be textual, uploaded images or links to websites (like YouTube). Each station has to be assigned with at least one clue.

The author can define whether all players will share the same starting point or the system will auto assign random

starting points. The author can also define the sequence of the stations in the game. The sequence could be automatically determined by the environment according to specific requirements like provision of the shortest and distinct path for each of the participants. The sequence of the stations can be identical for all participants or not, according to author's definition.

The author interface provides an ability to attach specific tasks to be performed by the players in each station, as a condition for advancing in the game. The task presented in a station may include quizzes or requirements for collecting different types of information that will be later used for class learning.

The author defines the special feedback that will be provided to players when they have reached the final station ("the treasure"). If the end station is identical to all, this feedback may be related to this specific site. If the players' paths are different, a generic feedback would be used to notify the player that he has completed the game.

The Treasure-HIT technological architecture provides a built in API that supports connectivity of the environment with other learning platforms. This feature enables teachers and students to use learning artifacts contributed in external environments in a Treasure-HIT game. For instance, a prior activity may involve students' in the definition of the sites of interest. Then, students may contribute the data on the location of the stations and their clues in other systems (like LMS) and this information could be imported to the Treasure-HIT author environment.

In the next versions the author environment will also include control and communication facilities allowing the teacher to follow the players' activity and to communicate with them in real time.

### B. The Player Environment

The Treasure-HIT player application serves for interaction during the game. It provides the clues for each station, verifies player's location, displays feedbacks and presents additional activities according to the player's performance. The interface was designed according to recent mobile users demand requiring support for cross platform mobile operating systems (MOS) [14]. Treasure-HIT provides support for a variety of GPS enabled mobile devices like iPhones and Android based devices that are commonly available to students.

Prior to activating a Treasure-HIT game for the first time, the user is required to install the Treasure-HIT player application according to the MOS used by his personal mobile device. Then, the user can to log in to the specific activity by entering a unique identifier that was provided by the teacher.

The player is presented with the initial instructions about the game and directed to his starting point. Clues directing to the next station are provided in various forms (text, pictures, and video). The player is challenged to identify and reach the station according to these clues. An example of clues provided to the player is illustrated in Fig. 3. When the player assumes that he has arrived to the desired location, he can verify his position by pressing the "Check Location" button (Fig. 3).

This action triggers the GPS location tracking.

If the detected location is within the tolerance range from the defined site, a confirmation will be provided and the activity will continue according to the author's definition:

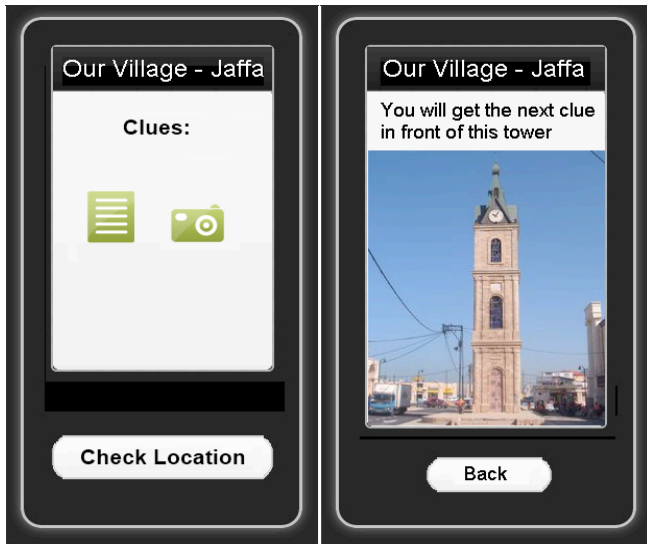


Fig. 3. Treasure-HIT end user's interface

specific tasks related to the site may be introduced and after their completion the player will be presented with the clues for the next station.

A Treasure-HIT activity can be enacted in different modes: as a competition between individuals or teams playing at the same time or as an activity to be performed by students in their time of choice. Younger students may be accompanied by their parents.

### III. IMPLEMENTATIONS AND TESTING

The first version of Treasure-HIT is currently tested with sample users in order to ensure technological stability and to verify the usability of the authoring and the player interfaces for the specific target population. Large scale testing with teachers and students is planned for the academic year 2013.

The national curriculum for elementary schools includes a comprehensive unit focusing on My Village. This unit is aimed to familiarize students with their close vicinity, to learn about its history and geography and to be aware of the local sites of interest. The teaching of this unit usually includes various outdoor activities combined with the class sessions and home assignments. The teachers in each school design their own activities, adapted to the specific characteristics of the school locality, according to the general curriculum guidelines. In small villages some of these activities may be shared by several schools.

Incorporating mobile treasure hunt activities in the teaching of My Village unit is part of the effort of the ministry of education to enhance technology supported learning and to take advantage of personal devices available to students for

conducting outdoor activities. Training sessions organized by the ministry of education with groups of teachers from 10 municipalities will start in December 2012. Teachers will design treasure hunt activities and enact them with students. A thorough evaluation study will accompany this implementation aiming to identify limitations and challenges and to adapt the system to the specific needs of teachers and students.

We expect, and hope, that teachers' pedagogical creativity will affect and improve the design of the system and will ultimately provide a collection of resources that other teachers can later use as examples.

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