LoCoL: Encouraging Social Interaction and Exploration Through a Distributed, Multi-Media, Location-Based Mobile Game

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Abstract. We present a mobile collector card game called LoCoL, which uses a GPS-enabled mobile phone with a built-in camera to collect, trade, and create digital artifacts from landmarks and places that players have visited. When a player carrying the phone with LoCoL enabled passes within a half-mile radius of a landmark, he or she collects a "card" for that location. Players may then trade with other co-located players to try and build a large collection of unique cards from places they have been or places their acquaintances have been. Additionally, if they discover new, interesting landmarks, they may share it with others by taking a picture with their phone's built-in camera and submit the location to the game as a new card which others may collect. There is an element of competition in that players compete world-wide to collect the highest number of unique cards or the most number of approved cards submitted. We hope to encourage players to learn about and explore new, interesting locations and promote social interaction by allowing users to trade cards and initiate conversations as a result of the game.

1 Introduction and Motivation

As Global Positioning System (GPS) enabled mobile phones become increasingly common, service providers will have the opportunity to offer consumers not only a variety of productivity enhancing applications but also interesting, educational and entertaining ubiquitous games. To provide owners of these mobile phones with a way to enjoy location sensing services, we have designed LoCoL (derived from Location Collector). LoCoL is a card collecting game with which players can collect digital cards related to interesting landmarks and places anywhere in the world when they enter within a half-mile radius of a card's GPS coordinates.

Collectors can compete against other players through a variety of measures, such as the most number of unique cards collected and the number of submitted cards approved. LoCoL's competitive structure encourages players to collect as many cards as possible. Through this collection, they have the opportunity to learn geography and history by recognizing pictures and reading their descriptions. Furthermore, the game encourages social interaction by allowing co-located users to trade cards with each other to increase their collection. Players can share hints about where to find

new cards. The overall size of the collection of cards is organic; any phone owner can contribute to the game by using a mobile phone's built-in camera to take pictures of locations and submit them to the game for approval. The unique characteristics of this game likely make it appealing to collectors of physical artifacts, frequent travelers, GPS enthusiasts, and possibly others.

While both GPS-based and mobile phone games already exist, LoCoL provides a game that allows users to play the game and collect cards both by hunting intentionally for cards and by serendipitously collecting them by passing within a new card's region. Players can compare their collections with users world-wide. Making a collector card game that is purely electronic can provide users with a fun way of collecting items without the expense of purchasing physical artifacts. Using mobile phones for this game is a cost-effective and efficient solution for players, since they would already be carrying around a device that includes GPS, network connectivity, and cameras. We hope to encourage people to explore new places, discover interesting landmarks, learn about the world both near and distant, and meet and interact with other players both online and in the physical world.

2 Description of the Game

The premise of LoCoL is simple. It is loosely based on similar concepts as collectible card games, such as the widely successful "Pokemon" and "Magic: The Gathering." Going beyond this metaphor, LoCoL leverages the additional features that players have on their mobile phones, including GPS, cameras, and communication capabilities. With LoCoL, players can not only collect items of interest, but they can add new items and communicate with each other about the game. A LoCoL card is defined as a digital artifact that has a unique card number, a photo of the location where it was created, its GPS coordinates, a short description of the place, the date it was collected, and the handle of the person who submitted it to the game. An example card is shown below, with both a "front" and a "back" that can be viewed.

(a)   (b)

Figure 1. An example LoCoL card. The front of the card is shown on the left (a), the back of the card is shown on the right (b).

For players to first access the game, it must either come preinstalled on their phone, or they may download it from the LoCoL website. New players must sign up for an account, which requires a unique handle and password. LoCoL requires accounts so that when a user collects a new card, the system credits her ranking, and if she upgrades to a new phone or borrows a friend's, she can easily access all of her game data. Users can choose to have the phone remember their user accounts and passwords so they do not have to log in each time they start the game. Once players have begun the game, they can browse their cards, view overall game statistics, view personal statistics, receive hints on where to find new cards, and trade cards with other players.

Figure 2. LoCoL options menu.

While the game is running, it can be sent to the background and the phone can be used as normal. LoCoL will attempt to obtain a GPS fix every thirty seconds and determine if the player is within a one-half mile radius of any cards. If she is, the card is added to her collection, and she is notified by a short tone. If the player wishes to view in the real world what is shown in the picture, LoCoL provides directions to the location where the picture was taken to help them find and explore new places. A player can obtain multiple copies of cards by revisiting a location after 24 hours have passed and can have a maximum of five copies of each card, allowing the player to build up a supply that can be traded with other players. We chose five to intentionally limit the number of copies of each card a user can stockpile, however, this value can be changed. This trading feature is designed to encourage players to meet and interact with people in the physical world who are also players in the virtual LoCoL world. To trade cards with other players, two or more players must be located within the same room. If "trade cards" is selected from the menu, a list of handles of players available for trading appears. The player selects who to trade with and is displayed that individual's collection. Users may choose to display only subsets of their collections, such as only the cards a player has that her trading partner does not.

Players have the ability to maintain their collections by browsing and editing cards. They can view all of the cards they have and read the information associated with each card. They may also delete copies of extra cards they do not want. If a player's collection is large, she may wish to use the search feature to find specific cards. Additionally, players can choose to trade cards with other players while browsing (*i.e.*, they see a specific card and decide to offer it to a friend).

When a player visits an interesting location for which no card exists, she can choose to make a card for that location by selecting "Submit Card" from the menu and taking a picture. GPS coordinates are associated automatically with the photo. The user can add a title and a short description of the location. The final step is to submit the card to a game moderator, who will approve or decline the card's addition. If the card is approved, it is added to that player's collection, credited with her handle on the back, and is made available for other players to collect. Submitting cards to the game is optional, so as not to exclude players who do not have cameras built into their mobile phones.
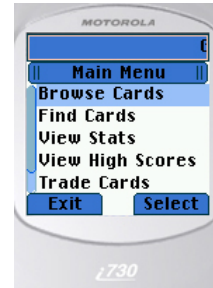
Players also can access a global ranking system that maintains a list of the players with the highest number of unique cards. A user may view the list of names and card counts, or view personal statistics that display how many cards have been collected, personal ranking among all players in the game, and the number of cards needed to move up a rank. To encourage people to submit new cards to the game, a central server also stores a list of the players who have submitted the most number of approved cards. Thus, publicly posted are two lists: one that ranks players based on the number of unique cards collected and a second that ranks players based on the number of approved cards created.

The game requires a set of game moderators to maintain the database of cards and approve new cards submitted by users. Game moderators accomplish these tasks through a web interface on a regular desktop computer.

3 Implementation

Our implementation of LoCoL uses a Motorola iDEN i730 cell phone with Nextel data service. The i730 features a 16-bit 130X130 resolution color display, a built in assisted-GPS module, a serial port for peripheral attachments, and the Mobile Information Device Profile 2.0 (MIDP) for the Java 2, Micro Edition (J2ME) development environment. LoCoL is written in J2ME using the MIDP 2.0 framework, although it is backwards compatible with MIDP 1.0 handsets. A Java-based central server stores registration information and user card collections. Figure 3 shows the high-level architecture of LoCoL.
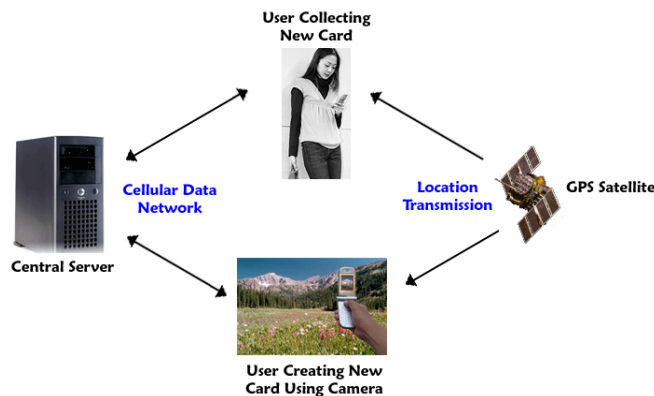

Figure 3: Diagram showing the high-level architecture of LoCoL. Users obtain location information from GPS satellites and communicate with a central server to maintain and add to their collection.

Motorola's Location API provides access to the A-GPS receiver for location information. The handset sends the user's latitude/longitude coordinates to the central server every thirty seconds using UDP. These coordinates are sent every thirty seconds because this time interval is frequent enough to acquire cards while driving in a car at 130 km/h (80 mph) and long enough to make it practical and affordable with

current mobile phone data plans (about 2 MBs of data a month if running 24/7, which is typical use of many mobile phone service providers). There may be situations where a user may graze a half-mile radius, so users can increase their location update frequency if they feel it is necessary. When a user actively interacts with the game, such as looking at current cards or trading, a TCP connection is created with the central server. The mobile handset acquires card collections from the server and renders them on demand. When a particular card is chosen, the phone downloads and caches other related cards (based on location) to help contend with the network latency while flipping through cards.

The Java-based central server stores the user's account information including the collection of cards, so that a user is not required to use the same mobile phone each time. Cards and user information are stored in a SQL data-base. The server also handles the card assignments by comparing a user's current latitude/longitude position with the cards in the database. Each time a user acquires a new card, their collection is updated in the database. Submitted cards are stored in the same system, and moderators control whether they are accepted or rejected using an administrator interface.

4 Related Work

Many location aware games have been developed as the availability of GPS location has become easier to leverage in mobile devices. For example, the "Can You See Me Now?" chasing game uses GPS enabled devices to allow three "runners" to run through actual city streets to chase up to 15 virtual players who are placed in a 3D model of the hosting city [6]. With similar concepts found in LoCoL, Mogi is a game in which players move about a physical environment to pick-up virtual items with the mobile phones and trade with other players online to complete item sets [8]. LoCoL differs from Mogi in that LoCoL supports a growing set of trading cards that are created by players who use the cameras on their phones to capture interesting locations. Additionally, the trading mechanism supported in LoCoL is available only when players are co-located with other LoCoL collectors. This feature is specific to LoCoL's goal of fostering face-to-face social interactions and differs from the trading mechanism supported in other cellular trading games, such as Digi-Koi [7].

Websites allow camera phone owners to easily capture and share interesting pictures, such as textamerica [3]. Other websites allow GPS enthusiasts to post stories and photographs of various places around the world, such as locations of different degree confluences [4]. These sites often allow users to share their visits to unique locations around the world. Similarly, collected LoCoL cards can be used to indicate that a user has visited various locations around the world. However, users can also trade collected cards for others. Although blogs, such as confluence.org, allow users to share their experiences virtually online, LoCoL supports this sharing only when a user is located in roughly the same space where a trading card was created or in person when collectors are co-present to enable a trade to occur.

The creation of information associated to a location for the purpose of sharing that piece of information has been previously explored in many context-aware applications, such as GeoNotes [5], E-graffiti [2], and StickeNotes [1]. Such systems allow

users to create and to leave virtual notes in a physical space, however, do not support the collection and trading of such items for entertainment purposes.

5 Conclusions and Future Work

LoCoL is a simple entertainment service that can easily be made available to anyone with a GPS and Java enabled phone. Players use LoCoL to capture pictures and information about interesting landmarks, to learn about the world through these tokens, and to socialize with one another virtually and in person. Members of our research group have played LoCoL and found it fun, informative, and easy to use, even for those individuals with no GPS experience. We plan to distribute the game to other players and use it as well as manual tools to expand the database of locations to include points all over the world. We further plan to conduct evaluations with players after they have used LoCoL for an extended period of time.

6 Acknowledgements

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