

A Context-Aware Smart Tourist Guide Application for an Old Palace^{*}

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Abstract

The goal of our research is to develop a smart context-aware self guided tour assistant as a context-aware real world application. As a context-aware tourist guide application, we have been developing a PDA-based location-aware tourist guide application for the old palace Deoksugung in the center of Seoul. It will guide visitors to the palace with information about: current location, attractions nearby, and details about specific buildings. Rich multimedia support has been incorporated into the system to provide extra features to enhance the self-guided tour.

1. Introduction

In the last few years significant efforts have been devoted in ubiquitous computing environment for capturing, representing, interpreting and exploiting context information [3, 4, 5, 6, 7,8]. However, we are still far away from developing smart real world applications, which allows for an implicit and intuitive awareness of context, and adaptation to behavior as efficiently as the human communication practice indicates. It is very important for ubiquitous computing to be useful to develop various smart context-aware real world applications.

We have been investigating location-based tourist applications targeted at held devices, such as PDAs

or cell phones. The hand held device is augmented with Global Positioning System (GPS) to provide regular updated information about the user's current position [1, 2, 7]. Such an application enables the user to participate in a self guided tour of a specific area that will display detailed information about specific features linked to their current position.

The goal of our research is to develop a smart context-aware self guided tour assistant as a context-aware real world application, which provides smart and personalized guide services based on implicit awareness of context. As a context-aware tourist guide application, we have been developing a PDA-based location-aware tourist guide application for the old palace Deoksugung in the center of Seoul.

It will guide visitors to the palace with information about: current location, attractions nearby, and details about specific buildings. Rich multimedia support has been incorporated into the system to provide extra features to enhance the self-guided tour.

In this paper we describe design and implementation of the application, and in particular focus on the context-sensitive features of the system. The hand held computing device used in the project is the HP pocket PC with GPS receiver. The PDA and GPS receiver is shown in Figure 1.

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Figure 1. PDA and GPS used in this project

While there have been a number of GPS enhanced tourist guide applications [1, 2, 7], this project focuses on a location-based practical application targeting the old palace Deoksugung in Seoul. We also provide a multi-lingual audio guide service and multi-modal guide service depending on the kind of users as well.

Main features of the system can be summarized as follows:

- 1) Location-based service based on PDA and GPS.
- 2) Simple and easy user interface.
- 3) Show attraction information near by the user's current position.
- 4) Several modes of guide for different kinds of users.
- 5) Provide a multi-lingual audio guide.

2. Overview of the System

We present a high level overview of the location-based tour guide to show its main features.

- 1) Location-based service based on PDA and GPS.

This application is implemented based on PDA and GPS to provide location-based tour guide services. It displays the user's current position and relevant information graphically on the tour map based on the position from GPS.

- 2) Simple and easy user interface.

This application provides users with simple and easy user interface, and provides an audio tour guide as well.

- 3) Show attraction information near by the user's current position.

This application guides users and shows attraction information around the user's current position.

- 4) Provide several modes of guide depending on the kind of users.

To provide user-friendly services, the application shows tour pages in one of three modes for different kinds of users: children, adults, and old persons.

- 5) Provide a multi-lingual audio guide.

The application also provides users with a multi-lingual audio guide for foreign tourists.

3. Design

As shown in Figure 2, the guide application program can be distributed from a PC. After distributed, users first have to synchronize database by clicking the 'DBSync' button in the main page. If users click this button, database is downloaded into PDA from the SQL server. Now, PDA receives position values through the GPS receiver. The program is now ready to operate and guide users.

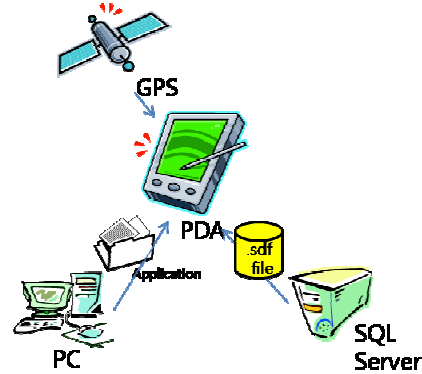


Figure 2. Architecture of the system

The overall structure of the application program is shown in Figure 3. For example, tour guide page operates based on SQL database and GPS module, which determines the current position from GPS information.

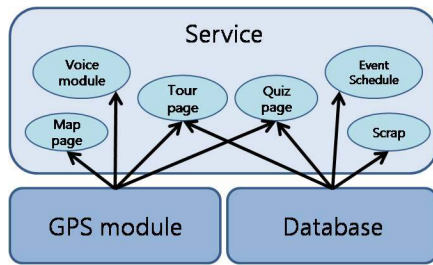


Figure 3. Structure of the program

4. Operation of the Smart Tourist Guide

Functions of the applications can be summarized as shown in Figure 4. The main page consists of three pages: Event schedule, Tour guide and DB sync. The tour guide consists of Map, Guide and Scrap pages. Each page and its function are described in the following.

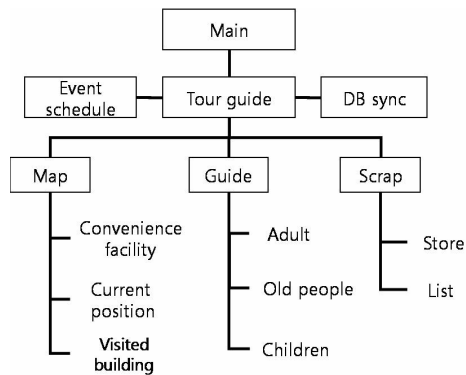


Figure 4. Function Diagram

4.1 Map Page

As in Figure 1, the map page is displayed when a user clicks map button. The map page has several services. It first shows the palace's whole area, and helps users find the current position, location of historic buildings, and other facilities like toilets and water fountains. The current position determined from GPS is always displayed on the map.

It also distinguishes between visited and unvisited places by different colors, and shows the course of the visitor that has been taken so far.

4.2 Guide Page

This page guides users to tour in the Deoksugung palace and provide users with the schedule of event and exhibitions in the palace. When the user passes a historic building in the palace, the information about it is displayed automatically as shown in Figure 5, and audio guide about it is provided immediately.

This guide page has three modes for different services for different people. Users can select one of three modes (Adults, Old Persons, Children) in this page. Each of them provides different services for different users.



Figure 5. Guide page

(1) Children Mode

The children mode tour page guides children users with information in one of three types of voices: friend, teacher and guide. This mode is set to the default 'Friend' voice. Children users can also take a quiz about the buildings to improve comprehension if they want.

(2) Adults Mode

The adult mode is set to the default 'Guide' voice.

(3) Old Persons Mode

The old person mode is set to the default 'Teacher' voice. Information is also displayed in bigger font size for old people who have difficulty in identifying small letters.

The Deoksugung palace hosts many events and exhibitions all the year round. National Museum of Art at Deoksugung also hosts many exhibitions and

runs programs. This guide page also provides users with the schedule of events, exhibitions and programs provided by Deoksugung and the National Museum Art of Deoksugung.

4.3 Other Pages

(1) Scrap Page

Users can scrap some pages into a scrapbook, if they want to see them again later. If the user clicks the scrap button while being guided, the current page of the guided building is clipped for later use. When the guide stops, if the user clicks the scrap button, it displays the list of clipped pages. Users can see the information about a building again by clicking the building's name in the list, if they want.

(2) DB Synchronization Page

Because this system sometimes needs to synchronize with the newly updated database, we provide this DB synchronization page for user's convenience. Users can synchronize the system with the newly updated database through this page. We also provide an input box for server address because SQL server address may be changed. This system should be connected to Internet for synchronizing database. Next, the user inputs server address, id and password in this page, and click sync button. If the new database is completely downloaded in PDA, an alert window about database synchronization will be opened.

(3) Option Page

After starting this program, users can select one of three modes in this page. Each of them is set to its default mode. Users can customize this mode by choosing voice and quiz, if they want.

5. Implementation

We implement the Smart Tourist Guide in Visual C#

on Windows XP.

5.1 Map positioning by GPS information

We divide the palace area into $5 \times 12 = 60$ blocks for efficient calculation of the current position by GPS information. The 60 small blocks are numbered from 1 to 60. One block covers a small region of latitude and longitude. When a user enters a block, the program first identifies the block number based on latitude and longitude information from GPS. Based on the block number, it shows the current position on the map page, and information about the building in the block. The current position is updated every 1 second.

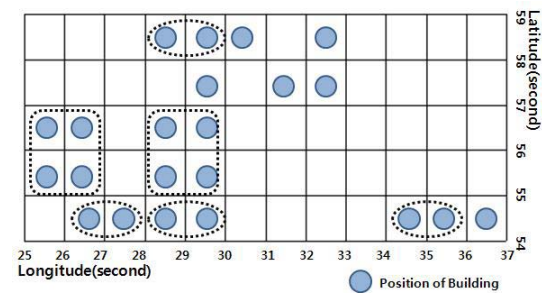


Figure 6. Blocks of the Palace

The small circles in Figure 5 are positions of building. Some circles are surrounded by a dotted line to represent a big building.

5.2 Implementation of tour guide

The information about buildings and events is stored at SQL server. Once the tour guide application has been started, the information is downloaded from the server into the application.

Once the current position is identified from GPS module, the application program is ready to guide the user with information about the current position and buildings around it. When the user passes a building, this guide finds out the building in the current block which is determined by location information from

GPS, and shows the information about the building.

The application provides information about events and exhibitions which take place in the Deoksugung and its National Museum of Art. Users can see a list of events and exhibitions by clicking the event schedule button, and can see the detailed information by clicking one of them. This part is independent from current position, so is implemented with schedule information in the SQL database only.

5.3 Implementation of other pages

(1) Scrap

The scrap function is implemented as follows. If users scrap the name of the guided building by clicking the scrap button, the application finds the building's name in the database and marks the record of the building.

When the guided tour stops, users can see the list of the names of scrapped buildings by clicking the scrap button. This list is constructed by running a SQL query to find out the records of the marked buildings. If users select one building name from the list, the application runs a SQL query to find all information about the building and displays that information. Finally, if users clear the marked building name by clicking clear button, it finds out the record and marks it off.

(2) DB Synchronizations

Because users can use smart devices like PDA more than two times, subscribers need to synchronize with publisher's database by using Merge Replication. The .NET Compact Framework provides the SqlCeReplication object to perform the merge replication.

Tourist Guide Application uses the SqlCeReplication object to synchronize with

database in SQL server. To do this, we first declared a method for synchronizing with event database and a SqlCeReplication object in it. Then, we gave values to several object properties such as InternetURL, InternetLogin, InternetPassword, Publisher, publisherDatabase, publication, subscriber and subscriberconnectionString. The InternetURL is SQL server CE agent (sscesa20.dll)'s URL. Because the URL may be changed, we get InternetURL, InternetLogin and InternetPassword from input box. When users click DB sync button in DB sync page, the method is called to synchronize with database in SQL server. This will complete the merge replication.

6. Related Works

There have been a number of research efforts into GPS-based hand held tourist applications, and we provide an overview of three of these systems. Our system is unique in that it focuses on a location-based practical application targeting the old palace Deoksugung in Seoul, and it also provides a multi-lingual audio guide service and multi-modal guide service depending on the kind of users as well.

Simcock et al. at University of South Australia developed a location based tourist guide application for the outdoor environment. This project focuses on software support for location based applications; they also discuss the processes involved in the development of this application [7].

Electronic tourist guide was investigated in a practical real-world environment [2]. They have built and tested different versions of electronic tourist guides for the city of Lancaster. They use a larger device (213mm x 153mm x 15mm in size and 850 grams in weight). This allows for a display to support a traditional web browser style interface, supplying a rich information service to the user. The wireless

communication allows a data store for tourism information and services.

Cyberguide is also a hand held electronic tourist guide system that supplies the user with context sensitive information [1]. Initially it was developed for indoor tours at the GVU, and then it was extended to operate outdoors with GPS. The focus of this system was investigating context sensitive computing, and as such only limited support for tour creation was implemented.

We also overview a number of areas currently being investigated by context aware computing with mobile computing. A conceptual Framework and a toolkit for supporting rapid Prototyping of context-Aware Applications are provided by Dey et al [3]. The use of hand held computing devices communicating via a wireless network has been investigated as a means to facilitate collaboration by Fagrell et al. [4]. Their architecture FieldWise is based on two application domains: first, mobile and distributed service electricians; and second, mobile news journalists.

7. Conclusion

As a context-aware tourist guide application, we have developed a prototype of a PDA-based location-aware tourist guide application for the old palace Deoksugung. We have shown how it can effectively guide visitors to the palace with multimedia information about: current location, attractions nearby, and details about specific buildings. We are improving the system for a smarter context-aware self guided tour, which provides smarter and more personalized guide services based on implicit awareness of context. We will also implement the application onto cell phones for more practical use.

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