Sri Lanka Institute of Information Technology

INERACTIVE GIS-BASED MOBILE TOURIST GUIDE

Project Proposal

Project ID: PIT-68

Submitted by:
1. DIT/07/C2/0262 – Chethana K.W.T.
2. DIT/07/C2/0257 – Koralage H.K.O.M.A.
3. DIT/07/C2/0325 – Gunawardana B.C.
4. DIT/07/M1/1158 – Munasinghe S.S
5. DIT/07/M1/2414– Rathnayaka R.M.K.P.

Submitted to:

(Supervisor’s signature)

Mr.Rupasinghe P.L.

Date of submission
March 01, 2010
**Project Title:** - Interactive Mobile Tourist Guide

**Project ID:** - PIT- 68

**Project Supervisor:** - Mr. P. L. Rupasinghe

**Group Members:**

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<tr>
<th>DIT No:</th>
<th>Name</th>
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**Date of Submission:** March 01, 2010
Abstract

The use of wireless networks in mobile tourist applications has brought about many services that have been branded “necessary” in many research projects. Mobile phones are pervasive devices, according to some estimates there are 2.5 billion mobile phone users in the world. The more mobile devices are sold, the more mobile services are developed and downloaded. Location Based Services (LBS) is one of those popular technologies. It provided valuable information based on user’s location such as nearest Fuel Station, Bank with the ATM machines etc…

This document presents the design issues and implementation of a context-aware ‘mobile tourism’ research prototype, which brings together the main assets of the Internet and mobile computing technologies. Namely, by using Internet web technologies it enables the creation of personalized portable tourist applications with rich content that matches user preferences. The users may download these customizable applications to their mobile devices. Thereafter, network coverage is only an option as the applications execute in standalone mode.

In this project, we propose to build the Mobile application for Tourist to enable them to spend quality time without wasting their time in finding proper guides. Our application provides them the necessary details about the tourist attraction sites, available accommodation and transport providers that resides closer to the tourist attraction sites and apart from that most significant feature in our system is that it provides services based on the current location determined via GPS or the manual entering of the current location or using cell ID.

The main purpose of this document is to provide a correct and detailed idea about the research and to provide complete idea about the problem solving approach. This document contains well structured chapters to guide the reader step by step effectively. It will address the problem area deeply and the solution for the problem very clearly. Finally it compares and contrasts the identified problem with the implemented solution.
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1. INTRODUCTION

Tourism is an industry which has adopted the use of new technologies. Computer science is connected with various tourist services (e.g. electronic tourist guides, digital interactive maps, tourist e-commerce transactions) mainly delivered via Internet. The Internet is a medium which is well tried and tested on many successful business models related to services provision. Recently the term ‘Mobile tourism’ has come into the spotlight. This term represents a relatively new trend in the field of tourism and involves the use of mobile devices as electronic guides and maps.

The first generation mobile phones, which used analog technology, were heavy and their coverage was patchy. Technical innovations in terms of hardware, software and protocols have contributed to the success of mobile phones and added them new capabilities. The handsets have become smaller and lighter, the battery life has increased, the reception has improved due to the improvements in digital technology and better use of the finite spectrum. The current generation of mobile phones is built using the digital technology and they connect to the Internet via new generations of wireless communications. Therefore they provide higher information transfer capability than the earlier generations. On the other hand, business and personal lifestyles are changing and evolving very fast. This calls for more flexible products and services that facilitate and support our new routines. In the mobile information society, delivering targeted and timely information and services has become essential.

Location-based services (LBS) provide users of mobile devices personalized services tailored to their current location. They open a new market for developers, cellular network operators, and service providers to develop and deploy value-added services. Location-based services answer three questions: Where am I? What's around me? How do I get there? They determine the location of the user by using one of several technologies for determining position, and then use the location and other information to provide personalized applications and services. Other services can combine present location with information about personal preferences to help users find food, lodging, and entertainment to fit their tastes and pocketbooks. There are two basic approaches to implementing location-based services:

- Process location data in a server and deliver results to the device.
- Obtain location data for a device-based application that uses it directly
IGMTG (Interactive GIS-Based Mobile Tourist Guide) represents a relatively new trend in the field of tourism and involves the use of mobile devices as electronic tourist guides. While much of the underlying technology is already available, there are still open challenges with respect to design, usability, portability, and functionality and implementation aspects. Most existing "mobile tourism" solutions either represent off-the-shelf applications with rigidly defined content or involve portable devices with networking capabilities that access tourist content with the requirement of constant airtime, i.e., continuous wireless network coverage.

This document presents the design and implementation issues of the IGMTG research project, which brings together the main assets of the two above-mentioned approaches. Namely, it enables the creation of portable tourist applications with rich content that matches user preferences. The users may download this personalized applications (optimized for their specific device model) from our web site or can purchase from our authorized dealers either directly to their mobile device or first to a PC and then to a mobile terminal (through wired or wireless connections). Using IGMTG users can find out the popular tourist historical site nearest to them based on their current location which is determined via GPS or the manual entering of the current location or using cell ID. And also they are provided with the necessary details on finding the nearest available accommodation and transport services.

The integration of multiple technologies, including tourism information systems, Internet and Geographic Information System (GIS) has given an exciting new access to tourism information. As information based society, tourist value systems and services that inform them about the location of touristic objects like hotels, restaurants, theatres, museums, etc. This helps the tourist to find the most relevant accommodation or to locate the position of a specific tourist place. The existing tourism information systems do not reflect this requirement. Mobile based GIS system provide more convenient for anyone to access Geographical information.

Geographical Query are more human understandable than a text information. Thus it’s very effective to used GIS-Data with mobile device due to now a days most of people familiar with the mobile devices than computers.

By considering current achievements in GIS-based system, some of the countries have build up mobile applications for tourist support. Most of the systems use Google Maps but the case of integrating and applying those technologies to our system is that the Google Map does not provide each & every detail of small locations of Sri Lanka.
GPS systems used by some vehicles today have the same problem mentioned above to find some locations. By implementing this system project team expect to fill the gap between tourist information (Geographical Queries) & the end User (tourist). It’s more easy to use mobile device rather than find information on pc before where ever you want to go. The brief introduction about the project is given in the introduction section. It also includes details about existing similar systems and comparison between those systems and how these systems differ from IGMTG. The objectives of implementing IGMTG are explained in the objective section. And the implementation is described in the methodology section. The initial budget for the system is given in the budget estimation section. Resources section includes the software needed for the implementation and also the task allocation among the team members.

1.1 BACKGROUND

With the improvements in the tourist industry, many tend to build interactive web sites for the purpose of guiding the tourist. But as the mobile technology developed mobile based applications become increasingly popular among the people. Mobile phones are now mini-computers which sense the environment through which they travel and they gather and generate data which can be easily harnessed and exploited yielding more intelligent aware systems. Newer mobile applications are leveraging the popularity of the Social Web revolution and in particular systems which encourage users to generate and share content online to enhanced social mobile applications.

Although there are many web sites developed for guiding tourist in Sri Lanka still there’s no any specific mobile application developed for such purpose.

Therefore our project team thought of developing a mobile tourist guide application which provides the necessary details on:

➢ Nearest popular and historical tourist sites based on the users current location.
➢ Nearest available accommodation providers
➢ Nearest available transport providers
➢ Details on the selected tourist site.

Mobile devices present many unique characteristics that make their use as electronic tourist guides particularly attractive, such as:
Ubiquity and convenience: mobile devices are portable, ubiquitous devices that come in many shapes and forms. There are various categories of mobile devices (i.e. Ultra Mobile PCs, Tablet PCs, PDA, Smart phones and Mobile phones). Even though there is a convergence of portable computing devices & mobile phones are still the most widely employed ubiquitous computing device readily available to tourists;

Positioning: by employing technologies like GPS and/or shine (i.e. Wi-Fi, Bluetooth) users may receive and access information and services specific to their location

Personalization: unlike PCs, handheld devices are typically operated by a single user, thereby enabling the provision of personalized services by wireless web portals.

However, several restrictions of mobile computing need to be carefully evaluated by tourist service providers: restricted energy capacity, limited computing power, amount of memory and storage space; small display size, limited color and font number support, small and hard to use keyboard (without the use of a stylus for most phones); limited bandwidth and high cost of wireless connections & although the capabilities of the mobile devices increase, the ‘resource gap’ between mobile and stationary devices will always be there.

1.2 LITERATURE SURVEY

Most existing commercial applications and research approaches in the field of mobile tourism basically fall within three main categories. That involve:

Navigational assistants, tourist or museum guides with pre-installed applications, namely rigidly defined content (in text, visual and auditory format) that cannot be customized according to user preferences.

Mobile devices that access mobile web portals, to browse or to update content.

Mobile electronic guide devices with content that is updated via external devices (i.e. shine or GPS) when the user is in range of the tourist attraction or via mobile network connections to access context-aware services.

The first approach presents the weakness in which the content of the mobile application can not be easily changed or dynamically updated; giving users content or map data that may be outdated. This is much in line with weaknesses of paper guides and paper maps.

The second approach implies the use of a mobile or wireless network to access Internet resources to portray information to tourists or to update information at regular intervals. This
approach requires constant connection (airtime) of the mobile device with a mobile network to offer access to web content. Similarly, the third approach assumes some type of network connection and tracking systems (e.g. GPS) to provide location-based services.

The Explore Sri Lanka is a system that will provide only the cost for a tour. This is also one type of Mobile Tourist Guide system which will provide only the travelling cost or in other words tour cost. The main different between Interactive GIS-Based Tourist Guide (IGMTG) system and Explore Sri Lanka is the portability and it will give some other features. The explore Sri Lanka system is a desktop system where IGMTG system is used in mobile applications. From a system like mobile application system, when the client want stop for a desktop machine while the traveling client will search the location from their mobile phone. So this will reduce the time and cost that taken to find the places. This IGMTG system is give more comparative benefits than the existing Explore Sri Lanka system. There are many web based systems in the internet that will also provide the details about the places , cab services and hotel but most of them are not Mobile based application when considering Sri Lanka situation. But in our system will be based on the mobile application which will provide the places but also the hotels, cab services, and also provide the nearest historic places travel destination and the cost of travelling. So based on this tourist can make arrangements with the hotels and cab services. Not only this, from the IGMTG system tourist can also find the low cost route to places to place Because of that time management as well as the cost management will be competitive.

The main objective of our system is to give a provide client services to the tourist which will give more competitive advantages. And make them satisfy with the Sri Lanka culture and ruins. Therefore the Tourist who are visit to Sri Lanka can manage their valuable time as well as the money in the way of effectively as well as the efficiency

Currently, tourism related information is dispersed in Blogs, Personal and Corporate Web sites. There is a need to provide a central location for add/retrieve information regarding tourism related services. Dedicated Navigation devices (like SAT-NAV from Dialog) are costly and not affordable for average user.
2. OBJECTIVES

Main objective of IGMTG is to implement a mobile tourist guide application to facilitate users in finding the most popular and historical tourist attractions and providing details on those selected sites. Therefore enable the tourists to enjoy the tour without any tension. If consider the cost factor it’s very cheap to use mobile navigation system rather than web system due to the commonness of the mobile devices. Also when comparing the cost for internet charges for pc is higher than mobile GPRS /3G services. And it’s also faster (around 3.5Mbps-7.2Mbps is now possible at Sri Lanka).One of the major goal to provide cost effective system for the end user.

Specific objectives

- Enable the users to find the closest historical sites from the current location by using mobile.
- Provide users the details on the available accommodation providers near to the user’s current location and also near to the selected historical site by using mobile.
- Provide users the details on the available transport providers by using mobile.

Generic objectives

- Provide users a user friendly environment to work with by providing the data based on the current location.
- Enable users to spend quality time by directly providing them the required detail without wasting time.
3. METHODOLOGY

Methodology describes how the project team is going to implement IGMTG system. First of all team have identified what are the main parts of our system. Basically the project will be research basis on mobile GPS navigation. When consider Sri Lanka’s present situation there are few mobile applications for tourists. Base on this issue project is divided the research into 3 main categories. Namely,

- implementing the mobile application
- Geo server /postgresql configuration
- Implementing the web interface
- Integration of above 3 modules (through a web service)

And also when consider the entire digital map of Sri Lanka, it is very huge & expensive therefore research part will be limited to city of Anuradhapura via the Puttalam Road. Since we are able to link up with the Dialog Research Lab, we were able to obtained the most secured data from them.

- Implementing the mobile application

In this module project team mainly focus on Google Android platform. Google Android is the only platform which supports java scripts. Google Map API is written & function calling through the java scripts. But in practical situation it’s very rare to have a Google Android phone in Sri Lanka by now a day. And even it’s not possible to have an android phone to everyone. By considering all these matters project team finally decide to use a standard J2ME supported phone for our application. But it should be GPS supported device.

Here project team are using the Web Services engine map into image conversion & image to map conversion. This image is the one that will be loaded to the phone. It will load as tiles into the phone or else the application will be slow due to the image size is large. Anyway Google Android also has 9 sec delay of loading JavaScript into memory at the first time program load. Image to map conversion will required when the user selected a location on our map and when he want to goes to the services details around that location.
- **Geo server /postgreSQL configuration**

  The roadmap is used in the format of shape file (.shp) & it is loaded to the Geo Server as a layer and the positions of the required locations (longitudes & latitudes) will load from the database (postgresql database) and integrate it with the other layers. Finally Google Map is add as an another layer to the Geo Server .Then project team combine all the layers into a one layer group. Three layers will be appearing as follows:

  1. Road layer

      This layer contain data locations such as junctions, road cross points (A&B roads), start & end location between nearest junction, length between these junctions and number of lanes.

  2. Point coordinates of locations layer

      This layer contains point locations of longitude & latitude of places. It is store in a postgreSQL database.

  3. Google Map

      This is initially use as a background layer.

    Advantage of using geo server is, it’s capable of handling any number of layers and combine those things as one map (layer group). And instead of using Google Map as a background layer can use our own map. (Some kind of scan map image also possible).that is the advantage of using GeoServer.Geo server capable of directly communicating with postgreSQL (POSTGIS plug-in required to work with GIS data)

- **Implementing the web interface**

  This is the main interface for web & it provides all the functions that capable. And if any user needs further details he can get to know all the detail through that web. This interface will create using jsp & servlet.

  And for this project team plan to use JSTL/ custom tags for scripting part. When create our own tag no one will able to read & understand our website by clicking the “viewsource”.This perspective make the security of the program high. Make using more complex java code at the JSP make the page load time considerable & weight of the page also will high.
Integration of above 3 modules (through a web service)

This is the final stage of the process & makes the application for run. In order to connect the mobile application & the geo server, Web Services engine will act as the intermediate for them. In order to make sure the security between the data project team use binary xml formats (make the program easy to read by the server). & the geo server can directly communicate with web interface. The services are handled by using the methods in servlet. After the integration the high level system architecture is as follow:

![High level architecture diagram]

FIGURE 1: HIGH LEVEL ARCHITECTURE

Research part(s)

As the Main problem project team identified, there is no all roads & junction on the Google Map (static). There are some marked locations of main cities. It's not enough to make a support for our project. So project team used a digital Map of Anuradhapura (*.shp) which is used by the road development Authority in Sri Lanka As a layer vise approach with Geo server.
➢ **Coordination Mapping:**

Since project team used a different map (coordination system different from Google Map: digital map used EPSG2010 coordination system: ellipses shape) project team need to bind all the Map information to the Google map. All that two maps are merged through a geo server.map GIS data to the Google Map will be a main research part.

And Google Map has different projection system. (Google map consider whole world as spherical shape).but that digital map of Sri Lanka use a different projection coordination system (center is piduruthalagala (lang, & latitude)).when binding GIS data with Google map there will be main problem during the projection of these two maps.

➢ **Device tracking.**

Since the user might be at the unknown location, then if he needs assistance from our application our application should able to assist him. For that purpose project team need to track his location. Then only project team can provide a map according to his location with the available services.

For the device tracking project team hope to use the GPS tracking or through the cell id .for that purpose project team got a support from dialog mobile research lab-university of moratuwa
3.1 WORK BREAK DOWN STRUCTURE

FIGURE 2: WORK BREAKDOWN STRUCTURE
4. RESOURCES
The following table will provide a brief description of tasks carried out by each team member and their responsibility in the project.

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<tr>
<th>Member</th>
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<tr>
<td>Chethana K.W.T.</td>
<td>• Lead the team</td>
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<td>• Conduct group discussions</td>
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<td>• Literature review</td>
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<td>• Requirement Analysis</td>
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<tr>
<td></td>
<td>• Design and develop the system</td>
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<td>• Database Handling</td>
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<td>• Testing</td>
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FIGURE 4: DIVISION OF WORK
4.2 REQUIRED SOFTWARE RESOURCES

- Postgresql 8.4
- Geo server 2.0.1
- Netbeans 6.1
- JSP Servlets
- J2ME 1.1
- Rational Rose
- MS Project
- MS Visio
- Google Map API
- MS office
- Quantum GIS
5. BUDGET AND JUSTIFICATION

In order to run Interactive GIS-Based Tourist Guide Application users should have an Android or any J2ME support Mobile Phone. Also need a digital road map because Google Map cannot identify some locations in Sri Lanka. Since the complete Sri Lankan map is very expensive, only a part of road map of Sri Lanka that is Colombo to Anuradhapura via the Puttalam was taken as the project area.

<table>
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<td>TRAVELLING EXPENSES</td>
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<tr>
<td>PRINTING AND STATIONARY CHARGES</td>
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<td>6,000.00</td>
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<td><strong>TOTAL BUDGETED COST</strong></td>
<td><strong>182,320.00</strong></td>
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FIGURE 5: BUDGET ESTIMATION
6. CONCLUSION

According to a tourism expert mobile tour guides will not replace tour guides or guidebooks, but they could help places that do not yet have plethora of guidebook documentation. Our perception is that mobile tour guides can be more active, efficient and exciting than books or live tours. This perception though is based upon future advancements in the field such as:

- further deployment of 3G networks (increased data rates, reduced cost of network connections);
- the upcoming of new services to change peoples' perceptions of cell phones (i.e. that devices can be used for entertainment rather than solely for talking);
- the upcoming of new devices with increased capabilities (i.e. support of Java by virtually all mobile devices);
- the overall cost of continuous network connection of mobile devices to the telecommunications operators network decrease.

In this paper a J2ME-based ‘mobile tourism’ research prototype has been presented. The main design objectives have been:

- To enable the automated creation of portable, personalized tourist applications (optimized for the specific user mobile device’s model) with rich and customized content
- To minimize the wireless connectivity requirement of the mobile tourist guide application user (following the application’s download and installation, network coverage is not further required as the applications execute on standalone mode, users should return online only to update their chosen tourist content)
- To cater for future dynamic application updates based on a ‘push model’, wherein new tourist content is pushed to the mobile terminal with minimal user intervention as soon as it is added by the administrator to the back-end database.

Regarding future work, the following directions are going to be studied:

- use of the optional MIDP ‘Location API’ which has been very recently released by Sun Microsystems to extend the tourist guide application so as to provide orientation, navigation and other location-based services (e.g. notifying the user when he/she walks next to a selected landmark)
➢ Design and implementation of algorithmic solutions (that take into account several parameters such as the user profile, the period of stay, the whether conditions, etc.) for suggesting near-optimal, daily tourist itineraries for tourists interested in visiting a specific set of sites (e.g. museums, archeological sites, parks, zoos, etc.).

➢ Design and implementation of a mobile peer-to-peer based framework using the J2ME platform [J2ME (2006)] for tourist-to tourist communication, in order to bypass the need for downloading content via mobile carriers networks where charges apply. Currently, a study of the use of social networks which allow users via Bluetooth, to “share” content among them offering the ability for collaborative filtering of content is on hand.

As our research unfolds project team are constantly following these technology advancements and incorporating them in our overall work.
7. BIBLIOGRAPHY

8. APPENDICES

- **J2ME**
  Java Platform, Micro Edition, or Java ME, is a Java platform designed for mobile devices and embedded systems. Target devices range from industrial controls to mobile phones and set-top boxes. Java ME was formerly known as Java 2 Platform, Micro Edition (J2ME)

- **J2EE**
  Java Platform, Enterprise Edition or Java EE is a widely used platform for server programming in the Java programming language. The Java platform (Enterprise Edition) differs from the Java Standard Edition Platform (Java SE) in that it adds libraries which provide functionality to deploy fault-tolerant, distributed, multi-tier Java software, based largely on modular components running on an application server.

- **Geo Server**
  An open source server written in Java - allows users to share and edit geospatial data

- **Postgresql**
  Often simply Postgres, is an object-relational database management system

- **Gantt chart**
  A chart used by project managers to show the project tasks, the schedule associated with these tasks and the people who will work on them. It shows the tasks start and end dates and staff allocations against a timeline.

- **UML (Unified Modeling Language)**
  A graphical language that is used in object oriented development that includes a several types of system model that provide different views of a system. The UML has become a necessary standard for object oriented modeling.
Netbeans
NetBeans refers to both a platform framework for Java desktop applications, and an integrated development environment (IDE) for developing with Java, JavaScript, PHP, Python, Ruby, Groovy, C, C++, Scala and Clojure.

IGMTG
Interactive GIS-Based Mobile Tourist Guide

LBS
Location-based service, mobile feature utilizing location information, such as GPS.

GPS
Global Positioning System - Space-based global navigation satellite system. It provides reliable positioning, navigation, and timing services to worldwide users on a continuous basis in all weather, day and night, anywhere on or near the Earth which has an unobstructed view of four or more GPS satellites.

Android Platform
Google Android - is a mobile operating system that uses a modified version of the Linux kernel.

Google Maps
Google Maps is a basic web mapping service application and technology provided by Google, free (for non-commercial use), that powers many map-based services, including the Google Maps website, Google Ride Finder, Google Transit, and maps embedded on third-party websites via the Google Maps API.

JSP
Java Servlet Technology - Java Servlet technology provides Web developers with a simple, consistent mechanism for extending the functionality of a Web server and for accessing existing business systems.
XML
Extensible Markup Language is a set of rules for encoding documents electronically. It is defined in the XML 1.0 Specification produced by the W3C and several other related specifications; all are fee-free open standards.

JSTL
JSP Standard Tag Library- A set of software routines in Java that are used in JSP pages by referencing them with tags. The JSTL is a common resource used by all JSP programmers; however, JSP custom tags can be written by any programmer who wants to develop a reusable routine.

3G
3G Networks - 3G allows simultaneous use of speech and data services and higher data rates (up to 14.0 Mbit/s on the downlink and 5.8 Mbit/s on the uplink with HSPA+). Thus, 3G networks enable network operators to offer users a wider range of more advanced services while achieving greater network capacity through improved spectral efficiency.

MIDP
Mobile Information Device Profile (MIDP) is a specification published for the use of Java on embedded devices such as mobile phones and PDAs. MIDP is part of the Java Platform, Micro Edition (Java ME) framework and sits on top of Connected Limited Device Configuration (CLDC), a set of lower level programming interfaces. MIDP was developed under the Java Community Process.

Servlet
A Servlet is a Java class which conforms to the Java Servlet API, a protocol by which a Java class may respond to http requests. Thus, a software developer may use a Servlet to add dynamic content to a Web server using the Java platform. The generated content is commonly HTML, but may be other data such as XML. Servlets are the Java counterpart to non-Java dynamic Web...
content technologies such as CGI and ASP.NET. Servlets can maintain state in session variables across many server transactions by using HTTP cookies, or URL rewriting.

- **Bluetooth**
  
  Bluetooth - an open wireless protocol for exchanging data over short distances (using short length radio waves) from fixed and mobile devices, creating personal area networks