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A Generic Framework for Accessing Location Based Information by Android Mobile Application

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Abstract - ***Smart phones have become ubiquitous due to their ever increasing capabilities and affordability. This has created huge opportunity for mobile application developers to create several applications for individual as well as corporate and social problem areas. Android and iOS operating systems have the major share in smartphones and they have millions of applications for their users in their official application stores which are ranging from simple games to serious business applications. However installation of applications demands resources in the smartphone which is very limited. Majority of the applications installed are not used all the time and their usage is restricted to few occasions or locations. Moreover several applications have a common usage pattern in which the same kind of content is displayed from repositories. We propose a model in which the user needs to install only one native mobile application which is supported by an intelligent web component which displays the services appropriate to his location. We have developed a framework in which the general format of data exchange is maintained in XML and an application engine decides which are the services to be displayed and from which data repositories. Thus, the user has to install only one application for multiple services which are available to him based on his location.***

Key Words: *Android, Mobile applications, Location based service, XML Specification*

1. INTRODUCTION

The available mobile applications in various platforms such as Android, iOS and Windows are solving range of problems from individual user requirements like personal data management to complex enterprise problems. However majority of the applications have similar kind of architecture in terms of content dissemination. Only the type and nature of data to be displayed in the client screen differs and most of the other aspects of the applications remain the same.

For example booking appointment in a doctor's clinic and reservation of a book in library are almost same in terms technical design and only the data management part differs. Most of the mobile applications that we use share these kinds of common features. So we are trying to address two major problems in this area.

The first one is to address the memory limitation problems of the device. Installation of all applications occupies plenty of memory space in the mobile device and it reduces the performance significantly. The next one is to provide the services only when it is necessary. Here we try to find out the location of the user and the services will be rendered to him based on his location.

2. OVERVIEW

A major requirement in the mobile application services is the necessity for location based services. As the mobile phones are always with the users, based on his location we could make the phone to provide customized services to him.

By using GPS and navigation facility the application finds latitude and longitude coordinates of the current location. This application automatically senses the current location of the user and according to their current location it provides the specified services, such as places which are present nearby and the its consisting features.

3. ARCHITECTURE

This section provides an overview of four major components in the proposed solution namely.

a. Mobile application
b. Application Engine
c. XML Service Specification
d. Database

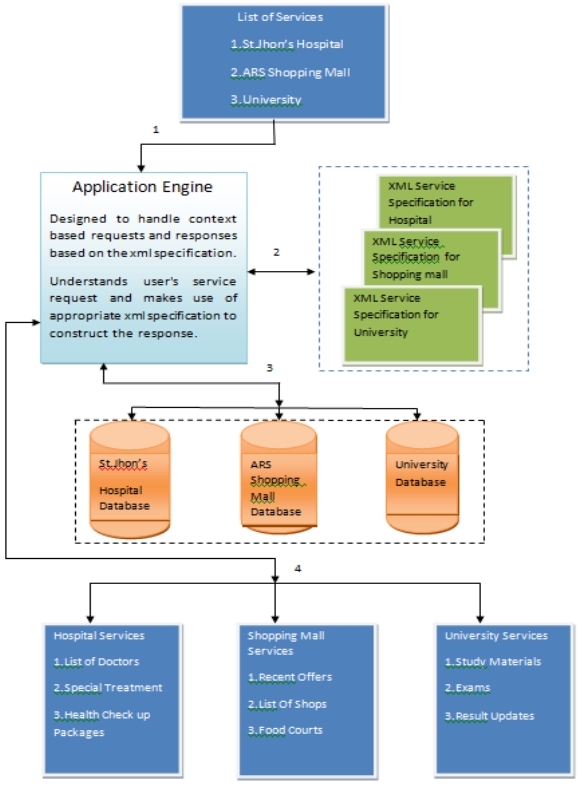

Fig -1: Architecture of the system

Mobile Application:

The mobile application is the native android application that would run in the android smartphone. The primary functionality of the application is to find out the current location of the user and to display the list of services. The entire services are listed in the database with the corresponding latitude and longitude coordinates.

The sample entries are here.

Latitude	Longitude	Service_Name
26585	698552	ARS Mall
26585	698552	St.John's hospital

The real database table will be more complex with location names and other details to handle overlapping of location information with services details.

The mobile application fetches the list of available services and displays them in a list view. The user can select any one of the listed application and make use of it. The display format and the content are determined by the application engine component.

Application Engine:

Application Engine has the complete responsibility in rendering the services selected by the user. This is the business logic component which communicates with the XML service specification and the client mobile application.

As per the example stated above, if the user enters a location where one of the services available are from ARS Shopping mall as per the service table entry in the data base, the application engine reads the service specification XML document to determine what needs to be displayed to the user.

In the ARS shopping mall XML specification, details such as the number of data dissemination functions and the data input functions are mentioned. The data dissemination functionalities are provided in terms of links or buttons and by clicking those necessary information will be pulled from the database and displayed in the mobile screen.

XML Service Specification:

XML is primarily used to contain self-described data. Due to it is a plain text format it is not platform or any language dependent. This can be processed by any tools or technologies as long as the appropriate parsers are available. So XML is used to specify configuration details in several occasions. We have decided to use XML to specify the common format in which the data needs to be exchanged between the mobile user and the service provider.

For example, the XML Service specification for a shopping mall would look like this.

```
<Service>
  <Servicename>ARS Shopping mall</servicename>
  <Service-id>025</service-id>
  <Category>Commercial</Category>
  <function>
        <function-name>Recentoffers</function-name>
        <function-type>Data display</function-type>
        <function-db>arsshoppingmall<function-db>
        <function-table>RecentOffers</function-table>
  </function>
  <function>
        <function-name>List of shops</function-name>
        <function-type>Data display</function-type>
        <function-db>arsshoppingmall<function-db>
        <function-table>shoplist</function-table>
  </function>
  <function>
  <function-name>Feedback</function-name>
  <function-type>DataEntry</function-type>
        <function-input>
        <input-type>text</input-type>
```



```
        <input-name>Enterthefeedback</input-name>
        </function-input>
        <function-db>arsshoppingmall<function-db>
        <function-table>feedback</function-table>
  </function>
</Service>
```

The above XML document is a sample service specification with major details required for a typical shopping mall application.

The root tag is service inside which all the functionalities of the service are defined. Basically two types of functionalities are observed commonly and they are data display and data entry. Any data centric application would display some data from the database as per the user's demand or the data will be obtained from the user's input and stored in the database. Any number of data display and data input functionalities could be available in a particular service.

The above sample xml document tells us, there are two data display functions and one data input function. They are recent offers and List of shops. The details about offers and shops are stored in a web backend. The database and table details are also configured in XML specification.

This will be understood by the application engine that will create dynamically the user screens. As per the above specification, two links will be created with labels 'Recent offers' and 'List of Shops'. When user clicks these links, the application will communicate with the database mentioned in the specification. The table name too has been specified.

Database:

After the xml specifications construct according to the user request, application engine knows the configuration of data provide to appropriate services and this type of data will fetches from the database. Here we use mySQLdatabase to store all the data.

4. IMPLEMENTATION AND RESULTS

The Location based mobile application services had to be implemented by considering suitable real world scenarios. So, a collection of services including a hospital, shopping mall, university were taken for example.

When the user is navigating from place to place, his geographical location is identified by the inbuilt GPS module of the Smartphone and the list of services mapped for that location are retrieved from the database.

Location Based service in the smartphone:

The client application screen given in fig.3 illustrates how the list of services is viewed based on the location. For the corresponding latitude and longitude values identified by the user the database returns three services namely, StJohn's hospital, ARS Shopping mall and Anna University. The following code is the one used for identifying the current location.

```
public Location getLocation()

{

  try

   {

    locationManager = (LocationManager) mContext.get

    SystemService(LOCATION_SERVICE);

    // getting GPS status

    isGPSEnabled = locationManager.isProvider

    Enabled(LocationManager.GPS_PROVIDER);

    // getting network status

    isNetworkEnabled=locationManager.isProvider

    Enabled(LocationManager.NETWORK_PROVIDER);

    if (!isGPSEnabled&& !isNetworkEnabled)

     {

       // no network provider is enabled

     }

     else

      {

        this.canGetLocation = true;

        if (isNetworkEnabled)

        {

          locationManager.requestLocationUpdates(

          LocationManager.NETWORK_PROVIDER,

          MIN_TIME_BW_UPDATES,MIN_DISTANCE

        _CHANGE_FOR_UPDATES, this);

        Log.d("Network", "Network");

         if (locationManager != null)
```



```
        {
          location= locationManager.getLastKnown
          Location(LocationManager.NETWORK_
          PROVIDER);
           if (location != null)
          {
              latitude = location.getLatitude();
              longitude = location.getLongitude();
           }
         }
       }
     }
}
```

The available services for a particular location is stored in a database and retrieved automatically. More complex algorithms can be developed to include services based on the preferences of the user and the location. For instance more services related to training centers, libraries can be provided for a student user.

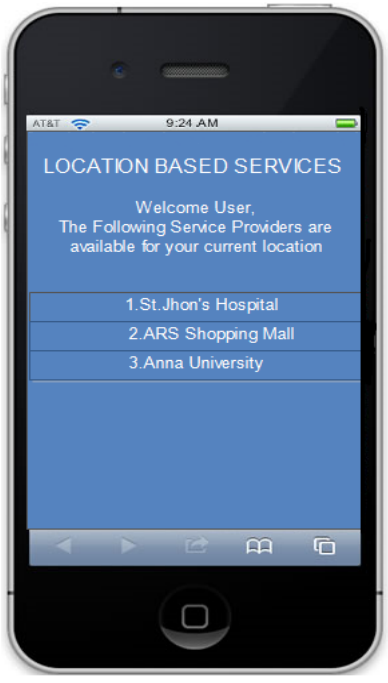

Fig- *2: Client Application*

When a list of services is displayed, they can be accessed by the user for information exchange. The user can access the information provided by the service under various topics or search criteria. The user also can post some data to the service, which may be a request for quote or feedback or anything else.

In the given illustration the user selects hospital service where he finds out, three major information sources which are Special treatment details, list of doctors, and health check-up packages. All the three services are simple data services in which a collection of data are sent to the users. The set of topics to be displayed for each service is configured in the XML file and the corresponding database details like the database url, database name and the password are also configured in the XML file.

Whenever a particular topic is selected, the corresponding data is fetched from the database and displayed in the mobile screen. Apart from data rendering services, there could be data input service which accepts data from the user according to the nature of the service. It may be a feedback to a service provider or a request for quotation or anything similar to that.

Fig-3: *Hospital Service*

In the above illustration we can clearly see that along with data rendering service, there is an appointment booking service

If it is a data rendering service, data needs to be fetched from a database component based on some search criteria. The name of the database table, name of the columns and the SQL query statements are all dynamically generated based on the XML configuration.

Once the XML Configuration is completed it will be shared across all the service providers. Every service provider will create a customized XML specification for their set of services which represents the database details like table name, column names, names of the topics, conditional checks etc.,

When the supplied XML files from the service provider are loaded in the server along with the populated database, the mobile application will automatically display the new content services with complete features without any single modification in the application.

XML Specification for data access:

```
DocumentBuilderFactorydocBuilderFactory =
DocumentBuilderFactory.newInstance();
DocumentBuilderdocBuilder =
docBuilderFactory.newDocumentBuilder();
Document doc = docBuilder.parse (new File
("hospital.xml"));

// normalize text representation
doc.getDocumentElement ().normalize ();
System.out.println ("" +doc.getDocument
Element().getNodeName());
NodeListlistOfServices = doc.getElements
ByTagName("service");
inttotalServices = listOfServices.getLength();
System.out.println("Total no of Service : " +
totalServices);

for(int s=0; s<listOfServices.getLength() ; s++)
{
  Node firstServiceNode = listOfServices.item(s);
  if(firstServiceNode.getNodeType() ==
Node.ELEMENT_NODE)
  {
   Element firstServiceElement=(Element)
  irstServiceNode;
  NodeListmainServiceList =firstService
  Element.getElementsByTagName("main");
  Element mainServiceElement = (Element)
  mainServiceList.item(0);
  NodeListtextMNList = mainService
  Element.getChildNodes();
  System.out.println(" " + ((Node)textMN
  List.item(0)).getNodeValue().trim());
  }
}
```

Fig-4: *Shopping mall service*

Fig-5: *University Service*

5. CONCLUSION

The implementation we have done for providing location based services with a single mobile application for android smartphones has clearly demonstrated that, by segregating the mobile application layer and the data base layer by an intelligent business logic solution is solving the problems related to location based service rendering as well as device memory limitation. Highly effective mobile solutions in all the problem areas could be developed by designing rich XML service specifications.

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