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Analysis of User Interface layout, Elements and Search Pattern for Location Base Service Mobile Application

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Abstract: The development of user interfaces for mobile devices is a challenging research topic as it addresses specific usage of mobile devices—users want rapid responses to their actions while minimizing the amount of information entered. Because of its nature mobile devices face many constraints such as limited size of display and motoric limitations on information input (Lauesen, S. (2005). Good usability is a primary requirement for interface design and is critical to attracting and retaining users, especially in business applications such as mobile e-commerce systems. In this paper, analyses of various layouts, elements and search patterns of user interfaces for mobile devices, for location based services mobile applications.

1. Introduction

Mobile devices impose great challenges on developing user-friendly interfaces for effective browsing of web content. Designing a usable user interface (UI) that is also effective within the constraints of mobile devices and the applied development technology is becoming a hot research topic. Good usability is the primary requirement for interface design(Borchers, J., Deussen, O., Klingert, A. and Knorzer, C. (1996) that is critical to attracting and retaining users, especially in business applications such as mobile e-commerce systems. As the user base of mobile devices grows faster than that of desktop computers it is essential to constantly research best principles of effective user interface usable UI and to evaluate their implementations by designing mobile applications according to these principles. In this paper, we analyze the design principles of user interfaces for mobile devices, formulate the requirements for a usable interface of a mobile application, describe the model and architecture of an interface of a developed mobile ecommerce system and present its evaluation based on a set of functional and non-functional criteria.

2. Location-based services

Location-based services (LSB) have emerged during the 1970s in the United States of America, when the United States Department of Defence (DOD) started using the Global Positioning System (GPS). The GPS is based on a satellite grid infrastructure. It is used for locating people, and objects. The early GPS implementation was accurate up to three meters (Spiekermann, 2004, p. 10). Originally, GPS was devised as a system that would be utilized by the military. However, in 1980s, the United States Government decided to allow the worldwide use of this system. Ever since, many industries have adopted this technology in order to make improvements of their products and services. Notably, the automobile industry now integrates GPS receivers in vehicles to provide location-based services available to drivers. An object or a person can be tracked by recording a set of coordinates, which include latitude, longitude, and when calculable, to a degree of certainty, the altitude. The data required in order to provide other connected systems with this information is received by a GPS receiver. During the 1990s, interest in LBSs and derivative products and services increased, especially with the increase in the use of mobile

communication devices. With the increase of the use of LBSs, the need for more precise GPS positioning emerged. The importance of GPS accuracy for different types of GIS applications is shown in the following table, formed according to (Bellocci, Genovese, Inuaggiato, &Tucci, 2002 LBS applications aim to provide real-time service, such as route planning, point of interest selection etc. (Meng, Zipf, &Reichenbacher, 2005). There are two methods for providing services based on geo-location. Either the user requests information, products or services for a geo-location he or she provides, or this information is provided for a geo-location automatically detected by means of a geo-positioning technology. Once the geo-location information is acquired, it is sent to the centre for data processing along with other parameters relevant to the service. This set of information is usually stored in a database for later analysis. Based on the received set of information, the database is queried in such a way as to provide a result set, which includes information on products and services relevant to the data set in the request. This data is geographically tagged, which means that it is weighted as more relevant when the user is closer to its location, than it would be if the user were further away. Applications that rely on LBSs can be user oriented or device oriented (Spiekermann, 2004, p. 13). User oriented applications are designed to provide information on products and services to users, based on the parameters selected by the user. For instance, these applications can point the user to the nearest computer component store. Device - oriented applications are designed to be self-activated and they usually do not require any input from the user prior to or after activation. These applications are made as integral parts of devices or objects, such as vehicles (for example, a GPS receiver embedded in an automobile). With such an application, users are seldom allowed to manage the device and its functions

4. Objective:-

To analyze Android applications' source code to obtain insight into common components, features, and user interface elements used. To achieve this goal, 400 of the most popular Android application packages (APKs) were downloaded from the marketplace and analyzed them to extract valuable information.

5.Methodology

The following methodology was followed.

1. Collect a large number of apps.
2. Decompile each app into code that can be analyzed to understand the app's UI design (e.g., XML) and actual programmed behaviors.
3. Extract a comprehensive set of features about each app from the app's listing details web page, user interface layout, and actual code.
4. Stats: Compute statistics (e.g., distribution, min., max, mean, outliers) with respect to a feature of interest.

Downloading and Decompiling of android applications packages (APK),to finds the most common features and components used by popular location based services(LBS) UI for mobile applications and to determine the most common user interface elements and identify the common combination

5.1 Analysis of interface layout for Location Based UI Applications.

The categories Travel& local and Shopping has the maximum number of applications having access to GPS permission(table-3), thus these categories are selected for analysis of User interface layouts of applications, 21,655 XML layout files of 34 applications were retrieved and analyzed for most frequent layout containers and widgets. In total, the

layout files contain 51,209Android standard layout containers

Apps	Layout	Layout/app
Linear	51.10%	769.59
Relative	23.86%	359.35
Frame	11.79%	177.53
Scroll View	1.75%	26.38
List View	0.40%	6.06
Absolute layout	0.00%	0
Grid	0.81%	2.76
Web View	0.45%	6.74
Constraint	10.29%	154.94
Table	0.19%	2.79

Table 1 : The standard layout containers

The columns show the name of the layout container, total number of times they are used. And the percent of the total number of layout containers.

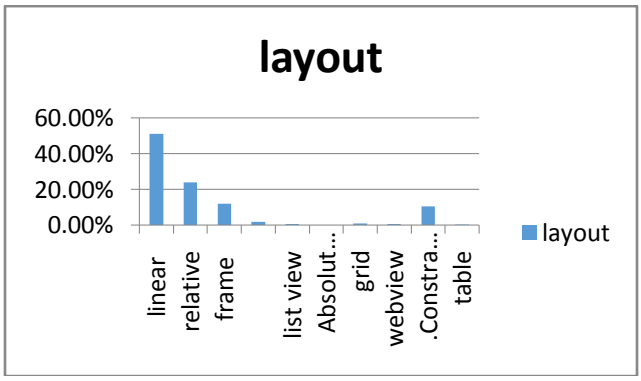

Chart 1

Table - 3 shows all standard layout containers in the data set. The LinearLayout accounts for 51.57% of all layout containers. The RelativeLayout accounts for 23.86% of all layout containers applications,Followed by frame and constraint layout respectively 11.79% and 10.29%. The ScrollView, listView, WebView and Table View account for only 1.75%, 0.40%, 0.45 and 0.19% of all layout containers. AbsoluteLayout was been used by any applications.

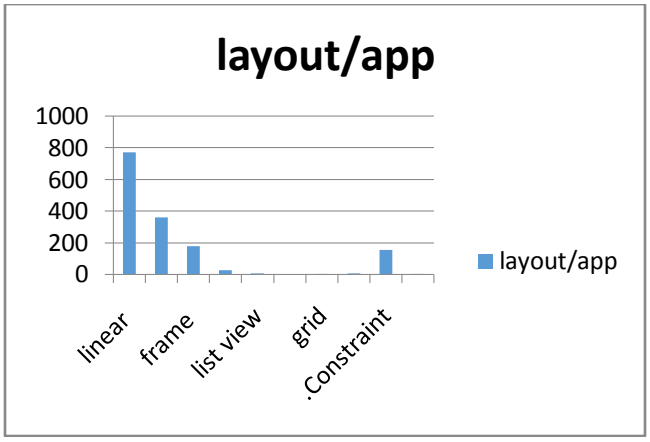

Chart 2 shows the average frequency of a layout is used by one application.

Which shows linear, relative, scroll and frame layout are used by all apps, Although list view and webview are used by 30 and 31 applications respectively but they account to less the 1% of total layout containers.(Appendix-B)

5.2 Analysis of UI controls for Location Based UI Applications.

Android Screen UI Components- an Activity displays the user interface of an android application, which may contain widgets like Button, TextView, EditText, etc. Typically defined in an XML file (for example, the main.xml file located in the res/layout folder).Android UI Controls are those components of Android that are used to design the UI in a more interactive way. It helps to develop an application that makes user interaction better with the view components. Android provides a huge range of UI controls of many types such as buttons, text views, etc.

UI is the only thing that a user interacts with within an Application. This is the reason that makes an Application look aesthetic and, more and more connective. To do so, the UI controls or Input controls are added in the respective application.

5.3 UI Controls

- TextView is used in place of label which describe just a piece of a static text.
- EditText is having text entering and editing capability, it is generally used to enter the text inside it.
- Button is used to pass an action or say an event.
- CheckBox having check/uncheck capability basically used for selection.
- RadioButton contain a round selection which is used in a group so that a user cannot select more than one option at the same time.
- RadioGroup is having more than one RadioButton when they are not allowed to get selected at the same time.
- ToggleButton can be used in an event that describes on/off functionality.
- ImageView is used to contain an image in it.
- ImageButton is a button having a look of a particular selected image.
- Spinner is a view that displays one child at a time and lets the user pick among them.
- Gallery is a view that shows items in a center-locked, horizontally scrolling list.
- AutoCompleteTextView is an editable text view that shows completion suggestions automatically while the user is typing. The list of suggestions is displayed in a drop down menu from which the user can choose an item to replace the content of the edit box with.
- ProgressBar is a visual indicator of progress in some operation. It displays a bar to the user representing how far the operation has progressed; the application can change the amount of progress as it moves forward.
- GridView shows items in two-dimensional scrolling grid. The items in the grid come from the ListAdapter associated with this view.
- AnalogClock is a widget display an analogical clock with two hands for hours and minutes.
- DigitalClock is a widget display a digital clock. It implements separate views for hours/minutes/seconds
- DatePicker is a widget for selecting a date. The date can be selected by a year, month, and day spinners or a CalendarView. The set of spinners and the calendar view are automatically synchronized. The client can customize whether only the spinners, or only the calendar view, or both to be displayed. Also the minimal and maximal date from which dates to be selected can be customized.
- TimePicker is a view for selecting the time of day, in either 24 hour or AM/PM mode. The hour, each minute digit, and AM/PM (if applicable) can be controlled by vertical spinners. The hour can be entered by keyboard input. Entering in two digit hours can be accomplished by hitting two digits within a timeout of about a second.
- ListView is a view that shows items in a vertically scrolling list. The items come from the ListAdapter associated with this view.
- RatingBar is an extension of SeekBar and ProgressBar that shows a rating in stars. The user can touch/drag or use arrow keys to set the rating when using the default size RatingBar. When using a RatingBar that supports user interaction, placing widgets to the left or right of the RatingBar is discouraged. The number of stars set will be shown when the layout width is set to wrap content.

For 34 applications 21,655 XML layout files were parsed to retrieved and analyzed for most frequent widgets. Total 50,391widgets were retrieved, 21such Widgets were analyzed (Appendix C) From the 21 analyzed widgets 15 most frequent widgets were sorted out these account to 99.77% of the total widgets used table-4 shows the percent and number of times the widgets are used.

S.No.	Widget	Apps	Percentage	Total
1.	Text View	34	58.92%	29691
2.	Image View	34	18.62%	9383
3.	View	34	11.60%	5847
4.	Button	34	3.35%	1690
5.	Progress Bar	31	2.12%	1069
6.	Image Button	34	1.25%	629
7.	Edit Text	27	1.05%	529
8.	Radio Button	34	0.93%	470
9.	Check Box	34	0.53%	265
10.	Spinners	21	0.40%	201
11.	Chronometer	34	0.22%	109
12.	Checked Text View	34	0.21%	105
13.	Date Time View	34	0.20%	101
14.	Rating Bar	17	0.17%	88
15.	Toggle Button	7	0.13%	67

Table 2 : Frequently used widgets

The fifteen most frequently used widgets used by the applications. The columns show the name of the widget, the number of applications that use the widget, the percent of the total number of widgets, and the total number of times they are used.

From the 50,391widgets retrieved, TextView is by far the most common element (58.92%) followed by ImageView (18.62%) and View (11.60%). Table … shows the fifteen most frequent widgets. Together, these frequently used widgets account for 99.77% of the total number of the extracted widgets and are used by more than half of the 34 applications. Chart- 8 further depicts how often on average a widget is used by an application.

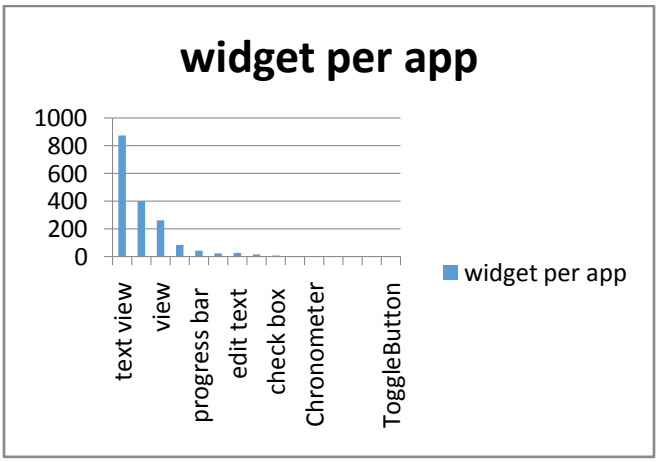

Chart 3 the average number of widgets per application for the most frequent widgets in the data set.

6. Extraction of Location search UI Patterns

The important trait of a successful app is to make sure that the required information a user wants should be quickly available to him in the minimum amount of time. This research aims at how users utilizemobile applications that offer an interface for finding locations and how the way of interaction changes depending on the users' intent.Navigational and location search applications (apps) have been an essential part of the apps offered by the major app stores . They are apps that take the user's current position into account and use this data for example to help users find locations. They can be categorized as Location Based Applications, or more general reactive Location Based Services (Küpper, 2005). the term location means a physical location like a shop or restaurant.

On analysis about first few applications for all the categories it was found that allthough apps has access to GPS permission ,it was mealy to find current location of the user. Categories like Local and Travels, Food and Drinks ,and Map navigations had apps which provide location tracing ,32 Apps of these three categories were selected for location search UI pattern extraction . Pattern methodology

that is widely used in the HCI community (J.O Borchers, 2000;)is used to document and categorize location search UI elements.

5 types of location search patterns were extracted from the analyzed apps. The five patterns search slot, categories, result-list, map and filters (fig 1-6)are not only used as standalone interface elements but also in combination, Google for example is using a combination of the search slot and filters.

Figure 1-6

7. Conclusion

It was determined which interface widgets and layout containers are most frequently used, and found that the two widgets TextView and ImageView that are just used to show labels and images account for over 50% of all widgets. Some interactive standard widgets, such as the ToggleButton and the SeekBar, can even be considered as esoteric. The Toggle-Button accounts for only 0.37% and the Seekbar accounts for 0.25%. The most frequent interactive widgets i,e Button and EditText suggest that the layouts of the analyzed applications are mainly used by entering text and pressing buttons.Combining the patterns it was identified that, search slot is used as the first level patter for search the other level of interface may very according to the requirement of the application result Ui map is more often use as a filter and search interface, The core of this analysis process is to access the characteristics of human perceptions with interactive Ui elements ,Ui patterns and Ui layouts which indicates that most frequent Ui interactive element (text view and button),most frequent Ui layout(linear layout) and the five Ui search patterns for location finding support to create an effective and user friendly user interface for location finding .

Further suggestions:-Based on the above statically analysis ,location based service search interface and new widget with combination of the most frequently use ui elements, layouts and search patterns for LBS mobile applications can be designed.

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