

User-Centered Design (UCD) Approach for Designing of Platform Independent Applications in Smartphone

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Abstract: With the dramatic growth in the mobile market and has reach a range where some software development company cannot neglect the need to contribute in it any longer. Designing a native mobile application involves lots of resources and this, might affect some of the issues with applications development and deployment. At present, there are different mobile device manufacturers which have different devices and development tools. The main solution to solve this issue would be to design a cross-platform application which exist on all mobile operating systems (OS), as it operates in some browser and consequently, can reach the major possible number of end-users. User-centered design (UCD) is a framework of processes (not restricted to interfaces or technologies) in which the needs, wants, and limitations of end users of a product, service or process are given extensive attention at each stage of the design process. In this paper, we propose User-centered design (UCD) for platform independent applications development is smartphones with different operations system.

Keywords: Smartphone, Platform-Independent, Framework, Architecture, Cross Platform.

I. INTRODUCTION

Mobile devices are the approaching train of the future of computing. Some of the issues when developing a mobile application is basically how to build mobile apps that are applicable to many mobile devices.

In generally, there are diverse mobile devices today, with various operating systems, such as Windows, iOS (Apple), Android (Micromax, Lava, Samsung, HTC), Blackberry OS.

All these devices have one major difference which are the screen sizes and different attributes. Users prefer to make use of any mobile devices of their choice, but for everyone it would be amazing accessing a particular mobile app on different devices. Additionally, developing a mobile app that runs on dissimilar devices needs the cross platform capability to brand more mobile apps accessible to users [11].

Platform independent means the execution of the program is not restricted by the type of OS environment provided. Smartphones and tablets are becoming universal and with them mobile applications. But what does the creation of different devices mean for developers entering the market? Do they target a single platform or build their applications for Windows, Blackberry, iOS and Android or other platform?[3].

Just as the usage of mobile phone and smartphones is growing ever year, so are users' hopes of the mobile user experience. Users expect applications that are easy to work with, have rapid reaction times and feature simple yet

gorgeous user interfaces. These mobile based applications have to know what users want to attain and to support them in doing so. At first glance it may seems sound easy, but it is actually the biggest challenge of a developer's job. Therefore the objective of this paper is to explore to the topic of usability and the principles of user interface design, which help to develop user-centered applications development.

Currently, end-users can interact with a service and information using different types of computing platforms comprising traditional office desktop pc, tablets, laptops, smart TVs, and mobile phones. This allows users to transfer their tasks from one user interface to another across devices or platforms.

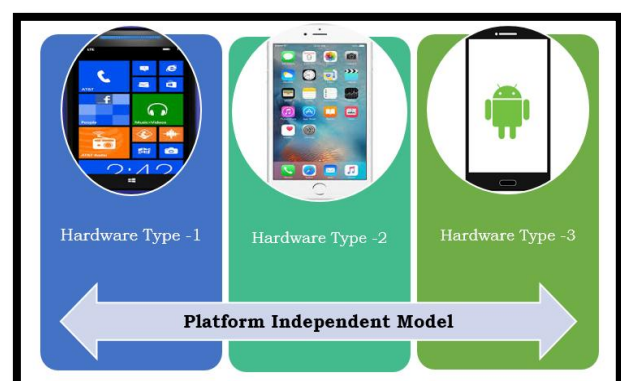


Fig.1. Platform Independent Model

For example, a user can search for an academic institute, marbles or restaurant from specific services, and then switch to the service image from their mobile phone to find the contact information of particular service, and then might transit to use a tablet to write a review about the service he or she used. This brings a new user experience theme in which a user interacts with Multiple User Interfaces (MUIs) to achieve goals horizontally (across platforms). This type of MUI access is different from traditional user experience involving interaction with a single user interface (vertical interaction) [9, 14].

II. DEVELOPMENT OF MOBILE APPLICATIONS

A mobile phone is a telephone hardware that is capable of connecting to a telephone system infrastructure using radio frequencies rather than wired connection. Initially, mobile devices were typically very excessively costly, big in size, very constrained in computational resources and with short battery life.

Yet, this innovative device set a revolution that will totally transformation the mobile device development from a terribly inefficient clumsy object to a must have device which gave individuals freedom, constant presence and capability to work anywhere the birth of a completely new reality.

In recent time devices started to get smarter and slimmer with decent displays, connectivity options, NFC, Bluetooth and infrared sometimes Wi-Fi, and a multitude of elegant features allowing them to be personal devices being carried around 24/7. It is one of the top 10 greatest inventions in the telecommunications industry in recent past.

According to, Bonnington C. (2015), with each passing season, another wave of mobile devices is released that's more capable and more powerful than the generation preceding it. We're at the point where anyone armed with a current model smartphone or tablet is able to handle almost all of their at-home—and even at-work—tasks without needing anything else. We're living proof: for the last two years, wired has been able to cover events like CES almost exclusively using our smartphones. Only a few years ago, this wasn't the case. In 2011, the Motorola Atrix paired with a laptop dock for clunky, limited smartphone-based computer experience. It was a great idea, conceptually, but ahead of its time. The smartphones of 2011 and 2012 weren't quite powerful enough to fulfil all of our computing demands. But due to increased processing power, better battery life, vastly improved networking speeds, and larger screen sizes on mobile devices, the shift away from the desktop is accelerating. As per Joel Hruska (2014), one of the widely discussed trends of the past few years has been the decline in PC sales and the rise in tablet sales. Tablets, more than smartphones, are credited with harming the US market — few people view a smartphone, even a highly capable device, as a complete desktop or laptop replacement [5,8].

These days it is more important than ever for software companies to cover as much of the mobile market as

possible with their applications. However the question that needs to be asked is what kind of mobile application this should be – a native application or web-based so called cross-platform application?

III. CROSS-PLATFORM SERVICE

The word cross-platform can be used to describe dissimilar entities in the field of information technology and computer science. For example, hardware devices, such as computer monitors, can be described as cross-platform as they can work with any operating system. Similarly, programming languages, such as Java or C, can be described as cross-platform as they can be used to write software for use on any operating system. Moreover, the term can be used to state to software that can operate on more than one platform. In this paper, we use the word cross-platform to refer to services that can be availed or accessed and used on two or more computing platforms [3, 15].

• ASSEMBLY OF SERVICES

Web services provide the technologies for assembling or connecting services together. For cross-platform services, a web service can be defined as a system, which can be developed or designed to support interoperable application -to-application communication over a network [6].

Interoperability of services can be of two types [3, 10].

- 1) Syntactic interoperability, and
- 2) Semantic interoperability.

1) Syntactic interoperability

In this type of interoperability, it depends on specified data formats and communication protocols to ensure data exchange and communication among heterogeneous software applications. Through syntactic interoperability, there is no assurance of constant interpretations of exchanged data between one applications to another.

2) Semantic interoperability

This type of interoperability refers to the capability of several services across platforms to interpret the exchanged information accurately and meaningfully. For connection services, different technologies of web services are available such as the use of SOAP, WSDL, UDDI, REST, XML, and JSON, which are elucidated concisely as follows [10]:

- SOAP: Simple Object Access Protocol is a protocol which enables communication between applications.
- WSDL: Web Service Description Languages is used to define web service interfaces, data and message types, and protocol mapping.
- UDDI: Universal, Description, Discovery, and Integration is a web service registry and discovery mechanism, used for sorting business information, and retrieving pointers to web service interface.
- XML: Extendable Markup Language provides a language for defining data and processing it.
- REST: Representational State Transfer is an alternative to SOAP that is developed on a set of principles describing how networked resources are defined and addressed.

- JSON: JavaScript Object Notation is an alternative to XML that uses name/value pairs instead of tags as used in XML.

IV.ASSESSMENT OF MOBILE DEVICES

The applications running on cross-platform is running on multiple platforms and there are many factors that essential to be taken into concern when developing a cross-platform application. Therefore we will be to compare and analyze Android's, iPhone's and Windows Phone's devices to be able to assess the capabilities of each platform. This kind of comparison is essential as it assistances us to know the challenges encountered by web application when trying to deliver the best probable running of a cross-platform application.

Several important features of mobile devices, which have an effect on the final user interfaces of mobile application. Such as, screen size, high quality resolution, changing portrait/landscape view, input devices and HTML5 support.

- Screen Size

Designing a web based application is very challenging task, as it needs many viewing viewpoints to be able to visualize what the final application is going to look like on a number of different devices. The first factor is the screen size in terms of screen resolution. In the past, the solution to the various screen sizes was to set a fixed width to an application, which up to a certain point provided a reliable rendering of an application (Fling, 2009). Today, however, this approach is limiting the capabilities of bigger screen sizes [7]. In order to overcome with this issue, Brian Fling (Fling, 2009) mentions using a design that allows fluid user interfaces which automatically adjust to the width and height of a web application. Not only is the fluid design the long-lasting solution to screen sizes, it also takes into consideration the screen orientation. This solution is also suggested by Allen Grant (Allen, 2012) [1,7].

- Display density

Pixel is the smallest unit to measure the screen resolution. In recent past a pixel was the preferred unit for defining the screen resolution. Pixel is very easily understandable concept and has worked just fine for many years. But in current scenario, yet, mobile displays are changing and the concept of pixels is not complete enough to apply to screens with density changes (Allen, 2012) [1].

Display density defines a smartphone is the fact that it is mobile. It can be taken anywhere and fits comfortably in the palm of a hand; therefore a phone has certain size constraints. Technology never stops evolving and is always looking for new ways to increase the resolution of a screen without changing the size of a device. Density change means that the same screen size of a device contains more pixels. This has an impact on the size of a pixel. If more pixels are placed on a regular screen, pixels effectively shrink. Display density is expressed in pixel per inch (PPI). It can be calculated as screen width in pixels divided by the width of display in inches. The higher the number, the sharper the screen appears.

- View – portrait and landscape

Cross-platform applications have very important feature that allows the changing of portrait and landscape view. A web based application runs in a mobile browser, which itself is a native application. This permits browsers to make use of hardware accelerators to define a device's orientation and rotation. Based on the angle, a web application rotates accordingly. The portrait and landscape view only support the idea of fluid design, as in landscape mode the dimensions of an application are exchanged and therefore add to the number of different screen sizes and resolutions.

All three operating systems – Android's, iPhone's as well as Windows Phone's native and third-party browsers — allow this feature of portrait/landscape view, unless deactivated.

In figure 2 and figure 3 we have designed the application Lost Locations Hawaii; that is compatible with landscape view and portrait view and compatible with iPhone, Android and Windows phone.

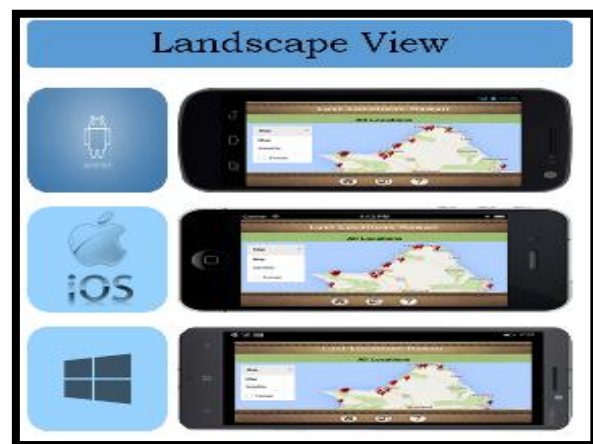


Fig. 2.Landscape view



Fig. 3.Portrait view

- User Input

Keyboard, mouse or touchpad is the most common input devices when working on a desktop or laptop all of which allow very precise input methods. But smart phones work differently. Smartphones are constrained to a relatively small screen and not only is the device's display used for viewing the content, but also for touch input. This implies

that a finger is considered as a primary input method for smartphones.

A mouse is exact, having only one or two pixels at the top of it; fingers on the other hand, are much bigger and less precise. Some users have thin fingers, others broader ones. However, ignoring the finger size it is still close to impossible to tap a typical link from a desktop webpage. Therefore it is necessary to design mobile applications – both cross-platform and native in a finger friendly manor. All three operating systems – iPhone, Android and Windows Phone have their own set of rules, which if followed should create a very finger friendly user interface and maximize the user experience [3].

V. USER-CENTERED DESIGN APPROACH FOR CROSS-PLATFORM

As per the International Organization for Standardization (ISO) in its part “Guidance on Usability” defines usability as “the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use”.

- Specific users – the importance of specific users is that the focus is not on all users, but only on the target group for the particular product
- Specific goals – specific goals mean that the product’s goals are identical with those of its users
- Specific context of use – users are using the application in a certain environment and it is essential that the application is designed to be used under those terms [6, 16].

• Usability testing

The reason why usability testing is so important is that every product is designed to be used in a certain way. Depending on the point when the usability testing takes place and on the expected result, there are two types of usability testing.

- 1) Formative and
- 2) Summative testing.

Formative testing: Formative testing is conducted during the development phase of a product. It is based on small studies and its purpose is to identify and fix user interface problems.

Summative testing: Summative testing requires larger number of users and generally takes place after the product has been finished. Its goal is to evaluate the overall quality of interfaces based on metrics.

• Experiments

A cross-platform service aims to provide pervasive and synergistic support for human activities in different contexts of use. For our products in order to check cross-platform support, we have conducted field testing. It is dedicated usability laboratory offers many advantages, sometimes it is preferred to conduct the usability testing directly in places where users are present and where they tend to use the product. This type of testing allows a facilitator to perform the test in real environment and to

better understand the conditions, such as lighting, internet connectivity, or workspace, in which the product is going to be used. In figure 4 we have shown conceptual view of cross channel services available on web on different systems (i.e. Windows, iOS and Android) [4, 12, 13].

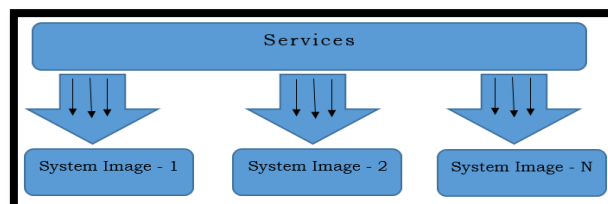


Fig. 4. Conceptual view of cross channel service(s) delivery

In figure 5 we have shown different applications developed by us in different platforms like Windows, iOS and Android.



Fig.5. Multiple User Interface and Cross-Platform Applications

• User Experience and Usability

User experience and usability can be conceptualized as mentioned below and illustrated in figure 6.

User experience is a broad term about multiple factors including system usability. It is associated with user perception, still, usability is more about the design of an ISO system. Usability can be impacted by environmental factors it includes social and organizational factors. But system usability can affect user experience negatively or positively, the impact of environmental factors on usability can lead to direct effect on user experience [10].

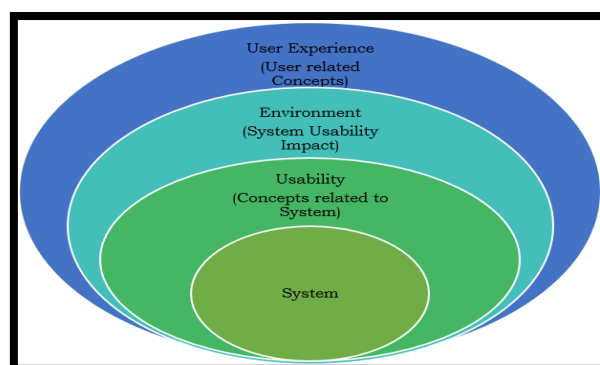


Fig.6. Relation between user experience and usability

VI. CONCLUSION

However native approach of mobile development permits the developers to exploit the full potential of the device hardware and platform features, it is not always the best approach when it comes to mobile development. Sometimes for fairly high hardware and resource intensive applications, native approach probably be a better case but the most of applications being developed and available on application stores do not require such resources. Selecting a native approach means taking a costly approach. The price factor can sometimes be the single most important factor that dictates which approach might best suit one's needs and commercial necessities. In this paper, we have explored the mobile development approaches that will allow developing cross-platform mobile solutions. We have practically implemented and shown cross-platform solution is an ideal way to minimize the cost associated in developing mobile applications and targeting different platforms.

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BIOGRAPHIES



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