Enhancing Mobile Application Development by Using Personalization Model

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Abstract

This paper aims to highlight the main factors that support the implementation of a model for software development, which take into mind users personalization, to produce a software capable of meeting the individual user requirement and the overall system requirement. The deployment of such models must provide a high level of personalization considering the usage, background, and culture difference among users, and serve each user as he or she wants. This paper also discusses the impact of the use of such model, conceding that end-customer who eagerly uses multiple applications on his Smartphone in everyday life would use another useful mobile app to carry out his business activities if the current app doesn't fulfil it. Not only do mobile applications help to stay ahead of the competition, but also can facilitate the reach out to a larger target audience by developing customize and personalize application.

المستخلص:

تهدف هذه الورقة الي دراسة العوامل الأساسية التي تدعم بناء نموذج تطوير برمجي يضع في الاعتبار إضافة الطابع الشخصي للمستخدمين بشكل عام و مستخدمي تطبقات الهواتف الذكية على وجة التحديد، وذلك من خلال تطوير منتج برمجي قادر على تلبية احتياجات المستخدمين الافراد كلا على حدى، كما يحقق المتطلبات غير الوظيفية للنظام ككل. مع مراعاة ان تطوير و تصميم نموذج بهذه المواصفات يجب ان يوفر درجة عالية من التخصيص و من إضافة الطابع الشخصي للمستخدمين، واضعا في الاعتبار طريقة

الاستخدام و الخلفية التعليمية و البيئية و الثقافة الخاصة بكل مستخدم، وخدمة كل مستخدم من المستخدمين بالطريقة التي يرغب و يأمل بها.
هذه الورقة ناقشت ايضا تأثير استخدام نموذج التطوير الموجة لاضافة الطابع الشخصي على المستخدمين الذين يقوم باستخدام عدد من تطبيقات الهواتف الذكية في حياتهم اليومية بشكل متكرر، وآلية الحيلولة دون انتقالهم الي تطبيقات اخرى خصوصا اذا كانت التطبيقات الجديد تؤدي بعض النشاطات التي يحتاجها المستخدمون، حيث ان تطبيقات الهواتف الذكية التي لها طابع شخصي لها القدرة للوصول الي اكبر شريحة ممكنة من المستخدمين وتضمن ديمومة الاستخدام و ولاء المستخدم.

Keywords—personalization, customization, software model, mobile app

• Introduction

There will be almost three billion Internet users, and that the number of mobile-broadband subscriptions will reach 2.3 billion globally. We live in an age of big data.

With hundreds of millions of various people spending countless hours on the mobile application to share,

communicate, connect, interact, and create user-generated data at an unprecedented rate, data from measured the time that users spent on mobile devices (through mobile apps and browsers) for a year, was more than 500,000 minutes by January 2014. In 2007 there were 400 million mobile users and 1,100 million desktop users. By 2014, the number of mobile users was nearly the same as desktop users (around 1,700 million). By 2015, the number of mobile users (1,900 million) exceeded the number of desktops (1,750 million). [1]

The mobile application has become one unique source of big data, more data does not necessarily beget more good, only more of the right (or relevant) data that enables us to clean gems.

In today's competitive business environment, both survival and growth are essential. Since the growth of a business enterprise is determined by the approach it adopts to embrace environmental

changes, it is essential to plan well ahead of time by ascertaining the likelihood of upcoming challenges. Being well prepared in a technology-driven environment clearly implies utilizing the best technological solutions to compete and retain your position in the market. [2]. Mobile applications have ushered in a new era in the business world. The technology has permeated every aspect of our lives within no time. Be it the business world or our personal lives, our dependence on mobile phones can be gauged from the amount of time an average individual spend with these handheld devices. As a service provider, one should understand that the end-customer who eagerly uses multiple applications on his Smartphone in everyday life would like using another useful "APP" to carry out his business activities easily. Another important fact is App market is a two-sided market, it provides a platform to bring two types of participants [3], such as apps users and apps developers. A two-sided market is two sets of participants interact through a platform and the decisions of each set of participants affects the outcomes of the other set of participants [4]. Not only do mobile applications help to stay ahead of the competition, but also facilitate reaching out to a larger target audience by developing customize and personalize application.

Building personalized mobile applications, i.e. those applications that are responsive to the individual needs of each user, is a challenging task. It involves a myriad of different technologies that range from simple database views to software agents and collaborative filtering algorithms. Personalization has become hype in areas such as electronic commerce, and we can find hundreds of applications that claim to be fully customizable to different user profiles or individuals. The number of possible personalization variants seems countless. As with other mobile features, a great variety of technologies and systems have been developed and are available in the market , but little or no attention has been paid to the process of modeling and designing personalized mobile applications [5].

Although it seems impossible to classify all the existing approaches

to personalization, using a simple conceptual framework allows us to show the main differences between most of them. We consider that mobile applications are hypermedia applications in the sense that users navigate information space composed of nodes connected with each other. The main difference between a "traditional" static hypermedia application and most mobile applications is that the latter may involve some business logic (application functionality). In addition, users may alter information while navigating adding products to a cart for example.

There are several different techniques to application developments, some take a more organized, engineering-based strategy to emergent company alternatives, whereas others may take extra step-by-step strategy, where application develop as it is designed part by piece. Figure 1 shown how to develop customized application.

Fig1: Customize Application Development

- A REVIEW OF LITERATURE

  The goal of this paper is to argue the need to approach the personalization issues in mobile applications from the very beginning in the application's development cycle. Since personalization is a critical aspect in many popular domains such as e-commerce, it important enough that it should be dealt with through a design view, rather than only an implementation view (which discusses mechanisms, rather than design options). [6] They present different scenarios of personalization covering most existing applications. The design approach is based on the Object-Oriented Design Method, they briefly introduce it, emphasizing the way in which they build mobile application models as object-oriented views of conceptual models. They show how to specify personalized mobile applications by refining views according to users' profiles or preferences. The study shows that an object-oriented approach allows maximizing reuse in these specifications. The study discusses some implementation aspects and compare their work with related approaches, and present some concluding remarks.

Juan Danculovic ,Gustavo Rossi , Daniel Schwabe , Leonardo Miaton [7], In this paper the authors present some patterns in Web applications that present some kind of personalized structure or behavior. The study first introduces the growing need to include personalization features in Web applications and present a taxonomy for reasoning about design structures for personalization. Finally, present four personalization patterns: Link Personalization, Content Personalization, Structure Personalization and Remote Personalization.

- Method of application customization

This section is divided into two subsections. The first subsection survey the concept of customizing Mobile Applications and the growing need for the implementation of customizable mobile apps. The second sub-section discusses the different between customized app and non-customized mobile application.

- The concept of mobile app customization:

During the past few years, Mobile and cell phone technologies have evolved very largely this evolution has been expected through the study of the previous development rates. Between 2013 and 2014 the global use of smartphones increased by 406 million, reaching 1.82 billion devices (up 5% in a year), and Internet usage via mobile devices has increased by 81% in one year, There were 13.4 billion apps that were downloaded in the first quarter of 2013 [8]. This development has been accompanied by substantial improvements in the field of communications, storage capacity and speed of processors that in order force software developer to get along with the increase in the number of mobile app users. More users require manufacturers to develop more flexible application to satisfy users personal needs, to catch up with the agility of market and short product lifecycles, nowadays industries are beginning to shift from mass production to mass customization to satisfy their user growing requirements. [9] Users cannot be satisfied with one-dimensional functionalities in today mobile environment. They want the mobile applications to be more intelligent. This intelligence includes the

ability of recognizing the user>s intention and context and the ability to adapt dynamically to the changing environment by itself. In other words, the demands for the software adaptation requirements move to the next level, which requires more intelligence [10]. Mobile app customization aims to develop a mobile app with the ability to serve deferent customer and users the way they want without the need of building a special application for each user. This practice helps developer achieving their goal by reducing the cost, having less time to market and having higher quality. Customized app development shortens the product development cycles and help compete with other mobile app developers, given the fact that the mobile application market is a high competition market. From the other side, mobile app customization has deferent problems associated with it. These problems include the difficulty of knowing the customer requirements because most of the mobile application are designed to the general market and not for a particular user, which means that there is a gap of communication between the developer and the customer, In order to fill this gap software a large scale of data should be continuously monitored and supervised. A large amount of information must be collected and analyzed. From another hand, the customers are always searching the app stores for a better personalized app that meet their unique requirements, this problem become a real challenge for the mobile app developer because the customer will stop using any app as soon as he/she find a more personalized app. One more problem is that designing and building a reusable mobile app is difficult and mobile app developers normally tray to make their app as standardize as possible to enhance reusability and reduce costs.

- Customized and non-customized mobile application

Mobile software development differs from Traditional software development in many aspects, as mobile Software must meet user specific needs and constraints. Along with these specific restrictions, software produced for mobile environments should be at a high level of quality, so it can operate correctly on different

mobile devices which exist or are expected to hit the market in the future. System and software designers in Mobile environments must handle these challenges. Due to The high demand on mobile app the concept of customization and personalization become a must in order to get rid of the vast amount of information flow and the concept of one product fits all (one-size-fits-all) . To do so developers are adding the concept of personalization to their products through getting to know the clients better to improve their business and increase profits. E-news, online shopping, and health services all these services are built around the concept of customization and personalization.

Studies inspiring personalization model also include content filtering. Which aims, in turn, to provide users with things he/she want without even requesting it.

- Personalization Model

Based on the rapid growth in the mobile phone Application since the appearance of smart phone a huge increase in the number of projects to develop mobile applications causing the mobile app revenues to hit $46 billion by 2016, the number of available mobile apps in major app stores now easily exceeds one million. As a result of this, the quality and quantity of mobile applications have introduced new concerns in the computer industry and science. Mobile app developers are moving to build a more personalized app, this process require the understanding of two essential parts which are a) user representation and b) user modeling, discuss in the next section.

- User representation

Since users are the key players in the mobile app development process they must be engaged in the software development in somehow, and to do so user must be represented in a manner that reflects their individual requirement. Moreover, because developers are trying to meet the requirement of several segments of users, which enforce user modeling to create a greater representation of the user so that individual users get a better chance of expressing their concerns

and get a greater degree of attention. Most of the current systems today are based on a single scheme which is based on that user information remains outside the scope of the system. User data are arranged in the form of groups called (User Profile). There is no standard model to how to deal with user profile nor a standard structure for user profile. Many applications require users to inter large amounts of data, and still system does not fully utilize this data. The large amount of data also make the handling of the user profile more difficult from manner of entering and preparing Profile compounding complexity of the system. The absence of structural unified mode means that user may repeat his inputs and requirement with deferent app that deal with it, some app essentially depends on user participation and interaction and provide options in the personalization process. While some other app often monitors user behavior and observe his activities such as recommender systems. Studies proved that systems that provide adding personal character are more successful than its peers that do not support this feature because the absent of the user overhead from preparing his profile in a manual process as shown in figure 2.[11]

Fig2: Traditional User Profile Structure

- User modeling strategies

Information and data are the base element in any successful software development project, mobile app developer are examining all possible strategies to collect the largest amount of information from the user, including user preferences, requirement, needs likes and dislikes. All techniques used in collecting user information fall into one of two strategies. The first one is explicit user information collection, which focuses on collecting the user data from the user as he supplies it by any technical forms. In other words, explicit refer to methods that require specific preference input such as ratings.[12] The data collected may contain user preference, user requirement, or any data that can help mobile app developer suggest the user view for the new mobile app that may include what he liked or disliked on previous editions.[13] Most

of the recommendation system today use some form of explicit user data collection such as rating or opinions to understand users requirements using different statistical method such as linear regression or correlation to find patterns of user behavior, or to predict the unknown user requirement.[14] One of the problems of explicit user information collection is the cost, because they need time from user's and require the user to participate. If users do not voluntarily provide personal information, no data can be gathered. In order to provide better insight of the user real needs mobile app can build a prototype of the information collected from user explicitly or design some functionality to validate collected information, This step assures that the customer viewed what he want and can be the first step to provide a personalized app. The implicit user information collection is the alternative strategy used to build a user profile. In this scenario the user is not required to enter any sort of data for his profile and the data is collected on his behalf, the main advantage of this technique is that it does not require any additional intervention by the user during the constructing profiles process of. [15]

- Mobile App Customization levels

The customization process can be divided into three main levels in order to be able to deliver different functionality to different user according to their needs and preferences, these levels are as following :

- data level

The personalization and customization process depend heavily on data, the more data available about user the more vendor and developers know about the targeted customer, this level is concerned with how to deal with users data.

- Functionality level

This level focuses on the tasks that the app can perform or the total number of functions available in order to customize the app to deliver deferent patterns of tasks.

- Display level

System can provide various forms of display to serve deferent user on a personal manner.

- Dissection

We want to make use of one of the main goals of personalization which is leveling to create a common platform for applications, such common platform ensures the sharing of individual user data between applications, by separating functionality from user data to give another app the ability to use user data rather than recollecting the data all over again. The problem that faces this cooperation lays on the fact that each application has its own scope, as every application is designed to address a particular area. Which means that the idea of building a unified representation for all applications for each user is not simple, nevertheless. This does not mean that the publication of individual user's data does not have some side effect that cannot be avoided, as the process of adding a personal nature. Nor does it mean that it is impossible to find a connection between these applications. For treating this problem a model is built to join data in a centralized repository (Centralized User Profile) so each application can use this model to access user information within the User profile repository.

The proposed model aim to enhance the ability of multiple application to sharing the same user profile and get used of the users> expression and activities such as their opinions on any product or service or their comments or reviews to create a unified user profile. This process support user interaction and participation which increase the amount of data collected, from the developers point of view the more data available the more effective the user modeling process becomes as the development of a successful mobile app influences other developer to develop and to target the market.

fig3: Personalization Implement Method

the model as shown in fig3 implement a unified user profile repository that hold the main user characteristic data which can be shared across multiple mobile app this data represent a particular user preferences on different application according to a

particular category depending on the mobile app type and creates a representation of the user data. Because the model is designed to address a number of different mobile app the model operate as an agent to deal with its own database of users, accessing the data of each user in the database or profile. These settings enable different applications to share data and access to the standard format in the database.

- **Conclusion**

This paper present some recurrent design structures that exploring and develop personalized applications and build different kind of personalization application one may usually find in successful web applications. Basically, we develop a method to customize application that allows the user to whatever they want such as create custom fields, validation rules, etc. using user profile. . The deployment of such models must provide a high level of personalization considering the usage, background, and culture difference among users , and serve each user as he or she wants. This paper also discusses the impact of the use of such model. The Method aim to enhance the ability of multiple application to sharing the same user profile and get used of the users> expression and activities such as their opinions on any product or service or their comments or reviews to create a unified user profile.

References

[1] D. Chaffey, "Mobile Marketing Statistics Compilation," Smart Insights, www.smartinsights. com/mobile-marketing/mobile-marketing-analytics/ mobile-marketing-statistics 27 Apr. 2016.

[2]http://www.mind-infotech.com/Services/customize-application-development.html

[3] Bakos, Yannis, and Evangelos Katsamakas. «Design and ownership of two-sided networks: Implications for Internet platforms.» Journal of Management Information Systems 25.2 (2008): 171202-.

[4] Rysman, Marc. «The economics of two-sided markets.» The Journal of Economic Perspectives 23.3 (2009): 125143-.

[5] Rossi, Gustavo, Daniel Schwabe, and Robson Guimarães.

«Designing personalized web applications.» Proceedings of the 10th international conference on World Wide Web. ACM, 2001.

[6] Akiki, Pierre A., Arosha K. Bandara, and Yijun Yu. «Engineering Adaptive Model-Driven User Interfaces.» (2016).

[7] Juan Danculovic ,Gustavo Rossi, Daniel Schwabe, Leonardo Miaton, Patterns for Personalized Web Applications, 2002.

[8] Stoyanov, Stoyan R., et al. «Mobile app rating scale: a new tool for assessing the quality of health mobile apps.» JMIR mHealth and uHealth 3.1 (2015): e27.

[9] Kuo, Tsai Chi. «Mass customization and personalization software development: a case study eco-design product service system.» Journal of Intelligent ,Manufacturing 24.5 (2013): 1019-1031.

[10] Eom, Hyo-Eun, and Seok-Won Lee. «Human-centered software development methodology in mobile computing environment: agent-supported agile approach.» EURASIP Journal on Wireless Communications and Networking2013.1 (2013): 1.16-

[11] Li, Simon, Kamrun Nahar, and Benjamin CM Fung. «Product customization of tablet computers based on the information of online reviews by customers.» Journal of Intelligent Manufacturing 26.1 (2015): 97110-.

[12] Pommeranz, Alina, et al. «Designing interfaces for explicit preference elicitation: a user-centered investigation of preference representation and elicitation process.» User Modeling and User-Adapted Interaction 22.4397-357 :(2012) 5-.

[13] Gauch, Susan, et al. «User profiles for personalized information access.» The adaptive web. Springer Berlin Heidelberg, 2007. 54-89.

[14] Ekstrand, Michael D., John T. Riedl, and Joseph A. Konstan. «Collaborative filtering recommender systems.» Foundations and Trends in Human-Computer Interaction 4.2 (2011): 81173-.

[15] Brusilovski, Peter, Alfred Kobsa, and Wolfgang Nejdl, eds. The adaptive web: methods and strategies of web personalization. Vol. 4321. Springer Science & Business Media, 2007.