

DunaKavics

A Dunaújvárosi Főiskola online folyóirata 2015. III. évfolyam II. szám

Műszaki-, Informatikai és Társadalomtudományok

CSERNÉ DR. ADERMANN

GIZELLA

Pedagógusok értékelési kompetenciái

HETYEI CSABA

Lapradiátorok hatásfokának vizsgálata és modellezése

ROLAND CSEH – JÓZSEF KATONA

Requirement analysis and specification of a Bill Monitor application based on Android Operating System

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Requirement analysis and specification of a Bill Monitor application based on Android Operating System

Abstract: The smart phone has become an accustomed tool for humanity, such as personal computer or debit card. Millions of people use it for making calls, browsing or for vehicle navigation all over the world. However, making phone calls or surfing the Internet are charged and many users tend to ignore the expenses of these services. This article provides a brief introduction about the initial steps, the requirements and specifications of developing an application for an android operating system from a software development aspect, which could provide users a complete bill about the charges for a current period of time or could show their balance and prevent users from overspending. In addition, these kinds of applications are hardly accessible for Hungarian users.

Keywords: Android, fragmentation, requirement analysis, specifications.

Összefoglalás: Az okostelefon az emberiség egy olyan megszokott eszközévé vált, mint például a személyi számítógépünk vagy bankkártyánk. A világon több milliárdan használják ezeket az eszközöket telefonálásra, böngészésre vagy éppen autós navigációra. A telefonálásért vagy a világhálón történő böngészésért fizetnünk kell, ráadásul sok felhasználó könnyen megfeledkezik arról, hogy egy adott időszakban mennyit költ ezekre a szolgáltatásokra. A cikk egy rövid bevezetést nyújt arról, hogy egy android operációs rendszerre történő fejlesztéshez milyen kezdeti lépéseken kell átesnünk, valamint szoftverfejlesztési szempontból, egy olyan alkalmazás követelmény feltárását és specifikációját ismerteti, amely egy teljeskörű „számlát” vezet számunkra az aktuális időszak forgalmi díjáról vagy éppen telefon egyenlegéről. Az ilyen alkalmazások nagyban segíthetik a felhasználókat túlköltekezéseik megállításában. Ráadásul az ilyen jellegű alkalmazások magyarországi felhasználók számára egyáltalán nem, vagy alig elérhetőek.

Kulcsszavak: Android, fragmentáció, követelmény feltárás, specifikáció.

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[5] Block, Ryan (August 28, 2007): "Google is working on a mobile OS, and it's due out shortly". Engadget. Retrieved February 17, 2012.

Introduction

Potential applications of smartphones nowadays greatly expanded, more and more applications are used as simple web browsing or e-mail in addition for example to support learning such as m-learning as well [1]. Under the concept of m-learning in general we refer to learning activities done on any mobile device and learning content available from anywhere [1]. These conditions are primarily met in case of smartphones, tablet PCs using the major operating systems: primarily Android, Apple iOS, Windows Phone, or others: Symbian, Bada and Blackberry platforms [2].

According to The Oxford Dictionary of Foreign Words and Phrases, the meaning of Android is defined as "human-like robot". This statement is not so far from what people really think about it: a small green robot, which can be found on at least the 70% of smart phones, since the most popular mobile operating system is the Android all over the world. This system is open source and can be used and customized easily. The Android mobile operating system uses a Linux kernel which was primarily designed for mobile devices with touchscreen, for instance, smartphones and tablets. [3, 4]

The Android Inc. started the development for the conventional non-touch screen phones. At first, Google only financially supported the Android Inc. and later bought up the company in 2005. The first big announcement was not made until November 2007, when the Open Handset Alliance consortium was announced and that they were working on the operating system, which would be Linux-kernel based and open source. There are lots of members of the alliance, such as phone manufacturers, application developers, mobile operators and chip makers. The first device, which did run this system, was already installed with touchscreen and was available in 2008 for public use. It was manufactured by HTC and T-Mobile and it run the 1.0 version of Android. However, the first large breakthrough was in April 2009 with the 1.5 version. Nowadays, Android mobile operating system is the most widely used mobile OS. [4, 5]

THE ANDROID VERSION-FRAGMENTATION

The versions of Android have been released with a certain code name since 2009. This code name always refers to a sweetness and follow one another in alphabetical order. They were also differentiated by a certain level of API, an application programming interface that describes how the various parts of the software work together. [6, 7]

Table I. Versions of Android.

Number of version	Name of Code	API	Release date	Phone	Tablet
1.0	-	1	2008.09.23	✓	
1.1	-	2	2009.02.09	✓	
1.5	Cupcake	3	2009.04.30	✓	
1.6	Donut	4	2009.09.15	✓	
2.0-2.1	Éclair	7	2009.10.26	✓	
2.2 – 2.2.3	Frozen Yoghourt	8	2010.05.20	✓	
2.3 – 2.3.2	Gingerbread	9	2010.12.06	✓	
2.3.3 – 2.3.7	Gingerbread	10	2011.02.09	✓	
3.0	Honeycomb	11	2011.02.22		✓
3.1	Honeycomb	12	2011.05.10		✓
3.2	Honeycomb	13	2011.06.15		✓
4.0 – 4.0.4	Ice Cream Sandwich	15	2011.12.16	✓	✓
4.1.x	Jelly Bean	16	2012.06.09	✓	✓
4.2.x	Jelly Bean	17	2012.11.13	✓	✓
4.3.x	Jelly Bean	18	2013.07.24	✓	✓
4.4	KitKat	19	2013.10.31	✓	✓

[6] Begun, D. A. (March 2011) [2011]: "Dealing with fragmentation on Android devices". Amazing Android Apps. For Dummies. Wiley.

[7] "Android Kernel Versions". elinux.org. July 7, 2011. Retrieved November 3, 2013.

[6] Begun, D. A. (March 2011) [2011]: "Dealing with fragmentation on Android devices". *Amazing Android Apps. For Dummies*. Wiley. p. 7. ISBN 978-0-470-93629-0. Retrieved May 22, 2013.

[8] Mark Wilson (September 23, 2008). "T-Mobile G1: Full Details of the HTC Dream Android Phone". *gizmodo.com*. Retrieved December 27, 2013.

[9] "Widgets Android Developers". *Developer.android.com*. Retrieved September 15, 2012.

[10] "Google Mobile". *Google.com*. Retrieved 2013-06-10.

At the beginning, the operating system was only developed and optimized for mobile phones and not for tablets. That is why Google and the consortium decided to divide the Android into two parts. The first line started to deal with only phones and the second one with tablets. Thus the first version of Android was presented in February 2011 only for tablets, which led to a strong fragmentation later. People welcomed it with mixed feelings. They liked the new version, but they were upset because there was not guarantee that mobile phones would get this new features as well. Google also realized very quickly that this conception would not lead to good. That is why the next major version was already developed for both devices. The 4.0 version, which was published in October 2011, was able to work on tablets and phones as well. With this step fragmentation was tried to be eliminated with more and less success. As a consequence of fragmentation, the user interface has been completely redesigned with lots of new features, which cannot be found and implemented for older versions of the system. [6, 8]

ANDROID WITH DEVELOPERS VIEW

Anyone can develop applications for Android and Google does not deny it, however, it is not as easy as some may think. It is not enough to implement the application, but it also must be optimized in order to support more and more devices, which can run different versions of Android. Because of fragmentation, development is not only difficult for users but also for software developers as the application has to be optimized for mobile phones and tablets as well. [9]

That is why Google and the Open Handset Alliance has been helping developers' work from the beginning. They created a site at www.developer.android.com, where anyone could find all help to develop Android. The site is only available in English language, thus English proficiency is a requirement. When the Honeycomb was released, there were so many features that the developers had to relearn almost the whole application development. At this time, design guidelines were not available, so each application was very different from one another in graphical user interface, using and controlling. After releasing Honeycomb, design guidelines were issued. [10]

GOOGLE PLAY STORE AND DEVELOPERS CONSOLE

Most of the well-known operating systems (for mobile phones or personal computer) have a kind of application sharing system. The same applies in case of the Android operating system. Currently, The Google Play Store (Figure I.) is an official application store for Android platform. The system was launched when the first device, which run Android system, appeared. At this time, its name was Android Market where people could find applications created by developers. However, it has expanded with loads of extra services so far, such as music, movies, books, magazines and Google's purchase of assets. It is important to note that not all services are available in all countries. For example, when the Market appeared, paid applications were not available in Hungary until May 2011. Music and books services appeared in our country in 2013. [11, 12]

Figure I. Google Play Logo.



Source: <http://brebenel-silviu.deviantart.com/art/Google-Play-Logo-289246645>

One of the most important part of the application development is spreading. A developer has a variety of opportunities to acquaint the program. The Google Developer Console (Figure II.) provides essential help with which anyone can upload their work to the Play Store. Having uploaded the application, the developer can decide whether it should be free of charge or not. [12]

In case of paid applications, the developers can decide about the price. They receive 70% of the sales price from Google and the remaining 30% covers the costs of management and spreading, so Google does not make profit from it. Developers can also specify which devices should be supported by the application and it is largely influenced by how the application was implemented, moreover, developers can also limit application use for specific models (e.g. Samsung models only).

[11] "About Google Play". Google. Retrieved 8 March 2012.

[12] "Paid App Availability". Google Play Help. Google. Retrieved 7 March 2012.

[13] Barra, Hugo (10 May 2011): "Android: Momentum, Mobile and More at Google I/O". The Official Google Blog. Retrieved 10 May 2011.

[14] Deleting apps from My Apps/My Orders – Google Play Help". Google. Retrieved 15 October 2012.

[15] Kővári, A.: „Hardwer-in-the-Loop Testing of an Electrohydraulic Servo System”, Proc. of CINTI 2009, Pp. 631–642, 2009.

[16] Kővári, A.: „Influence of cylinder leakage on dynamic behavior of electrohydraulic servo system”, Proc. of SISY 2009, Pp. 375-379, 2009.

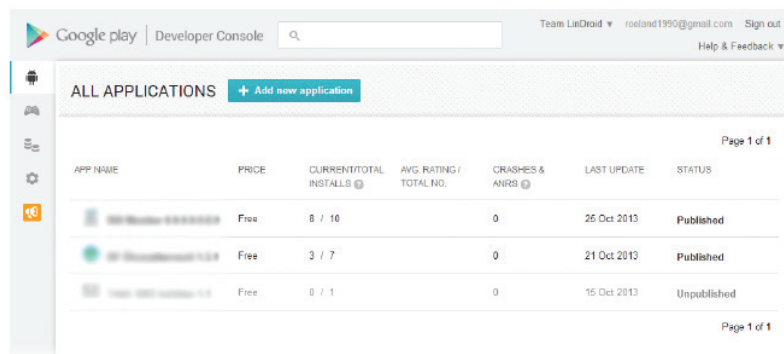
[17] Kővári, A.: „Real-Time Modeling of an Electro-hydraulic Servo System”, Computational Intelligence in Engineering, Springer, Pp. 301–311, 2010.

[18] Kővári, A.: „Hybrid Current Control Algorithm for Voltage Source Inverters”, Proc. of ECBS-EERC 2009, Pp. 65–70, 2009.

[19] "Developer Registration". Google Play for Developer Help. Support.google.com. Retrieved 7 March 2012.

In addition, developers can specify in which countries the application should be available (in some countries it may be limited according to mobile phone service providers), in which categories the application should be sorted into and age recommendation can be given. So developers can be sure that the correct target audience easily finds their developed application. If an application has become public even for just a testing, there is no opportunity to delete it, but developers can withdraw from the store. All applications have a different package name which is memorized by Play Store, so probably that is the reason why applications cannot be deleted. [13, 14]

Figure II. Developer Console.



The screenshot shows the Google Play Developer Console interface. At the top, there's a header with the Google Play logo, 'Developer Console', a search bar, and user information: 'Team LtdDroid', 'roland1990@gmail.com', and 'Sign out'. Below the header, there's a section titled 'ALL APPLICATIONS' with a '+ Add new application' button. A table lists the applications with columns: APP NAME, PRICE, CURRENT/TOTAL INSTALLS, AVG. RATING / TOTAL NO., CRASHES & ANRS, LAST UPDATE, and STATUS. The table shows three applications: 'My Android App 1.0.0' (Free, 8 / 10 installs, 0 rating, 0 crashes, last update 26 Oct 2013, Published), 'My Android App 1.0.1' (Free, 3 / 7 installs, 0 rating, 0 crashes, last update 21 Oct 2013, Published), and 'My Android App 1.0.2' (Free, 0 / 1 installs, 0 rating, 0 crashes, last update 15 Oct 2013, Unpublished). The page is labeled 'Page 1 of 1'.

APP NAME	PRICE	CURRENT/TOTAL INSTALLS	AVG. RATING / TOTAL NO.	CRASHES & ANRS	LAST UPDATE	STATUS
My Android App 1.0.0	Free	8 / 10	0	0	26 Oct 2013	Published
My Android App 1.0.1	Free	3 / 7	0	0	21 Oct 2013	Published
My Android App 1.0.2	Free	0 / 1	0	0	15 Oct 2013	Unpublished

TEST OPPORTUNITIES IN THE PLAY STORE

The software test has slightly different aspects and phases than hardware testing where the correcting and finalizing the operation and parameters of each component are finalized by iterative test method and the result can be evaluate by simulation test [15–18]. Android software test opportunities were firstly introduced in 2013 at Google I/O conference. These test opportunities are [13, 19]:

- **Alpha Testing:** In an alpha version of a product, debugging and implementation of services are not complete, but the main requirements are satisfied. The alpha release is the first build of an application for the software testers. With the Developer Console it can be managed completely.
- **Beta Testing:** The first beta version of the application generally includes all features which are defined in the requirements during the planning, but even in this case, there may be some errors, so in this status the application cannot be used in everyday life. Some developers refer to this phase as a preview, technical preview or early release. There are two types of beta testing; closed testing and opened testing. During closed testing a small closed group examines the application, whereas the open test is published and available to anyone. The Developer Console helps to achieve closed beta testing.
- **Staged Rollouts:** There is a possibility to use this test method if a new version or update of the application is received. If the application once achieved the final version, alpha and beta testing phases are skipped after updating. Therefore, if the developers does not want everyone to receive the new update immediately, they can decide how many percent of the user base gets the new version. Later, developers are able to expand it so people get the new update gradually. By the time all users can reach the new version, the developer gets information about how users like the new version and what needs to be improved in the next version.

Requirements analysis resulting in a software specification

The first steps of the software development are the requirements exploration and the tasks specification. The following sections will try to answer the questions of what the application have to do and what type of problems must be solved.

REQUIREMENTS ANALYSIS

The following hardware and software requirements are needed:

- **Hardware requirements:** The device has to run the Android Operating System and has to have all the necessary elements of mobile hardware (radio module, SIM card reader, antenna, etc) and it has to be able to connect to mobile networks.
- **Software requirements:** The device has to run at least the 2.3 or higher version of Android, which has a call log and SMS storage, which contains entries, too.

SPECIFICATIONS OF SOFTWARE REQUIREMENTS

Nowadays, many people use smart phones, but there are few applications which effectively take advantages of the opportunities provided by these devices. One of these opportunities is based on the most important functions: making phone calls. My aim is to implement an application, which can solve a general problem within Hungarian users. This problem is the current bill or balance issues of the mobile phone. It is easy to forget that how much money is spent on making phone calls in a period of time or how much money is still available on one's balance. An application could solve this problem. It must be able to effectively keep track of making phone calls and sending messages with call and text messages logs, which are available on the phone. In addition, plenty of customization options must be ensured for users so that they can easily set their own mobile phone to the contract. The problem must be solved by logs file and the contract information. The application must contain a convenient function, which allows users to easily view the current balance, even without opening the application. Moreover, the applications should provide the opportunity for users to be able to keep their mobile bill within a financial framework. In fact, the application must do its function automatically. Having installed the application, the users should set it to their contract, which from that point does not require any particular intervention to proper function.

The most important features that has to be solved:

- Following contract or prepaid phone card bills;
- Following the billing period correctly (each subscription has a date when the period is restarted);
- Handling free minutes and free text messages;
- Managing free phone numbers and text messages numbers;
- Within the network and outside the network minutes / text messages fee, free minutes and text messages tracking;
- Handling periods (business, outside business and free hours);
- Calculating with tax of the phone;
- Service for monthly limit and balance limit;
- Invoice report function (in case of subscription);
- Handling the balance charging (in case of prepaid);
- Managing other monthly expenses;
- Nice and simple HOLO theme user interface based on the Android Design Guidelines;
- Various HOLO themes;
- Consistent appearance in case of Android 2.3 or even 4.x with ActionBarSherlock management;
- Advanced options understandably;
- Widgets and/or notification on the status which is updated automatically after finishing a phone call or sending a text message;

- Roaming notice;
- Logging the program events correctly.

Comparison the specified application with the most similar and popular applications

In this chapter, the required and specified application is compared to the most popular applications in the world that are similar to the specified application and are also available on the Play Store. Table II shows the comparison.

Table II. Comparison of applications.

	Bill Monitor	Phone Free Assistant	dodol Phone	Phone Monitor	CallInspector
Setting the type of the contract (pay monthly or prepaid)	✓	–	–	–	–
Billing method (based on second or minute)	✓	✓	–	–	–
Service setting (T-Mobile, Telenor and Vodafone etc.)	✓	–	–	–	–
Type of contract (personal, business)	✓	–	–	–	–
Tax of service	✓	–	–	–	–
Mobile Internet management	✓	–	✓	✓	✓
Other charge management	✓	–	–	–	–
Bill notification	✓	✓	✓	✓	✓
Monthly limit	✓	–	✓	✓	–
Fee management	✓	–	–	–	–
Free minutes management	✓	✓	–	–	–
Free phone number management	✓	–	–	–	–
Fee of minute management (within or outside the network)	✓	–	–	–	–
Periodic fee of minute (business or outside business hour)	✓	–	–	–	✓
Free text message management	✓	–	–	–	–
Fee of SMS management (within or outside the network)	✓	–	–	–	–
Count of character of text message	✓	–	–	–	–
Roaming	✓	–	–	✓	✓
Period management (business or outside business hour)	✓	–	–	–	✓
Theme management	✓	–	✓	–	–
Widget	✓	–	✓	–	✓
Free	✓	✓	✓	✓	✓

As the table shows, there are not flexible applications for Hungarian people. However, there are more applications which are not included in the table, but are more or less similar to the specified application and available on the Play Store. These are not in the TOP 5 downloaded applications. The examined applications were downloaded by thousands and their average scores are above 4.0. One application is better in some respect than the other one, but none of them have a specific Hungarian property management, such as different contract, service or tax of service management.

Conclusion

In the first part of the article, a mobile operating system is introduced, which is mostly used on smart phones all over the world. During the introduction of this system, different versions of the operating system are described, which resulted some problems that led to fragmentation at the beginning. An option how these problems can be solved is also defined. The mobile operating system is examined from the point of view of software developers. The following section describes an application store, where the developers are able to publish their implemented application at any time, in addition, the application store provides lots of opportunities to setting and specifying the applications. Moreover, the developer console is described, where among other useful opportunities, different testing facilities are demonstrated, which were presented in the 2013 Google I/O conference. Having explained the helper function of the developed applications, a requirement analysis and specification of an application is presented, which can help Hungarians. This application is able to follow and monitor phone bills, moreover, it can help people to prevent overspending in the simplest possible way, for example by using a widget. Finally, a comparison shows that more usable, flexible and fitting applications at Play Store are not available for Hungarian people.