

Lecture Notes in Electrical Engineering 365

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Proceedings of Second
International Conference
on Electrical Systems,
Technology and Information
2015 (ICESTI 2015)

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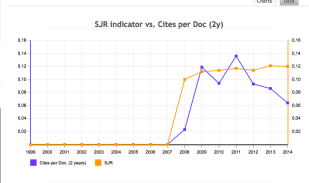
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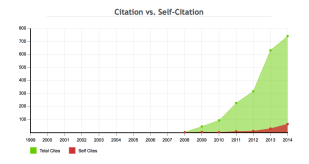
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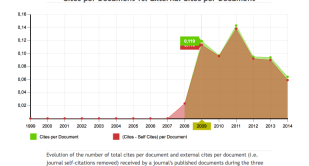


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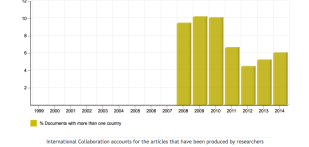
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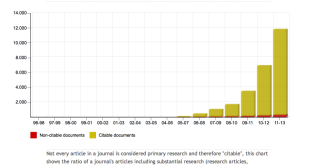
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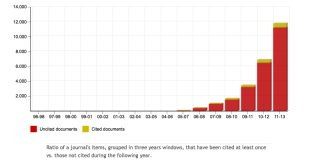
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Not every article in a journal is considered primary research and therefore 'citable', this chart shows the ratio of a journal's articles including substantial research (research articles, conference papers and reviews) in three year windows.



Ratio of a journal's items, grouped in three years windows, that have been cited at least once vs. those not cited during the following year.

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Chapter 61

Enhancing University Library Services with Mobile Library Information System

Singgih Lukman Anggana and Stephanus Eko Wahyudi

Abstract An Indonesian University has to serve three main activities: Research, Teach, and Outreach. To support those activities, one of the most important facilities was library. Library has evolved from its previous original purposes to keep and preserve resources, such as books and other materials. The development of Information and Communication Technology (ICT) shifted the main library features to a broader one. However, some studies show that the end of traditional library maybe not near, as many still prefer to read printed format books instead of electronics one. Thus, it is still necessary to introduce the use of ICT to enhance the user experience of using university library service. ICT can be used to allow the user to find collection, borrow books, and many other services using mobile applications. This paper discusses the development of an Android mobile application that support the library information system, allowing the users to use the library services in a more convenient way remotely. There are number of server-side or client technologies used for the development, including: Android SDK, Laravel Framework, Laravel Dispatcher, Iron.io, Google Cloud Messaging (GCM), and Android Volley. A preliminary study carried out to gather the features needed by the prospective users, then followed by an analysis and design stages, then implemented using the aforementioned technologies. Finally, upon successful implementation stages, it was followed with a series of interviews to its prospective users, both the university's librarian as well as the prospective users. In conclusion, the developed apps met the users expectations whilst a number of improvements can also be done to boost the user experience and usability.

Keywords Android · Hybrid library · Library information system · Mobile apps

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61.1 Introduction

The rapid development of Information and Communication Technology (ICT) also push the limit of what can be introduced to its users that support their work. Numerous applications of the technology also made possible as the number of the technology users also increasing dramatically. Based on January 2015 data, approximately 42.4 % of more than 7 billion world population are Internet users [1, 2]. Among of those figure, 45.6 % are people from Asia countries, which is approximately 1.4 billion people. In Indonesia, more than 71 million people use Internet, which is more than 28 % of its population. Those figures record a growth of 753 % compared to the year of 2000 data. Approximately 51 %—more than 3.6 billion people are unique mobile phone users. Among those, 2.7 billion people or 38 % of those are using smartphones [2].

In general, there are 3 main activities that Indonesian University should focus on—called *Tridharma*, which include: research, teach, and community service. To support these activities, a library is one of the main facilities needed. Universitas Ciputra Surabaya as one the leading universities in Surabaya also tries to improve the quality of its library service.

Digital Library is a popular terminology that has been around for more than a decade. It refers to the use of Information and Communication Technology and other services that provide a means of repositories of digital contents, including that of electronic documents and other multimedia files [3, 4]. The documents might be web pages, scanned legal documents, electronic books, or many other document types [4].

With the availability of the ICT infrastructure and digital contents that support the development of Digital Library, there is a question that the end of traditional library might be in the very near future, replaced by Digital Library. Some researches show that a physical library will stay for a very long period, as some people still prefer printed format book compared to digital format [5]. Some researches suggest that libraries should progress to hybrid library [5], a library that still maintain printed resources and start to move towards digitalizing books and collect electronic resources [8].

ICT introduces a lot of possibilities to improve the efficiency and effectiveness of traditional as well as hybrid library types. It can be used to enhance some of their main services, including book loans and returns. The availability of mobile technology should also allow them to use it to find the library collection that they need to borrow even though when they are mobile.

This paper discusses of the development of an Android mobile apps to enhance the user experience of borrowing book in a university library, especially at Universitas Ciputra.

61.2 Library

The definition of a library is a place where information resources, such as: books, periodicals, magazines, and other materials—including videos and musical recordings, are stored and available for people to borrow or use [6, 7]. A library usually provides a number of rooms and facilities, including collection rooms, reading rooms, audio-visual facilities, and many other facilities [7].

In the past few decades, we witness the emergence of ICT that shift of the library services and functions. Many information previously only available in printed format becoming accessible in electronic formats [8]. The original concept of library are changed, books were switched by information whereas those information are for dissemination not for preservation [8].

Libraries in this modern era should improve its facilities and functionality [8–10]. It should provide convenient and comfortable seating areas. The collection should be organized in a way that is easily to be retrieved both the printed and non-printed resources collection. It should start to digitalize its collections to allow computer to process the information contained and allow for faster information searching. It should also provide more services, both online and offline one, for examples: providing high-speed Internet terminals, a mobile app to allow the member to get information and have a virtual tour of the collections. It should organize innovative activities and learning programs in order to attract more people to come.

This paper discusses the development of a mobile application that could enhance or improve the user experience on a traditional as well as hybrid type of university library. The apps will allow them to browse collections, book or borrow books, pay late returns penalty fees, and several other services.

61.3 Mobile Apps Development Technologies

There are a number of mobile platforms or operating systems available in the market: IOS, Android, Windows Phone, Blackberry, and some others. Based on May 2015 market survey result [11] shown on Table 61.1, Android leads in a very significant number which is 78.0 %, compared to the 18.3 % of iOS which is the closest rival. The number is declining from 81.2 % on previous year, it still very strong for other competitors to catch up.

Table 61.1 Smartphone OS market share, Q1 2015

Period	Android (%)	Ios (%)	Windows Phone (%)	BlackBerry OS (%)	Others (%)
Q1 2015	78.0	18.3	2.7	0.3	0.7
Q1 2014	81.2	15.2	2.5	0.5	0.7
Q1 2013	75.5	16.9	3.2	2.9	1.5
Q1 2012	59.2	22.9	2.0	6.3	9.5

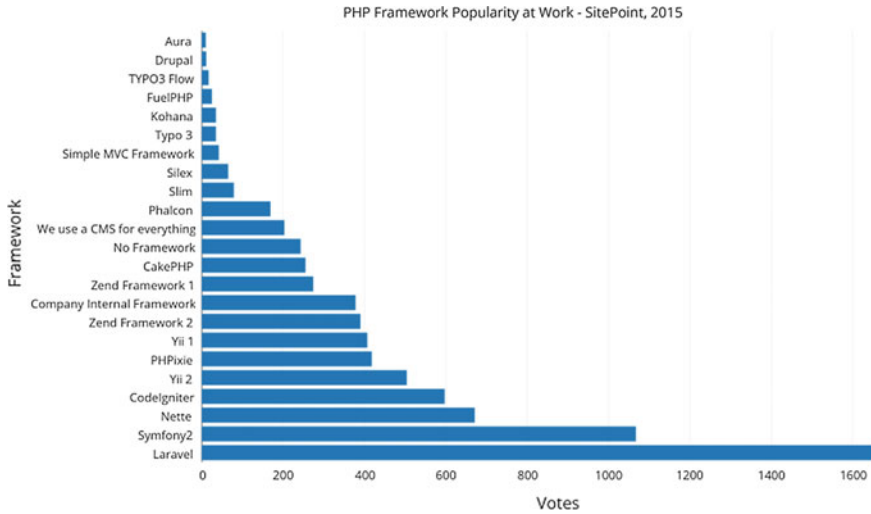


Fig. 61.1 PHP frameworks market share [12]

There are some technologies that support the development of mobile applications. There are many frameworks that support mobile apps developer to create apps in an easier and faster way. The emerging cloud technologies also a major technology that support the scalability of the backend feature.

Mobile apps usually need a backend application and database. For this purpose, there are some frameworks available in the markets that support developers for a faster development stage. Many of those frameworks are using PHP as basis the scripting language, for examples: Laravel, CodeIgniter, Symphony, Yii, and many more. Laravel is one of the most popular and widely used in the last couple of years as seen on Fig. 61.1.

Laravel is an open-source framework developed by Taylor Otwell. Laravel designed to facilitate the developers in their applications by providing features such as security, RESTful routing, queue, unit test, schema builder, and many other features. There are many advantages of using Laravel Framework, such as: a large community, easy to understand documentation, supports PHP dependency by using the composer.

There are a number of plugin that works on top of Laravel to support this project development, such as Iron.io and Laravel Dispatcher. Iron.io is a cloud-based service IaaS (Infrastructure as a Service) that provides asynchronous message queue and task. This service is useful to ease the job on the server that requires heavy work, such as: large-scale email delivery, delivery notification, date checks, and more. Dispatcher is useful for scheduling purposes that allow the application to run artisan command without the need to create cron tab configuration manually.

Another technology required in typical mobile apps is notification. For this purpose developers can use Google Cloud Messaging (GCM). GCM provide some Application Program Interface (API) that provides the interface between the



Fig. 61.2 System design

application and the server. The cloud-based messaging services can transmit data from the server into the smartphone in real time. It handles the queue and delivery to the target device.

To improve the application networking performance, there is an HTTP Library called Volley. This library can help Android to perform efficiently and fast networking. There are many advantages of using a Volley: automatic scheduling, simultaneous multiple networks request, network demand priorities and cancellation, and the availability debugging and tracing tools.

61.4 Analysis and Design

The features provided in the system decided based on a study of 31 respondents of the mobile information system prospective users. Additionally, a comparison to a similar web based information system also conducted. Based on that study, the main features that should be provided in the system are: user authentication, lending system, late return penalties, notification system, loan history, collections, loan extension, and delivery system.

The mobile library information system application consists of 2 different systems: the actual Android application and web based administration application.

Figure 61.2 depicted the system architecture design where the Android apps will be able to communicate with the server using the Internet connection. The server then will be able to communicate with database server as well as to communicate with Google Cloud Messaging service that will be able to send push notifications to the Android device.

61.5 Results and Discussions

The application developed using variety of technologies previously mentioned. Android was chosen as the target mobile platforms due to its popularity [11]. The Android SDK was used as the basis for the Android mobile application development, whereas PHP and Laravel frameworks as the basis for the server-side scripting language and the administration application features respectively. Additionally there are some other technologies used, including: Google Cloud Messaging (GSM), Laravel Dispatcher, Iron.io, and Volley HTTP Library.

Figure 61.3 depicted some of the mobile application interfaces: the main interface for user authentication (a), navigation drawer (b), book collection (c), and book details (d). The interfaces were designed using the latest Flat UI theme found on the latest Android versions.

Figure 61.4 shows the front page of administration applications upon successful login attempt to the system. The administration dashboard was developed using responsive web technology. The page also uses of flat color scheme to introduce the modern look and feel.

Upon completion of the implementation stages, a system test was conducted both on the mobile application on the client side as well as the administration application. To test the Android application for the client side, a survey was carried out to get feedback from prospective users. Another test was performed with the university's librarian for the administration application.

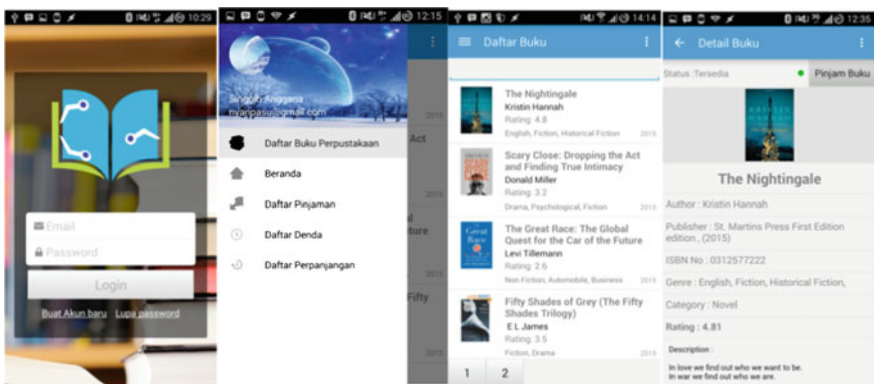


Fig. 61.3 Android mobile apps interface, left to right a, b, c and d

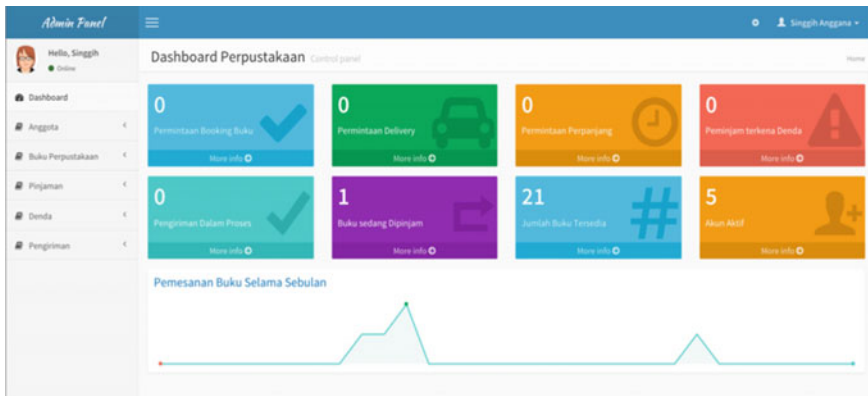


Fig. 61.4 Administration application interfaces

The users agree that this mobile application helped them to use the university library services remotely. They could find books, view loans list, book some books, borrows books, as well as to extend the loans. The use of native mobile apps also allows them to get notifications for some services.

The client side mobile application users agreed that the application was easily understood and they did not find any difficulties on using it. While some parts of the interface might need improvement in terms of usability, but in general the application was simple enough to use. They also did not have any problems on finding books from the collection, even though if there were more filter criteria provided the feature might be more helpful. Borrowing books also easily performed while they demand more information about book currently on loan.

The librarians test the administration system provided in the back-end side based on the user scenarios. The scenarios including new user account registration, book loans, lost item, late return fines, fines payment, and other scenarios. The staffs found that the application user interface was easy to use, the button arrangement as well as the naming were easy to understand. Book loans through the mobile phone were considered as an innovative feature not previously available in any similar applications. Book loan extension might needs more consideration to avoid misused. Ultimately, the challenge to use the system is the integration of the system with currently running system, the security features to ensure the data safety.

61.6 Conclusion

Information and Communication Technology can be used to enhance the user experience of using traditional or hybrid library services through an Android mobile application. The apps can be used to enable the user to check the book availability as well as to borrow the book without having to go to the library. The collaboration

with other services such as delivery service may also boost the user experience. The developed application works according to the intended functionality, based on features decided on the design and analysis stages. Android features such as notifications on the mobile devices also added another functionality that is not found in traditional web based information system. Future development of the system might be needed, to allow the member to access other libraries using the same application.

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