Course Information Broadcast System Using Google Cloud Messaging on Android Mobile Device

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Abstract

In daily life, information is very important, especially in this modern era. This also applies in education environment, especially in the college. Information that up-to-date about course activity is very important for the students. This information usually announced by the lecturer or the department through verbal or written information. For example, using department bulletin boards or electronic media such as websites that provided by the university or using social media. Therefore, it is important for students to check information regularly. This certainly become quite a problem and time consuming. Each student must come to the bulletin boards location or checked all the information provided through electronic media regularly. Therefore, in this research we build an application that have ability to broadcast lectures or course information update in real time using Google Cloud Messaging (GCM) that running on android mobile devices. This application also have files upload and download feature that related to the course, shared course calendar agenda that inputted by lectures, and sending message between the lecturer and the students, so that they can ask directly to the lecturer. The objective about this research is to find and build a suitable application to broadcast course information in university (using two university as a testing sample) using android and GCM technology. Based on test results, the application is already running well on many types of android mobile devices and gives real time information from lectures to the students. Testing is also done using questionnaires to potential users, which found that 80% of respondents are satisfied with the features that have been provided by this application. So this research can conclude that this application already meet user need.

Keywords: Android; broadcast; courses; information; Google Cloud Messaging; mobile device.

1. Introduction

In daily life, information is very important, especially in this modern era. This also applies in education environment, especially in the college. Information that up-to-date about course activity is very important for the students. Lectures and department usually give the information about the courses using verbal or through paper media that tacked on a bulletin board to notify a course information lecture to students or through electronic media such as websites and social media. This causes frequent inefficiency, because student must checked all the information regulary. The information that becomes one with the information, so student must find and read all of the information very carefully. This is very inefficient, time consuming, and often cause the miss-information.
Therefore it is necessary to have a system to broadcast information directly to the user that needed some particular information and give it in real time when the information is entered. So, this research would like to make an announcement/information broadcast system especially on courses information in college. This application would distribute information in real time through mobile applications on Android-based devices using Google Cloud Messaging. The use of android as complementary educational facilities has done such learning media [1, 2, 3, and 4], test online [5], class attendance [6], accessing paper citation [7], etc. The information can be given by the lecturers or by the head of department. The information will be distributed only to those who need it, for example information from lecture will be given only to students who attend to a particular course. So that each user only receives information related to the activities that they done. In addition, the application also provide with upload and download files related to the course that’s being followed, sharing course agenda/calendar that inputted by lecturer, and a message delivery system between faculty and students.

The objective from this research is tried to build suitable application to broadcast course information especially on university environment. To collect user requirement analysis and testing this research will use 100 student (with various age, various semester level that they are taken, and various major) from two university.

For the platform of the application will be used mobile device based on Android. Because IDC research study states that [8] five-year forecast for shipments of smartphone worldwide (from 2012 to 2016) reached $659.8 \times 10^6$ units in 2012, up 33.5 % from 494 200. 000 units shipped in 2011. The smartphone shipments will grow by 18.6 % annually up to 2016. The worldwide smartphone market is ready to resume double-digit growth in the coming years. There is a wider choice of types and vendors of smartphones, too many choices cellular operators that provide Internet access, and factor prices tend to fall will drive the delivery of higher again in the coming years. IDC research believe Android will maintain its leadership position during the period 2012 to 2016 (and this will continous in the future [9], Table 1) in addition there is also a iOS (Apple), BlackBerry, and Windows Phone as a rival to Android.

Until right now the majority of smartphone vendors already produce Android-based smartphones, such as Samsung, HTC, Lenovo, LG and many other vendors. This is because Android is open source operating system that freely distributed and used by any vendor. So, it make android application is a right choice to implementation this research.

Table 1. Smartphone Demand Forecast [12]

<table>
<thead>
<tr>
<th></th>
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<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Android</td>
<td>1,254.6</td>
<td>82.6%</td>
<td>7.6%</td>
<td>1,624.4</td>
<td>84.6%</td>
<td>4.6%</td>
<td>6.9%</td>
</tr>
<tr>
<td>IOS</td>
<td>231.2</td>
<td>15.2%</td>
<td>-0.1%</td>
<td>269.0</td>
<td>14.0%</td>
<td>3.2%</td>
<td>3.0%</td>
</tr>
<tr>
<td>Windows Phone</td>
<td>23.8</td>
<td>1.6%</td>
<td>-18.5%</td>
<td>17.8</td>
<td>0.9%</td>
<td>-5.7%</td>
<td>-9.4%</td>
</tr>
<tr>
<td>Others</td>
<td>9.5</td>
<td>0.6%</td>
<td>-15.1%</td>
<td>9.2</td>
<td>0.5%</td>
<td>4.8%</td>
<td>-3.9%</td>
</tr>
<tr>
<td>Total</td>
<td>1,519.0</td>
<td>100.0%</td>
<td>5.7%</td>
<td>1,920.4</td>
<td>100.0%</td>
<td>4.3%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

Source: IDC Worldwide Quarterly Mobile Phone Tracker, March 3, 2016
Android itself uses Java programming language that originally developed by James Gosling while still at Sun Microsystems and released in 1995. Java adopted syntax from C with a simpler object model. Generally, Java applications compiled into P-code (byte code) and can run on different Java Virtual Machine (JVM).

Java is a programming language that is general/ non-specific (general purpose). Java can run on several different operating system platforms. Currently, Java is the most popular programming languages in use, and is widely used in the development of various types of software applications or web-based applications. Because Java can work on multi-platform and multi-device and can run in almost all computers and other devices that support Java, with little change or no change at all in the code [10].

For broadcast system this application will used Google Cloud Messaging. Google Cloud Messaging (GCM) for Android is a service that helps developers to send data from the server for applications on Android devices [11]. The data can be a message that tell Android that there is new data that retrieved from the server (for example a movie file that is uploaded by the user), or it can be a message of up to 4 KB of data payload (such as instant messaging applications). GCM services handle all aspects of a message delivery and queue to the target application [12]. GCM allows android applications for mailed them to the server for broadcasting messages a notification to all existing clients, as seen on Figure 1.

![Google Cloud Messaging System Architecture](image)

**Figure 1.** Google Cloud Messaging System Architecture [12]

2. Material and Methods

The research started by collecting user Information and requirement from 100 student from two university with various age, various major, and various semester level. Based on information from respondent, found that on majority respondent check courses information two times a day (Figure 2).
The courses information usually provide on Department/University information board (as seen on Table 2) using paper media.

Table 2. Course Information Media

<table>
<thead>
<tr>
<th>Information provide on</th>
<th>Number of Respondents</th>
</tr>
</thead>
<tbody>
<tr>
<td>Social Media &amp; Chatting Group (Facebook, Line, WA, etc.)</td>
<td>20</td>
</tr>
<tr>
<td>University Website/E-learning</td>
<td>10</td>
</tr>
<tr>
<td>Department/University Information Board</td>
<td>70</td>
</tr>
</tbody>
</table>

Respondents expect there is an application that is capable to broadcast courses information to the participants automatically and instantly. So the courses participants didn’t need to check courses information regularly.

The system design from this course information broadcast system as can be seen on Figure 3. The application will send the account that generated by the GCM into a Registration ID. GCM then sends Registration ID to store in the database. Furthermore, if there is a broadcast message, the GCM will send information to the mobile device automatically (push). When the application to make changes to the new messaging, then the application will send the message to the server. Then the server will send the latest notification to the GCM, and GCM will automatically broadcast the message to all the Registration ID on class participants in the database with JSON format so that class participants will get the latest notification of a class that registered by the student.
Figure 3. Application Design System

3. Result and Discussion

There are two user applications, one that run on mobile devices based on android and others on web applications for mobile device non android. In this application, students can view information in according to courses that followed (Figure 4).

Figure 4. Course Subjects that Followed by User

Messages delivery can be done through the same application with lecturer or administration login (Figure 5). Before delivering the first information the user must choose where the information should be given.
Figure 5. Messaging

The information will appear as a notification message on a mobile device user (Figure 6). This notification will automatically appear when the broadcast process inputted by lecturer/administrator, so the information that received remains up-to-date. The information will broadcast using Google Cloud Messaging (GCM) so that users can receive information in real time and instantly updated when there’s an Internet connection. To view detailed information user can login into the application.

Figure 6. Notification Received Messages

Broadcast information can also be entered via website, as shown in Figure 7 and 8. This website also serves as a place to set up a list of existing courses with all of the participants.

Figure 7. Website Application
Figure 8. Maintain Courses Data

Lecturers can also provide information of learning plan activities in calendar (Figure 9 and 10) by using the add event facility.

Figure 9 Testing Add Event Calendar

Figure 10. Update the Courses Calendar
Courses activity calendar can be synchronized with student calendar, as shown in Figure 11 and Figure 12. Thus, students get whole courses activities that he or she attend.

![Calendar Synchronizing](image1)

**Figure 11. Student Synchronize Calendar**

![Student Calendar](image2)

**Figure 12. Student Calendar**

This application also provided an upload and download files to support courses activity process (Figure 13).
This course information broadcast application is already tested with various types, brands, and specifications of mobile devices based on Android, as can be seen in Table 2. It is found that there’s no significant correlation between the smartphone hardware with the success to received information. The most influential thing is the Internet network so that information provided can be received well.

Table 3. Specifications for Mobile Device Testing

<table>
<thead>
<tr>
<th>Device</th>
<th>Operating System</th>
<th>Display size</th>
<th>CPU</th>
<th>Internal Memory</th>
</tr>
</thead>
<tbody>
<tr>
<td>Samsung Galaxy S4</td>
<td>Android 4.2.2 (Jelly Bean)</td>
<td>1080 × 1920 pixels, 5.0 inches (~441 ppi pixel density)</td>
<td>Quad-core 1.5 GHz Krait</td>
<td>16 GB storage, 2 GB RAM</td>
</tr>
<tr>
<td>LG G2</td>
<td>Android 4.2.2 (Jelly Bean)</td>
<td>480 × 800 pixels, 3.7 inches (~252 ppi pixel density)</td>
<td>Quad-core 2.26 GHz Krait 400</td>
<td>2 GB storage, 512 MB RAM</td>
</tr>
<tr>
<td>Sony Xperia Z</td>
<td>Android 4.2.2 (Jelly Bean)</td>
<td>1920 × 1080 pixels, 5.0 inches (~443 ppi pixel density)</td>
<td>Quad-core 1.5 GHz Krait</td>
<td>16 GB storage, 2 GB RAM</td>
</tr>
<tr>
<td>Sony Xperia ZL</td>
<td>Android 5.0 (Lolipop)</td>
<td>1920 × 1080 pixels, 5.0 inches (~441 ppi pixel density)</td>
<td>Quad-core 1.5 GHz Krait</td>
<td>16 GB storage, 2 GB RAM</td>
</tr>
</tbody>
</table>

The application then tested again (via questionnaire) to the respondents using various mobile device hardware specification. From the respondent found that (Table 3) the application already meet user requirement (80 % strongly agree) and be able to receive the information in real time (100 % strongly agree). So can conclude that this research already meet with the user requirement.
Table 4. Respondent Opinion

<table>
<thead>
<tr>
<th></th>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
<tbody>
<tr>
<td>application are compliant with the needs</td>
<td></td>
<td></td>
<td>20</td>
<td>80</td>
</tr>
<tr>
<td>the information given is informative</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>appealing interface</td>
<td></td>
<td></td>
<td>40</td>
<td>60</td>
</tr>
<tr>
<td>Information received in real time</td>
<td></td>
<td>5</td>
<td>10</td>
<td>85</td>
</tr>
</tbody>
</table>

4. Conclusion

The conclusion from this research is with the presence of these applications, students can receive course information up-to-date in real-time, directly to his or her mobile device through the GCM. So the lecture information can be delivered quickly and accurately. From the test to 100 potential users using questionnaire, showed that the 80% of user feel a great helped by this application and found this application it is important to implement.

References


