Push Notification Service for Enhancing Relation between Parents and Educational Institutions: A case Study on Egyptian Schools.

HaithamEl Ghareeb
Department of Information Systems,
El Mansoura University
El –Mansoura, Egypt
helghareeb@mans.edu.eg

Nashaat E. Khamessy
Department of computer and information systems
Sadat Academy, Cairo, Egypt
wessasalsol@gmail.com

Rasha A. Sattar Ali
Department of Information Systems
El-Mansoura University
El-Mansoura, Egypt
ratsh@hotmail.com

Abstract **—with the growing interest in utilizing mobile communications to enhance the interactions between different partners in educational institutions, particularly in schools. However, how communicating with parents via applications while aren't actively running is quite a challenging demand. On the other hand, the addressed success of the Android supporting features provided a good candidate to support applications with real time information. Moreover the Android platforms supports efficiently customizable notifications, which allow applications based on Google Cloud Messaging (GCM) to specify the pushed events. In this paper we demonstrate and validate the adequacy of mobile services to enhance the interaction between schools and parents based on efficient use of push notification service in both real time and critical information. The paper presents a proposed notification system; MParent, that actively provide alerts and messaging between parents and schools. Also, an open approach was used to determine the reaction of the parents depending on what they want to be pushed to their phones .The proposed system, the MParent, was implemented, tested and validated. Evaluation and questionnaire results have proven how proposed system satisfy both parties; parents and school administrations.**

Keywords: **Mobile Services, Android Systems, Push Notifications, Parents, Educational institutions.**

I. INTRODUCTION

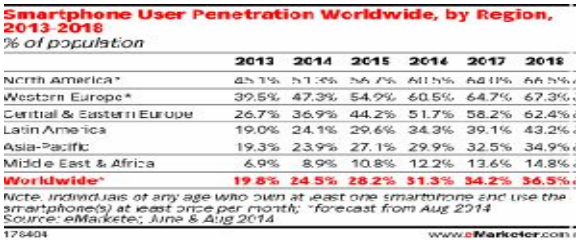
As society becomes increasingly dependent on technology, schools are investing more time and money in technological means of communication,Safa[1] study examined the role of new information communication technology (ICT) in improving parental involvement in schools and social institutes and uncovers barriers that prevent usage of technology to promote communication. As society becomes increasingly dependent on technology, schools are investing more effort in technological means of communication. Access to computer and Internet technologies is increasing all over Europe In work places and schools both educators and parents are provided with access to electronic communication. Rogers [2] study examined the role of communications technologies in fostering parental involvement in middle schools and uncovers barriers that prevent usage of technology to promote communication.The purpose of his study was to evaluate the role of two interpersonal communications technologies, cell phone and e-mail, and one mass communication technology; school websites, in the communication practices between middle school students' parents/guardians and teachers. The results indicate that many parents still rely on traditional forms of communication such as landline phones, printed newsletters, and face-to-face communication, which discloses that educators and parents alike are not taking full advantage of the convenience and quickness of communicating through electronic means like e-mail and websites.

Insimilar research, Mechael [3] identified that in the case of information transfer and communication, the family in Egypt has become a central point for communication to access emergency transportation, health services, and information.

One example of buying a mobile phone in "case of emergency" was shared by a respondent who uses his mobile phone to reassure his children. Heconcludedthat, improved telecommunications is influencing health and well-being, particularly in developing countries and in Egypt.Mobile phones are making important, often unacknowledged, contributions towards improving economic conditions, assuring the well-being of family members, and enabling availability and accessibility to deal with "unexpected situations" and emergencies as they occur. Mobile devices or Smartphones nowadays are widely used and provide great communication and multimedia capabilities, which make the delivery of learning activities and out of class interaction a more realistic approach [3].Despite people communicate for different reasons, stillone reason for the lack of cell phone use in communicating with educational instituations could be the cost [3**].**

Nevertheless, mobile applications come to overcome such problem and supply alternative economic solutions, Mobile push notifications are an important feature of mobile computing services and they have been widely implemented, According to eMarketer, there is, and would be, a widespread of Smartphone usage across the globe with morethan one-third of the world residents will have a smartphone by 2018 [4], as illustrated in Fig. 1.

IRJECE



Smartphone User Penetration Worldwide, by Region, 2013-2018
% of population

	2013	2014	2015	2016	2017	2018
North America*	45.1%	51.3%	56.7%	61.5%	64.8%	66.5%
Western Europe*	39.5%	47.3%	54.9%	60.5%	64.7%	67.3%
Central & Eastern Europe	26.7%	36.9%	44.2%	51.7%	58.2%	62.4%
Latin America	19.0%	24.1%	29.6%	34.3%	39.1%	43.2%
Asia-Pacific	19.3%	23.9%	27.1%	29.9%	32.5%	34.9%
Middle East & Africa	6.9%	8.9%	10.8%	12.2%	13.6%	14.8%
Worldwide*	**19.8%**	**24.5%**	**28.2%**	**31.3%**	**34.2%**	**36.5%**

Note: individuals of any age who own at least one smartphone and use the smartphone(s) at least once per month; *forecast from Aug 2014
Source: eMarketer, June & Aug 2014
178404 www.eMarketer.com

Fig. 1: Worldwide Smartphones Usage 2013-2018 [4]

Smartphones have become increasingly popular and even more essential personal device to have, therefore, a wide number of teaching, learning and educational collaborator applications have been developed for achieving such goals [5]. Due to that, e-communication became a promising environment that enhances and optimizes communication means by utilizing pre-existing information systems and delivers them in a contextual, more meaningful manner [6].

One major issue for using Smartphones for delivering school news, triggers and reminders are push notification services which have become an important type of services to deliver contents to users. Many commercial mobile applications, such as social network system Facebook, hangout system Tinder, instant messaging system WeChat, were implemented with mobile push notifications. Applications supporting special services such as weather service, travel service or traffic service were also implemented with mobile push notifications todeliver time sensitive and personalized contents to mobile users. The most important character of mobile push notifications is a service provider pushes real time notifications to subscribers based on their current contexts like their identity, locations, status, and emotions. Mobile push implemented based on a third party service such as Apple or Googlethat's why they are not fairly complex to implement in some situations[7].

Thisresearch reported here has taken an open approach, in that it investigated what parents want pushed to their mobile phones, and whether the content should be sent automatically or only if they requested it (that is via subscription). Additionally, in this paper,we measure the solution performance and how application satisfiesparent's needs. Our solution provided great convenience and flexibility system to receive light messages or notifications from application servers to notify parents for updated and critical school news,the system improves battery life for wireless instruments, network bandwidth can efficiently be used; it resolves cost problems for many of service subscribersas well.

This paper organized as follows, section 2 introduces literature review on notification service and section 3 clearly initiatesthe proposed system; Mparent, While section 4 presents system evaluation. Lastly, section 5 concludes the reasearch by offering some key points focused on in other sections.

II. SMARTPHONE NOTIFICATION SERVICE

A notificationis a message dialog that is shown on the surface of a smartphone screen [8]. To send a notification, the sender application first prepares a notification object and registers a trigger event for it. When the trigger event occurs, this notification will be fired. Security permissions on most smartphone platforms, such as Android, BlackBerry OS, and Windows Phone.

Despite the differences in design and implementation, notification services on existing smartphone platforms can be categorized into three types[8]:

- *Pop-up Notification* notifies the user by popping up a notification,dialog on screen, e.g., the Toast Notification on Android and Dialog Notification on BlackBerry OS.
- *Status Bar Notification* adds a notification view as a status bar at the top of screen, e.g., theMessage List on BlackBerry OS 7, the Status Bar Notification on Android, and the Notification Center on iOS 5.
- *Icon Notification* shows the notification by making changes on the icon of a sender application in the main menu, e.g., the Badge notification on iOS 5 and the Icon Update function onBlackBerry OS 7.

In this paper,we focused on push messaging on Android because it is an important aspect for application developers. Push messaging is in many situations a vital aspect of the usability and functionality of an application [9]. Additionally, as stated by Gartner [10], the popularity of the AndroidPlatform means that this area of research highlights challengesthat affect a considerable amount of software developers. Meanwhile,Google cloud messaging (GCM) come to support android platform and third party application server in a high reliability and good performance[11].

Since GCM is a free service, it helps developers to reduce the cost for messaging in their systems. GCM allows up to 4 KB messages; therefore, it is typically used to send small messages such as update messages or real-time information like weather reports. GCM requires devices running Android 2.2 or higher. The push notification service provides notifications via cloud on the client's system. The notifications are pushed by the cloud to the client's device notifying that they have some data to fetch [12].

III. OUR PROPOSED SYSTEM

A. Overview

Figure 2.depict the basic architecture of the proposed Mparentsystem. Mparent is a mobile notification service.Using our proposed system, developer can push notification for critical, emergency or any of school events to all of parents or segment of parents, while every device own key ID Registered in third party server ,The system broadcasts the message using parents cloud storage database via Intent broadcast. Our notification service model is based on pull mechanism & push mechanism.

IRJECE

Pull mechanism used to register the device at the central storage system, this process achieved via the traditional request/response model where client raises a request and server upon receiving the request appropriately prepares a response and sends it back to the client. Push mechanism utilizing third party channels. We imposed The Parse library which provides push notifications by using Google Cloud Messaging (GCM) if possible. On devices that do not support GCM (such as the Amazon Kindle Fire), Parse will use a background service that maintains a persistent connection to the Parse Cloud to deliver pushes. This allows Parse Push to work on all devices running Android 2.2 or higher [13].

On Android devices, when a device receives a push notification, our application's icon and a message appear in the status bar. When the user taps the notification, he can remove it from his device screen. Notifications can be broadcast to all parents, such as in critical events, or sent to just a subset of parents, to give personalized information.

B. System Design and Implementation

Our solution has been undertaken at international school in new Cairo, Egypt. The first step in developing a test environment for our Mparent system was to conduct interviews with school information technology (IT) department. The aim wasto acquire an in-depth knowledge of parent's data presentation and school own rules and regulation regarding the permission of such data. During the interviews, the IT specialist made it clear they only allow parents to be notified about permitted data afterregistration process.

Therefore, the concept of Mparentwas based on extracting legible information. After that an interview was conducted with students' parents, we noticed that many of these parents do not check (or even use) their private email accounts regularly, nor do they go onto the school web site to check announcements pertaining to their kids studies. But almost all parents have an android mobile platform and use it with high frequency. Many parents travel significant distances (up to 100kilometres) and can following up their kids events and announcements using it.

Our research presents the findings of an investigation into what these parents want pushed to their mobile telephones. In achieving this aim, the following questions needed to be addressed:

- What services do parents want pushed to their mobile phones?
- Given these services, which ones do they want pushed via a subscription service and which ones as a mandatory call?
- Do academics and administrators perceive correctly what parents want pushed to their mobile phones?

After that an interview with school staff was conducted, Staff participants were from the school's service divisions, including Student Services, Student Administration, Information Services (Library, Printing and Bookshop), Information Technology Services, and Facilities. After analysis to all interviewees' answers, researchersstart their implementation phase,which consists of two main parts; the google cloud messaging service, and android client application.

For utilizing the GCM service, three procedures wereneeded [12]:

1) Aresearchermust register with the GCM service in the Google APIs console page to get project ID and API key. A project ID is granted to each Gmail account after the user creates a Google API project and then GCM toggle has to be turned to ON.
2) Next, after a GCM-based application is installed on a mobile device, the device requests a PNS in the background by transmitting the package name of the application and the developer's project ID to the Google push server. After the request accepted, the Google push server provides a registration ID to the device for identifying the application on the device. The device needs to deliver the registration ID and corresponding information, such as device ID, to the developer. However, Google does not provide any methods or protocols for this delivery. Therefore, the researcher maintaineda server to receivethe registration IDs using own communication protocol.
3) Lastly, whenever a researcher wants to send a push message to the mobile device, she/he can transmits the push messageincluding the registration ID of the receiver, API key, and contents to the Google push server. If the message sent is verified as legal, the Google push server delivers the push message to the device. Push messages are transmitted and received using the HTTPS protocol and hence contents cannot be intercepted or modified [12].

Consequently, an Androidclient application has been implemented. Android platform has an advantage due to its virtual machine and integration with database Web service, android services and GCM server. During the implementation phase, the following components were used to build the Android application: Activity, Service, Broadcast Receiver and Content Provider and intents as following.

1) Activities

An activity is a single screen of an application such as a browser window or a settings page. It consists of the visual components that present data in the form of images orallow the user interaction like a button [14]. An appliance using GCM requires the use of a code to start and stop the registration

IRJECE

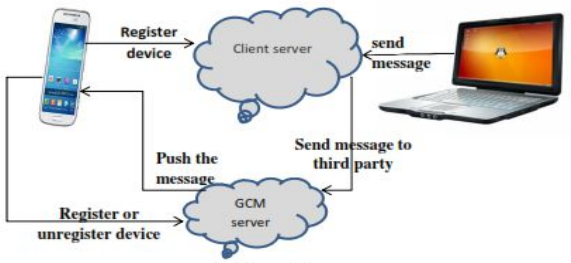


Fig. 2: Mparent Architecture

Services. Each application has multiple activities where the transition amongdifferent activities is initiated through intents,onCreate() method is the initial techniqueof setting up of an Activity[14].

2) Service

This is most used for functionalities that are run in the background. However, it does not have a visual interface.One of the most famous services is Google Android push notification which is known by to send data to Android apps as soon as the data is available, in this way Android app doesn't have to make requests to the server to know if new information are available. Using Android push service, by this way apps can save smartphone battery and reduce the network traffic: the user experience is also improved [15].

3) Broadcast receivers

This component receives and react to notifications sent to the Androidsystem [15].

4) Content providers

This is the element responsible for the storage andretrieval of data. This makes them accessible to all the applications [14].

5) *Intents*

Unlike content providers, all the other components are activated using Intents [16]. Intent refers to synchronously; all of these activities are classes from the Androidapp. In our Mparentsystem, the message contains a Uniform Resource Identifier (URI). The Android utilizes different hooks in the application components to deliver thIntents. The New Intent method is used for an Activity, on Bind for service, Context for broadcast actions or the send Broadcast or any other similar methods. Android sends the Intent to the one Receive method of all matching registered receivers.

IV. EVALUATION

To assess the performance of Mparent ,two evaluation phases have been imposed, the first phase an application for Android push notification service has been developed and tested on real android S4 device as shown in Fig. 3,4,5.The testing set up is based on one PC used to build the android application and to create the database model.

One has been considered that all Android notifications are built on the base layout format, which includes basic elements:

- A *notification icon*, which represents the originating app or the notification type if the app supports different types of notifications.
- The notification title or it could be the name of the sender if the notification is a personal message.
- The notification message.
- A *timestamp*

Furthermore, Applications can set the following types of notification metadata:

- Priority: The priority level determines how and when notifications are presented. For example, In Android 5.0, high-priority notifications mostly displayed as Heads-up notifications.
- Visibility: Specifies how much notification content is to be displayed when the notification appears on the lock screen.

IRJECE

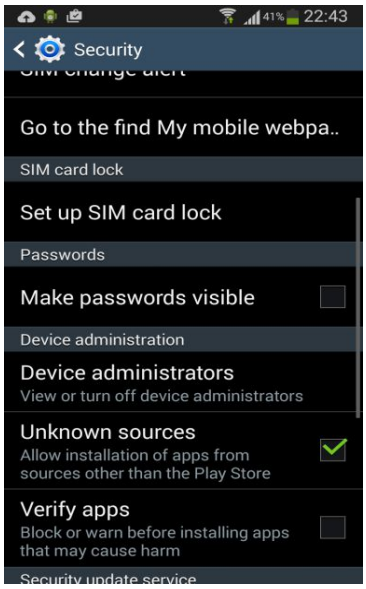


Fig. 3: Screenshot of Mparent installation process

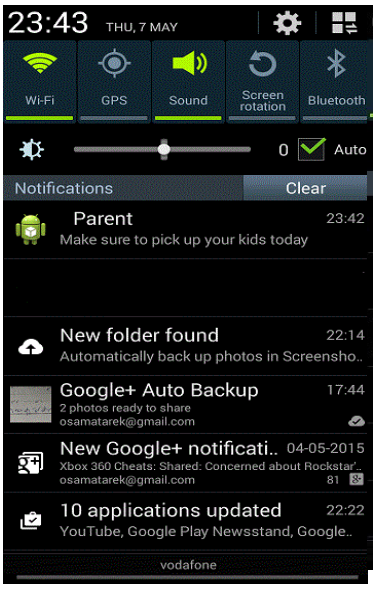


Fig. 4: Screenshot of push notification of all registered parents

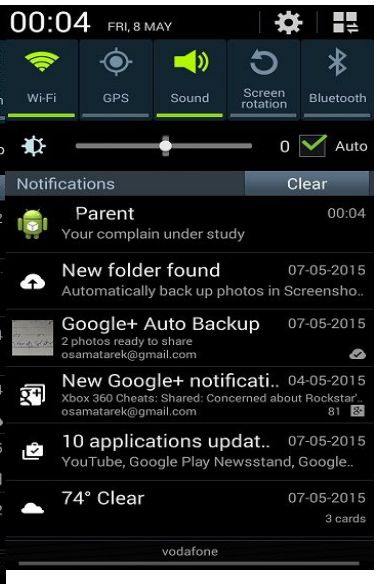


Fig. 5: Screenshot of push notification to segment of parents

Second phase,after installing the app on parents' android devices and testing it during 10 days, experimental questionnaires has been distributed and discussed with parents,school administration , method for result analysis reviewed. Material for evaluation, including printed questionnaires, platforms, mobile phones, tablet and laptop were utilized. About 50 peopleparticipated, 10 of them from school administration,40 presented as students' parents. All of participantswere aged between 23 and 50 years old. All participants had previous knowledge of mobile phones and mobile communication, but had not previously used the type of application employed in this test, questionnaire statements shown in table 1.

Table I: Questionnaire Statements

1	I can remove unneeded pushed notification from my device easily.
2	Pushed messages time accurate & appropriate.
3	User needs is considered in suggested services.
4	This mobile service is helpful and I will always use it.

After deep analysis for staff and parents feedback, it's found that experiment results exposed positive facts about Mparent performance as depicted in Fig .6, highlighting that the majority of the users found thatnotifications regarding school issues have been covered; moreover the vast majority found pushed messages time accurate andappropriate as well, most of participants feel comfort towards using this mobile app.

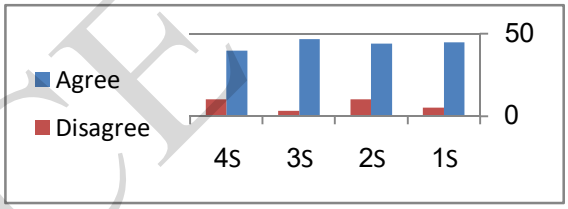


Fig. 6: Participates Feedback about Mparent

V. CONCLUSION

This paper has demonstrated the added value of using the push notification while also presented itsApplication in mobile systems. The research proposes the use of notification based system on Android platform to improve interactions between the school and students' parents. The system is implemented and testedutilizing the reuse of Android components to push notifications from client server and third party GCM applications. The push notification service can be used in other academic and learning applications simultaneously by making only small modifications. All the services utilized in the proposed solution were evaluated in different Android system devices with good satisfaction results. This research opens up future work to investigate mobile technologies with other new features to support collaborative learning and admission systems as well as establish other frameworks in different scenarios. Also, the applicability, profitability of the push services to other mobile platforms can be studied.

REFERENCES

[1] S. Husain, "online communication betweenhome and school. Case study: improve the usabilityof the unikim communication platformin the primary schools of tierp municipality", Master, Uppsala university, 2012.

[2] R. Rogers and V. Wright, 'Assessing Technology's Role in Communication between Parents and Middle

IRJEC

Schools', Electronic Journal for the Integration of Technology in Education, vol. 7, pp. 36-58, 2008.

[3] N. Mechael,"Mobile phones and the preservation of well-being in Egyptian families",Columbia University,pp1-10, 2011.

[4] eMarketer. "APAC's Low Internet, Smartphone User PenetrationWon't Change Much in Coming Years". 2014 [cited 2015 3-March-2015];Availablefrom:http://www.emarketer.com/Article/.

[5] Chen, Chang, and Y. Wang, "Ubiquitous learningwebsite: Scaffold learners by mobile devices with informationawaretechniques". *Computers & Education*, Vol. 50, No. 1., pp. 77-90, 2008.

[6] H. Mohammad, A.Fuad,"Using Mobile Technologies For Enhancing Student Academic Experience: University of Jordan case study", Vol. 10, No. 1, IJIM Journal, pp. 1-6, 2016.

[7] I. Warren,A. Meads,S. Srirama, "Push Notification Mechanisms for Pervasive Smartphone Applications", Pervasive Computing, IEEE, Vol. 13, no. 2, pp. 61-71, 2014.

[8] [8] Smartphones for Phishing and Spamming",PennylVamia state University, pp. 1-3, 2013.

[9] J. Hansen and T. Gronlil, 'Towards Cloud to Device Push Messaging on Android: Technologies, Possibilities and Challenges', Int. J. Communications, Network and System Sciences, pp. 839-849, 2012.

[10] Gartner, Inc. the world's leading information technology research and advisory company,http://www.gartner.com/.

[11] M. Wang, B. Shah, S. Priya, T. Chen, "Client server Android application with notification service in personal cloud storage System for Cloud Computing", term project , pp. 7-10, 2012.

[12] R. Lee, K. S. Lee, "Punobot: Mobile Botnet Using Push Notification Service in Android" springer international publishing, switzerland, pp. 127-137, 2014.

[13] Parse messaging, "parse cloud messaging", 2012. [Online]. Available: https://parse.com/tutorials/android-push-notifications/. [Accessed: 10-10 - 2015].

[14] S. Brahler, D. Fakult, "Analysis of the Android Architecture",University of lands baden,Helmholtz ,2010.

[15] D. Felker, &J. Dobbs, Android Application. Development for Dummies", Indiana 2011.

[16] A. Joseph, D., Lauren, and Shane C. "Advanced Android Application Development",Addison-Wesley professional,p.200, 2011.

IRJECE