The Development of System Notification via Mobile Application using API Call for Phatthana Nikhom Hospital Personnel

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Abstract

The objectives of this research were 1) to develop mobile application for Phatthana Nikhom Hospital to receive notifications using API call and 2) to evaluate effectiveness of the developed mobile application. The samples consisted of 1) 3 experts in database system and information system development and 2) 30 of system testers. The instruments used were 1) interview 2) questionnaire to evaluate system performance and 3) questionnaires to evaluate user satisfaction. Data were analyzed using mean and standard deviation (SD). Java were used as programming language in developing system. Database used in this research were SQLite, a database program on mobile devices and MySQL, a database program on server.

The research findings indicated that notifications of work systems via mobile application consisted of following sub-systems; accessibility management, notification types management, notification message management, API data receiving management, and mobile application setting. The system was tested for its overall performance by 3 experts in information system development in 4 areas; 1) user requirement 2) functional requirement 3) usability and 4) security. The results revealed that the performance of developed system in all areas were at excellent level with a mean of 4.08 and a standard deviation of 0.34. For user satisfaction, it was evaluated by 30 system testers in 4 areas; 1) application data 2) application template 3) usage 4) overall user satisfaction. It was found that overall user satisfaction on system were at excellent level with a mean of 4.19 and a standard deviation of 0.69

Keyword: API system, notification, mobile application

Introduction

Since iPhone by Apple and Android by Google was launched in 2009, smartphone industry has grown rapidly. Smartphone not only includes the basic features such as calls and SMS service but also offers add-on functions which can be downloaded conveniently, for instance, social

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network applications, e.g. Facebook and Line. At present, there are a large number of mobile phone users according to the statistics from National Statistical Office, Ministry of Digital Economy and Society (2021) which conducted survey on mobile phones, internet and computer users by interviewing head of household and over-6-year-old family members across 83,880 households. It stated that the number of mobile phone users amount to 60.5 million (94.8%), computer users amount to 16.8 million (26.4%), and internet users amount to 49.7 million (77.8%) Regarding types of mobile phone used among population, it was found that 86.4% use smartphone, 12.7% use feature phone and 0.9% use both smartphone and feature phone. For Phatthana Nikhom Hospital personnel, 100% of them use smartphone. Most program development relevant to the hospital personnel is assigned to notify each personnel via their LINE group or privately regarding concernment/involvement. For example, leave management system that is specified to submit a request for leave to get the approval from personnel's superior, meeting reminder (date, time, and place) to relevant attendees, newly registered COVID-19 cases, daily COVID-19 cases, and a situation of patient assistance in responsible area as shown in figure 1 and figure 2. Such examples have created numerous LINE groups to let each personnel reaching out all related notification. Therefore, the researcher has an idea to develop notification system via mobile application for the hospital personnel by receiving information from other communication channels through Application Programming Interface (API) and acts as notification hub. The developed system allows user to customize notification as for preferences such as notification types, notification with melody or voice, time frames for notification. In addition, it can be added up the unlimited number of program's notification via API which helps facilitate and meet user's needs for receiving notification from each program.

Objectives

    1. To develop notification system via mobile application for Phatthana Nikhom Hospital personnel using API call

    2. To evaluate effectiveness of notification system via mobile application for Phatthana Nikhom Hospital personnel using API call

Literature Review

    For the purpose of application development to receive notification via API for Phatthana Nikhom Hospital, Lopburi, the researcher has studied about the relevant document, articles, theories, and researches as follows; knowledge about mobile application, mobile application design and development, API, Android Operating System, and Java.

Mobile Application

    Mobile Application is the combination of two words i.e. "Mobile" and "Application". Mobile is typically a portable communication device which not only performs basic features but also capable to function as a computer. With a characteristic of mobility, the key features of mobile are small-sized, lightweight, low-power consumed, and capable intercommunicate with computer. Application is software designed to help user perform activity which requires User Interface (UI) to be the point at which human users interact with a computer. Therefore, mobile application is software application specifically developed for the use on mobile devices, such as smartphones

and tablets. The mobile application allows users to accomplish their needs and also provides user with easy access.

In the present year, there are many of mobile phone or smart phone's operating systems have been developed. The most popular operating system are iOS and Andriod; in consequence, a great number of applications has been created or developed for smartphone. For example, map, games, chatting applications. Many businesses focus on mobile application development in order to expand communication channels with users, such as default app, i.e. Facebook that allows users to share their stories, feeling, location, pictures by application itself without access to web browser. (Saowakhon & Werachart, 2021)

Figure 1 Example of COVID-19 case status tracking notification of Phatthana Nikhom's primary care

Figure 2 Example of COVID-19 cases statistic alert in a group of Phatthana Nikhom Hospital committees

Mobile Application Design and Development

Regarding mobile application design and development for smartphone, it is necessary for developer to study the basic features of each device because there are numerous smartphone brands in the market today whose size and feature varies. The followings are the important features of smartphone to consider when designing a mobile application. (Thanyalak & Boonrat, 2012; Wiwat, 2012)

Size - Application design is required to concern the ability to adapt to different device's screen size to contribute maximum ease-of-use and efficiency

CPU - Smartphone equipped with faster processor allows application to run faster. Application should be designed and developed to fit each device in order to reduce errors that may occur while using.

Memory - Memory indicates a device's ability of recording data. Developer should design application that demands memory as less as possible in order to be able to support low-memory devices

Operating System - Each type of operating system demonstrates the different outcomes, so developer should design application to be able to run on all operating systems.

Application - Application designer or developer should make application simple to use – regardless of user's age, gender, education, or language – to deliver user a great performance.

Application Programming Interface (API)

API is the acronym for Application Programing Interface which acts as an intermediary that receives request, processes data, and then sends response back to the program automatically.

API allows communication or information exchange of a system with other system, between user and server or server and server. In view of developer, API is a software used in help access data on external server or send data to store on external server. It enables interaction and data exchange between systems independently. (Sarunya, Chatchawan, Purin, 2017)

The main function of API is to receive a request from client i.e. applications, e.g. web application, mobile application, and desktop application, etc. When a client makes request, API will receive request, then process it and send a response, which consistent with the received request, back to the client or application for further use. The advantages of API are (Manoch, 2019) 1) reduce effort and time spent in developing application or website 2) increase website traffic 3) make a website user-friendly and provide user a widespread access to information 4) API can send and receive data across server with ease

Many companies use their own API to provide requested information to customers. For example, Google Maps, Line, Facebook, and banks. API call consisted of 1) URL to send request 2) Methods which is through the use of HTTP request that makes a request to obtain information or service from a provider 3) Parameter which is data a provider demands for accessing target information or to include API key in order to identify the requester. Users tend to register membership to get an individual API key.

Android Operating System and Java

Android Operating System is a popular operating system as a result of the cooperation between Google and over 30 mobile phone manufacturers in developing Android for the use in mobile devices and new technology gadgets as a free software. This gives freedom to programmer or application developer to download Android SDK whose job controlled by Java and Android NDK controlled by C or C++ language free of charge.

Java is an important programming language for Android development, first released by Sun Microsystems' engineer. It was developed to be used for object oriented programming at its core and able to run on any computer that provides different environment with one compiled code (platform independent). The primary purpose of Java development is for installation on multiple gadgets whose CPU is installed with Java Virtual Machine (JVM). In the present day, Java is widely popular and used in various fields.

Research Methodology

Research methodology comprises of 5 steps as follows;
The development of notification system via mobile application for Phatthana Nikhom Hospital personnel using API call consisted of 5 following steps; 1) problem definition and feasibility study 2) data analysis 3) system design 4) system development 5) data collection. The details are as below;

1. Problem definition and feasibility study

The research conducted interview as group discussion. The samples are 3 hospital personnel – a doctor, nurse, and computer officer. It summarized that there are a large number of systems using in Phatthana Nikhom Hospital. For example, supplies and durable goods inventory

management system, leave management system, meeting room booking system, COVID-19 cases status tracking notification system. Individual personnel receives different notification regarding their involvement in systems through LINE group chat. With its characteristics of group chat, a target may not directly notify. This problem introduced the need of mobile application that puts notifications from several systems together and enables user to personalize their notification such as notification types and notification schedule.

2. Data analysis

In light of the problem and user requirement, the researcher analyzed data by using Data Flow Diagram (DFD) and Entity Relationship Model to create system process. The workflow diagram will be used in system design and system software development.

Data Flow Diagram presents the organizations or person and process related to system, the information flowing through a process, and information being stored in process by using Context Diagram. Context Diagram is a top level data flow diagram of DFD that shows the function of the entire system in relationship to external entities. The developed system consisted of system administrator, user, and hospital's work systems

– System Administrator assigns user access permission and confirm subscription for API data of personnel who involved in work systems

– Personnel have to subscribe for API data in field of their responsibilities which give them a permission to receive notification

– Hospital work system assigns applicable API-key to systems in order to verify with API subscription from user.

3. System design

To build an effective data management, it leads to the development of notification system via mobile application for Phatthana Nikhom Hospital personnel using API call that uses local SQLite database and MySQL database. Local database stores setting and API data whereas MySQL database stores user data and subscribed API.

The system is designed into data flow diagram which is a physical model. This model visualizes how problem is solved by developed system. Technologies and computer programs are used in system development taking part in designing of output, input, input/output format, database, and prototype. The system architecture are as shown in figure 3.

The notification system for Phatthana Nikhom Hospital personnel using API call is designed to be based on Client/API/Server. Client is a general user who able to make a request for information from hospital work system though API that user has subscribed while system administrator manages user data including user access permission to systems thought API.

– Client is an application in user's mobile phone. Client sends a request, a parameter, to server through API.

– Server is a database acting as service provider to client. After receiving a request from client, server processes that information and then, deliver response back to client

– User can reach out following information in notification system through user interface; user access data, detail of message received from subscription, application setting data, data of subscribed API.

– Both Java UX/UI and database access takes part in developing application

– API server uses retrofit as HTTP Client Library for communicating with server.
In the matter how API works, API searches for the information on database server that receives a request from client (through mobile application), processes information and sends the information back to client

    4. System development

    A study on recent work systems and the problem contributed to an system analysis and re-design by developing notification system via mobile application for Phatthana Nikhom Hospital personnel via API call using Java, MySQL database, and SQLite database.

    5. Data collection, conclusion, data analysis, and user manual creation

    After developed, the system was examined its effectiveness by 3 experts in information system development and then was improved according to experts' suggestions. Next, system was evaluated user satisfaction by 30 Phatthana Nikhom Hospital personnel following by making summary, analyzing data that obtain from evaluation and creating user manual.
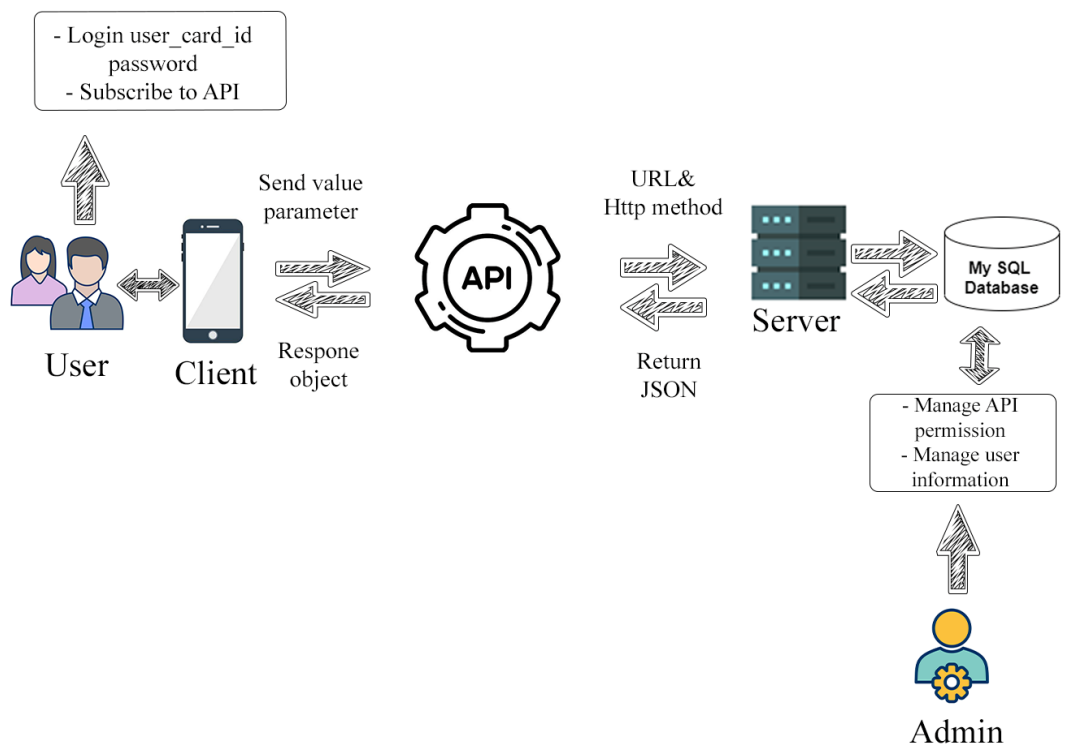

Figure 3 System architecture of notification system via mobile application for Phatthana Nikhom Hospital personnel using API call

Research Instrument

    Research instrument used for this study consists of tools for treatment and tools for data collection as follows;

1. Notification system via mobile application for Phatthana Nikhom Hospital personnel using API call

2. System effectiveness evaluation form for experts in information system development in which contains 12 questions about following 4 measures; 1) user requirement 2) functional requirement 3) usability and 4) security.

3. User satisfaction questionnaire for those who received a testing notification through mobile application in which contains 12 questions about following 4 measures; 1) application data 2) application template 3) usage 4) overall satisfaction with application

Statistics used for analysis are mean, standard deviation, and dependent t- test. The collected data was compared to rating scales (Boonchom, 2010) as follows;

Mean range = 4.51 - 5.00 considered as very high
Mean range = 3.51 - 4.49 considered as high
Mean range = 2.51 - 3.49 considered as moderate
Mean range = 1.51 - 2.49 considered as low
Mean range = 1.00 - 1.50 considered as very low

Research Findings

The research findings consist of result of system development, result of system effectiveness evaluation from experts in information system development, and result of user satisfaction evaluation. Findings are as follows;

Result of development

Result of development of notification system via mobile application for Phatthana Nikhom Hospital personnel using API call

System development was arisen from a study on problem finding out a requirement and progressed to system re-design that will meet user requirement using technologies, database management, and application processing to help manage data. A study on design and how system works resulted in a successful developing of the notification system via mobile application in following scopes.

    1. Privileged access verification system

    2. Program setting system

    – store setting data; sound setting, vibrate notification, subscription

    – allow to turn on/off sound notification

    – allow to turn on/off vibratie notification

    – show user data

    3. API subscription management system

    – subscribe to get information through API

    – delete/adjust request frequency of each API

    – delete/adjust message quantity of each API

    – show details of API that user subscribes

    4. API message notification management system

    – show quantity of message notification as set by user

– select to see more details of each message.

– delete message notification

Figure 4 shows User Interface for API subscription. The example of User Interface displaying notification from API is as shown in figure 5

<u>Result from system effectiveness evaluation</u>

The developed system was evaluated effectiveness in 4 areas; 1) user requirement 2) functional requirement 3) usability and 4) security by a group of 3 experts in information system development whose professions are analyst & designer, programmer, and computer technical officer. After that, the result from evaluation was analyzed using statistics, interpreted by rating scale, and summarized findings as detailed in Table 1

Table 1 Result from system effectiveness evaluation revealed that overall performance of the developed system were at high level with a mean of 4.08 and a standard deviation of 0.34.

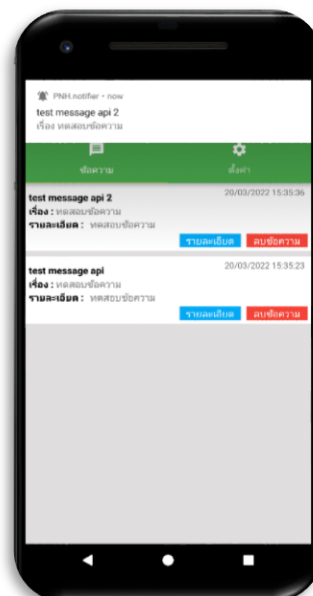**Figure 4** User Interface for API subscription

Figure 5 User Interface for displaying notification from API

Result from user satisfaction evaluation

The researcher carried out trial run of the developed system by users, consisting of 27 persons who made API subscription and 3 system administrators. 53.3% of sample users are over 25 years old. Afterwards, the result from system trial run was analyzed using statistics, interpreted by rating scale, and summarized findings. The questionnaire about satisfaction is divided into 4 areas; 1) application data 2) application template 3) usage 4) overall user satisfaction as shown in table 2.

Table 1 - Result from system effectiveness evaluation revealed that overall performance of the developed system evaluated by 3 experts were at high level with a mean of 4.08 and a standard deviation of 0.34. Table 2 - Result from user satisfaction evaluation showed that the overall user

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satisfaction evaluated by 30 sample users were at high level with a mean of 4.19 and a standard deviation of 0.69.

Table 1: Result from system effectiveness evaluation

Description	$\bar{x}$	S.D.	Interpretion
User requirement	4.00	0.50	High
Functional requirement	4.33	0.29	High
Usability	4.17	0.29	High
Security	3.83	0.29	High
Overall effectiveness	**4.08**	**0.34**	**High**

Table 2: Result from user satisfaction evaluation

Description	$\bar{x}$	S.D.	Interpretion
Application data	4.12	0.64	High
Application template	4.30	0.68	High
Usage	4.18	0.67	High
Overall user satisfaction	4.17	0.79	High
Overall Satisfaction	**4.19**	**0.69**	**High**

Discussion

The development of notification system via mobile application using API call for Phatthana Nikhom Hospital personnel consisted of following sub-systems; privileged access verification system, program setting system, API subscription management system, and message notification of each API management system. These sub-systems performed work effectively at high level regarding experts' opinion, especially functional requirement measure. For result of trial run by 30 hospital personnel, it shows that user satisfaction were at high level, especially the application template which has the highest score of mean. This result is in accordance with the previous research of Suzanti et al. (2020), the development of mobile application to facilitate students in monitoring of Trunojoyo Madura University's dormitory activities.

Suggestion

This research suggests that notification system via mobile application can be improved to reach greater performance and meet the needs of user in other areas by adding functions to facilitate users. For example, data storage of API subscription, and also basic configuration for database in server so as to increase convenience which allow to install program in multiple mobile devices with single configuration. Moreover, in light of designing a good API, following issues should be considered 1) API should be easy to use and hard to misuse 2) APIs should be self-documenting 3) requirements should be gathered before starting design 4) example code should be exemplary. These significant issues agree with research of Bloch (2006).

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