Design of Online Application for Agricultural Machinery Service based on Android Operating System

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Design of Online Application for Agricultural Machinery Service based on Android Operating System

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Abstract. Utilization of agricultural machinery recently becoming big issue to increase agriculture production in Indonesia. In these couple years Indonesian Ministry of Agriculture massively granted agricultural machineries to the farmers for increasing rice production. Considering that farmer's paddy field are scattered in villages area, it can be happening that agricultural machinery in one village may overutilize where the other still underutilize. The objective of this research is to design an online application for agricultural machinery service for optimizing the utilization of agricultural machinery. The application was developed under Android operating system which is commonly used for mobile phone. The method of this research was following System Development Life Cycle which include investigation, system analysis, design, implementation, installation and testing steps. There are three sub systems in this application i.e. system for operator, machinery provider and machinery user. The application contains several functions such as machinery data management, order management and machinery services scheduling. In the user application, detail data such as field location, type of machinery, order time, and supporting map of the location can be input and read by the machinery provider easily. The application was tested under several Android operating systems and the results showed that the application can run satisfactorily.

Keywords: Agricultural Machinery, Android, Online, Service System.

1. Introduction

Starting from 2013 until 2017 there were drastic increase of agricultural machineries that government grants to farmers throughout Indonesia in purpose of implementing agriculture mechanization. Despite of those massive grant from government, according to Yunus et. al. in 2017, in Kolaka Regency, usability of power tiller is only 62% which is far from fully utilization. One of the main reason is the distribution of those agricultural machinery were not well spread throughout regency as the machinery in one village may overutilize where the other still underutilize.

Indonesian Ministry of Agriculture actually already try to suppressing that problem with creating UPJA, a new form of business based on agricultural machinery services which managed by chosen farmer aided by local agriculture offices and *Brigade Alsintan*, an army task force for agricultural machinery utilization which is resulting a creation of brand new service system.

The traditional perception of service system is that of a service delivery system. The system consist of elements (resources like people with skills, competencies, and knowledge, but also things like facilities, tools, materials, computer programs) that have a structure (organization and configuration), a behavior (described as a process or mechanism), and a purpose (to deliver a service) [1].

People in Indonesia already familiar with online service system. Transportation service system such as GOJEK, Grab, and Uber are growing rapidly for past couple years. Those service system based on Android smartphone for high accessibility because Android as one of operating system for smartphone is start to dominating the market. According to StatCounter [3], in August 2017, Android smartphone user in Indonesia is 83.99% from 43% smartphone user from 173 million handphone user and projected will be growing in following years. Because of that, this research objective is to design an online application for agricultural machinery services for optimizing the utilization of agricultural machinery.

This application which only cover system for machinery services provider is a part of one system for the agricultural machinery services. The whole system main objective is to increase the usability, accessibility, and effectivity of agricultural machinery services.

2. Material And Methods

The method of this research was following System Development Life Cycle of O'Brien and Marakas [3] that is investigation, identifying information and data flow from current system, identifying current system problem, crucial data, weaknesses, and the new system feasibility for the sake of getting the solution; system analysis, for defining user identity, and information, functional, and non-functional requirements; design, designing new system based on investigation and analysis; implementation, creating the designed system; and installation and testing.

The application system was developed with JDK as compiler, Android Studio and Android SDK as Integrated Development Environment (IDE), Adobe Photoshop CC 2018 as UI design tools, Firebase as BaaS (Backend as Services) for authentication and database, and Google Maps API.

3. Results

3.1 System Investigation

The current conventional system of agricultural machinery services in Indonesia is identified from survey and interview to farmers and services providers in Klaten and Sukoharjo Regency, Central Jaya Province. The whole sequence of services still counting on direct communication which is very fragile against information loss. Information accuracy is also the problem that occur frequently because of different subjectivity from farmers and services providers. The last problem identified is detail of the order often just remembered by the services providers.

The application was built in Android apps. and named as AgriMach (Jasa Tani) Apps. The application at least need database for data storage and Google Maps integration with Google Maps API for support its map-accessing function. For that purpose, the application architecture is formulated and depicted in figure 1.

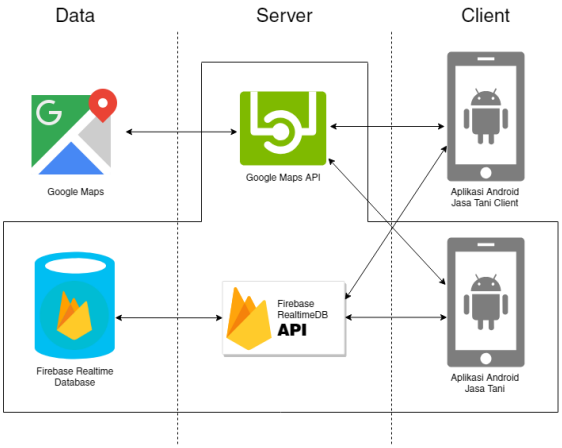

Figure 1. AgriMach application architecture

The newly developed application can be directly applied in the study area because the farmers are used to hire agricultural machinery service provided by UPJA or personal rental service by agricultural machinery owners. Based on data analysis from field survey, it is confirmed that the online application is organizationally feasible because that online rental service procedure was built by following the current rental system. The application is also economically feasible for the farmer because there is no additional effort and cost are needed other than installing application on their Android smartphone. Most of farmers in study area are already having smartphones with data package which has free access to Google Maps. The application is technically feasible because almost all smartphone as the application hardware also having GPS sensor which is needed for location finder as well as measurement of the map area. The application is also operationally feasible because of high rate of smartphone ownership among farmer society, several number of

internet provider with reasonable pricing, high coverage of signal at those study area, and high usability of smartphone.

3.2 System Analysis

3.2.1 User Identification and Information Requirements

The AgriMach Apps. is specially designed for agricultural machinery services in paddy cultivation which include machinery for land preparation, planting or transplanting, and harvesting that served in separate service packages. The required information for ordering machinery online service need more detail data such as location, date, type of machinery, and field conditions. Those detail information in very importance for decision making by machinery owners.

3.2.2 Functional Requirements

The functional requirements is obtained from system main function and scheduling. Functional requirements in this application was divided into user and owner requirement. For machinery owner the functions were managing order, selection of available machines, considering detail information of order, and ability to save and make scheduling for those orders.

3.2.3 Non-Functional Requirements

Non - functional requirements for the application were defined as the ease of use of the application, good user experience, easy to access, and data security. In order to perform those non functional requirements, it was decided to use Android operation system with cloud

3.3 System Design

System design begin with detailing the use of application by creating use case diagram with machinery services providers became main actor. Then, each of use case must be described for reference for activity diagram. Activity diagram has function as description of application flow and becoming guidelines for implementation of each stage.

System database design was made based on use case diagram. In this application three main tables of data were used i.e. table for user, table for machinery and table for order where its relationship is shown in Fig. 2. Data flow in the database occurs between users, data bases, systems and Google Maps. Almost all data is entered by users starting from personal data , technical data, and order data. However, exceptions to location data are due the data is entered by the system that gets input from Google Maps API after the user selects the location on the displayed map. The data flow of the location retrieval process is illustrated in figure 2.

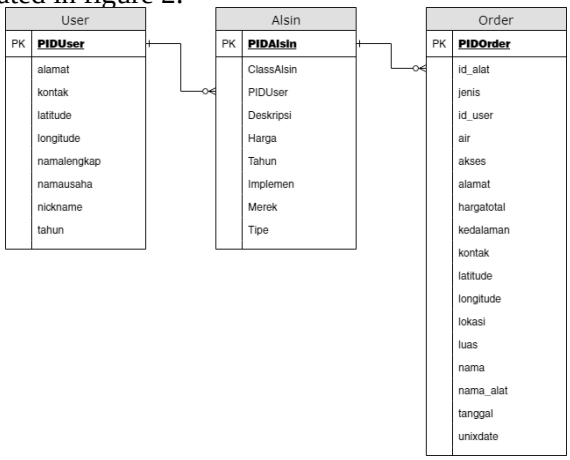

Figure 2. Entity relationship diagram

Design of user interface (UI) of the application was made based on anticipating what user might need to do and ensuring that interface elements are easy to be accessed, understand, and facilitate all necessary actions. The UI design is done with Adobe Photoshop CC 2018 and its sample is shown in figure 3.

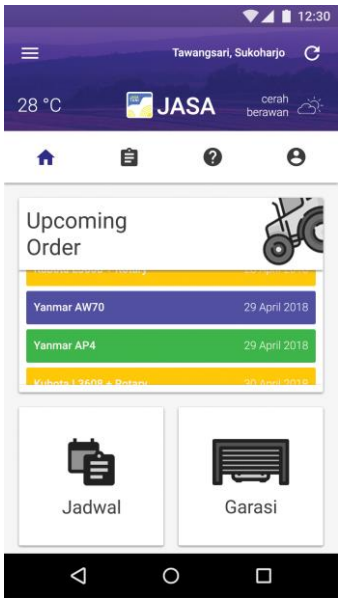

Figure 3. Designed UI of application

3.4 System Implementation

System implementation was started with database development with Firebase Realtime Database which is No-SQL system. No-SQL is all database and data storage which does not follow the principles of RDBMS and is generally related to big data which is accessed and managed on a network scale. Firebase Realtime Database is cloud-hosted database that stores data in the form of JSON documents and synchronize in real time to all connected clients. The data structure is slightly different from the general RDBMS, i.e. data of FRTDB is stored in key-value pairs. As shown in figure 4, a key can store values and have other keys that are on underneath or commonly called a node. The data structure built for the AgriMach Apps system has four nodes namely tools (alat), end order, new order, ongoing order, and user.

Figure 4. Root data structure

User interface (UI) for this application is implemented in Extensible Markup Language (XML) in layout resource file written in Java. Application algorithm and flow is implemented in Java classes which follow previously created activity and data flow diagram. All of those code simulated in Xiaomi Redmi Note 5 Pro with USB debugging method during the development process.

3.5 Installation & Testing

Finished application was compiled to android application package file (.apk) then it was installed in Android smartphone. Installation was followed by application test by using black box method [2]. This testing method ignoring the process and structure inside the system but focusing on expected input and output. The items of functional testing were user authentication, data base entry and loading, data base administration, integration and link to Google map, navigation and calender and connecting to phone dialing. Testing were carried out on four tester smartphones, namely Asus Zenfone 5 for Kitkat 4.4.2 Android OS, Samsung Galaxy Grand Prime for Android OS Lollipop 5.0, Samsung J7 for Marshmellow Android OS 6.0.1, Asus Zenfone 3 Max for Nougat Android OS 7.0, and Xiaomi Redmi Note 5 Pro for Oreo Android OS 8.1.0. Based on test results, it was proven that the application can run all its functions properly on all tested devices and all android OS. The process of requesting permission to use supporting aplication such as using GPS for finding locations and access phone application to do dialing contact numbers do not experience any problems for all devices. That function relating to the database can also run well at the time of application.

4. Conclusion

Online application for agricultural machinery service based on Android Operating System namely AgriMach Apps was successfully developed using Android Studio with the Firebase Realtime Database as its database. Based on the test results, this application can be used satisfactorily with the Android 5.0 (Lollipop) operating system up to Android 8.1.0 (Oreo). The application requires an internet connection for data communication with databases and GPS installed devices to access the user's location. The main functions of the application are managing personal data, owned machinery, and orders (scheduling); displaying order and machinery data; and integration with maps and navigation and calendar application. The size of the application that was successfully built was 3.98 MiB.

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