Designing and Developing an Agricultural Product Sales Application Catalog with a Hybrid Application Development Framework

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Abstract. The use of e-commerce systems continues to increase in Indonesia, but the field facts show that e-commerce in agriculture is still relatively low compared to other fields. The problems faced are limited e-commerce infrastructure, lack of the farmers' knowledge on the benefits of e-commerce, and application design, which is challenging to use. Those problems cause a lack of e-commerce use in this field. Besides, the characteristics of technology users in agriculture also have a considerable influence. In this paper, a mobile-based application is developed to facilitate farmers in promoting agricultural products sales. One of the problems faced in developing mobile applications is the diversity of mobile device platforms. A mobile application can ideally run on multiple platforms. This paper contributes to building an application by using a hybrid method for application development to be used on the Android and iOS platforms. The application built aims to display agricultural products of farmers. The filter feature also makes it easier to find agricultural products in this application. The application is built using the Flutter framework to use one source of the same code on several mobile operating systems at once. There are some slight differences between the output versions of the Android and iOS platforms. Although there are some subtle differences, the similarity rate reaches 90%.

Keywords: agricultural commerce application, hybrid application development, platform, comparison

1. Introduction
Agriculture is one of the sectors producing natural resources and plantations, fisheries, forests, and livestock. Natural resources are the economic backbone of an area that contributes to the welfare of society [1]. In Java Island, Indonesia, the agricultural land population around 41% [2], but the marketing of agricultural products, in general, is still traditionally constrained by information and computer technology [3]. A solution that can help in the marketing process of agricultural products is needed. One solution that can be taken is to build an application that allows farmers to display and market their products. The system uses the development of a catalog system for agricultural products that can be easily accessed, supports high mobility, can be used by many parties, both sellers and buyers, and can be used on platforms that are most widely used by public in general.
In this research conducted, a catalog system was developed for the sale of agricultural products. This catalog was developed on a mobile platform. Mobile technology was chosen because of the ease of use of access to technology. Based on the results of this research conducted, it is known that most of the potential users of the system have mobile devices in the form of cellphones or tablets. Based on research conducted in [4], it is known that there are two main issues in the development of mobile devices. First, the issue of various mobile device screen sizes and second is the issue of differences in system platforms on mobile devices. One way to overcome the differences in platforms on mobile devices, in this study, a mobile application development was carried out using a hybrid application development method. Applications can be used on two types of operating systems: Android and iOS platforms.

This research has contributed to building the application of the hybrid method for mobile application development. The application also contributes to a system that supports the expansion of the agricultural product market through a mobile catalog. The implementation of this application will impact increasing the sale of products directly by farmers and make it easier for buyers to select and order the agricultural products needed.

This paper is organized into five sections. The first section contains an introduction, followed by a literature review in the second section. The third section discusses the application of the method followed by analysis and discussion in the fourth section and conclusions in the last section.

2. Literature Review

2.1. Catalog
Catalogs are one of the media for publication to promote the products offered. The product catalogs are known to be practical in conveying all types of information as generally, catalogs can also be said as a presentation tool of product features. In the product catalogs, the content includes how the seller’s relationship with the buyers, the seller’s profile, and the most important part is such as to explain the quality of the product or service.

Not only that, product catalogs also contain the required seller data such as telephone numbers, address information, email, website (if any), operational hours, how to order, and payment methods. In general, product catalogs are often found in certain places such as libraries, shopping centers, restaurants, and many other places. The more attractive the design of a catalog, the more potential it will be to increase the sale value of the products being marketed.

Regarding the positive side of the catalogs, this paper will also build a sales catalog application for agricultural products. Using catalogs and attractive designs will potentially increase the sale value of the agricultural products being marketed. The modern marketing process has a very big role as direct support for increasing a business [5]. The purpose of marketing is to bridge what producers and buyers want in completing the production process [6]. The publication in catalogs is not only for agricultural products but also means of agricultural production.

2.2. Mobile Application
Mobile applications are quite widely used by current users. Smartphone users in Indonesia continue to grow at an annual compound growth rate of 33% from 2013-2017 [7]. This can be seen as an opportunity to create marketing media for agricultural products in mobile applications.

Mobile applications are one of the results of technological developments. The applications that used to be available only on PC, but nowadays can also be used on a handheld device. The various mobile operating systems that can be found on smartphones are Symbian OS, iOS, RIM BlackBerry, Windows Mobile, Linux, Palm, WebOS, and Android [8]. The majority of operating systems used by users in various countries, particularly Indonesia, are the Android and iOS operating systems. Based on data in July 2018, it showed that the Android operating system is 90.64%, iOS has increased to 5.34%, Blackberry is 0.38%, Series 40 is 0.37%, Nokia is 0.33%, and others are up to 2.31% [9].
No matter what the mobile operating system is, but in essence, the mobile application must meet the following things: 1. Improve the quality of human life, 2. Improve communication, 3. Improve existing business processes, 4. Increase customer satisfaction. The ideal mobile application is user-friendly, especially for customers. User experience is one of the most important things which is then related to customer satisfaction.

2.3. Hybrid Framework

A framework is a tool used in developing an application. Frameworks can be functions, plugins, or concepts so that it forms a system. By using a framework, an application can be arranged and structured neatly.

However, using a framework does not mean it is free from coding. In this paper, we will use a hybrid framework. The goal is to be able to build applications that can run on various operating systems using one program code source. The operating system that is targeted is the operating system that is mostly used by users in multiple countries, such as Android and iOS [9].

Different from native programming, of course, hybrid also has its advantages and disadvantages. Here are the advantages and disadvantages of hybrid and native frameworks:

1. Native Programming has a more challenging development process, while the hybrid process is much easier and cheaper.
2. Applications can run on several operating systems at once if you use Hybrid, while native can only be on one operating system
3. Hybrid performance cannot be as good as native
4. Native program features do not fully exist in hybrid; therefore, it will be difficult to make any special features.

Seeing the facts above, the performance problem can be a serious problem. To overcome this problem, this paper uses a flutter framework which is claimed to have a fairly good performance of up to 60 FPS [10]. The hot reload feature is also provided by this framework, which allows programmers to see the results of code changes more quickly. Flutter is a hybrid framework made by Google, which is still developing. Although it is still developing, many companies have used this framework because it can run on several operating systems and have good performance [11].

2.4. Agricultural Product Sales Application

Agricultural products can be sold in several ways. In 2014 there was an agribusiness application that introduced bananas [12]. The method used is Rapid Application Development (RAD). This application supports the management of user data, customer data, product data, and sales data. In 2017 there was research on E-farming application [13]. The application made was web-based using the Software Development Life Cycle (SDLC) method. In 2018, research in the field of agricultural e-commerce was conducted by Fachriyan by creating an agribusiness marketplace [14]. Unlike previous research, this research will be designed and built a multi-platform mobile application. Another multiplatform application is tanihub, which also connects directly between farmers and buyers [15]. However, one of the features developed in this study is the pre-order feature. The data managed is not only product data, but also seller data and buyer data. The method used in making the application in this study is Scrum. Scrum is an additional framework for software or product development and can increase the speed and flexibility in development [16], this is the basis for implementing Scrum for the development of this agricultural application.

3. Research Methodology

In this research, we use The Scrum methodology. This system development is carried out using the Scrum method which consists of planning, staging, development and release. The first stage is planning, at this stage the developer sets the right goals and funding. the requirements and iterations that will be prioritized will be identified. At the development stage, the system is implemented and the release stage is the final stage of deploying. Details are explained in the paragraphs below.
In this research, the data on agricultural products used is not limited to natural agricultural products and applies to agricultural production facilities. From the requirements analysis stage, the sales system developed in this study aims to display the farmer’s agricultural products. If there are interested buyers, they can interact with the seller through the address and telephone number provided by the system. The system can also direct the seller’s locations using maps. Another feature provided by this system is the availability of filters, which makes it easy to find a product. Based on these filters, potential buyers can sort products based on specific criteria.

At the development stage, this study uses a multi-platform approach. The purpose of using this multi-platform is to support the scalability, availability, and reusability aspects of the program. The scalability aspect is used to support developing applications with other system integration. The availability aspect supports applications available on various platforms. The reusability aspect supports speed in making systems available on various platforms in a short amount of time. The code made is only one code, but it can be applied and used on many platforms. The framework used is Flutter.

3.1. Business Process Application Design
The application development process is carried out by the Scrum method, involving a team of 4 persons, with their respective assignments as the product owner, scrum master, front-end developer, and back-end developer. The product owner manages how the business process of the application runs and provides direction when one or more features change.

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**Fig. 1. Use Case Application Diagram**

**Fig. 2. Sitemap application for buyers**

**Fig. 3. Sitemap application for sellers**
In Fig. 1, there is a use case diagram application. The two main roles of the application are buyers and sellers. Buyers can search for products (by category, keywords, stores, and the status of products sold), view detailed information about products sold, information about sellers, as well as view seller contacts. Buyers can also register as sellers through the registration process available in the application, after which they log in to enter the store admin page.

Activity diagrams and sitemaps explain the application features and overall usage process. The application sitemap is different for each user role. Fig. 2 is a sitemap application for buyer pages, while Fig. 3 is a sitemap application for admin/seller pages. When the user has logged in as a seller, the application will automatically enter the admin page when they reopen the application again. Therefore, the seller does not need to log in every time he/she wants to use it.

3.2. Database Application Design

The database used in this application is the Dutatani database. Dutatani is a system developed specifically to support the business process in agriculture toward precision farming. This system has been in development since 2016 [17]. The system is named Integrated Agricultural Information System (IAIS). Several applications in agriculture have been carried out [18]. After that, an integrated SIP blueprint was developed by developing Architecture Vision [19], Business Architecture [20], and defining IAIS stakeholders [21]. Besides, there are several systems developed, such as the Agricultural Portal [22], Farmer and Farmer Groups Information System [23], Farmers Activity Information System [24], Information System of Agricultural Products’ Purchases and Sales [25] and Agriculture Mapping System [26]. Three systems that have been developed can be accessed via the website at http://dutatani.id. Dutatani is an integrated database for the whole system in IAIS. The database entity relationship diagram and details of the data variables used special for mobile commerce needs are explained in Fig. 4.

The Dutatani database uses MySQL, which is accessed by the REST API in php programming language. There are 11 tables that are used, such as product table (master_produk_tani), user (master_user), user details (master_detail_user), ordering (trans_pemesanan_commerce), stores (master_kel_tani), product units (master_satuan_saprotan), product categories (master_kategori_alatbahan), province, district, sub-district, and kelurahan_desa.

3.3. Application Interface Design

The design of the application interface is made to cover all pages or activities of the application. The login and register page on Fig. 5 and Fig. 6 will appear first for new users. However, if the user has
registered or entered in the application, the page will not occur again. The main page in Fig. 7 contains the categories of products sold that are displayed with 2 types of test displays, which aimed to enable users to make it easier to search for the products they want directly. On the main page, there is also navigation to the search page or shopping cart page. The shop detail page will be displayed like Fig. 8 for display with card view, and Fig. 9 to display the list view. The selected product details will be displayed with a model view like Fig. 10.

The design of the application interface is made to cover all pages or actions of the application. The login and register page on Fig. 5 and Fig. 6 will appear first for new users. However, if the user has registered or entered in the application, the page will not appear again. The main page in Fig. 7 contains the categories of products sold that are displayed with two types of test displays, which aimed to enable users to make it easier to directly search for the products they want. On the main page, there is also navigation to the search page or shopping cart page. The shop detail page will be displayed like Fig. 8 for display with card view, and Fig. 9 to display the list view. The selected product details will be displayed with a model view like Fig. 10.
4. Results and Discussion
This application has been successfully developed with a display in accordance with the design. This application has been developed with Flutter which means it can be installed on Android or iOS Operating System (OS). In this paper, each figure contains 2 versions of OS. The left side is the Android version, and the right side is iOS version as in Fig. 11, which is the first-page image displayed when the application is opened. The display of Fig. 11 contains product categories as well as recommended products.

![Fig. 11. The Front Page of the application](image1)

Fig. 12. Product Detail Page

The product detail page is shown in Fig. 12. This page is equipped with a product image, a shortcut button for the seller’s telephone number, as well as the seller’s location shortcut. The seller location button will be connected to the Google Map, while the phone number button will be connected to the mobile call feature. Application users do not need to log in because this application uses a model to meet directly between the seller and buyer. This design makes it easy for users and aims to increase prospective buyer interest because they can see the product without logging in first. If prospective buyers find it easier to see the product catalog, of course, it will provide added value for the sale of these products. The possibility of prospective buyers to buy the product will be greater.

![Fig. 13. Seller Enter Menu](image2)

Fig. 14. Error Code on Seller Enter Menu

The login page is intended for sellers who will publish their products. This page is shown in Fig. 13. There is a problem with the Seller Enter Menu. The problem happened on iOS OS. The code is
searched for Application ID and can not found the ID, shown in Fig. 14. The problem can be solved when the code is commented on, or the text field is manual entry. The application can be run normally again after the error fixed.

In this paper, we can see a comparison between 2 OS outputs, as seen on Table 1. There are 20 pages that are compared, and there are 2 differences in them. There are some colors that are darker on iOS when compared to Android in Shop Product Detail. There is an error page in Seller Enter Page when retrieving the application ID on iOS. So the calculation of the similarity of output obtained by using Hybrid Programming in both OS versions is $\frac{18}{20} = 90\%$.

| Page                     | Similarity | Page                     | Similarity |
|-------------------------|------------|-------------------------|------------|
|                         | Android    | Ios                     | Android    | Ios                     |
| Front Page              | v          | v                       | Seller List| v          |
| Product Detail          | v          | v                       | Disclaimer | v          |
| Seller Enter            | v          | v                       | Personal Data Completion | v          |
| Product Category        | v          | v                       | Seller's Shop | v          |
| Product Search          | v          | v                       | Profile    | v          |
| Search Shop             | v          | v                       | Profile Update | v          |
| Shop Product Detail     | v          | v                       | Manage Product | v          |
| Shop Information        | v          | v                       | Add new Product | v          |
| Seller Login            | v          | v                       | Purchase Recording | v          |
| Forget Password         | v          | v                       | Purchase Reporting | v          |
|                         |            |                         | Passed     | 20   18 |

5. Conclusion
In this paper, the authors have succeeded in designing and developing an application for selling agricultural products. This application is developed by designing interfaces and databases, and the results made are also in accordance with the design. The application is developed using the Flutter Framework. The Flutter Framework is a hybrid framework that can support application development for various operating systems (such as Android, iOS, etc) on mobile devices. The application can be compiled into several applications on Android and iOS with just the same source code.

Testing were carried out on twenty features on the system using two operating systems (Android and iOS). The testing results show that there is a slight difference between the output versions of Android and iOS, as there are some colors that are darker on iOS when compared to Android. Besides that, there is an error page when retrieving the application ID on iOS, even though it comes from the same source code. Although there are two differences, the similarity rate reaches 90%. This research shows that hybrid development in agriculture mobile application using Flutter Framework can make development system easier and also faster.

Acknowledgment
The authors thank the Institute of Research and Community Empowerment (Lembaga Penelitian dan Pengabdian kepada Masyarakat / LPPM) Universitas Kristen Duta Wacana which has funded this research with contract numbers: 047/D.01/LPPM/2020 and the Faculty of Information Technology Universitas Kristen Duta Wacana.

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