



Android-Based Introduction to Agricultural Crops and Pests

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Abstract

The number of farmers in Indonesia continues to increase during the pandemic. However, this increase was not accompanied by good literacy related to plants and pests. The main factor is the increasing amount of information that is not credible. This research was conducted to provide alternative solutions for farmers or the community, especially novice farmers in obtaining plant and pest information through an android application. This application was developed using the Kotlin programming language on Android Studio with the Waterfall Development Method. Based on the results of functional testing, the application can run well and pass all test scenarios using the Black Box method and can run on smartphones with Android 5.0 to 9.0 systems, without closing the possibility of a new Android version.

Keywords: Agriculture, Crops, Pests, Waterfall, Android application

1. INTRODUCTION

Agriculture is the science or practice of agriculture, including cultivating land to grow crops and raising animals to produce food, industrial raw materials, energy sources, and other products that humans need [1]. The science covers several sectors in general, including food crops, plantations, forestry, animal husbandry, and fisheries. The food crop sector is the main sector in agriculture because it is one of the basic human needs. In fact, the cultivation of food crops has various obstacles, including climate, soil, irrigation, and controlling pests and diseases. As a tropical country, Indonesia has excellent agricultural potential. Based on data [2], the agricultural sector has absorbed 33.4 million workers from the total population. However, the large number of workers in the agricultural sector is not accompanied by good literacy about plants and pests. It is difficult to be involved in the world of agriculture because we need to know about agricultural science, especially now that there is a lot of less credible information. With the



development of the use of technology, knowledge and information are not only obtained from formal education. Sources can come from print or electronic media. One of the electronic media that is often used today is a smartphone with the Android operating system. Android is an operating system released by Google which is specifically made for smartphones and tablets [3]. Therefore, we propose a digital-based solution by developing “Android Based Recognition of Agricultural Crops and Pests” to introduce agricultural crops and various pests that can infect crops.

Several previous studies regarding the introduction of plants and pests are research conducted by [4], the result of this research is the application of the introduction of pests and diseases in plants. Research conducted by [5], the result of this study is an android-based flora and fauna introduction application that is useful for SDN 1 students. In getting to know flora and fauna with animation media. Research conducted by [6], the result of this study is an augmented reality-based application as a medium for introducing plant and pest species to farmers. The application is used as a medium for conveying information to farmers and the authorities about plants and pests that attack them. Research conducted by [7], the results of this study are increasing knowledge of cassava farmers, changing views on how to control cassava pests, and controlling cassava pests in an environmentally friendly manner. Research conducted by [8], the result of this research is the introduction of Toraja traditional clothing and accessories in a more interesting and interactive three-dimensional form using Augmented Reality. Research conducted by [9], the results of this study are to facilitate field officers and farmers in identifying a fruit fly pest and how to handle it. Without having to wait for the results of the field office report to the head office and sending an expert to the field. And farmers no longer have to wait for pest experts to come and teach them how to handle pests.

2. METHODS

The data collection technique used in this writing is a literature study. Conducting library research by searching or collecting information from books, articles, and journals and browsing the internet to obtain secondary data.

The stages of research were carried out to follow the stages of software development in the Software Development Life Cycle (SDLC) with an approach using the Waterfall model. The SDLC (Software Development Life Cycle) method is the process of creating and modifying systems and models and methodologies used to develop software engineering systems. The Waterfall model emphasizes sequential and systematic stages [10]. As shown in Figure 1. SDLC is different from RUP which has an iterative process for each development process [11].



Figure 1. stages of research with the *waterfall* model

1. Requirement

The authors collect the necessary data such as preparing the Android Studio software and other supporting software, as well as creating and finding the assets needed.

Table 1. Requirement hardware and software

Hardware	Software
a. Laptop HP Intel(R) Core(TM) i3-6006U CPU @2.00Ghz, RAM 8GB, SSD 240GB.	a. Android Studio Bumblebee
b. Smartphone dengan OS Android	b. Figma
	c. Draw.io
	d. Kotlin 1.6.0
	e. Android SDK
	f. Lucidchart
	g. MySQL
	h. Xampp

2. Analysis

The following is an analysis of application requirements:

1. Page to see the features of the application
2. Pages to choose interesting plants
3. Page to see a list of plants of interest
4. Page to see a list of the syllabus on plants of interest
5. Page to view syllabus details
6. Page to see the video introduction to agriculture
7. Page to see the current weather at the location
8. Page to see a list of pests or diseases on plants
9. Page to view detailed pest or disease information

3. Design

At this stage, the authors designed the Use Case Diagram, Entity Relation Diagram (ERD), and the User Interface. The following are the Use Case, Entity Relation Diagram (ERD), and the user interface for the application to be designed:

a. Use Case Diagram

Use Cases are used to find out what features are on the system and who has the right to use these features [12].

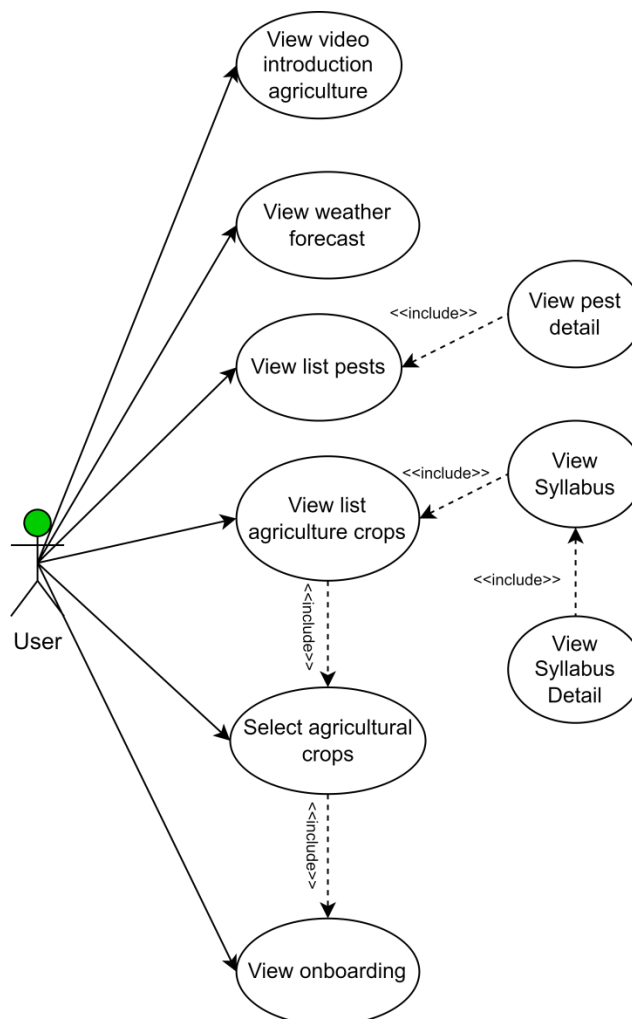


Figure 2. Use Case Diagram

As seen in Figure 2, there is a user actor who has 9 functionalities, namely view onboarding, select agricultural crops, view list agriculture crops, view list pests, view weather forecast, view video introduction agricultural, view detail, view syllabus, and view syllabus detail.

b. Entity Relation Diagram

Entity Relationship Diagram is a diagram used for designing a database and shows the relationship between objects or entities and their attributes in detail [13].

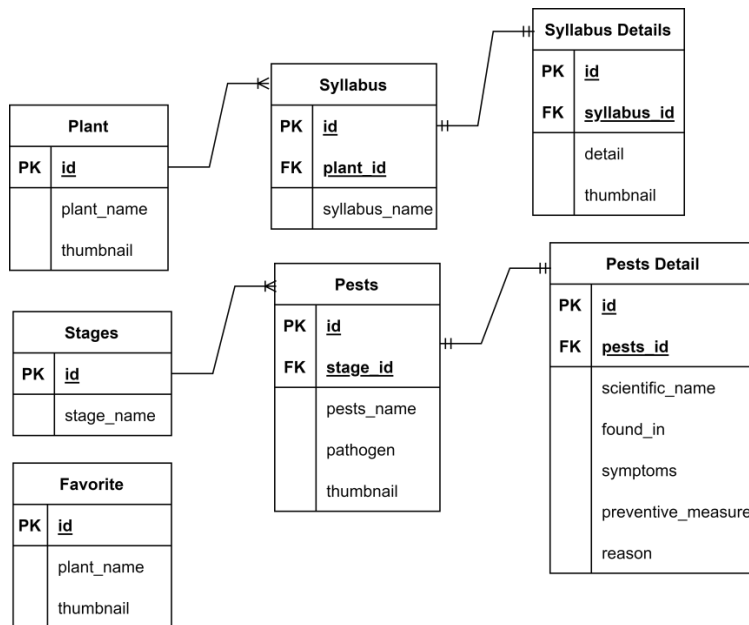


Figure 3. Entity Relation Diagram

As seen in Figure 3, there are 7 objects that will be in the database, namely plants, syllabus, syllabus details, stages, pests, pest details, and favorites.

c. Interface

Interface design is used to create an overview of the layout, what components will be used, and also defines what functionality is in the application in a visual form [14]. At this stage, the author performs 2 stages of design, namely wireframe and mockup. The results of the interface design can be seen in Figure 4.

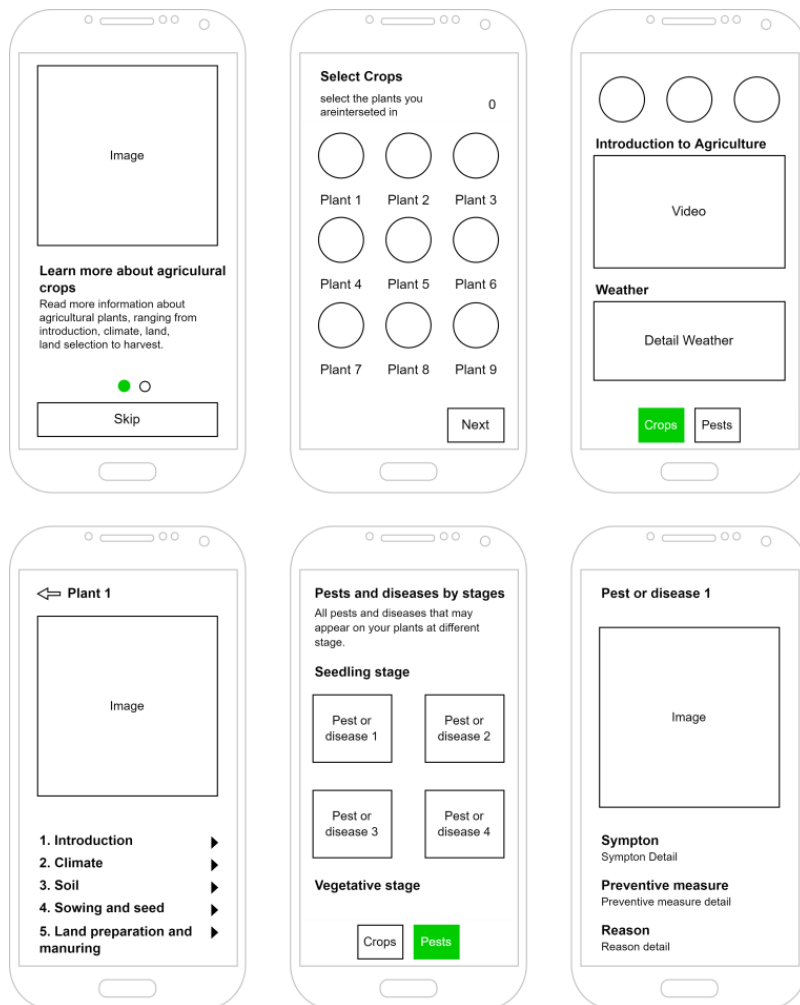


Figure 4. Wireframe Interface

4. Implementation

At this stage, the implementation of all the results of the design that has been carried out is carried out to be developed into an application. Development is done using Android Studio Bumble Bee. The programming language used is the Kotlin programming language. The minimum limit for supported devices in this application is Android version 5.0, also known as Lollipop.

5. Testing

Application testing using black box. Used to test software in terms of functionality by using a scenario that has been given. Application testing will be done after creating an application and has been built with extension (.apk).

3. RESULTS AND DISCUSSION

The research conducted has successfully implemented all stages and has succeeded in developing an Android-based "Agrarian" application. The "agrarian" application is made for farmers and the community, especially novice farmers to introduce crops and pests that can infect crops. The way the "Agrarian" application works is that the user selects the plants of interest. After selecting the plants of interest, then enter the crops menu to select the plants want to know about. After choosing a plant, the user can immediately find out information about the introduction of plants to the harvest stage.

3.1 Application Display Result

a. Onboarding

In the onboarding view, there are 2 slides, each of which explains the features contained in the application. There is also a skip button. as seen in figure 4.

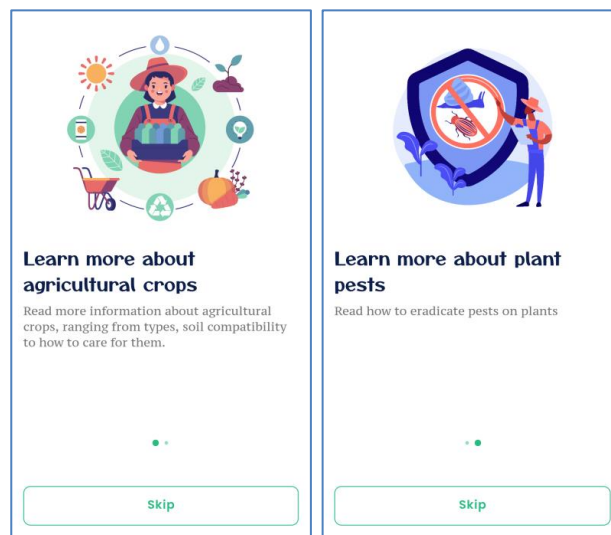


Figure 4. Onboarding

b. Select Agriculture Crops

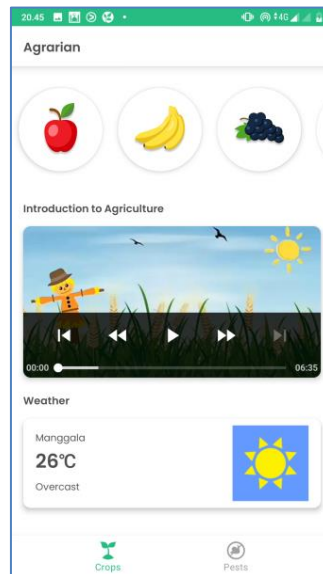
On this display, there is a list of crops, where users can choose the plants of interest. If the user does not select, the Next button will not be active, as shown in Figure 5a. If the user selects, the Next button will be active, as shown in Figure 5b.



Figure 5. Select Crops

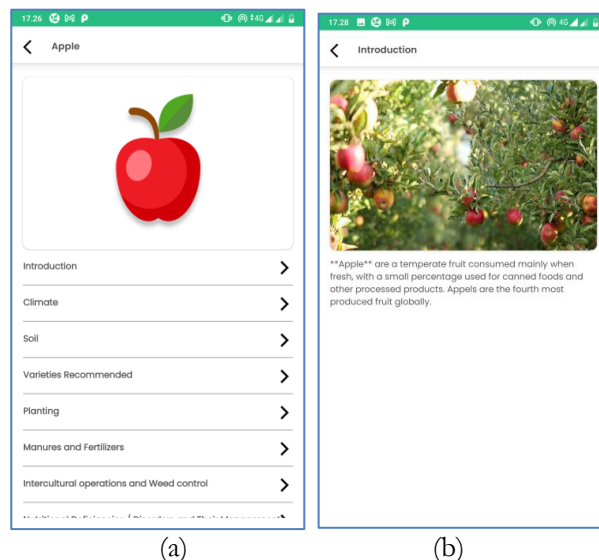
c. Menu Crops

The crops menu page displays a list of plants selected by the user where when one of the plants is clicked it will display crop information from the introduction stage to harvest stage, besides that there is also an animated agricultural introduction video, and a weather forecast by location. as shown in figure 6.

**Figure 6.** Menu Crops

d. Syllabus and Syllabus Detail

In this view, there is a list of crop syllabus. as shown in Figure 7a. If the user selects a syllabus, the details of the syllabus will be displayed. As seen in Figure 7b.



(a) (b)
Figure 7. Syllabus (a) and Syllabus Detail (b)

e. Menu Pests

The pests menu displays a list of pests and diseases on plants based on stages from the seedling stage to the harvest stage. as shown in figure 8.

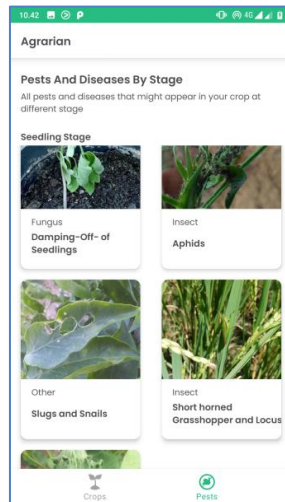


Figure 8. Menu Pest

f. Pests or Diseases Detail

In this view, there are pictures, symptoms, prevention, and causes of pests which are explained in detail. as shown in figure 9.



Figure 9. Pest or Diseases Detail

3.2 Black Box Testing

Black box testing is done to find out whether the software can function properly [15]. The black box testing that has been carried out shows that all function are running well and as planned. Of the 17 scenarios that have been tested, all went well and as expected. The results of the Black-Box test can be seen in table 2 and 3.

Table 2. Black-Box testing

Layout	Scenario	Expected function	Status
Onboarding Select Agriculture Crops	Doing scroll onboarding	Onboarding is able to display each layout from left to right or vice versa.	Success
	Clicking the skip button.	Switch layout to layout select agriculture crops.	Success
	Go to layout select agriculture crops.	Layout displays all plant data in the form of a list and displays a progress bar when the data is loaded.	Success
	Select crop.	One of the plants will change color and display the total number of plants that have been selected. If the user doesn't select any crop then the next button doesn't work.	Success
	Clicking the next	Switch layout to crops menu layout.	Success

Table 3. Continuation of Black-Box testing

Layout	Scenario	Expected function	Status
Crops	Go to crops layout.	The layout displays a list of selected crops, a video introduction to agricultural crops and weather predictions.	Success
	Clicking an item on the crop list.	Switch layout to syllabus layout and display syllabus list.	Success
	Clicking video.	Videos can be run.	Success
Syllabus	Go to syllabus layout.	Showing plant syllabus list.	Success
	Clicking an item on the list.	Switch layout to detail syllabus layout.	Success
	Clicking the back button.	Back to crops layout.	Success
Syllabus Detail	Go to the detail syllabus layout.	Show detail syllabus information.	Success
	Clicking the back button.	Back to syllabus layout.	Success
Pests	Go to pests layout.	Displays a list of pests or diseases by stage.	Success

Pest Detail	Clicking an item on the pest list.	Switch layout to pest detail layout.	Success
	Go to pests detail layout.	Show details of pests or diseases in detail.	Success
	Clicking the back button.	Back to pests layout.	Success

4. CONCLUSION

Applications “Agrarian” have been developed systematically using the Waterfall development method. With this application, farmers can choose the crop of interest, then the application will display information about the crop from the introduction stage to the harvest stage, and farmers can easily get information about agricultural pests that threaten crops. The test results show that the features in the system developed can function properly and succeed in displaying appropriate information. Suggestions for further research are to add a feature where farmers or the community can receive the best crop recommendations based on location.

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