The Application Development for Ornamental Plant Seedlings Using Android-Based Mobile Sensor Technology

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ABSTRACT

Department of Housing and Settlements, Land and Landscaping (DPKP3) are government agencies that manage housing, settlements, land and plantations (DPKP3) located in the city of Bandung. This Service Office is located on Jalan Caringin No. 103 Babakan Ciparay Bandung. This Dinas Office is the holder of authority in the field of planting. Parks in the city of Bandung in tanamin with several types of ornamental plants. Ornamental plants have a lot of diversity in shape, color and aroma. Everything we can use to beautify the house in accordance with what we expect. Ornamental plants are plants that can meet psychological needs, improve the environment, and have the value of satisfaction as a hobby. Functionally, ornamental plants can help renew oxygen in the air, helping to reduce gas pollutants and noise. Then it takes an android application that can provide recommendations for ornamental plants using mobile sensor technology. The sensors used are humidity sensor, temperature sensor, and ambient light sensor, openwethermap where the three sensors will detect the level of humidity, temperature, and light intensity in the user environment then the application will recommend plants that are suitable for the environment, for Openweather as a sensor replacement if not supported by the sensor. Based on the results of alpha testing and beta testing this study can be concluded that this application can provide recommendations for searching ornamental plants, so that the intended purpose can be met.

Keywords : *Geotagging, Location Based Service, Ambient Light Sensor, Humidity Sensor, Temperature Sensor, openwether map, Android*

1. INTRODUCTION

Department of Housing and Settlements, Land and Landscaping (DPKP3) are government agencies that manage housing, settlements, land and plantations (DPKP3) located in the city of Bandung. This Service Office is located in Jaan Caringin No. 103 Babakan Ciparay Bandung. This Dinas Office is the holder of authority in the field of planting. Parks in the city of Bandung in tanamin with several types of ornamental plants.

Ornamental plants have a lot of diversity in shape, color and aroma. Everything we can use to beautify the house in accordance with what we expect. Ornamental plants are plants that can meet psychological needs, improve the environment, and have the value of satisfaction as a hobby. Functionally, ornamental plants can help renew oxygen in the air, helping to reduce gas pollutants and noise [1].

One of the characteristics of ornamental plants can be distinguished based on the physical and living place of ornamental plants, by identifying plants both physically and horticulturally, then the selection, management and accuracy of ornamental plants will be more appropriate and appropriate, and the function of plants will be more optimal. The difference in height of a place will have a different climate [1], Lowland areas have high temperatures and low humidity so plants that require high temperatures and low humidity will grow well in the lowlands, while in higher areas, namely the medium terrain is lower and the humidity is higher, the plants requires medium temperature and moderate humidity will grow well in the medium [2] [1], but the lack of public knowledge about ornamental plants will be less optimal.

We can not only plant ornamental plants indoors, we can plant ornamental plants in outdoor areas. So that not only does the interior look beautiful, but the outdoor appearance becomes beautiful in the presence of ornamental plants. But not everyone knows how to plant ornamental plants. How to plant ornamental plants can not be done carelessly, must have guidelines and knowledge about plants that will be planted and the most important thing is to pay attention to the plant media, such as what land is suitable for plants to be selected, what fertilizer to use, water content to water it, and weather forecasting while taking care of it. Therefore we need an application that uses an Android-based mobile device that can help people in how to plant ornamental plant nurseries

Based on an interview with Ms. Ima Primasari as the Head of the Production Statistics Section, she

revealed that a technology is needed to record the position of the KSK (Kecamatan Statistics Coordinator) and staff when conducting a jelly survey. This is felt necessary so that the survey position can be traced back to when there was an inspection from the Provincial BPS or the Agriculture Service.

In this study, the application was built based on Android, because Android is an operating system for Linux-based mobile devices that includes the operating system, middleware and applications. Android provides an open platform for developers to create their applications, in addition according to a survey reported on the website detiknet states that android users in Indonesia in 2016 reached 41 million users [3], The technology in this application utilizes temperature sensor technology to determine the temperature around, the Ambient Light sensor shows the surrounding lighting, Humidity sensor measures humidity around, therefore the Android based application is chosen.

From the problems that have been presented, we need a solution to build an application with the aim of helping problems in planting ornamental plant seeds, with the help of Android applications and utilizing location-based service technology and API service using AccuWeather. So the writer raises the theme and title "Application Development Recommendation of Ornamental Plant Nursery Utilizing Mobile Sensor Technology in the Office of Housing and Settlements, Land and Landscaping in the City of Bandung".

2. CONTENTS OF RESEARCH

2.1 Theoretical Basis

In this section, the theories that support problem solving are considered relevant to the subject.

2.1.1 Decorative plants

Ornamental plants are plants that can meet psychological needs, improve the environment, and have the value of satisfaction as a hobby. The plants and their beauty have a broad imagination effect and revive the spirit of self. The existence of plants in the environment can have a humanizing effect and can help restore the health condition of the mind which is burdened with sadness, pain, and problems. Functionally, ornamental plants can help renew oxygen in the air, helping to reduce gas pollutants and noise [5]. Properly regulated plants will help direct air circulation, become a veil, soften hard architectural lines, and provide a striking surface texture [1].

In the construction of this application, the types of ornamental plants used are types of ornamental flowers, leaf ornamental plants, hydroponic ornamental plants, and hanging ornamental plants. The following is an explanation of each type.

1. Flower Ornamental Plants
   Flower ornamental plants are defined as plants that have beautiful flowers with one or many colors. Flower ornamental plants can add to the beauty of a room or the surrounding environment and make it look more beautiful. There are many types of flower ornamental plants that can be planted inside or outside (around) houses such as roses and jasmine flowers.
2. Leaf Ornamental Plants
   Leaf ornamental plants are one type of ornamental plants that have the beauty and characteristics of the leaves. There are many types of leaf ornamental plants that can be planted inside or outside (around) the house such as aglonema flowers and red start taro flowers.
3. Hydroponic Ornamental Plants
   Hydroponic plants are plants whose planting medium is not in the form of soil. This one planting technique usually uses water planting media. There are many types of hydroponic ornamental plants that can be planted inside or outside (around) homes such as orchids.
4. Hanging Ornamental Plants
   Hanging ornamental plants are a type of ornamental plants whose planting media can be hung, using this hanging technique, ornamental plants will look more beautiful and attractive. One example of hanging ornamental plants is like begonias.

2.1.2 Terms of Growing Ornamental Plants

Requirements for growing ornamental plants can be seen in table 1 [4].

Tabkel 1 Terms of Growing Ornamental Plants

No	Names Of Plants Ornamental	The Latin Name	Growing Conditions
1	Sri Rejeki	*Aglaonema crispum*	The conditions are : 1. A suitable height of around 300-400 m dpl 2. Temperature, ideal growth in temperature conditions in lowland areas 3. Humidity 50-75%. 4. Light, don't need too much sun. being in the middle plain, using shading net 20% - 25%.
2	Begonia atau Daun Antik	*Begonia rex*	The conditions are : 1. Light intensity ranges between 2000-2500 fc. 2. Temperature, between 15-30 °C. 3. Water needs, begonias are susceptible if the media conditions are excess water. 4. Air humidity is above 50% try not too high.
3.	Bromelia Pink Grass	*Bromelia sp.*	The conditions are : 1. light evenly distributed and must be shared with a protective net with a range 60 % - 75 %.

No	Names Of Plants Ornamental	The Latin Name	Growing Conditions
			2. Light intensity, need shade 65 % - 75 %. 3. Temperature 16°C-26°C tropical and sub-tropical climate. 4. Humidity from 50 % - 60 %.
4	Bunga Krisan	*Chrysanthemum morifoliu m*	The conditions are: 1. Air temperature 20°C – 26°C 2. Humidity, requires high humidity for the initial formation of seed roots, cuttings require 90-95%. 3. Sunlight, requires long irradiation 4. Height of place 700-1200 m dpl
6	Bunga Kertas	*Bougainvillea berberidifolia*	The conditions are: 1. Temperature, 10°C-20°C (night temperature) and afternoon temperature 19°C-29° C 2. Humidity between 50-80 % 3. Light, does not require full illumination

2.1.3 Sensor

Sensor is a tool that can be used to measure, analyze, monitor a condition and then respond to changes around it. This tool can be found on modern devices such as smartphones with the Android operating system, as smart phones that have a package of advanced technology. [5] [6]

Some kinds of common sensor type categories:

1. *Motion Sensor*.

   Motion sensors is a tool that serves to measure the strength of acceleration and rotation along three axes (X, Y, Z). This category includes speed or acceleration, gravity sensors, gyroscope, and vector rotation.

2. *Environmental Sesnsor*.

   Environmental sensors adalah alat yang berfungsi untuk mengukur berbagai parameter keadaan sekitar, seperti suhu udara dan tekanan, pencahayaan, dan kelembaban. Kategori ini termasuk barometers, photometers, dan thermometers.

3. *Position sensor*.

   Position sensors is a tool that serves to measure the physical position of the device. This category includes orientation sensors and magnetometers.

In the construction of this recommendation application, the author uses three types of sensors that are in the category of environmental sensors or Environmental Sensors, including [5] [6].

1. *Ambient Light Sensor*

   Ambient Light Sensor is a device that is used to adjust the screen brightness automatically based on ambient light.

2. *Temperature Sensor*

   Temperature Sensor is a device used to measure the temperature in the surrounding environment.

3. *Humidity Sensor*

   Humidity Sensor is a device used to measure humidity in the surrounding environment, this sensor is suitable for measuring the level of humidity around so that the compatibility of a plant can.

2.2 Analisis Sistem

System analysis aims to identify the problems contained in the system, as well as determine the needs of the system built. The analysis includes problem analysis, analysis of similar applications, system architecture analysis, non functional needs analysis and data analysis [9].

2.2.1 Problem Analysis

Problem analysis is the stage of describing existing problems before the application is built and aims to build the development of this multimedia application. Analysis of existing problems includes the following :

a. Cropping officers have difficulty finding out what ornamental plants are suitable for the environmental conditions of the plant.

   When the officers planted ornamental plant seeds, it was difficult to care for them because they were not suitable for environmental conditions that would plant the ornamental plants, but the plants were good, beautiful to plant in the environment.

b. Lack of public knowledge in the treatment of ornamental plants.

   When people plant ornamental plants, treatment for this plant is usually the community gives fertilizer not measured or the dose given is less or more given, not in accordance with weather conditions when applying fertilizer, weather information is needed in order to predict fertilizer care of ornamental plant seeds.

c. Nursery officers still have difficulty choosing ornamental plants with criteria that are in accordance with the surrounding conditions, whether ornamental plants can grow in the surrounding conditions

2.2.2 Analysis of System Architecture

System architecture analysis aims to identify the architecture to be built. The following is a system architecture image from the application of a recommendation for searching ornamental plants. A description of the system architecture can be seen in the picture 1 following:

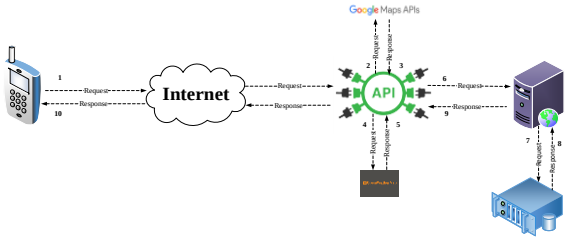


Figure 1 System Architecture to be Built

The following is an explanation of the system architecture picture above:

1. The user's mobile device requests web server data through the API via the internet network.
2. API does a Google Maps Fire data request
3. The Google Maps API sends data and sends it back to proceed to the OpenWeathermaps API
4. API performs the Open Weather API data request
5. The Open Weather API accepts requests and provides data
6. The web server receives data requests from the API and determines the type of request received by the API.
7. The web server receives data requests and the web server retrieves the data in the database.
8. The web server receives data transfers and the web server stores data in the database.
9. After the web server receives the requested data, the data is returned in the form of JSON to be processed by the user's mobile device.
10. Then sends the response to the user according to his request.

2.2.3 Functional Needs Analysis

The analysis that will be carried out on this diagram includes the identification of actors, identification of Use Cases and Identification of Use Case Scenarios which can be seen in Figure 2 below:

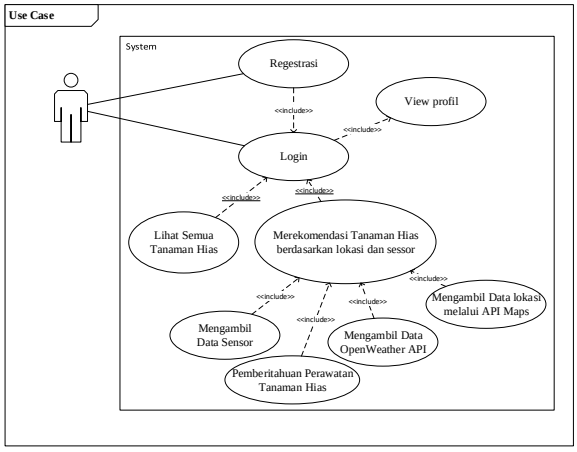


Figure 2 *Use case diagram*

2.2.4 Non Functional Needs Analysis

Non-functional analysis is a description of the analysis needed to determine the specifications of the system requirements. This specification also includes what elements or devices are needed for the system to be built until the system is implemented. Analysis of non-functional requirements can determine the input specifications required by the system, the output that will be generated by the system and the processes needed to process inputs so as to produce the desired output.

In this analysis the needs of non-functional systems explain the analysis of hardware (software), software (software), and users (users) as an analysis of deficiencies and needs that must be met in the system design that will be applied.

2.3 System planning

The design will begin after the system analysis phase has been completed. Design can be defined as the depiction, planning and sketching or arrangement of several elements that are separated into one whole and functioning unit. This stage involves configuring the software and hardware components of a system so that after installation of the system it will really satisfy the design that has been set at the end of the system analysis stage..

2.3.1 Relation Scheme

Relationship scheme from the development of recommendation application for ornamental plant nurseries utilizing mobile sensor technology in the housing and residential areas, land and landscaping in the city of Android-based Bandung as shown in the following 3:

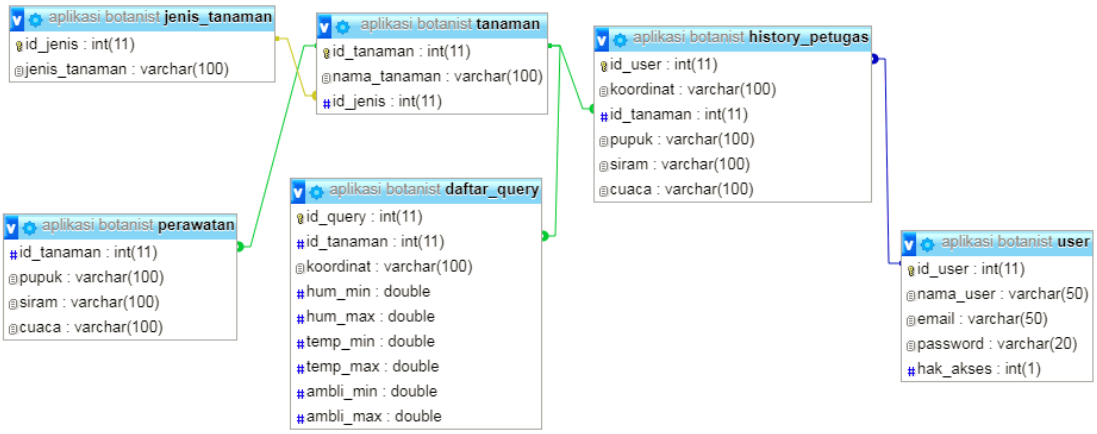


Figure 3 Skema Relasi

2.3.3 Interface Design

Interface (interface) is a form of display of programs that appear on android devices that aim to provide an overview of the application to be built, so that it will facilitate the implementation of applications according to the screen size and make it easier in making applications. The interface design for the ornamental plant nursery recommendation system can be seen in Figure 4 below:

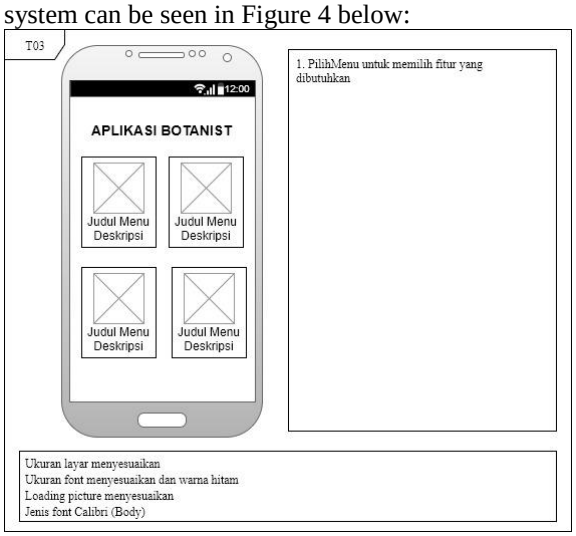


Figure 4 Interface Design for Main Menu

2.4 System Testing

This stage is the most important thing that aims to find mistakes or lack of application. This test is intended to recognize whether the application that has been made meets the criteria that are in accordance with the application design goals or not. Testing of the application system Nursery Recommendation Utilizing Mobile Sesnsor Technology in the Office of Planning and Settlements, Land and Planting in the City of Bandung will use testing strategies, alpha (black-box) testing and beta testing [10].

2.4.1 Beta Testing Scenario

The system testing will be divided into two stages. The first stage of alpha testing is testing the program based on the functionality of the program by using the blackbox testing method. The second stage is conducted research on respondents or system users by collecting data using questionnaires. The method used in this study is the Likert scale method. Testing was carried out using a questionnaire given to 8 people. With 5 statements answered with 5 categories of answers that can be seen in table 2 below:

Table 2 Questionnaire Answer Category

Kategori Jawaban	Bobot	Range Persentase
Sangat Tidak Setuju (STS)	1	0% - 20%
Kurang Setuju (KS)	2	21% - 40%
Cukup Setuju (CS)	3	41% - 60%
Setuju (S)	4	61% - 80%
Sangat Setuju (SS)	5	81% - 100%

A percentage search of each answer will be carried out using a formula:

$$Y = \frac{TS}{Skor\ Ideal} \times 100\%$$

Information:

Y = Presentation Value

TS = Total score of respondents = ∑bobot x frekuensi

Ideal score = Maximum weight x number of respondents

The statement given consists of 5 statements, namely:

1. This application provides recommendations in the search for ornamental plants that are suitable with the Officer environment.
2. This application provides recommendations in the search for ornamental plants that match the criteria that the officer wants.
3. The appearance of this application is quite interesting.
4. This application uses language that is easy to understand.
5. This application is easy to understand and use.

2.4.2 Alpha Testing Results

Alpha testing is done using a black-box method that focuses on the functional requirements of the software. The purpose of this black-box method is to find malfunctions in the program. If from the input data that is given the process of producing an output that matches the function of its function, then the application that has been made is correct. But if the output produced does not match the functional needs, then there is an application program error.

Table 3 Aplha Testing

Interface Implementation	Test Details	Test Type
	1. Display the login page 2. The user enters a username and password	Black Box
	1. Displays a list of plants 2. Choosing plants 3. Display crop details	Black Box
	1. Display the form to get sensor data 2. Press the crop button 3. Display a list of plants that match the sensor data 4. Display crop details	Black Box
	1. Request to openweather fire 2. Obtain weather data	Black Box

2.4.3 Beta Test Results

Following are the results of the percentage calculation of the answers chosen by 8 respondents in the application study of tile tools:

1. Processing of the First Statement

"This application provides recommendations in the search for ornamental plants that are suitable for my environment"

Table 4 Processing of the First Statement

Kategori Jawaban	Bobot	Frekuensi Jawaban	Total Skor
Sangat Setuju	5	6	30
Setuju	4	1	4
Ragu-ragu	3	1	3
Tidak Setuju	2	0	0
Sangat Tidak Setuju	1	0	0
Jumlah		8	37

Then the calculation results are obtained as follows:

$$Y = \frac{37}{8 \times 5} \times 100\% = 92{,}5\%$$

2. Processing of the Second Statement

"This application provides recommendations in the search for ornamental plants that match the criteria I want"

Table 5 Processing of the Second Statement

Kategori Jawaban	Bobot	Frekuensi Jawaban	Total Skor
Sangat Setuju	5	4	20
Setuju	4	3	12
Ragu-ragu	3	1	3
Tidak Setuju	2	0	0
Sangat Tidak Setuju	1	0	0
Jumlah		8	35

Then the calculation results are obtained as follows:

$$Y = \frac{35}{8 \times 5} \times 100\% = 87{,}5\%$$

3. Third Statement processing

"The appearance of this application is quite interesting"

Table 6 Processing of Third Statement

Kategori Jawaban	Bobot	Frekuensi Jawaban	Total Skor
Sangat Setuju	5	2	10
Setuju	4	6	24
Ragu-ragu	3	0	0
Tidak Setuju	2	0	0
Sangat Tidak Setuju	1	0	0
Jumlah		8	34

Then the calculation results are obtained as follows:

$$Y = \frac{34}{8 \times 5} \times 100\% = 85\%$$

4. Processing the fourth statement

"This application uses a language that is already understood"

Table 7 Processing of the Fourth Statement

Kategori Jawaban	Bobot	Frekuensi Jawaban	Total Skor
Sangat Setuju	5	4	20
Setuju	4	2	8
Ragu-ragu	3	2	6
Tidak Setuju	2	0	0
Sangat Tidak Setuju	1	0	0
Jumlah		8	34

Then the calculation results are obtained as follows:

$$Y = \frac{34}{8 \times 5} \times 100\% = 85\%$$

5. Fifth statement processing

"This application is easy to understand and use"

Table 8 Fifth Statement Processing

Kategori Jawaban	Bobot	Frekuensi Jawaban	Total Skor
Sangat Setuju	5	5	25
Setuju	4	2	8
Ragu-ragu	3	1	3
Tidak Setuju	2	0	0
Sangat Tidak Setuju	1	0	0
Jumlah		8	36

Then the calculation results are obtained as follows:

$$Y = \frac{36}{8 \times 5} \times 100\% = 90\%$$

3. CLOSING

3.1 Conclusion

Based on the results of the research, system design analysis and implementation and testing carried out, the following conclusions were obtained:

1. This application is very helpful for users in getting recommendations for finding ornamental plants that are in accordance with the surrounding environment and criteria for appropriate ornamental plant seeds.
2. This application can also help to maintain more ornamental plants.
3. The final result of the design in the form of an application to recommend searching for ornamental plants by using the Android mobile application to simplify the recommendation of ornamental plants.

3.2 Suggestion

Based on the results of the implementation and testing, this information system can still be developed so that the proposed system can work and function optimally. Some suggestions that can be done, among others:

1. The application that was designed later can still be developed again by adding several features to find more details of the ornamental plants that he wants.
2. In this application it still needs to be developed again so that it is more intense to know the plants that have been planted.
3. The next study is expected to be able to build the system to increase plant data, or maintain it.

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