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Design an Integrated Web-Based Plant Commodity Monitoring Information System

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ABSTRACT
In order to increase agricultural commodities in the Jombang Regency area to be higher, innovations are needed that can have a positive impact on the progress of the existing agricultural sector. One aspect that can support this progress is the existence of a plant commodity monitoring information system. The crop commodity monitoring system is a web-based application aimed at viewing and assessing the process of food crop growth systematically, starting from the planting period to the harvest period. From this system , historical crop data will be obtained, where these data can then be used *as knowledge* material for the Jombang Regency Agriculture Office in terms of policy making, such as the supply of seeds and fertilizer needs on subsidized and non-subsidized land, determination of planting periods, or predictions of agricultural products next year. In addition, this system also provides information related to plant conditions, plant age and instructions in determining plants to suit existing land. To realize this, the author designed and built an integrated web-based crop commodity monitoring information system on agricultural land. This research uses R&D (*Research and Development*) method. The test results using Black Box show that the functionality of this information system has been running well. The final result obtained from this study is that the system is more efficient and has comprehensive data than the old system that has been operating in the Jombang Regency Agriculture Office.

***Keywords**: Agriculture, Plant Commodities, Monitoring, Web, Jombang Regency Agriculture Office*

INTRODUCTION
Agriculture is one of the most important factors in improving the economy and maintaining food security in Indonesia (Yusuf et al., 2021). With the increase in population and high economic growth, the demand for food needs automatically increases. The reduction in agricultural land area and the influence of climate change are also initiators of instability in the seasonal agricultural production process. This is the basis of the problem for the Jombang Regency Agriculture Office to always strive to improve agricultural commodities in its area in order to produce sufficient, quality and affordable food.

Based on the analysis of the services of the Jombang Regency Agriculture Office, there are indeed major problems faced by farmers in Jombang Regency, including the decline in soil fertility due to the use of chemical fertilizers and the high conversion of productive agricultural land to non-agricultural (Nazilah, 2018). The following is data from the Central Bureau of Statistics of Jombang Regency (jombangkab.bps.go.id) which shows the development of land area according to its type in Jombang:

Table 1. Land Area by Type (Hectares), 2015-2018

Land Type	Year			
	2015	2016	2017	2018
Paddy	48.777	48.777	48.704	48.701
Non Paddy	51.659	51.637	51.637	51.637
Non Agricultural	15.584	15.606	15.609	15.615

From Table 1 above, it can be seen that the area of paddy fields in Jombang Regency from 2015 to

2018 decreased by 6 hectares, while non-paddy fields decreased by 22 hectares. In addition, the expansion of non-agricultural land reached 31 hectares in 2018. That is, when the area of agricultural land decreases due to land use change, what happens is that agricultural production will be threatened to fall as well. Here is a table showing the results of food crop production in Jombang district:

Table 2. Production (Ton) Of Food Crops In Jombang Regency, 2015-2018

Food Crops	Year			
	2015	2016	2017	2018
Rice	450.555	475.079	448.863	481.229
Corn	205.801	234.538	242.997	269.099
Soybean	9.747	6.429	6.595	5.280
Peanut	1.059	1.059	898	999
Green beans	231	-	110	41
Cassava	10.148	24.588	31.648	3.1
Sweet potato	5.412	1.839	738	0,9
Sum	682.953	743.532	731.849	756.680

From Table 2, it can be seen that food crop production fluctuates from year to year. In 2015, production reached 682,953 tons, increased to 743,532 tons in 2016, then decreased to 731,849 tons in 2017, and again rose to 756,680 tons in 2018. Although some commodities experienced an increase in production in the early years, in the following years there was a significant decline. For example, sweet potato crop production which reached 5,412 tons in 2015 dropped dramatically to 0.9 tons in 2018.

In addition to production problems, there are also technical obstacles in the monitoring system used so far. Monitoring data collection is still done through Excel, resulting in a long time to input data into the database before it is displayed on the website. In addition, the current monitoring system only covers farmers' land that receives seed and fertilizer subsidies from the government, so non-subsidized agricultural land is not detected.

Based on the above background, it is clear that system development is needed to overcome these problems. As a solution, the author designed and built an information system for monitoring agricultural crop commodities, especially food crops. This system is in the form of a web-based application that aims to track and evaluate the process of growing food crop commodities on agricultural land systematically, from planting to harvesting. This system will be integrated with Android devices and other devices that will be used by extension workers in the process of monitoring food crops in Jombang Regency.

This system provides a number of benefits, such as providing information on plant growth, planting schedules, fertilizer use, and guidance in choosing crop commodities according to land conditions. The ultimate goal of this research is to develop the concept of E-Government in the Jombang Regency Agriculture Office so that it can operate more effectively.

METHOD

In this study, the author applied the Research and Development (R&D) method. This method is a series of steps to develop a new product or improve an existing product, so that the product can be accounted for (Winarni, 2021). There are various models that can be applied in system research and development, one of which is the ADDIE model developed by Dick and Carey in 1996, and this model will be used in this research.

The ADDIE model includes several stages that need to be passed, namely analysis, design, development, implementation, and evaluation. However, in this journal, the authors limit the focus to only the implementation stage. This decision was taken considering that reaching the evaluation stage requires a long time. Here are the stages of Research and Development that will be applied in this research:

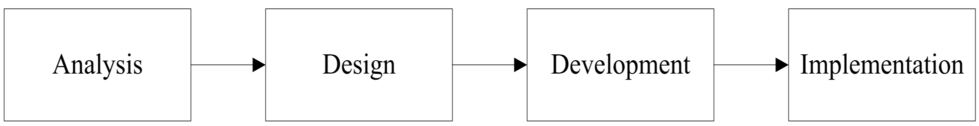

Figure 1. ADDIE Model Research and Development

- Analysis

At this stage, problem identification and problem solving are searched based on problem findings. As for its implementation, the author conducts literature studies through scientific journals, books, or other documents to find concepts or theoretical foundations regarding the information system to be built and conducts interviews with the head of the UPT implementing extension services of the Jombang Regency Agriculture Office, Rudi Priono, to find out existing problems, such as how the system is currently running and how the system is expected in the future.

- Design
  At the design stage, a study of the old system that has been running or a study of other systems that have been running well. The purpose of system design in general is to give users a general overview of the new system (Susanti, 2021). As for the system design design, the author describes the system model through context diagrams, flowcharts, and entity relationship diagrams.
- Development
  The main activity in this stage involves writing computer programs using programming languages based on predefined algorithms and logic. After that, system testing is carried out to identify problems that may arise when the system is run before finally being tested to users. This integrated web-based monitoring information system is designed using PHP programming language and CodeIgniter framework. This framework is designed with the principles of models, views, and controllers that govern system development procedures. Database management is done through a MySQL database which is then integrated with the system framework. System testing in this study was carried out using the Black-Box Testing method.
- Implementation
  At this stage, the implementation of the information system that has been built to replace the old information system that has been operating in the Jombang Regency Agriculture Office is carried out. During implementation, the system design that has been developed will be applied to actual conditions.

RESULT AND DISCUSSION

In the process of developing an Integrated Web-Based Plant Commodity Monitoring Information System, a design is needed that acts as a system design to describe an essential system model. Below summarizes the system design that has been compiled by the author.

- **Context Diagram**
  A context diagram is a graphical representation that gives an overall picture of the activities taking place within a system (Noviandhiny et al., 2018). The context diagram can be seen below:

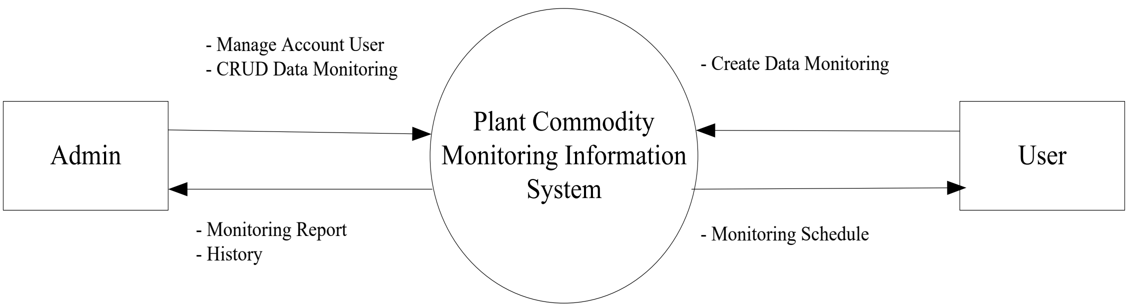

Figure 2. Context Diagram

Based on the context diagram above, it can be seen that this system has two types of users, namely admin and user. The main difference in data management is that the admin has the authority to perform CRUD operations on the monitoring data, while the user only has the authority to create monitoring data.

- **Flowchart System**
  Flowchart System is a process of drawing the steps of a program to be built. As for the flowchart it can be seen in the following figure:

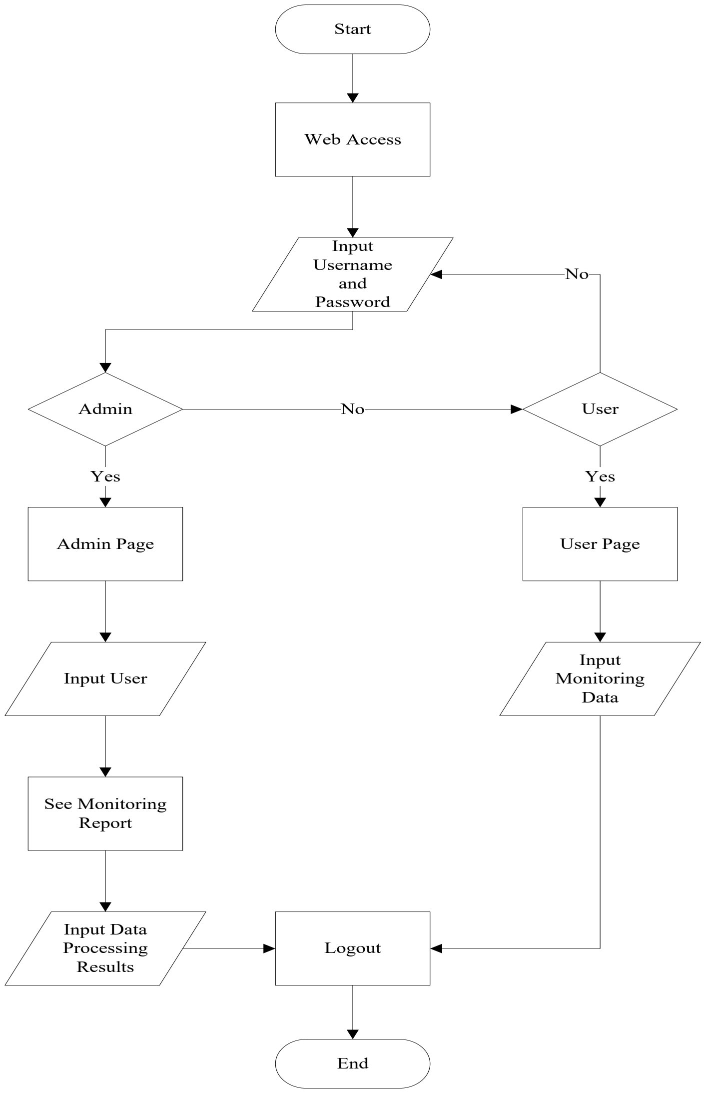

Figure 3. Data Management Flowchart

- **Entity Relationship Diagram**
  Entity Relationship Diagram is a model used to explain relationships between data in a database based on basic data objects that have relationships between relationships (Felik et al., 2021). With the Entity Relationship Diagram, the database system can be depicted neatly and structured. The Entity Relationship Diagram can be seen in figure 4.

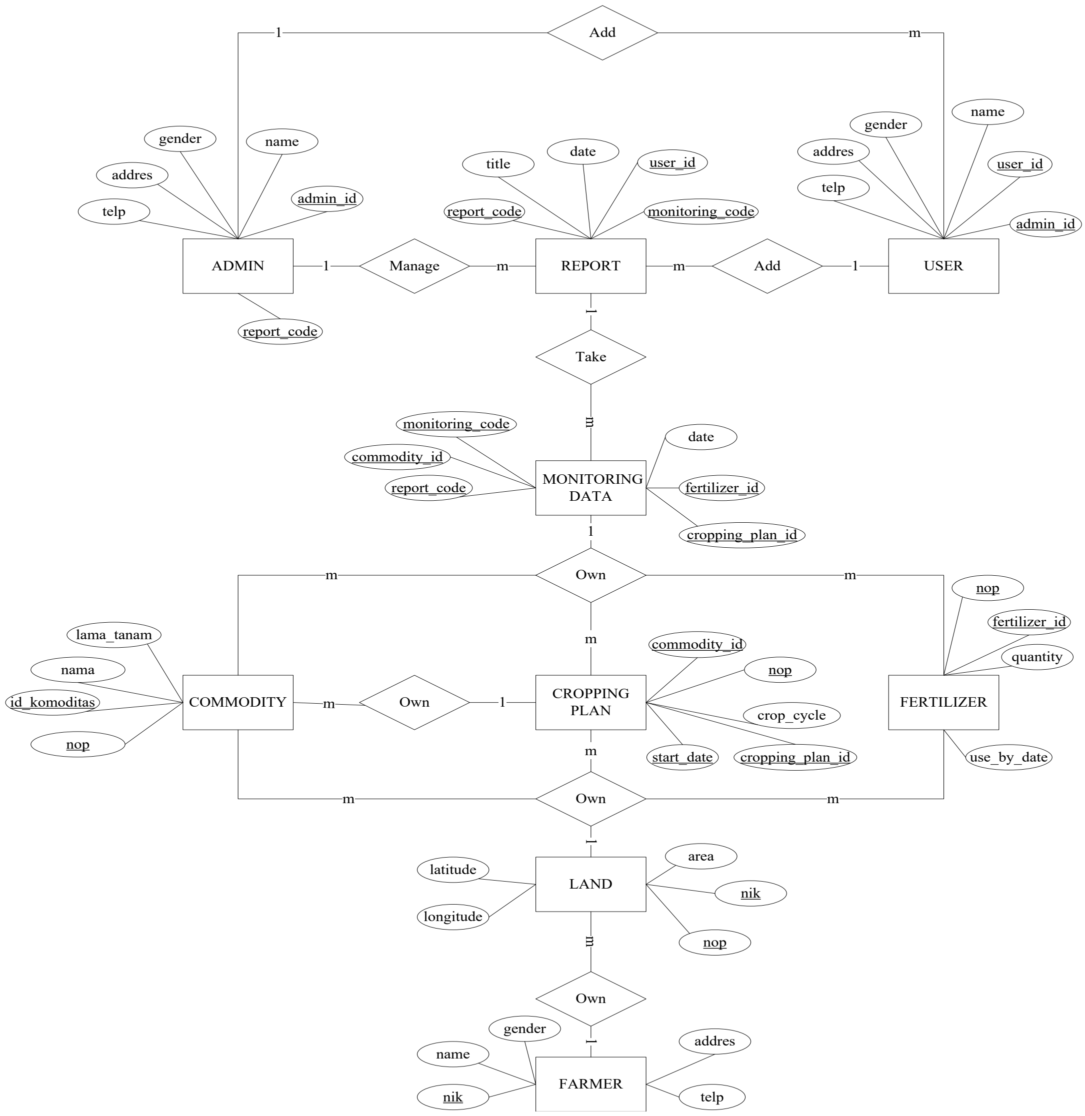

Figure 4. ERD

- **Result**
  Based on the previous system design design, an Integrated Web-Based Plant Commodity Monitoring Information System was produced that is able to process crop commodity data, fertilizer use, and planting pattern plans on a land. Here's a look at the system that has been designed:
  - **Data Management Monitoring**

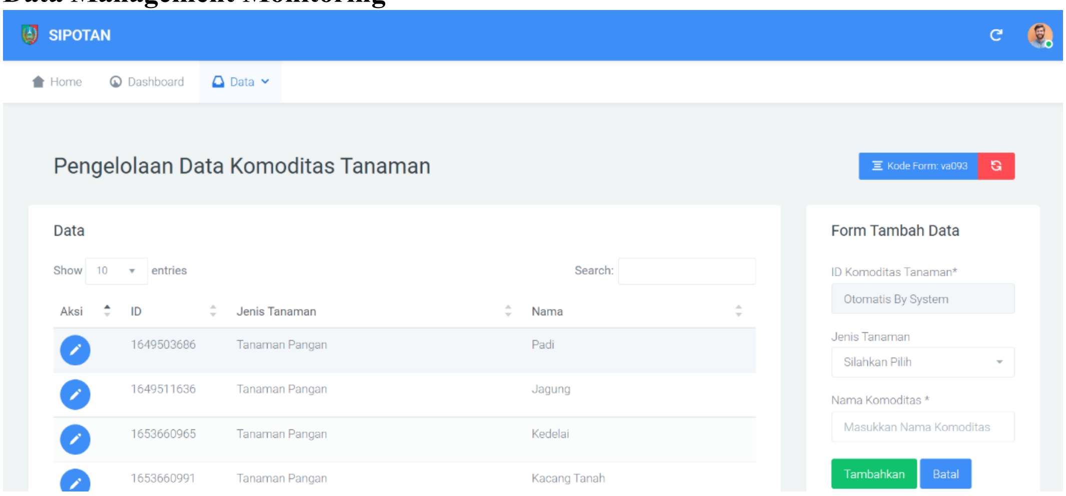

Figure 5. Plant Commodity Form

In the crop commodity form above, the monitoring data that has been added will be displayed in table form. The monitoring data on crop commodities is taken based on farmers' crops in the Jombang Regency area and focuses on food crops, including rice, corn, soybeans, peanuts, green beans, cassava, and sweet potatoes.

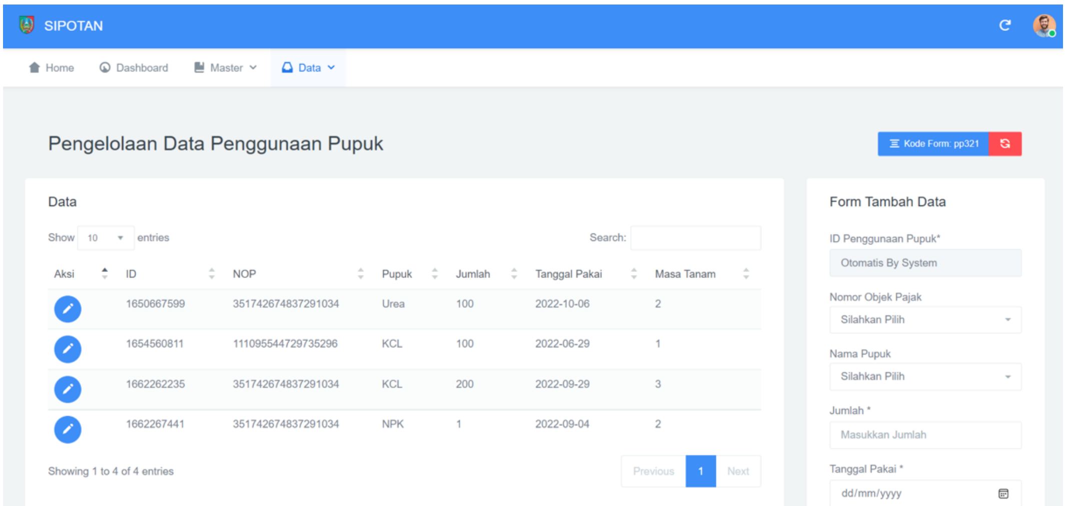

Figure 6. Fertilizer Use Form

In the *fertilizer use form*, the table displays fertilization activities carried out by farmers on agricultural land. Overall, the fertilizer use table contains data on Tax Object Number (NOP), data on fertilizers used by farmers, dates of fertilizer use, and during the planting period to how many activities were carried out.

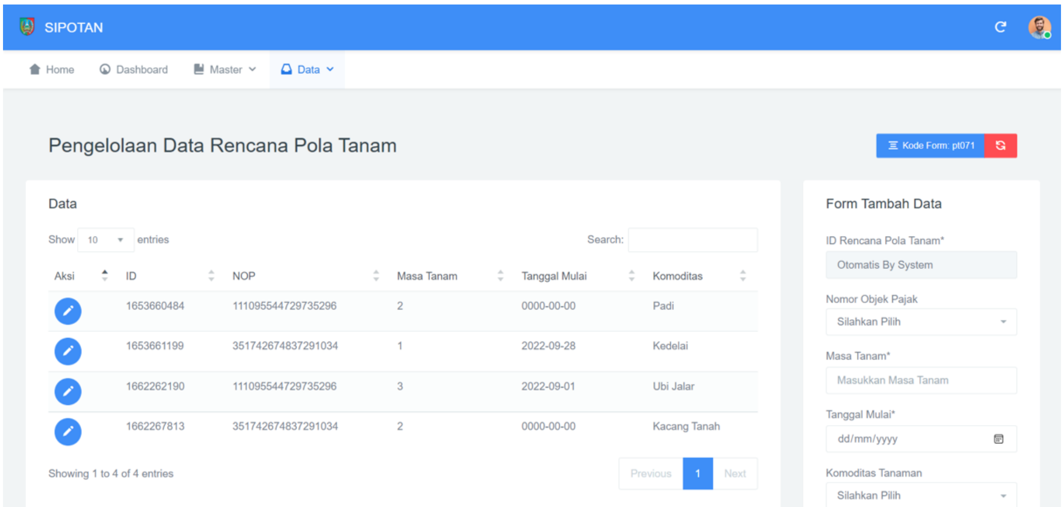

Figure 7. Cropping Plan Form

In the planting plan form, the results of the table display data on Tax Object Number (NOP), planting period, planting start date, and farmers' crop commodities. From this planting plan form, it can be known how much harvest in each region.

- **Discussion**
  - **System Testing**

    System testing in this study using Black Box Testing. Black Box testing is carried out by creating test cases that are in the nature of trying all software functions to match the required specifications (Muharni, 2021). This test focuses only on the functionality and output of the software based on what is seen. The results of system testing can be seen in table 3.

Table 3 Data Management Black Box Testing

Test Scenarios	Expected Results	Test Results
Blank data input	The system will refuse and display the message "Add Failed, There Are Fields You Haven't Filled In!"	Succeed
Uninput data	The system will remove the fields in the data input field	Succeed
Input all data	The system will save the data and display it on the table	Succeed
Find data that has been inputted in a table	The system will display data according to the user's request	Succeed
Click an action to update the data	The system will update according to the data entered by the user and display in the table	Succeed
Click an action to delete data	The system will delete the data selected by the user and update the table data	Succeed

CONCLUSIONS

Based on the results of research that has been carried out in this Final Project, it can be concluded that Black Box testing shows that the system runs well in accordance with the expected expectations. The success of this food crop commodity monitoring information system has a significant impact on the development of E-Government in the Jombang Regency Agriculture Office. This is because the system is able to produce accurate information in the process of processing agricultural data, which greatly supports policy making by the Jombang Regency Agriculture Office.

The presence of this food crop commodity monitoring information system also has a positive impact on the efficiency of processing food crop monitoring data compared to the previous system used in the Jombang Regency Agriculture Office. In this new system, the input data is directly captured by the database system, eliminating the need to input data repeatedly. In addition, the new system is also more comprehensive because it includes subsidized and non-subsidized land data, and has the ability to control fertilizer use to suit the conditions of each field.

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