Weather data processing application system web-based for pest control of rice plants diseases

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Abstract. One of the factors that influence the success of rice cultivation is the control of pest and disease disruption. Disruption and development of disease pests are very dependent on the weather conditions so that weather information is needed that develops in the planting area so that disruption and the development of pest pests can be controlled and does not have a significant effect on the productivity of rice plants. Therefore, we need a way that can be used as a guide for farmers so that they can overcome the limitation of farmer’s knowledge on the effects of changing weather conditions. The main weather components that affect the growth and development of rice plant pests are temperature and humidity. The research aims to develop software that functions to process temperature and humidity data on the growth and development of rice plant pests so that it can help farmers to maintain the development and control of rice plant pests. The system design method used is object-oriented methods, namely the Rational Unified Process, which consists of several stages including inception, elaboration, construction, and transition. The application system developed was designed using web-based technology that can be accessed through the use of smartphones so that farmers can easily access it. With a simple appearance and user-friendly interface, it makes it easier for farmers to understand the features available in the application system.

1. Introduction

One of the factors influencing the growth and productivity of rice plants is the disruption of disease pests. Losses caused by pests and diseases can thwart crop yields [1–3]. Therefore, special handling is needed in anticipating disruption from pests and diseases. The growth and development of pests are greatly controlled by changes in weather, especially temperature and humidity of the air [4,5].

It was explained that some pests and diseases are very dependent on the condition of specific temperatures and humidity of the air. High-temperature air humidity is very stimulating growth and development of some pests such as grasshoppers, sloths, leafhoppers, and caterpillars. This situation occurs, especially in the dry season. However, from the results of subsequent studies, it turns out that each pest has relatively specific support of the state of temperature and humidity. In the rainy season, the air temperature is relatively low but reversed with relatively high humidity [6–8]. This situation is very triggering the growth and development of the disease. Some diseases that are tolerant of low air temperatures and high humidity are bacteria, sooty dew, and leaf rot. Therefore, the measurement of temperature and humidity regularly and continuously is an attempt to control the growth and development of these pests and diseases.
In general, all regions have been equipped with weather conditions, including air temperature, humidity, and the sun (sunny, cloudy, or rainy) [9,10]. The information will be used as input data for processing the impact on the growth and development of rice plant pests so that information will be obtained about what types of disease pests have the opportunity to emerge while providing alternative solutions in the form of technical, mechanical handling or the use of pesticides that are considered relevant to the type pests that arise [3,6,11,12].

The software system developed will utilize input data in the form of weather information released by each area that facilitates it. This system was also developed using web technology. This is based on that most of the people have used cellular phones as a communication tool. Based on the results of observation, almost all mobile phones used by the public have been able to access the website [13–15]. This situation makes it easier for the community, especially farmers, to utilize the application system.

The application system developed is designed so that it is expected to meet the needs of farmers in maintaining their crops. With a simple appearance that is easy to understand, it is also equipped with features that are relevant to the business processes that occur in conducting plant maintenance. By paying attention to the design of the user interface, this software pays attention to the design of the user-friendly interface. The main consideration of this interface design is directed at the characteristics of the users of the system, namely farmers with limited background knowledge and ages ranging from 25 years to 40 years.

2. Methods
Rational Unified Process (RUP) is a type of software development approach that is done repeatedly (iterative), focuses on architecture (architecture-centric), more directed based on the use of cases (use case driven). RUP is a software engineering process with defining well (well defined) and well structured (well structured). RUP provides a good structural definition for the life cycle of software projects [16]. The iterative process in global RUP can be seen, as shown in Figure 1.

![Figure 1. Iterative process of RUP [16].](image)

There are four stages in the rational unified process method which will be presented as follows [16]:

2.1. Inception
At this stage, it is the preparation stage that focuses on the system requirements based on the user's environment. Starting with setting system specifications, system boundaries, and defining the need for the system to be made (requirements).
2.2. Elaboration
The elaboration phase is more focused on system architecture planning. This stage can also detect whether the desired system architecture can be made or not. Detecting the risks that might occur from the architecture created. This stage is more on the analysis and design of systems and system implementation that focuses on the prototype of the system. At this stage, system modeling is developed by starting to identify actors, drawing use case diagrams, activity diagrams, sequential diagrams to class diagrams, which are then used as a reference for designing systems.

2.3. Construction
This construction phase focuses on developing components and system features. This stage is more on the implementation and testing of systems that focus on software implementation in the program code. This stage produces a software product which is a requirement of the initial operational capability limit.

2.4. Transition
This stage is more on the deployment or installation of the system so that it can be understood by the user and produce a software product, which is a requirement of the initial operational capability limits. Activities at this stage include user training, system maintenance, and testing.

3. Results and discussion

3.1. Inception
The system was developed using web technology facilitated by Xamp, which is integrated so that it is a package of several programming languages. With such specifications, the design results will be supported by the programming language used, which starts from the design of the database, the design of the main menu to the design of the user interface [17].

As end-users are farmers with ages between 25 years and 40 years. This system can be accessed from cellular phones that have Android technology. The use of web technology that can be accommodated by cellular phones with Android technology will support the ease of access in cellular phones so that especially for farmers, they do not need additional hardware devices, not do they require special training in operating them.

3.2. Elaboration

![Figure 2. System architecture.](image-url)
Figure 2 explains the architecture of the designed software system. The architecture explained the sequence of processes that occur since the system is executed by the user to display the status of the given message in the form of an information display. With this architecture, it will be easier for developers to detect errors that occur so that the software becomes reliable.

3.3. Construction

3.3.1. Interaction class diagram

![Class diagram of Interaction between weather, pest, and pesticides.](image)

From the class diagram in Figure 3, that the identified classes show the relevance of the business process of maintaining plants from the effects of weather changes (air temperature, humidity, and sun brightness) on the growth and development of pests and pesticides used [6,7].

3.3.2. User interface design. The resulting interface is a representation of the class diagram that was designed. So that it can be expected that there will be the relevance of the interface produced with the running business processes. Thus the application of this application system will provide benefits for farmers, especially farmers, with limited insight and experience to maintain plants so that their products can be controlled properly.
The interface is relatively easy to understand so that it will help farmers to operate the application system. By entering the weather measurement data that includes air temperature, humidity, and the sun's state of the system will provide an initial prediction about the disruption of pests that may occur. In general, each region will provide weather data that includes air temperature, humidity, and sun brightness so that farmers will easily enter the weather information into input data for the application system.

3.4. Transition

The results of the design are then simulated for potential users. From the audience with prospective users will get responses that address various aspects, as seen from Table 1.

Table 1. Test result.

| Software Component | Response | Indicator | Follow up | Remarks |
|--------------------|----------|-----------|-----------|---------|
| Completeness of features | Can accommodate the wishes of the information needs of diseases. | Content of information concerning the type and status of pest and diseases, as well as the initial actions to overcome them. | Socialized to be implemented. | OK |
| User interface | Simple and easy to understand for ordinary users. | Layout color, Font Type and Size, Icon, Picture. | There is no special training. | OK |
| Response time | Relative is quite high by using an android cell phone that has 2 gigabytes of RAM. | There is no delay. | Socialized to be utilized. | OK |
| Error message | Provide complete notification when an error occurs providing input. | Have a notification every time an error occurs. | Does not require special training. | OK |

The results of tests conducted randomly are drawn from Table 1. Based on Table 1 it can be concluded that the application system is relatively easy to operate without requiring special power and skills.
4. Conclusions
Based on the results and discussion, the developed application system is relatively relevant when connected with business processes that occur in maintaining plants so that it is expected to be beneficial for farmers who need it. The developed application system is web-based, which can be accessed via cell phones that are commonly used by the community, including farmers, so that it can be easily applied to farming communities without having to be accompanied by special training. To improve the effectiveness of the application of the results of this study, this research needs to be continued or developed for the maintenance of other crop cultivation. Further research needs to be developed that can sharpen the aims and benefits of research for the community.

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