



Design Web Dashboard Monitoring Plant Factory Experimental Garden Faculty of Agriculture, Udayana University

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ABSTRACT

Information technology is now always experiencing a rapid increase in its use, one example is the website. Website is a collection of web pages, summarized in a domain, which is located in the World Wide Web (WWW) on the internet. This information media is useful in various fields, one of which is in agriculture. Where the information provided can help farmers in providing better results. One of the problems in agriculture that can be seen is related to the tropical climate in Indonesia. This greatly affects environmental conditions and can cause farmers to experience crop failure. One solution that can be done in this scope is with a plant factory. Where the plant factory is a technological concept that facilitates the formation of the right and good environment for plant growth, easy to control, does not require large land and is applied indoors. In its application, the plant factory still has shortcomings related to its information media. In this study, a monitoring website dashboard was designed to function as a medium of information on the plant factory. In system design, where the website is built using several components such as HTML, PHP, MySQL and Laravel Framework. To determine the performance of the system, testing is carried out with the black box method which aims to test on application details such as the appearance of the application, functions in the application, and the suitability of the function flow with the desired process then with the system usability scale (SUS) method. Where the measurement of the quality of web-based information systems, to evaluate the level of user satisfaction with the system services.

Keywords : Plant Factory, Website, Monitoring, Dashboard

INTRODUCTION

Information and communication technology is now always experiencing rapid improvement in its increasingly diverse use in accordance with modern and sophisticated human activities. One aspect that is the main highlight today is the use of information and communication technology as an information medium, for example is the website. All publications from these websites can form a huge information network. Pages of the website will be accessible through a URL commonly called the homepage. This URL organizes the pages of the site into a hierarchy, although the *hyperlinks* on the page organize the readers and tell them the overall structure and how this flow of information is running [1].

This information media is useful in various fields, one of which is in agriculture. Where the information provided can help farmers in developing, maintaining and providing better agricultural results. One of the problems in agriculture that we can see is related to the tropical climate in Indonesia. This makes the weather in Indonesia experience changes that greatly affect environmental conditions in the agricultural sector. As a result, in the long dry season, the land becomes barren and the temperature in the air rises. While in the rainy season, high rainfall causes inundation on agricultural land.

The high rainy season causes horticultural crops to be susceptible to various diseases and viruses, as a result of which the price of horticultural commodities rises, besides that the price of pesticides to repel plant pests also rises. Horticulture is farming activities such as vegetables, fruits and ornamental plants planted on plantation land or yards. In addition to weather factors, the availability of land for horticultural crops is also a problem. To prevent crop failure due to extreme weather conditions and limited land, technology is needed that can reduce the impact or consequences of these conditions. One solution to overcome the problem of extreme weather conditions and limited land in the agricultural sector is a *plant factory*. Where *the plant factory* is a technological concept that facilitates the formation of the right and good environment for plant growth, is easy to control, does not require large land, and is applied indoors so that it is not affected by outdoor weather conditions [2].

Based on the background above, in the *plant factory*, there are still things missing, one of which is the information media related to the environmental condition of the farm room. Therefore, in this study, the author will design a website *dashboard* for storage and display input data from the *Arduino microcontroller installed* in the plant factory where the input results are first sent to the *blynk server then the data will be retrieved from the server and stored in the database*. Then the results will be displayed on the *monitoring system* on the web for information media.

RESEARCH METHODOLOGY

This research was conducted at the Experimental Garden of the Faculty of Agriculture, Udayana University, Jalan Pulau Moyo 16X Denpasar, Bali. The implementation time starts from July 2021 to December 2021. Data Analysis can be seen in Figure 1:

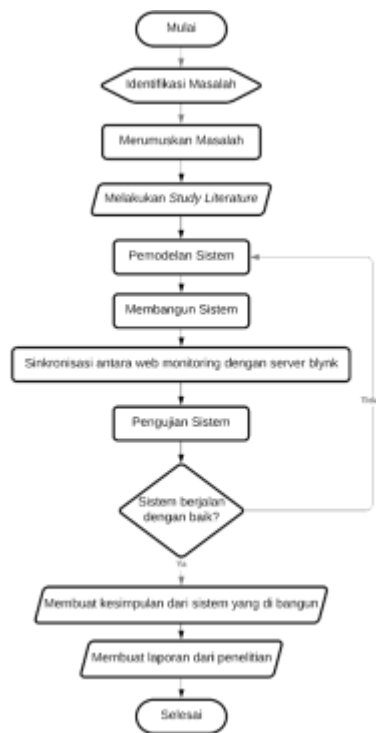


Figure 1. *Research Flowchart*

The following is an explanation of *the flowchart* figure 1:

Step 1. Research begins with identifying the problem.

Step 2. Carry out the formulation of problems.

Step 3. Conduct *literature studies* by collecting reference data and *tools* to build systems.

Step 4. Perform database modeling and web views for *Plant Factory monitoring*.

Step 5. Design database and web view for Plant Factory monitoring.

Step 6. Synchronize web monitoring with the blynk server.

Step 7. Perform web monitoring testing whether the data is displayed correctly.

Step 8. Make results and conclusions from the built system.

Step 9. Make a report of the research process.

RESULTS AND DISCUSSION

This research resulted in a website-based monitoring dashboard. There are several stages carried out including identifying problems, collecting reference data, then designing and modeling the system, then testing the system, and taking conclusions and making reports. This website has two purposes, the first is to help Plant Factory officers in monitoring the condition of the Plant Factory and the second is to provide information to the public who want to try to start making a Plant Factory.

Discussion

Udayana University Plant Factory Website is a website that functions to monitor Plant Factory located in the Experimental Garden of the Faculty of Agriculture, Udayana University and also to provide information to the public related to Plant Factory. In the discussion of this website will be presented and

explained about how this website is built and integrates it with other supporting components.

Dashboard Page Discussion

The dashboard page is divided into 4 sub pages, namely pool page 1, pool page 2, room page 1 light intensity and page 2 room 2 temperature and humidity.

Pool Page Discussion 1

On the pool 1 page contains information related to pool 1 at Plant Factory, the information on this page contains a graph of the state data from pool 1 and also a feature to change the time and date of the data and a feature to download data. Here in figure 2 can be seen on the pool page 1.



Figure 2. Pool Page 1

Pool Page Discussion 2

On the pool 2 page contains information related to pool 2 at Plant Factory, the information on this page contains a graph of the state data from pool 2 and also a feature to change the time and date of the data and a feature to download data. The following in figure 3 can be seen on the pool page 2.



Figure 3. Pool Page 2

Discussion Room Page 1 Light Intensity

On the page room 1 light intensity contains information related to room 1 light intensity in Plant Factory, the information on this page contains a graph of state data from room 1 light intensity and also features to change the time and date of the data and features to download data. Here in figure 4 can be seen on the page of room 1 light intensity.



Figure 4. Room Page 1 Light Intensity

Discussion Page Room 2 Temperature and Humidity

On the page room 2 temperature and humidity contains information related to room 2 temperature and humidity in Plant Factory, the information on this page contains a graph of state data from room 2 temperature and humidity and also features to change the time and date of data and features to download data. Here in figure 5 can be seen on the page of room 2 temperature and humidity.



Figure 5. Courtyard Room 2 Temperature and Humidity

Website Testing Using *Black Box Testing Method*

Black box testing is a test method used to test Plant Factory web monitoring is in accordance with previously designed features whether it is running according to its function. Here are the results of the tests carried out.

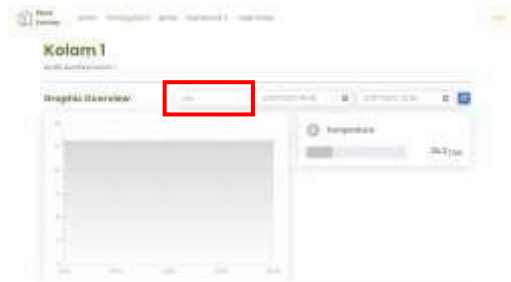
Dashboard Functional Testing

The results of the dashboard functional test consist of four sub-menus, namely pool 1, pool 2, room 1 light intensity and room 2 temperature and humidity that successfully display the expected page. Here's the dashboard functionality.

Functional Testing of Pool Dashboard Page 1

The functional testing results of the Pool 1 dashboard page consist of role charts, reloaded time and day data, and downloads that successfully display the expected functionality. Here's the functional picture.

The visitor chooses a graphic role. In figure 6 visitors before selecting a graphic role and in figure 7 visitors after selecting a graphic role.



Gambar 6. Pengunjung Sebelum Memilih Role Grafik



Gambar 7. Pengunjung Setelah Memilih Role Grafik

Visitors clicked reloaded time and day data. In figure 8 visitors before clicking reloaded time and day data and in figure 9 visitors after clicking reloaded time and day data.



Gambar 8. Pengunjung Sebelum Mengklik Reloaded Data Waktu dan Hari



Gambar 9. Pengunjung Sesudah Mengklik Reloaded Data Waktu dan Hari

The visitor clicks download. In the picture 10 visitors before clicking download and in the picture 11 visitors after clicking download.



Gambar 10. Pengunjung Sebelum Mengklik Download



Gambar 11. Pengunjung Setelah Mengklik Download

Functional Testing of Pool Dashboard Page 2

The functional testing results of the Pool 2 dashboard page consist of role charts, reloaded time and day data, and downloads that successfully display the expected functionality. Here's the functional picture.

The visitor chooses a graphic role. In figure 12 visitors before choosing a graphic role and in figure 13 visitors after choosing a graphic role.



Figure 12. Visitors Before Choosing a Graphic Role



Figure 13. Visitors After Selecting a Graphic Role

Visitors clicked reloaded time and day data. In figure 14 visitors before clicking reloaded time and day data and in figure 15 visitors after clicking reloaded time and day data.

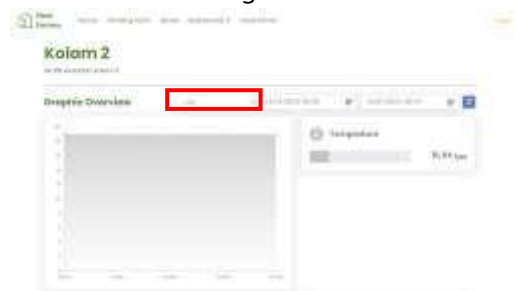


Figure 14. Visitors Before Clicking Reloaded Time and Day Data



Figure 15. Visitors After Clicking Reloaded Time and Day Data

The visitor clicks download. In the picture 16 visitors before clicking download and in the picture 17 visitors after clicking download.



Figure 16. Visitors Before Clicking Download



Figure 17. Visitors After Clicking Download

Functional Testing of Room Dashboard Page 1 Light Intensity

The results of functional testing of the dashboard page of room 1 ca-haya intensity consist of role graphs, reloaded time and day data, and downloads that successfully display the expected functions. Here's the functional overview.

The visitor chooses a graphic role. In figure 18 visitors before choosing a graphic role and in figure 19 visitors after choosing a graphic role.



Gambar 18. Pengunjung Sebelum Memilih Role Grafik



Figure 19. Visitors After Selecting a Graphic Role

Visitors clicked reloaded time and day data. In figure 20 visitors before clicking reloaded time and day data and in figure 21 visitors after clicking reloaded time and day data.



Figure 20. Visitors Before Clicking Reloaded Time and Day Data



Figure 21. Visitors Before Clicking Reloaded Time and Day Data

The visitor clicks download. In the image 22 visitors before clicking download and in the image 23 visitors after clicking download.



Figure 22. Visitors Before Clicking Download



Figure 23. Visitors After Clicking Download

Functional Testing of Room Dashboard Page 2 Temperature and Humidity

The functional test results of the room 2 temperature and humidity dashboard page consist of role charts, reloaded time and day data, and downloads that successfully display the expected functions. Here's the functional picture.

The visitor chooses a graphic role. In figure 24 visitors before choosing a graphic role and in figure 25 visitors after choosing a graphic role.



Gambar 24. Pengunjung Sebelum Memilih Role Grafik



Figure 25. Visitors After Selecting a Graphic Role

Visitors clicked reloaded time and day data. In figure 26 visitors before clicking reloaded time and day data and in figure 27 visitors after clicking reloaded time and day data.



Figure 26. Visitors Before Clicking Reloaded Time and Day Data



Figure 27. Visitors After Clicking Reloaded Time and Day Data

The visitor clicks download. In the picture 28 visitors before clicking download and in the picture 29 visitors after clicking download.



Figure 28. Visitors Before Clicking Download



Figure 29. Visitors After Clicking Download

Testing Using *System Usability Scale*

Testing using a usability scale system is a test carried out by asking to fill out a questionnaire regarding the monitoring web dashboard of the Plant Factory that has been built. First of all, respondents will be given a website address to access. Then respondents are given time to access the website that has been created. After trying, respondents were asked to open the questionnaire link that had been distributed to fill out the SUS questionnaire. Questionnaires were given to 20 participants aged 21 years to 30 years. The results obtained from the questionnaire can be seen in table 2. The next step is to convert the scale of values from each respondent's statement and the values can be seen in table 3.

Table 2. Questionnaire Results of All Respondents

Respond	Question									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Q10
1	5	1	4	3	4	2	4	2	4	4
2	3	3	3	3	4	3	4	2	4	2
3	4	2	4	3	4	2	4	2	4	3
4	4	2	4	3	4	2	4	2	4	2
5	4	2	4	2	4	4	3	2	4	4
6	4	2	5	1	5	2	5	1	4	2
7	4	2	4	3	4	2	4	2	4	3
8	3	2	5	1	4	2	4	2	4	1
9	4	4	4	5	4	3	4	3	3	5
10	4	2	4	3	4	2	4	2	4	2
11	4	2	4	2	5	3	5	2	4	2
12	3	1	5	1	4	2	5	1	4	2
13	4	2	4	1	5	5	4	2	5	1
14	5	2	5	1	5	1	5	1	5	1
15	5	1	5	1	5	3	5	1	5	2
16	4	2	4	2	4	2	4	2	4	2
17	4	2	5	2	5	2	4	1	5	3
18	3	3	4	2	4	3	4	1	4	3
19	4	2	4	3	5	2	4	4	4	3
20	4	2	4	4	4	3	4	2	4	3

Table 3. Converted Respondent Data

Respond	Question										Sum	Results Times 2.5
	R1	R2	R3	R4	R5	R6	R7	R8	R9	R10		
1	4	4	3	2	3	3	3	3	3	1	29	72.5
2	2	2	2	2	3	2	3	3	3	3	25	57.5
3	3	3	3	2	3	3	3	3	3	2	28	70
4	3	3	3	2	3	3	3	3	3	3	29	72,5
5	3	3	3	3	3	1	2	3	3	1	25	57,5
6	3	3	4	4	4	3	4	4	3	3	35	87,5
7	3	3	3	3	3	3	3	3	3	2	28	70
8	2	3	4	3	3	3	3	3	3	4	32	80
9	3	1	3	0	3	2	3	2	2	0	19	47,5
10	3	3	3	2	3	3	3	3	3	3	29	72,5
11	3	3	3	3	4	2	4	3	3	3	31	77,5
12	2	4	4	4	3	3	4	4	3	3	34	85
13	3	3	3	4	4	0	3	3	4	4	31	77,5
14	4	3	4	4	4	4	4	4	4	4	39	97,5
15	4	4	4	4	4	2	4	4	4	3	37	92,5
16	3	3	3	3	3	3	3	3	3	3	30	75
17	3	3	4	3	4	3	3	4	4	2	33	82,5
18	2	2	3	3	3	2	3	4	3	2	27	67,5
19	3	3	3	2	4	3	3	1	3	2	27	67,5
20	3	3	3	1	3	2	3	3	3	2	26	65
Average												73.75

SUS is a global aspect of subjective usability assessment perceived by users. The SUS score indicates the acceptance rate of the user. SUS scores are analyzed and interpreted using acceptability ranges, grade scales, and adjective ratings.

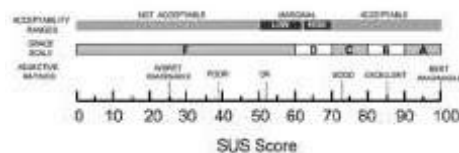


Figure 30. SUS Score

Based on figure 30 in the acceptability ranges, the SUS score must be more than 70 [13] to be included in the acceptable category. The SUS score of the Plant Factory website of Udayana University before 73.75 is included in the acceptable category. The grade scale for the scale used is 0 – 60 for grade scale F, >60 – 70 for grade scale D, >70 – 80 for grade scale C, >80 – 90 for grade scale B, and >90 – 100 for grade scale A [14]. The SUS score of Plant Factory website of Udayana University of 73.75 is included in grade C. In the adjective rating for the value of considered good if the value is more than 70.4 [15]. The SUS score of the Plant Factory website of Udayana University of 73.75 is in the good categories. From the measurement results using the System Usability Scale (SUS) illustrates that user ratings are acceptable to users but still need to be evaluated and adjusted to the information displayed to be more consistent.

CONCLUSION

The conclusions that can be drawn from the research that has been done are as follows: It has been successfully designed to build a monitoring website dashboard to monitor the condition of the room in the plant factory. Dashboard monitoring website has successfully displayed data in real time according to the state of the room in the plant factory. Based on testing using the black box method, all functions contained on the website have run according to the expected functions and scenarios. Based on testing using the System Usability Scale (SUS) method, a score of 73.75 is in the acceptability ranges of the acceptable category, the grade scale value is at grade C and adjective ratings are considered good. From these results, the website is acceptable for users but still needs to be evaluated and adjusted to the information displayed to be more consistent. Based on the analysis of the simulation results of optimization of capacitor placement and capacity in the Tabanan feeder distribution system, it can be concluded

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