Software Quality Evaluation Of MV5PAS Airport Authority Region III Using FURPS Model

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ABSTRACT

The widespread use of software to enhance organizational efficiency makes software development essential. The Airport Authority Region III Office uses MV5PAS software for operational activities, aiming to improve public services. Ensuring software quality is crucial for optimal performance, which this study evaluates using the FURPS model. This model assesses software based on five characteristics: functionality, usability, reliability, performance, and supportability. The study employs a mixed-method evaluation approach. Functionality and usability are assessed via a questionnaire with 25 respondents, while reliability is tested using WAPT V.10.1. Performance is measured with GTMetrix web analysis, and supportability is tested across different OS and browsers. Results indicate that MV5PAS meets the FURPS model standards in four categories. Functionality scores 0.983 ($0 \le X \le 1$), reliability achieves $R = 0.982$, usability scores 80.2, and supportability is confirmed through successful multi-device testing. However, performance requires improvement, receiving a "D" on the GTMetrix Grade. This highlights the need for quality enhancements to optimize the system's overall efficiency.

Keyword: Software Quality Evaluation, FURPS, Functionality, Reliability, Usability

1. INTRODUCTION

The increasingly widespread use of software as a means to improve the efficiency and effectiveness of an organization's operations makes software development common and often implemented by organizations. This makes a lot of software or information systems appear and are developed by various parties for the benefit of the organization. According to data, by 2023 as many as 71% of business organizations use websites for their business interests [1]. Software quality is something that must be considered by the organization so that the software can continue to run optimally and have satisfactory performance. According to [2] software quality is the conformity between software functional requirements and defined performance requirements. Based on this definition, it can be concluded that quality software is software that is able to meet functional needs and is able to provide performance according to what was previously determined. One way to measure software quality is by conducting evaluation activities. Evaluation is a step to observe the effectiveness and efficiency of the system [3], with the evaluation of the quality of a software can be known and explored.

The Office of the Airport Authority Region III is a Technical Implementation Unit within the Ministry of Transportation which is under and responsible to the Minister of Transportation through the Director General of Civil Airport. The Airport Authority Region III Office plays an

important role in ensuring compliance with Airport safety and security regulations, airport operational services, and airspace management in its area, which includes several airports in East Java, including Juanda International Airport. In carrying out its functions, The Airport Authority Region III Office has an information system or software with the name MV5PAS which is used as a means to support the company's operational activities in the hope of facilitating services to the MV5PAS software used by partner company stakeholders in terms of administration of making and managing airport passes. Account registration activities, file administration processes, verification, to payment and monitoring of pass card printing can be done digitally through this application.

The MV5PAS software that was developed needs to be evaluated for quality again, especially after several maintenance activities from 2019 to 2024. Based on the information obtained, there are problems that arise related to the application, namely the system fails to update data because the user fails to upload data, this hampers the process to the next stage, causing wasted time and reduced user efficiency in using the application.For this reason, it is necessary to evaluate the quality of the software to determine whether the software is still feasible and in accordance with the purpose of making the application and in accordance with user needs using certain test methods and standards.It is hoped that this evaluation can find out the expectations and expectations of MV5PAS application users.

FURPS is a framework introduced by Robert Brady that has been tested and is one of the basic software quality models that exist comparable to the McCall, Boehm, Dromey, and ISO models [4].There are 5 characteristics that can be used to measure the quality of a software, namely Reliability, usability, performance, functionality, and Supportabiliy,. Through this model, a software can be evaluated for quality using existing characteristics, ensuring that a software meets quality standards will improve software performance and efficiency while minimizing software failures in carrying out its functions.In this research, the FURPS model is used as Airport Authority Region III's software analysis model.The FURPS model is divided into several characteristic categories, namely user's requirements, functional and non-functional requirements [5].

2. METHODS

This section will explain the research methodology used and the steps that will be carried out in this research, namely literature study, data collection, data testing using the FURPS model/standard, results and discussion, as well as conclusions and suggestions which are described in accordance with the following research methodology figure.

Figure 1. Research Flow

2.1 Literature Study

This stage is the stage for researchers to explore and study basic and supporting theories that can be used to support the making of research. By conducting a literature study, researchers will gain an understanding related to the concept of research theory that is useful for achieving the objectives of the research. The study of Airport Authority Region III software makes understanding of research objects such as features, appearance, or software problems known and explanations related to the FURPS model and testing methods such as GTMetrix and WAPT 10 will clarify the concept of software testing models and techniques. The material obtained as the basis and support for research is taken and studied from various sources such as books, e-books, journals, observations, interviews and scientific research.

2.2 Data Collection

At this stage, information and data are collected by researchers for research purposes and preparation. The steps taken are by conducting interviews with Airport Authority Region III information technology authorities to find out information, needs, and problems in existing software, then from the results of researcher observations and interviews, a questionnaire will be distributed as a test tool on the characteristics of functionality and usability to MV5PAS application users. [6] states that 20 people are the minimum number of respondents needed to test the usability of a system. In this study, 25 users of the MV5PAS application, namely stakeholder companies partnering with the Airport Authority Region III Office, were determined as research respondents. Respondents' positions vary between company staff, admins, operators, and supervisors.

2.3 FURPS

The FURPS standard has 6 main characteristics, in this research, testing is carried out in accordance with the six existing characteristics, but for each sub-characteristic in each main characteristic, certain sub-characteristics will be used in accordance with this research. The six main characteristics are Functionality, Usability, Reliability. Performance, and Supportability. The measurement method used to test each characteristic is differentiated according to the testing aspect.

1. Functionality

   In this characteristic, the software is tested using a questionnaire as a test tool. There are 36 questions that will be used to test the functionality of the MV5PAS software. Respondents of this questionnaire are stakeholders of Airport Authority Region III office partner companies who use the application for the purposes of making fitting services. Later, through the existing questions, it will be known which functions are running properly and which are not running (failed).

   The results of respondents' answers will be entered into the following formula [7].

   $$X = 1 - \frac{A}{B} \qquad (1)$$

   Where:
   X = Functionality
   A = Number of functions that work
   B = Number of all functions

2. Usability

Usability character testing is done by giving questions to respondents. The value obtained will be tested using the System Usability Scale (SUS) method [8]. Respondents amounted to 25 MV5PAS application users (partner company staff of Airport Authority Region III Office).

3. Reliability

According to [9] Reliability is a software quality attribute that expresses the likelihood of a system or software component to function without failure within a given time and in a specific background. Reliable software is software that can provide user needs when users need it, one of the problems that makes a software fail to provide output according to the requested needs is due to the high number of loads that are charged to the software, for this reason, to test the reliability of the software can be done by load stress testing, namely the software will be given a 'load' in the form of virtual users who use the software in time and resources that exceed reasonable (abnormal) usage. The test results observed are page, session, and hit. The tool used to perform the test is WAPT version 10.

4. Performance

At this stage, the performance of the MV5PAS software will be tested. Software performance can be measured by considering processing speed, response time, and efficiency [10]. One way to measure the performance of web applications is to use GTMetrix developed by GT.net. This tool was created with the aim of helping website owners or managers measure website performance. In this test, the variables of performance testing results with GTMetrix that are considered are speed index, time to interactive, performance rate, and GTmetrix Grade.

5. Supportability

The supportability characteristic has sub-characteristics which are divided into two categories based on its users, namely end users and developers. In this research, only tests will be carried out that are directly related to end users, namely the compatibility sub-characteristic. Testing is done by running the application on various browsers and also devices that have different operating systems. The following is a table of supportability characteristics testing instruments on the compatibility sub-characteristic [11]. There are eight criterias to test the instruments called 1) The MV5PAS app can be opened on smartphones with Android OS, 2) MV5PAS app can be opened on smartphones with IOS OS, 3) MV5PAS application can be opened on Laptops with Windows OS, 4) MV5PAS application can be opened on Laptops with MacOs OS, 5) The MV5PAS app can be opened using the Google Chrome browser, 6) The MV5PAS application can be opened using the Mozilla Firefox browser, 7) The MV5PAS app can be opened using the Opera browser, 8) The MV5PAS app can be opened using the Safari browser.

6.   RESULTS AND DISCUSSION

This chapter contains the results of data collection and analysis of test results for each test characteristic in accordance with the test method for each characteristic discussed in the previous chapter. From the results of data collection and analysis of test results, it will be known how the quality of MV5PAS software owned by the Region III Airport Authority Office is tested by the FURPS standard.

3.1. Functionality Characteristic Testing Results

Functionality characteristic testing produces data in the form of questionnaire answers by respondents with a total of 25 respondents. By using the functionality testing instrument, the following data recapitulation results were obtained in Table 1.

Table 1. Recapitulation Of Functionality Testing

No	ACTION	SUCCEED	FAILED
A	**AKUN**	25	0
Q1	Daftar Akun	25	0
Q2	Login	25	0
Q3	Mengubah Password	23	2
B	**DASHBOARD**		
Q4	Mengakses Halaman "Dashboard"	25	0
C	**PAS ORANG**		
Q5	Mengakses Halaman "Sedang Diproses"	25	0
Q6	Mengakses Halaman "Pengajuan Baru"	25	0
Q6.1	Menggunakan Fungsi "Edit"	25	0
Q6.2	Menggunakan Fungsi "Hapus"	25	0
Q6.3	Menggunakan Fungsi "Pilih Pengajuan"	25	0
Q7	Mengakses Halaman "Direvisi/Dikembalikan"	24	1
Q7.1	Menggunakan Fungsi "Edit"	24	1
Q7.2	Menggunakan Fungsi "Hapus"	24	1
Q8	Mengakses Halaman "Buat Penagihan"	25	0
Q8.1	Menggunakan Fungsi "Pencarian"	25	0
Q8.2	Menggunakan Fungsi "Create Invoice"	25	0
Q9	Mengakses Halaman "Menunggu Pembayaran"	25	0
Q10	Mengakses Halaman "Laporan PAS Orang"	25	0
Q11	Mengakses Halaman "Pencabutan"	25	0
Q6.1	Menggunakan Fungsi "Detail"	25	0

No	ACTION	SUCCEED	FAILED
D	**PAS KENDARAAN**		
Q12	Mengakses Halaman "Lacak Proses"	24	1
Q12.1	Menggunakan Fungsi "Unggah"	24	1
Q13	Mengakses Halaman "Pengajuan Baru"	25	0
Q13.1	Menggunakan Fungsi "Pendaftaran"	24	1
Q13.2	Menggunakan Fungsi "Edit"	24	1
Q12.3	Menggunakan Fungsi "Hapus"	24	1
Q14	Mengakses Halaman "Direvisi/Dikembalikan"	25	0
Q14.1	Menggunakan Fungsi "Edit"	25	0
Q15	Mengakses Halaman "Buat Penagihan"	25	0
Q15.1	Menggunakan Fungsi "Create Invoice"	25	0
Q16	Mengakses Halaman "Menunggu Pembayaran"	25	0
Q17	Mengakses Halaman "Laporan PAS Kendaraan"	25	0
Q18	Mengakses Halaman "Pencabutan"	25	0
Q18.1	Menggunakan Fungsi "Detail"	25	0
E	**TIM (TANDA IZIN MENGEMUDI)**		
Q19	Mengakses Halaman "Sedang Diproses"	24	1
Q20	Mengakses Halaman "Pengajuan Baru"	25	0
Q20.1	Menggunakan Fungsi "Pilih Pengajuan"	25	0
Q20.2	Menggunakan Fungsi "Edit"	25	0
Q20.3	Menggunakan Fungsi "Hapus"	25	0
Q21	Mengakses Halaman "Direvisi/Dikembalikan"	25	0
Q21.1	Menggunakan Fungsi "Edit"	25	0
Q22	Mengakses "Halaman Buat Penagihan"	25	0

No	ACTION	SUCCEED	FAILED
Q22.1	Menggunakan Fungsi "Create Invoice"	25	0
Q23	Mengakses Halaman "Menunggu Pembayaran"	25	0
Q24	Mengakses Halaman "Laporan TIM"	25	0
Q25	Mengakses Halaman "Pencabutan"	25	0
Q25.1	Menggunakan Fungsi "Detail"	25	0
F	**KUOTA PERUSAHAAN**		
Q26	Mengakses Halaman "Sedang Diproses"	24	1
Q27	Mengakses Halaman "Baru/Perubahan"	25	0
Q28	Mengakses Halaman "Daftar Perubahan Kuota Perusahaan"	25	0
Q29	Mengakses Halaman "Penggunaan Kuota Perusahaan"	25	0
G	**LAPORAN PELANGGARAN**		
Q30	Mengakses Halaman "Pelanggaran Perorangan"	25	0
Q31	Mengakses Halaman "Pelanggaran Perusahaan"	24	1
H	**BASIS DATA LAMA**		
Q32	Mengakses Halaman "Basis Data Lama"	23	2
Q32.1	Menggunakan Fungsi "Download"	23	2
I	**PROFILE**		
Q33	Profil Saya	25	0
Q34	Ganti Password	22	3
Q35	Butuh Bantuan	23	2
Q36	Sign Out	22	3

Based on the respondents' answers to questions related to the functionality test, it can be calculated as follows:

$$X = 1 - \frac{25}{1450}$$

$$X = 1 - 0,0173$$

$$X = 0,983$$

The results of the above calculations above get a value of 0.983 $(0 \leq X \leq 1)$ so it can be concluded that the Airport Authority Region III Office MV5PAS software has excellent functionality standards according to ISO / IEC standards, 2001 with a perfect value (all functions can be run properly without failure).

3.2. Usability Characteristics Test Results

Usability characteristics testing produces data in the form of questionnaire answers by respondents with a total of 25 respondents. By using the SUS testing instrument, the data recapitulation is obtained in Table 2.

Table 2. Recapitulation Of Usability Testing

No	Respondent	Questions									
		1	2	3	4	5	6	7	8	9	10
1	R1	3	3	4	1	4	3	4	1	5	3
2	R2	5	5	5	2	5	5	1	1	4	2
3	R3	5	1	5	1	5	1	5	1	5	1
4	R4	5	1	5	1	5	1	5	1	5	1
5	R5	5	2	4	1	5	3	4	2	4	2
6	R6	5	1	5	1	5	1	5	1	5	1
7	R7	3	3	3	2	3	2	4	2	4	2
8	R8	5	1	5	1	5	2	4	1	5	2
9	R9	5	3	5	5	5	3	5	3	5	5
10	R10	5	1	5	1	5	1	5	1	5	2
11	R11	5	1	5	1	5	5	5	1	5	1
12	R12	5	1	5	5	5	1	5	1	5	1
13	R13	5	3	5	3	5	5	4	3	4	4
14	R14	5	1	5	3	5	5	5	1	5	2
15	R15	5	1	5	1	5	1	5	1	5	2
16	R16	4	3	5	2	5	4	5	1	4	4
17	R17	3	1	3	3	3	3	3	1	3	2
18	R18	5	1	5	1	5	1	5	1	5	1
19	R19	3	3	3	3	3	3	3	3	3	3
20	R20	5	2	5	3	5	4	5	1	3	5
21	R21	5	1	5	1	5	1	5	1	5	5
22	R22	4	2	4	2	4	2	4	2	4	4
23	R23	4	2	5	2	5	4	5	2	5	2

No	Respondent	Questions									
		1	2	3	4	5	6	7	8	9	10
24	R24	3	3	5	1	3	3	5	1	3	3
25	R25	5	2	5	2	5	2	5	2	5	4

From the SUS score data for each of the questions above, calculations will be made using the SUS formula and calculation method, namely odd-numbered questions, the score will be reduced by 1, even-numbered questions will be reduced by 5. The score for each respondent is calculated individually and the sum of the scores for each question is multiplied by 2.5. The results of calculating and processing data using SUS rules can be seen in the Table 3.

Table 3. SUS Calculation Result

No	Respon dent	Questions										Total	Value (Total x 2,5
		1	2	3	4	5	6	7	8	9	10		
1	R1	2	2	3	4	3	2	3	4	4	2	29	73
2	R2	4	0	4	3	4	0	0	4	3	3	25	63
3	R3	4	4	4	4	4	4	4	4	4	4	40	100
4	R4	4	4	4	4	4	4	4	4	4	4	40	100
5	R5	4	3	3	4	4	2	3	3	3	3	32	80
6	R6	4	4	4	4	4	4	4	4	4	4	40	100
7	R7	2	2	2	3	2	3	3	3	3	3	26	65
8	R8	4	4	4	4	4	3	3	4	4	3	37	93
9	R9	4	2	4	0	4	2	4	2	4	0	26	65
10	R10	4	4	4	4	4	4	4	4	4	3	39	98
11	R11	4	4	4	4	4	0	4	4	4	4	36	90
12	R12	4	4	4	0	4	4	4	4	4	4	36	90
13	R13	4	2	4	2	4	0	3	2	3	1	25	63
14	R14	4	4	4	2	4	0	4	4	4	3	33	83
15	R15	4	4	4	4	4	4	4	4	4	3	39	98
16	R16	3	2	4	3	4	1	4	4	3	1	29	73
17	R17	2	4	2	2	2	2	2	4	2	3	25	63
18	R18	4	4	4	4	4	4	4	4	4	4	40	100
19	R19	2	2	2	2	2	2	2	2	2	2	20	50
20	R20	4	3	4	2	4	1	4	4	2	0	28	70
21	R21	4	4	4	4	4	4	4	4	4	0	36	90

No	Respondent	Questions										Total	Value (Total x 2,5
		1	2	3	4	5	6	7	8	9	10		
22	R22	3	3	3	3	3	3	3	3	3	1	28	70
23	R23	3	3	4	3	4	1	4	3	4	3	32	80
24	R24	2	2	4	4	2	2	4	4	2	2	28	70
25	R25	4	3	4	3	4	3	4	3	4	1	33	83

Average Score (Final Result)	80,2

The next stage of calculation, the SUS score of each respondent is calculated the average score (Final Result) by summing up all scores that have been multiplied by 2.5 and dividing by the number of respondents. The following formula calculates the SUS score:

$$SUS = \frac{\sum x}{n} \qquad (2)$$

Where $\sum x$ is the number of SUS scores and n is the number of respondents. Based on this formula, it can be obtained:

$$SUS = \frac{2005}{25}$$
$$SUS = 80.2$$

According to Jeff Sauro, the minimum average score is said to be good, namely 68 [12], while from the calculation results that the SUS value obtained by MV5PAS software is 80.2. So based on the results of the above calculations and in accordance with the SUS score scale, it can be concluded that the Airport Authority Region III Office MV5PAS software is acceptable and gets a predicate B or "Excelent" on usability characteristics.

3.3. Reliability Characteristics Test Results

Reliability characteristics testing is done by load stress testing using the WAPT version 10.1 application. By using this application, the test scenario can be set according to the desired characteristics, methods, and number of users, in tests conducted on the MV5PAS application of Airport Authority Region III Office, the test method used is fixed which means that the number of application users during testing does not change,

the number of virtual users used is 20 users. Testing was carried out for 20 minutes using the WAPT version 10.1 application with the test results can be seen in Figure 2.

Figure 2. Reliability Testing Result

The test results observed are page, session, and hit. Based on the test results above, it can be calculated as follows in Table 4:

Table 4. Realiability Variable

Variable	Total	Variable	Total
Successful pages	1105	Failed pages	0
Successful sessions	20	Failed sessions	0
Successful hits	4116	Failed hits	93
Total	5241	Total	93

By using the formula from the nelson model [13], namely:

$$R = n - \frac{f}{n} = 1 - \frac{f}{n} = 1 - r \tag{2}$$

Where:
R = Reliability
f = Total Failure
n = Total Test Case (test variable unit)
r = error rate

Then, the reliability of MV5PAS software can be calculated as follows:

$$R = 1 - \frac{f}{n} = 1 - \frac{93}{5241} = 0,982$$

$$r = \frac{f}{n} = \frac{93}{5241} = 0,0178$$

The results obtained from the calculation using the Nelson formula are the value of R (Reliability) = 0.982 or 98.2% while for the value of r (error rate) = 0.0178 or 1.7%.

According to Telcordia standards quoted from [14], software that has good reliability has a minimum reliability value of 95%. Therefore, MV5PAS software can be said to have excellent reliability and meet the standard with a value of 98%.

3.4. Performance Characteristics Test Results

Performance testing of MV5PAS software is done by considering processing speed, response time, and efficiency. Testing is done using the GTMetrix web by paying attention to speed index, time to interactive, performance rate, and GTmetrix Grade. The results of performance testing can be seen in the following Figure 3:
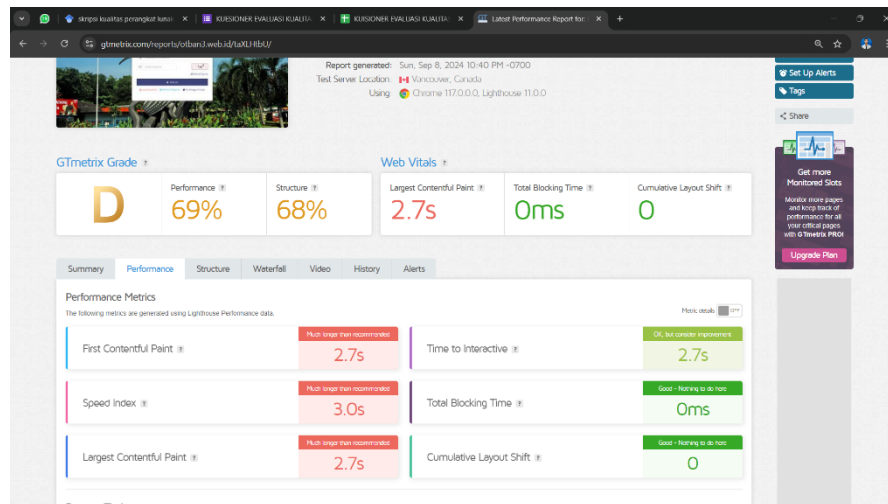

Figure 3. Performance Characteristics Testing Results

From Figure 3 it can be observed that the results of testing the performance of The Airport Authority Region III Office MV5PAS software get 3.0 seconds for the speed index metric, 2.7 seconds for the Time to Interactive metric, 69% for the Performance Rate, and for the GTmetrix Grade value it gets the predicate "D".

3.5. Supportability Characteristics Test Results

Testing the supportability characteristics of the Airport Authority Region III Office MV5PAS software is done by running the application on smartphones with Android & IOS operating systems and also on laptop devices on different browsers, namely Google Chrome, Mozilla Firefox, and Opera with the Windows operating system and Laptop with MacOS operating system using the Safari browser. in Table 5 can be seen the results of testing the supportability characteristics that have been carried out.

Table 5. Supportability Test Results

Criteria	Test Result	
	Succeed	Failed
The MV5PAS app can be opened on smartphones with Android OS	✓	
MV5PAS app can be opened on smartphones with IOS OS	✓	

25

Criteria	Test Result	
	Succeed	Failed
MV5PAS application can be opened on Laptops with Windows OS	✓	
MV5PAS application can be opened on Laptops with MacOs OS	✓	
The MV5PAS app can be opened using the Google Chrome browser	✓	
The MV5PAS application can be opened using the Mozilla Firefox browser	✓	
The MV5PAS app can be opened using the Opera browser	✓	
The MV5PAS app can be opened using the Safari browser	✓	

Pages from the MV5PAS software can be loaded properly on various types of devices with different operating systems and browsers. Views and functions can be loaded and run properly without any display errors or malfunctions. Therefore, it can be concluded that the MV5PAS software meets the Supportability characteristic standards, especially in the Compatibility aspect (Compatibility of the website with various browsers and devices) [15].

CONCLUSION

Based on the results of research and discussion that has been carried out on the quality analysis of MV5PAS software using the FURPS standard, the following conclusions can be drawn:

1. Functionality: MV5PAS software is feasible and very good with the calculation results worth 0.983 ($0 \leq X \leq 1$) so it can be concluded that The Airport Authority Region III Office MV5PAS software has excellent functionality standards according to standards (ISO / IEC, 2001).
2. Usability: MV5PAS software is feasible and good with the SUS value obtained by MV5PAS software is 80.2. It can be concluded that the MV5PAS software of Airport Authority Region III 3 Office is acceptable and gets a predicate B or "Excelent" on usability characteristics.
3. Reliability: MV5PAS software is feasible and very good with an R (Reliability) value = 0.982 or 98.2% while for the r (error rate) value = 0.0178 or 1.7%.
4. Performance: MV5PAS software is still slightly below the "good" standard by getting a "D" predicate on the GTMetrix Grade.

5. Supportability: MV5PAS software is feasible and very good. MV5PAS Software was successfully opened and run without problems on various types of devices and browsers, namely smartphones with Android & IOS operating systems, laptop devices on different browsers, namely Google Chrome, Mozilla Firefox, and Opera with Windows operating systems and Laptops with MacOS operating systems using the Safari browser.

Based on the test results using the FURPS model, MV5PAS software has met most of the quality criteria, namely in the aspects of functionality, Usability, Reliability, Supportability. Nevertheless, improvements in the Performance aspect will be useful to improve the quality of the software to make it more responsive and efficient. This optimization will provide added value in supporting the operational activities of the Airport Authority Region III Office.

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