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SENTIMENT ANALYSIS FOR IMPROVING THE QUALITY OF IMMIGRATION M-PASSPORT SERVICES

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Abstract

Sentiment analysis to improve the quality of M-Passport Immigration services. The type of research to be conducted is descriptive research. Descriptive research is research that describes or explains a particular phenomenon, condition, or object systematically, factually, and accurately. This study collects information to answer the researcher's questions by paying attention to aspects obtained from many research data, so that it can describe a condition, event, or phenomenon specifically and sequentially. Therefore, this study wants to describe specifically and obtain facts about the sentiment of M-Papsor application users through reviews on the Google Play Store platform. The data source in this study is secondary data. Secondary data is taken from user reviews of the M-Passport application on the Google Play Store starting from June 1, 2022 to June 30, 2024 using the scrapping method. Based on the labeling process with the help of Python on the Google Collaboritory platform, the distribution of review data on the M-Passport application was obtained with positive user opinions of 12.32% and negative user opinions of 87.67%. Based on sentiment analysis using the Support Vector Machine (SVM) and Naïve Bayes Classifier (NBC) algorithms, the best accuracy results were obtained through the SVM method with an accuracy of 98%, precision 97%, recall 98%, and f-measure 97% while the NBC method obtained an accuracy of 87%, precision 88%, recall 84%, and f-measure 86%. Where, from these results it can be interpreted that the Support Vector Machine (SVM) algorithm has good performance in classifying sentiment on the M-Passport application. Based on the identification of the service quality variable in the negative sentiment class, the reason users gave the most negative comments was because of the reliability factor which obtained the highest percentage of 43.5%, the responsiveness factor of 27.6% empathy of 11.2%, tangibility of 8.9% and assurance of 8.7%.

Keywords: Public Services, M-Passport Application, Sentiment Analysis, Support Vector Machine (SVM), Naïve Bayes Classifier, Service Quality

1. INTRODUCTION

The rapid development of information technology and supported by the increasingly rapid development of the internet has urged several areas of life to start implementing and using current developments to the maximum (Komarudin, 2022). No exception in public service agencies, information technology is a necessity in implementing a system to facilitate services to the public and help advance government agencies so that E-Government is realized in the government sector. The Directorate General of Immigration under the Ministry of Law and Human Rights as one of the public service agencies according to the Strategic Plan of the Directorate General of Immigration 2020-2024 takes on the role of organizing quality public services in the legal sector. In this case, immigration is responsible for providing public services that are legally certain, clean and fair, in accordance with the principles of public service so as to provide as many benefits as possible to the community. The Directorate General of Immigration as the agency managing the M-Passport Application based on the research results obtained is an improvement in the quality of service provided to the public as users of the M-Passport Application. Poor service quality can be seen from the results of the negative sentiment class obtained which has a higher percentage compared to positive sentiment.

The percentage of negative sentiment towards the M-Passport application produced by this study is 87.67%, if the percentage of negative sentiment for a service exceeds 80% this indicates

that the majority of feedback or reviews received are very negative and can be indicated that there is a significant major problem with the service, product, or customer experience that must be addressed immediately. According to Forrester Research, one of the world's most influential research and consulting institutions, the importance of maintaining company growth through customer sentiment and experience where the percentage of negative sentiment should be below 10-15% indicating that the problems complained about by users are relatively minor compared to positive feedback. If the percentage of negative sentiment is above 80% it usually indicates that there is a very significant problem with the quality of service that can affect the company's reputation and result in a decrease in public trust.

In maintaining the image of the Ministry of Law and Human Rights organization, it is hoped that there will be massive improvements that can be made by the Director General of Immigration as the manager of the M-Passport application which can be seen from the results of the identification of service quality dimensions in the research, the reliability variable has the highest frequency in the negative sentiment class, which is 43.5%, the high negative sentiment class in the reliability variable refers to the ability or reliability of the M-Passport application which is considered still lacking in providing the promised services consistently, on time, and accurately. User complaints are dominated by the M-Passport application which often errors, crashes, hangs, requests time out, and maintenance times that are too long so that users input data and submit applications repeatedly so that users feel they are being made difficult when applying for a passport. This certainly greatly affects user perceptions of the M-Passport application so that the Director General of Immigration should take serious steps to address these complaints starting from increasing the reliability of the M-Passport application performance by optimizing application performance so that it has a fast and responsive loading time, reducing server workload or needing to consider increasing the capacity of the server used.

In the responsiveness aspect, negative sentiment was 27.6%, which refers to the still low ability and willingness of the Directorate General of Immigration as the provider of M-Passport to assist users in responding to customer requests, questions, and complaints effectively and timely, leading M-Passport users to express their emotions and dissatisfaction in reviews and ratings of the M-Passport application. In the M-Passport application review, it can be seen that users often complain about how the application manager does not respond to the complaints they submit regarding obstacles that occur when using the application. So this can be a special concern for the Directorate General of Immigration to address these complaints by adding help features, FAQs, and call centers to the M-Passport application to manage user feedback directly on the application so that it is easier to access and users can directly report problems or complaints without having to look for other communication channels and focus on complaints related to applications on the M-Passport application.

In the empathy aspect, which is the third highest negative sentiment at 11.2%, it refers to user dissatisfaction with the feedback from the Directorate General of Immigration, both in terms of employee response when users come to the Immigration Office directly to complain about obstacles in using the M-Passport application. In overcoming this, the Directorate General of Immigration needs to follow up by conducting more training in improving immigration officer services related to empathy and effective communication so that officers understand the importance of listening, responding quickly, and handling user complaints or problems with a friendly and understanding attitude. In the tangibility variable, the negative sentiment class is 8.9% which refers to user dissatisfaction with the physical aspects and real experience when using M-Passport starting from the appearance of the application, clarity of information to ease of navigation of the M-Passport application. In the M-Passport review, it can be seen that users feel unhelpful with the M-Passport application, this occurs as one of the impacts of the lack of reliability of the M-Passport application.

To overcome this, the Directorate General of Immigration needs to improve the reliability of the M-Passport application and can improve the user experience by making navigation clearer,

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so that users can easily find important features such as passport application, status check, and payment, then add a step-by-step guide or short tutorial for new users to make it easier to understand how to use the M-Passport application. In the assurance variable, the negative sentiment class is 8.7% due to user doubts about the M-passport application in terms of security and accuracy. As can be seen in user reviews related to the many complaints in the payment section where there are still frequent obstacles and the verification process is long so that in some cases there are payments made repeatedly which have an impact on user losses and anxiety. So it is hoped that the Director General of Immigration can convince users, especially in terms of payment verification because this greatly affects the application's reputation, credibility, competence, accuracy of information, and professionalism in user services.

2. IMPLEMENTATION METHOD

Types of research

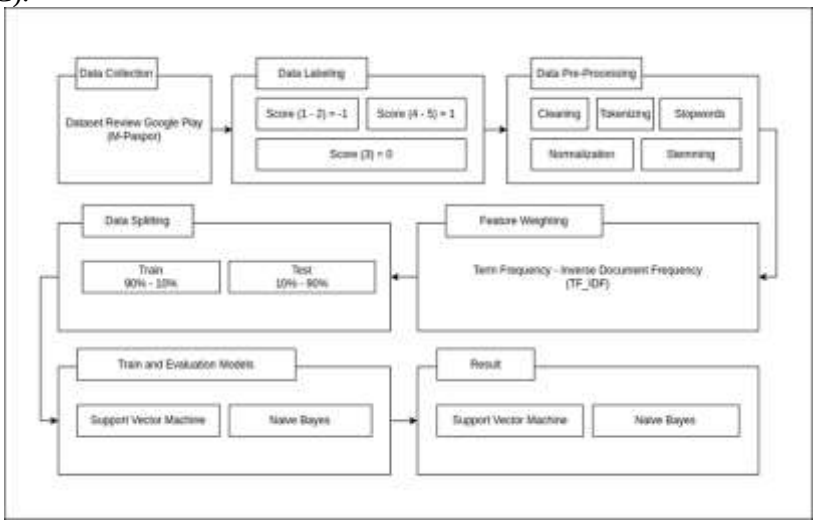
The type of research to be conducted is descriptive research. Descriptive research is research that describes or explains a particular phenomenon, condition, or object systematically, factually, and accurately. This research collects information to answer the researcher's questions by considering aspects obtained from many research data, so that it can describe a condition, event, or phenomenon specifically and sequentially. Therefore, this study wants to describe specifically and obtain facts about the sentiment of M-Papsor application users through reviews on the Google Play Store platform.

Data Source

The data source in this study is secondary data. Secondary data is taken from user reviews of the M-Passport application on the Google Play Store starting from June 1, 2022 to June 30, 2024 using the scrapping method.

Research Stages

This study aims to analyze user/public sentiment towards the M-Passport Application based on reviews or reviews given in the Google Play Store using the help of machine learning-based sentiment labeling by comparing Support Vector Machine (SVM) with Naïve Bayes Classifier (NBC).



Source: Secondary Data (processed), 2024

Figure 2.1 Research Stages

3. RESULTS AND DISCUSSION

Accuracy Results of SVM and NBC Sentiment Analysis

Sentiment analysis is a natural language processing method that determines the tone of a piece of writing whether it is positive or negative and to find out the emotions, attitudes, and opinions behind the words. This is one of the important components to understand public sentiment regarding the quality of service provided. To get more accurate results, this study uses the Support Vector Machine (SVM) and Naïve Bayes Classifier (NBC) algorithms as sentiment analysis methods where it is known that both methods have their respective advantages.

When processing data starting from the data collection stage, data labeling, data pre-processing to weighting, results will be obtained for data division by dividing the data into 2 (two) models, namely training and testing. This data division is carried out to obtain the best comparison on the sentiment analysis method used. In the processing of sentiment analysis for both algorithms, SVM and NBC, it was found that the best comparison result for training data and testing data was 90:10 with the data splitting image in Figure 3.1 below.

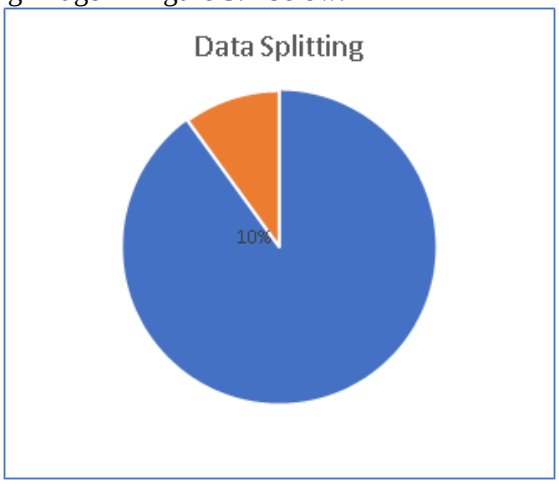


Figure 3.1 Data Splitting

The results of the classification report obtained from sentiment analysis using the Support Vector Machine algorithm with data division as above can be seen in Figure 3.2 below.

	precision	recall	f1-score	support
negatif	0.99	0.97	0.98	1081
positif	0.97	0.99	0.98	989
accuracy			0.98	2070
macro avg	0.98	0.98	0.98	2070
weighted avg	0.98	0.98	0.98	2070

Figure 3.2 Classification Report

In the classification report there is an accuracy value generated by the algorithm, the accuracy obtained in the study using the SVM algorithm is 98%. Where, this number is quite high for the level of accuracy in sentiment analysis. The results of the classification report obtained from sentiment analysis using the Naïve Bayes Classifier algorithm with 90:10 data splitting can be seen in Figure 4.33 below.

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	precision	recall	f1-score	support
negatif	0.86	0.90	0.88	1081
positif	0.88	0.85	0.86	989
accuracy			0.87	2070
macro avg	0.87	0.87	0.87	2070
weighted avg	0.87	0.87	0.87	2070

Figure 4.33 Classification Report

In the classification report there is an accuracy value generated by the algorithm, the accuracy obtained in the study using the NBC algorithm is 87%. Where, this figure shows that the NBC accuracy level is still lower than the accuracy results of the SVM method so that in this condition the best accuracy level is obtained in sentiment analysis with the SVM method.

Analysis and Discussion of Confusion Matrix

The accuracy of the algorithm performance used in sentiment analysis can be measured by the presence of a confusion matrix. The Confusion Matrix functions as a tool for evaluating the performance of the classification model used in sentiment analysis where this study uses the Support Vector Machine (SVM) and Naïve Bayes Classifier (NBC) methods. Measurement of the accuracy of the performance of the method used is done by looking at the values in the predicted class and the actual class. The matrix table is a form of confusion matrix in the form of an accuracy calculation process by knowing the number of test data that is correctly classified and the number of test data that is wrong in its classification. The following is a picture of a matrix table containing an explanation of the location of the matrix.

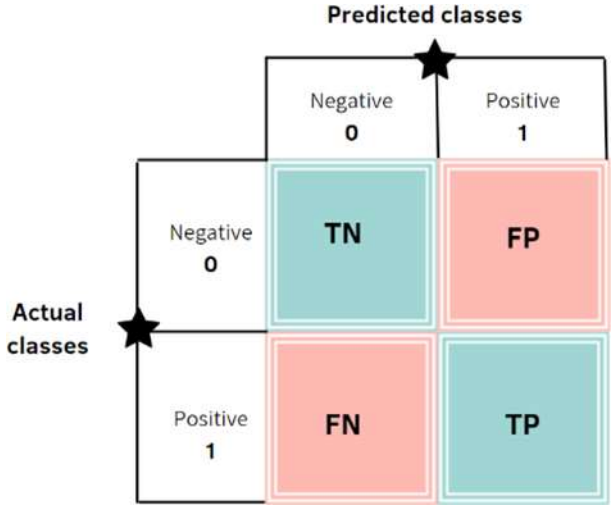

Figure 3.4 Confusion Matrix Table

The description of Figure 4.6 is as follows.

True Positive (TP): Cases where the model correctly predicts the positive class True Negative (TN): Cases where the model correctly predicts the negative class

False Positive (FP): Cases where the model predicts the positive class incorrectly (often called typo)pe I error or false alarm)

False Negative (FN): A case where the model incorrectly predicts the negative class (often called type II error or miss)

The following shows the results of the confusion matrix for the two sentiment analysis methods in the following image.

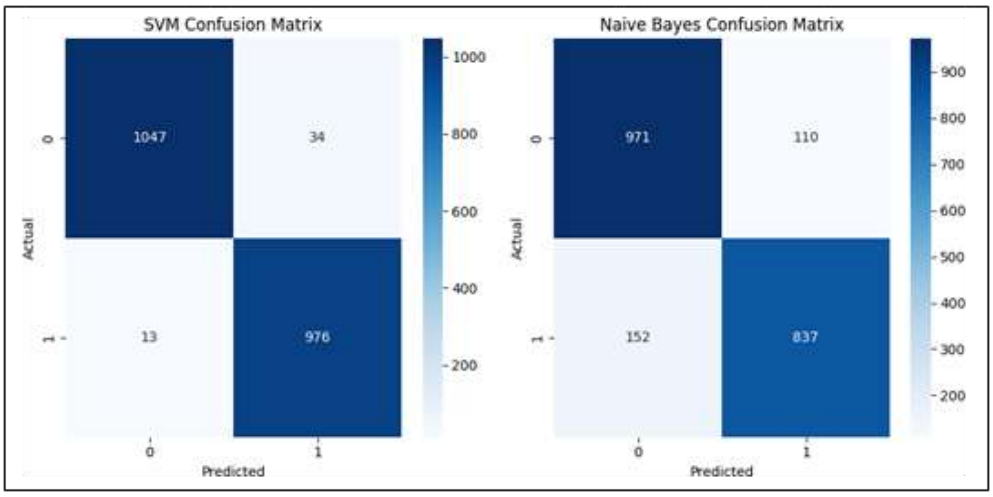

Figure 3.5 Confusion Matrix

In the SVM confusion matrix obtained, it shows the results of the calculation and testing of the model with the test data used in the negative labeled reviews can be predicted correctly by the model for 1047 data and the possibility of making a mistake in making a prediction of 13 data. While for positive labeled reviews, the possibility of making a correct prediction of 976 data and the possibility of making a prediction error of 34 data.

$$accuracy = \frac{TP + TN}{(TP + FP + FN + TN)}$$

$$= \frac{976 + 1047}{(976 + 34 + 13 + 1047)}$$

$$= \frac{2023}{2070}$$

$$\boldsymbol{accuracy\ SVM = 0,977 \approx 0,98 = 98\%}$$

$$precision = \frac{TP}{TP + FP}$$

$$precision = \frac{976}{976 + 34}$$

$$\boldsymbol{precision\ SVM = 0,966 = 97\%}$$

$$recall = \frac{TP}{TP + FN}$$

$$recall = \frac{976}{976 + 13}$$

$$\boldsymbol{recall\ SVM = 0,986 = 98\%}$$

$$F - Measure = \frac{2x\ precision\ x\ recall}{precision + recall}$$

$$F - Measure = \frac{2x\ 0,966\ x\ 0,986}{0,966 + 0,986}$$

$$\boldsymbol{F - Measure\ SVM = 0,97 = 97\%}$$

In the NBC confusion matrix obtained, it shows the results of the calculation and testing of the model where the test data used in the negative labeled reviews can be predicted correctly by the model for 971 data and the possibility of making a mistake in making a prediction is 152 data.

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While for positive labeled reviews, the possibility of making a correct prediction is 837 data and the possibility of making a prediction error is 110 data.

$$accuracy = \frac{TP + TN}{(TP + FP + FN + TN)}$$

$$accuracy = \frac{837 + 971}{(837 + 110 + 152 + 971)}$$

$$\boldsymbol{accuracy\ NBC = 0,873 \approx 0,87 = 87\%}$$

$$precision = \frac{TP}{TP + FP}$$

$$precision = \frac{837}{837 + 110}$$

$$\boldsymbol{precision\ NBC = 0.884 = 88\%}$$

$$recall = \frac{TP}{TP + FN}$$

$$recall = \frac{837}{837 + 152}$$

$$\boldsymbol{recall\ NBC = 0.846 = 84\%}$$

$$F - Measure = \frac{2x\ precision\ x\ recall}{precision + recall}$$

$$F - Measure = \frac{2x\ 0{,}884\ x\ 0{,}846}{0{,}884 + 0{,}846}$$

$$\boldsymbol{F - Measure\ NBC = 0,86 = 86\%}$$

M-Passport Application Data Visualization

This stage is the result of data preprocessing represented through word cloud visualization based on each sentiment class. Word Cloud displays words with the highest frequency, the more frequency of occurrence of a word, the larger the word will be, meaning that the word has a higher frequency of occurrence in the dataset used. The following shows the results of the visualization using word cloud in the positive sentiment class in Figure 3.6

Figure 3.6 Positive Visualization

In the data visualization, not only the word cloud is displayed but also the frequency of the words that most often appear in positive sentiments, as follows.

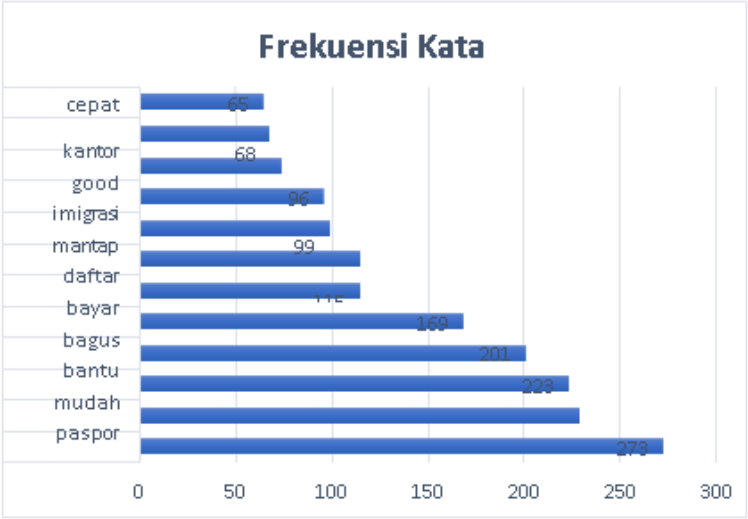

Figure 3.7 Positive Frequency

The results of the visualization using wordcloud in the negative sentiment class are in Figure 3.8.

Figure 3.8 Negative Visualization

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In the data visualization, not only the word cloud is displayed but also the frequency of the words that most often appear in negative sentiments, as follows.

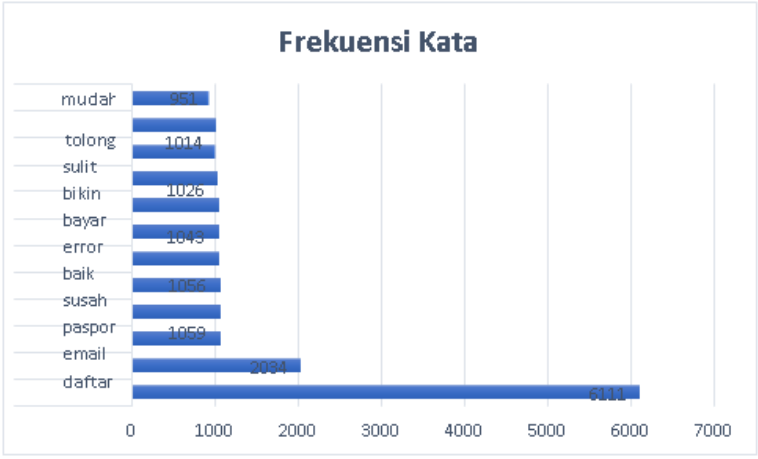

Figure 3.9 Negative Frequencies

Analysis of M-Passport Service Quality Factors

Based on the classification results using the service quality dimensions, the following percentage graph was obtained.

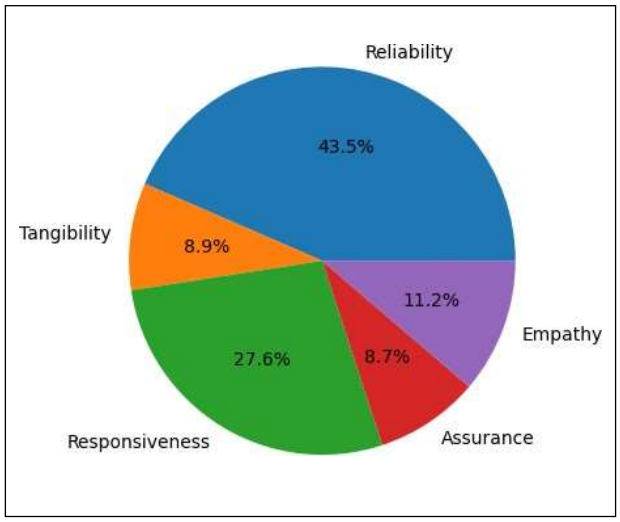

Figure 4.40 Service Quality Graph Analysis

The service quality factor of the M-Passport application with the highest percentage of negative sentiment is the reliability variable of 43.5%, the second highest is the responsiveness variable of 27.6% then followed by the empathy variable of 11.2%, the tangibility variable and the assurance variable of 8.9% and 8.7% respectively. Each variable/dimension of the SERVQUAL service quality factor of the M-Passport application will be described as follows.

1. Reliability Variable

   Based on the results of the negative sentiment classification on the service quality factor, the highest percentage was obtained in the lack of reliability aspects in the M-Passport application, which was 43.5%. In the reliability variable, the M-Passport application should provide the promised services consistently, on time, and accurately. This emphasizes the importance of consistency and accuracy of M-Passport services as the main factors in building public trust as users in passport applications. Measurement of the reliability aspect can be assessed from the success of M-Passport users in passport applications without any technical problems such as the M-Passport application suddenly erroring, crashing, hanging, force closing, but the application must function stably without

repeating the application. The reliability aspect also includes the accuracy of information related to passport applications, service consistency, and the reliability of the features owned by the M-Passport application such as payment features that function properly. However, in the reviews of M-Passport Application users, it was found that the reviews were dominated by complaints regarding the lack of reliability of the M-Passport application when used. An example of this review can be seen in Table 4.11 below.

Table 3.11 Review of Reliability Aspects

No	Users	Content
1	User 1	I'm confused as to why the application can't be opened for the past three days. It says there's a system error. When will it return to normal?
2	User 2	Why is it like this: "request time out", please add more servers, so that access is faster.
3	User 3	every time it is openedalways maintenance. It's been like that for days. It really hinders and is of poor quality
4	User 4	The experience of entering personal data in this application is very bad, at first I was happy because I could take care of my passport from home online, but in fact the application often crashes when entering personal data and then returns to the main menu, please update and improve this application, really annoying to use this app

Source: Secondary Data (processed), 2024

2. Responsiveness Variable (Responsiveness)

The second highest service quality factor in the negative sentiment classification is the responsiveness variable of 27.6%. The responsiveness variable refers to the ability and willingness of the Directorate General of Immigration as the provider of M-Passport to assist users in responding to customer requests, questions, and complaints effectively and on time. Things that can be categorized in the responsiveness variable are how quickly the service provider responds to requests or questions from the public as users, the ease for users to get solutions, assistance, or services when needed, and providing clear, easy-to-understand, and timely information about what users need to do or expect. However, in the reviews of M-Passport Application users, it was found that the responsiveness of the M-Passport application manager was still lacking when problems occurred when the M-Passport application was used. An example of this review can be seen in Table 4.12 below.

Table 4.12 Reviews Related to Responsiveness Aspects

No	Users	Content
1	User 1	please provide a "help & support" tab in the application if complaints and comments here are never read & responded to, thank you
2	User 2	If you are not ready to go online, don't force yourself, rather than making things difficult for people. I haven't been able to register an account for 2 days, and there's no response when I chat on live chat. What are you guys doing, getting paid by the people and not doing anything, it's just troublesome

3	User 3	redupppp star makes super slow apk. The admin is slow to respond too. The app isn't good yet, don't dare to release it yet, it's okay if the Ojol apk loses. If you don't really need it, nausea, open this apk. it can't be repaired... lots of money, lots of good people. especially..!!!
4	User 4	register can't log in and complaints comments on m passport no response at all from m passport one star because the apk doesn't work and doesn't help at all

Source: Secondary Data (processed), 2024

3. Variable Empathy (Empathy)

The next service quality factor on negative sentiment is the empathy variable of 11.2%, referring to the ability of the Director General of Immigration to provide sincere attention to users and how well the Director General of Immigration understands the specific needs of M-Passport application users when experiencing obstacles when using the application. The empathy quality aspect also includes the ease and convenience provided by the application to meet user needs. Features such as good accessibility, simple navigation, personalization of services such as notification settings and attention to feedback from M-Passport application users. However, in the reviews of M-Passport Application users, it was found that the empathy of managers towards M-Passport application users was still lacking when obstacles occurred when the M-Passport application was used. An example of this review can be seen in Table 4.13 below.

Table 4.13 Reviews Related to Empathy Aspects

No	Users	Content
1	User 1	terrible. the app is not supported on some android phones. but using ios it runs smoothly. because the app has many bugs when reporting to cs at immigration, they are blamed because the device is not supported. and the officers turn a blind eye because the reviews are not satisfactory.
2	User 2	severe application errorthen, until the immigration officer tried to use his cellphone but there was an error, the funny thing was there was no solution, he was told to let me know that the app was in the development stage, you should know about the error and allow people to take care of it offline. Meanwhile, when there is an error, offline you can't go online and it also fails, it ends up being outside the office a lot. The broker offered to be able to interview directly today for 1 million, how do you want it to be clean?
3	User 3	It's quite easy for those who are not tech-savvy. But it's so torturous for those who really need it... but are hampered by the difficulty of operating it. application and notthe friendliness of the officers at the local immigration....

4	User 4	I can't log in for a week and I'm annoyed that my account is suspended, why? It's strange, especially since I came to the immigration office and asked for a solution, the officer said yes, it can't be done if it can't be done online, huh? Does this officer have any other solution for direct verification? Working at the immigration office must be trained, how come there's no solution, but instead I'm told to go to immigration, it's funny, it's like I'm complaining to someone who shouldn't be in the office immigration, no advantages

Source: Secondary Data (processed), 2024

4. Tangibility Variable

The next negative sentiment service quality factor on the tangibility variable (tangibility) of 8.9% which refers to the physical aspect or real evidence felt by M-Passport users in real terms (experience) from the application service, both from the application display, clarity of information to the ease of navigation of the M-Passport application when used which can affect user perceptions of the quality of M-Passport services. The tangibility aspect also includes cross-device accessibility where the application can function well on all devices, the presence of visual guides or tutorials in the application to help users understand the process of using the service, such as video tutorials or infographics in the passport application process, professional display quality, and has complete features that are relevant to user needs. However, in the reviews of M-Passport Application users, it was found that the tangibility of the M-Passport application was still lacking compared to the expectations of M-Passport application users. An example of this review can be seen in Table 4.14 below.

Table 4.14 Reviews Related to Tangibility Aspects

No	Users	Content
1	User 1	the font size in the application is small and the display is not clear enlarged. please fix. why there is no web version?
2	User 2	Register an account when you log in, there's nothing on the app display. just keep going that's it
3	User 3	I have received a verification code for account registration, but the display in the application does not change to the verification code request section. In the end, it is useless to get the code but cannot enter the code. I have tried it many times, but there is no change.
4	User 4	This app is not efficient, instead of making things easier for the public, it actually makes things more difficult. This app should have been tested before being published. It's really bad.

Source: Secondary Data (processed), 2024

5. Assurance Variable (Guarantee)

The next negative sentiment service quality factor is the assurance variable of 8.7%. This quality factor is related to the agency's ability to instill a sense of trust in terms of security, accuracy, and competence in users related to the M-Passport application. This dimension focuses on the ability of the Directorate General of Immigration in the M-

Passport application to be able to create a sense of security and comfort for users both in terms of user data security, application reputation, compliance with government standards, credibility, competence, accuracy of information, and professionalism in user services. In the M-Passport application review, user doubts about the M-Passport application were still found. An example of this review can be seen in Table 4.15 below.

Table 4.15 Review of Assurance Aspects

No	Users	Content
1	User 1	the application is super slow..... please improve it again, for the sake of comfort and security
2	User 2	slow x because many people access it. I have made a payment after registering but it's been almost 2 hours and I haven't received confirmation of my payment status. what should I do?
3	User 3	have made payment but the status says waiting for payment.
4	User 4	I have made two payments, why hasn't it been confirmed in the application? And how do I get the funds back?

Source: Secondary Data (processed), 2024

CONCLUSION

The following conclusions were drawn based on the results of this study, which are explained as follows.

1. Based on the labeling process with the help of Python on the Google Collaboritory platform, the distribution of review data on the M-Passport application was obtained with positive user opinions of 12.32% and negative user opinions of 87.67%.
2. Based on sentiment analysis using the Support Vector Machine (SVM) and Naïve Bayes Classifier (NBC) algorithms, the best accuracy results were obtained through the SVM method with an accuracy of 98%, precision 97%, recall 98%, and f-measure 97% while the NBC method obtained an accuracy of 87%, precision 88%, recall 84%, and f-measure 86%. Where, from these results it can be interpreted that the Support Vector Machine (SVM) algorithm has good performance in classifying sentiment in the M-Passport application
3. Based on the identification of service quality variables in the negative sentiment class, it was found that the reasons why users gave the most negative comments were due to the reliability factor which obtained the highest percentage of 43.5%, the responsiveness factor of 27.6%, empathy of 11.2%, tangibility of 8.9% and assurance of 8.7%.

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