INNOVATIVE LEARNING MODEL FOR DHARMAGITA BASED ON TELEGRAM CHATBOT

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Abstract

In the digital era, instant messaging has become a vital aspect of people's daily lives, especially among the younger generation. This presents opportunities to utilize technology that can be integrated into instant messaging as a learning medium. This research innovates to develop a learning model for Dharmagita, also known as sacred Hindu songs, using a chatbot as a platform aimed at attracting the interest of the younger generation in studying Dharmagita as a cultural heritage. This chatbot was developed using the Rasa framework, which is founded on Natural Language Understanding (NLU). Based on the results of the User Acceptance Test, the Dharmagita Chatbot received a positive response from users. The chatbot model achieved an accuracy value of 86.7%, an F1-score of 88.4%, and a precision of 91.1%. These results underscore the effectiveness and reliability of the chatbot in facilitating learning and engagement with Dharmagita content.

Keywords : Chatbot, Rasa Framework, Natural Language Understanding, Dharmagita

INTRODUCTION

Bali is an island with religious and cultural aspects closely related to the lives of its people. One visible expression of this is the religious ceremonies or yadnya that the Balinese community still regularly conducts. An important element that must be present in a yadnya ceremony is Panca Gita, which consists of five types of sounds accompanying its implementation. One part of Panca Gita is Dharmagita, which consists of four parts: Sekar Rare, Sekar Alit, Sekar Madya, and Sekar Agung [1].

Dharmagita is one of the Hindu cultures that should be developed as a way to enhance the quality of religious life among Hindus, especially the younger generation [2]. However, with the rapid development of technology, Dharmagita is beginning to lose its existence. This is due to many young generations considering Dharmagita as something outdated, traditional, and even deemed irrelevant [3]. Therefore, this study aims to address this challenge by developing Dharmagita informational media that can attract public interest, especially the younger generation.

One evidence of technological advancement is the fact that more than half of the Indonesian population now has access to smartphones [4]. Smartphones can have a positive impact, one of which is making it easier for users to access information or search for a website, eliminating the need to carry books or go to the library to find information [5]. A feature closely associated with smartphones today is instant messaging. The fact that instant messaging is ingrained in the daily lives of people, especially the younger generation, presents an opportunity to utilize instant messaging as the basis for Dharmagita information. An information medium that operates on the same system as instant messaging is a chatbot. A chatbot is a service that interacts with users through text conversations. Chatbots work to replace the role of humans in handling conversations via instant messaging [6]. This is expected to attract the interest of the younger generation in Dharmagita because it is packaged with technology that gives a modern impression.

One of the research studies related to Dharmagita discusses about development of an Android-based Dharmagita Information System. This research utilizes Black Box Testing techniques and the PSSUQ Method. The results of this study indicate that the Dharmagita Information System has minimal bugs or defects after undergoing Black Box Testing techniques, and the PSSUQ score results indicate that the application is well-received by users. [7]

Previous research related to the implementation of chatbot discussed the development of access media for Sloka Bhagavad Gita and Hindu prayers through instant messaging, specifically the Telegram chatbot. Based on the User Acceptance Test (UAT) analysis on the user aspect, it was found that 85.8% of respondents agreed that using a chatbot as a means of accessing prayers or slokas was easier compared to using other media, and the chatbot was able to provide information more quickly than other media [8].

Another relevant study discusses the development of online programming learning media based on Telegram. The problem faced is the limitations of quota, space, and time in teaching during the Covid-19 era. The result of this research is the existence of a Telegram Chatbot that can assist students in learning courses. Based on this research, it can be concluded that the chatbot is an effective alternative learning media [9].

Based on several previous studies, the implementation of technology in the context of religion and culture has shown positive impacts by providing faster access to information compared to traditional media. The main difference between this study and previous research lies in the technology platform used. Previously, a Dharmagita Information System based on an Android mobile application had been developed, while this study will utilize a chatbot. Given that previous studies on chatbots yielded positive results, offering an alternative medium for learning Dharmagita, aside from mobile applications, is expected to enhance public interest in studying Dharmagita. Moreover, chatbots, like ChatGPT and Gemini are currently trending, making them a timely and relevant choice for this purpose.

This research chooses the Telegram platform for chatbot development because it provides the Telegram Bot API and is widely used in the community, especially by students for communication in their classrooms [10]. The ease of access to information is supported by the fact that users only need to send specific information requests to the chatbot, which will then provide relevant information. The study aims to provide easy access to information about Dharmagita and its relationship with Yadnya Ceremonies to the Hindu community and the younger generation in general through a chatbot medium.

METHOD

The primary objective of this research is to evaluate the public reception of the chatbot as a learning medium for Dharmagita. This includes the creation of a Telegram chatbot for Dharmagita learning utilizing the Rasa framework. The development methodology employed is the Waterfall Method, selected for its structured and sequential nature [11], which is particularly suitable for projects characterized by clear and predefined requirements. The Waterfall Method facilitates systematic progress through key stages, comprising literature review, chatbot design, implementation, and evaluation, aimed at providing an alternative learning medium to captivate the interest of the younger generation.

Telegram

Telegram is a cloud-based instant messaging application that focuses on speed and security. Telegram is designed to allow users to exchange messages in the form of text, audio, video, images, and stickers easily and securely [12]. Telegram is advantageous in chatbot development because it features the Telegram Bot API, an open-source technology used to build Telegram Bot applications for developers.

System Overview

The chatbot design process begins with creating a general system overview. The system overview is a representation of the overall flow of the system to be built [13]. The general overview of the Dharmagita Chatbot is displayed in Figure 1.

Based on Figure 1, it can be concluded that the chatbot consists of several main components, namely Telegram as the communication platform between the user and the bot, Rasa as the bot development framework, and the Dharmagita Mobile Application API as the data source to answer user questions.

Use Case Diagram

Use case diagram is a UML diagram to define the functionality and graphics of a system in relation to actors, uses, and relationships [14]. The use case diagram depicts interactions between users and the system. The use case diagram for the Implementation of Chatbot in the Dharmagita Learning System is displayed in Figure 2.

The Dharmagita Chatbot is designed to be able to answer various types of user questions. Figure 2 shows that the chatbot can respond to user questions about Dharmagita information in text and audio formats, information about Yadnya in text format, and the relationship between Dharmagita and Yadnya in text format.
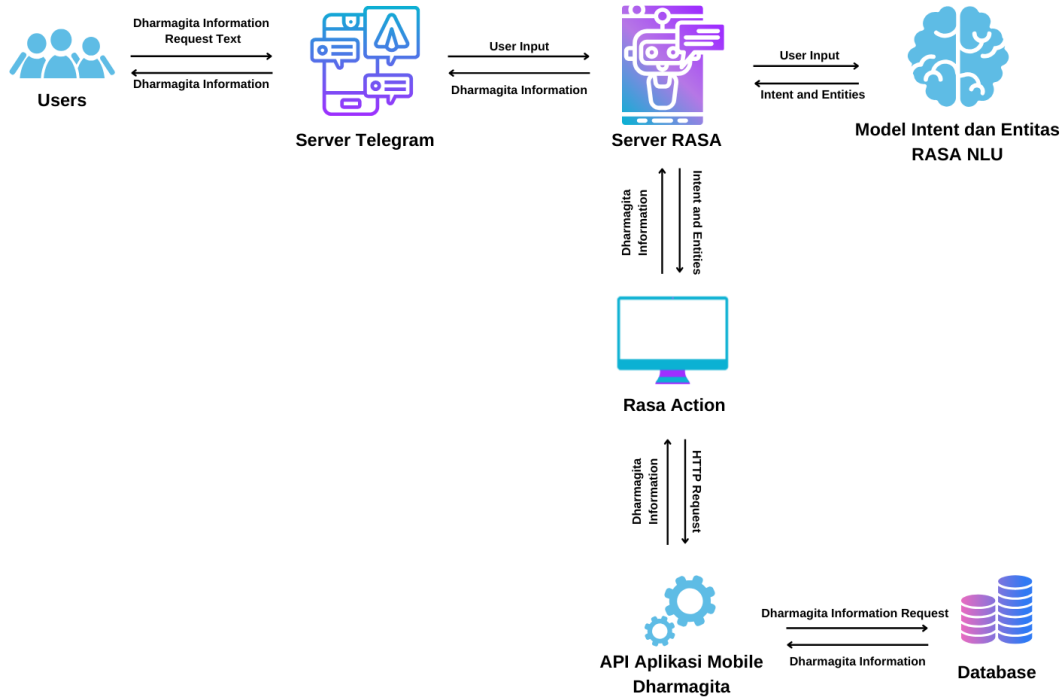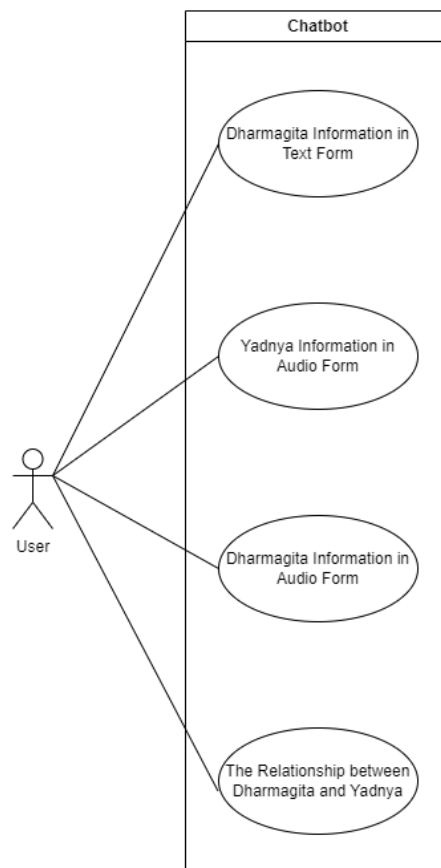
Figure 1. System Overview

Figure 2. Use Case Diagram

Rasa Framework

As explained in the System Overview, this chatbot will be designed using Rasa. Rasa is a framework used to build chatbots [15]. This framework is developed based on a data-driven approach, often referred to as the data-based approach. Rasa is a chatbot development framework that focuses on Natural Language Understanding (NLU). NLU is a branch of Natural Language Processing (NLP) that focuses on text interpretation and information extraction from messages, such as intent and entity [16].

The Rasa framework consists of two main components, namely Rasa NLU and Rasa Core. Rasa NLU is a library used to process Natural Language Understanding, while Rasa Core is a library responsible for managing dialogues. Rasa Core is responsible for predicting the responses that the bot should give based on the information received from the user [17]. Both components play a crucial role in creating models for Rasa chatbots.

The model development is carried out through several stages, including Data Preparation, Data Labeling, creating Rasa Actions, creating Rasa Stories, and Evaluation.

Data Preparation

Data preparation is the stage where a dataset consisting of general questions about Dharmagita, which will be used for training the model, is collected. Data is gathered through a form filled out by teenagers aged 15-24 years. Respondents are asked to answer several questions about Dharmagita and Yadnya that they want to know.

Data Labeling

The next stage is labeling intent and entity in the acquired question dataset. Intent represents the meaning of the commands given by the user [18]. Entity in general, is a symbol used to represent categories of things in a concise form [19]. Entity is the type or category of information desired by the user. An example of data labeling in the Rasa framework can be seen in Figure 3.

```
- intent: informasi
  examples: |
    - Cari informasi [kidung](jenis) [wargasari](judul)
    - Apa makna dari [kidung](jenis) [turun tirta](judul)?
    - Apa makna dari [kidung](jenis) [wargasari](judul)?
```

Figure 3. Data Labeling

Figure 3 shows an example of labeling intent and entity in the data. Data with the same intent will be grouped in the same section. Words

acting as entities will be enclosed in square brackets and followed by the entity name of the word placed in parentheses.

Rasa Action

An action is an activity that can be performed by the chatbot [20]. In the designed chatbot, actions will be focused on calling the Dharmagita Mobile Application API to obtain information according to the user's preferences.

Rasa Rules and Stories

Rules and Stories are parts of Rasa used to train the chatbot in conversing using machine learning dialogue management. Stories contain a collection of storylines that the chatbot will learn. When a user provides input with a specific intent, the sequence of actions that the chatbot should take will be included in Stories to be learned during the training process according to the rules outlined in Rules [21]. Examples of stories can be seen in Figure 4.

```
stories:
- story: greeting 1
  steps:
  - intent: greet
  - action: utter_welcoming_message
  - action: action_display_response
```

Figure 4. Rasa Stories

Model Evaluation

Model evaluation is a testing process aimed at assessing how accurately the chatbot predicts the intent of user questions and the actions it should take based on the provided test stories. Test stories are created manually, including example messages sent by users along with the actions the chatbot should perform, complete with the intent and entities that the model should recognize.

User Acceptance Test

User Acceptance Test (UAT) is a testing process by application users with the output result in the form of a test result document that can be used as evidence that the developed chatbot has been well-received and is able to meet the requested needs. The UAT testing process aims to ensure that the developed chatbot can handle tasks according to the specified specifications [22].

RESULT AND DISCUSSION

The development of Chatbot Dharmagita begins with model training and continues with model evaluation and UAT.

Training Model

The Chatbot Dharmagita developed using the Rasa framework has several Intents and Entities as listed in Table 1 and Table 2.

Table 1. List of Intents

Intent	Function
Greet	Greetings message
Closing	Closing message expressing gratitude
Dissapointment	Message expressing disappointment
Informasi	Request for information about a specific type or part of Dharmagita.
Informasi Detail	Request for information about a specific title of Dharmagita.
Informasi Umum	Request for general information or understanding of Dharmagita.
Informasi *Yadnya*	Request for information or understanding of Yadnya and its parts.
Contoh *Yadnya*	Message requesting to display examples of ceremonies from a Yadnya.
Contoh	Message requesting to display examples of titles from a specific part of Dharmagita.
Lirik	Request to display Dharmagita lyrics
Audio	Request to display Dharmagita audio
Dharmagita Yadnya	Request to display the relationship between a Dharmagita and a Yadnya.
Yadnya Dharmagita	Request to display the titles of Dharmagita sung at a specific Yadnya.

Table 2. List of Entities

Entity	Function
Judul	Title of Dharmagita
Jenis	Desired type of information
Yadnya Type	Type of Yadnya

After the process of labeling intents and entities is completed, the next step is to complete the rules and stories of Rasa, followed by training the model. This process involves configuring various components called Rasa NLU Pipelines. These pipelines include data preprocessing and algorithm modeling. Below is the configuration of the Rasa NLU Pipelines used for training the model.

```
pipeline:
  - name: WhitespaceTokenizer
    intent_tokenization_flag: True
    intent_split_symbol: +
    lowercase: true
  - name: RegexFeaturizer
  - name: LexicalSyntacticFeaturizer
  - name: CountVectorsFeaturizer
  - name: CountVectorsFeaturizer
    analyzer: char_wb
    min_ngram: 1
    max_ngram: 4
  - name: DIETClassifier
    epochs: 100
    constrain_similarities: true
  - name: EntitySynonymMapper
  - name: ResponseSelector
    epochs: 100
    constrain_similarities: true
  - name: FallbackClassifier
    threshold: 0.68
    ambiguity_threshold: 0.1
```

Figure 5. Rasa NLU Pipelines

Model Evaluation

The evaluation results of the trained model are presented in Table 3. Based on these results, it can be concluded that Rasa successfully predicted the Actions correctly for 22 out of a total of 26 Actions. The obtained F1-Score value is 88.4%, the Precision value is 91.1%, and the Accuracy obtained is 86.7%.

Table 3. Model Evaluation

Metrix	Score
F1-Score	88,4%
Precision	91,1%
Accuracy	86,7%

The confusion matrices of entities and intents can be seen in Figure 6 and Figure 7. Confusion matrices display the comparison between actual entities and intents with the entities and intents predicted by the model.
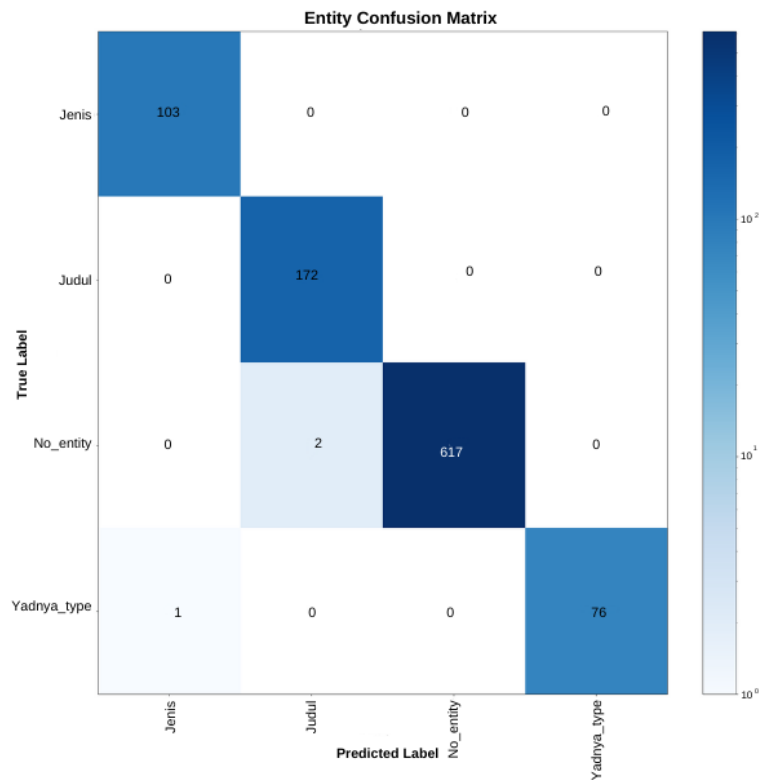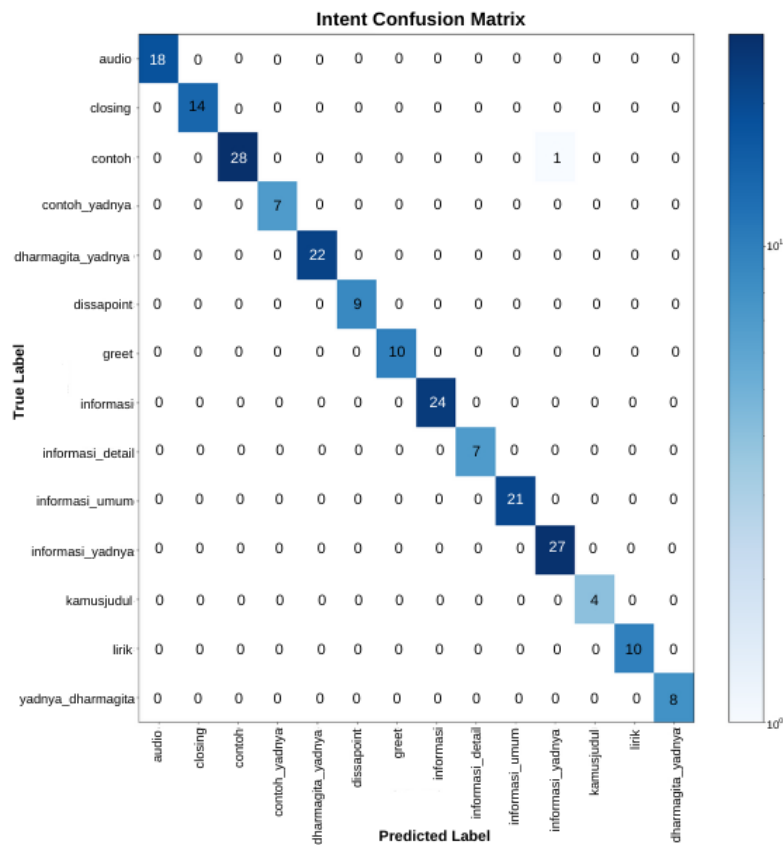
Figure 6. Entity Confusion Matrix

Figure 7. Intent Confusion Matrix

Figure 6 shows the Entity Confusion Matrix of Chatbot Dharmagita. Based on the figure, it is evident that the chatbot has predicted entities well, but there are still some prediction errors. The chatbot wrongly recognized non-entities as title entities twice and wrongly identified yadnya_type entities as title entities once. Figure 7 shows the Intent Confusion Matrix of Chatbot Dharmagita. Based on the figure, it is evident that the chatbot has predicted intents well, but there are still some prediction errors. The chatbot incorrectly identified the intent contoh as the intent informasi yadnya once.

Chatbot Interface

The designed Chatbot Dharmagita can be accessed through both Telegram Mobile and Telegram Desktop. Users are given the opportunity to inquire about the information they desire, ranging from general knowledge about Dharmagita and Yadnya to examples of Dharmagita audio. The interface results of this chatbot are displayed in Figure 8.
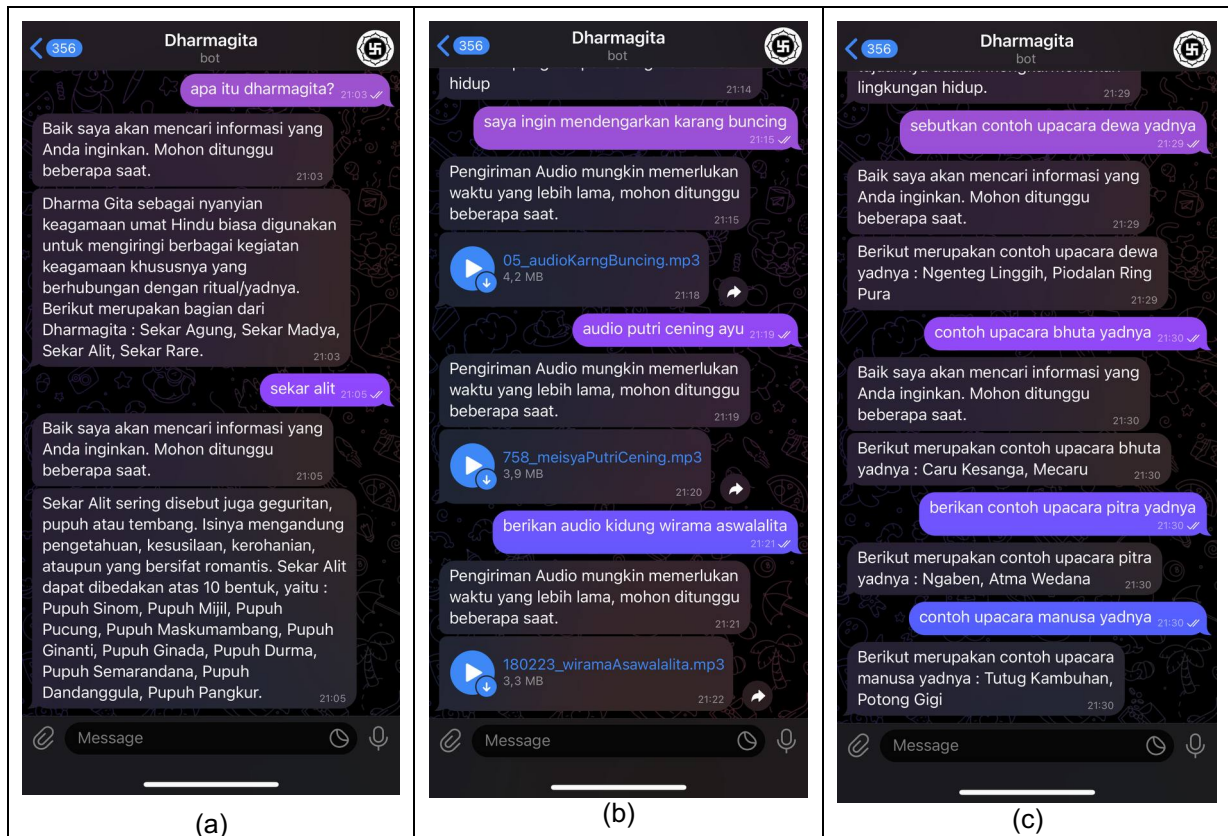

Figure 8. Dharmagita Information (a), Dharmagita Audio (b), Yadnya Information (c)

The main features of Chatbot Dharmagita are illustrated in Figure 8. Dharmagita information involves interactions when users inquire about general information regarding Dharmagita that they wish to know. If the Dharmagita data is available in the database, the chatbot will send it as a response message. However, if the desired information is not available in the database, the chatbot will send a message indicating that the data is not available (8a). In addition to text-based information, the chatbot can also send information in the form of audio. The sent audio will be in the form of a file that users can listen to and save to their respective devices. The audio file will be named the same as the audio file when stored in the database (8b). Another feature of the chatbot is displaying information about Yadnya that users want to know about (8c).

UAT Results

he next stage for Chatbot Dharmagita is the User Acceptance Test to assess whether the built chatbot can be well-received by users. The UAT question list can be seen in Table 5. The table shows that there are 6 questions to be asked to the respondents during the UAT. The questions are categorized into 3 aspects: user

aspect to assess the user experience and ease of use of the chatbot, interaction aspect to evaluate how the chatbot interacts with users, including responsiveness and accuracy of the information provided by the chatbot, and system aspect to evaluate the overall performance of the chatbot. The questionnaire results will be calculated according to the indicators and point values that have been determined and presented in Table 4.

Table 4. List of Weighted Answers

Code	Description	Weight
VG	Very Good	5
G	Good	4
N	Neutral	3
PG	Pretty Good	2
NG	Not Good	1

The questionnaire was distributed to the general public with a total of 72 valid respondents. The results of the UAT calculation can be seen in Table 5, Table 6, and Table 7.

Table 5. List of Questions

No	Questions	Usability Aspects				
		VG	G	N	PG	NG
System Aspects						
P1	Is the chatbot easy to use?	41	28	3	0	0
P2	Does the chatbot provide clear usage instructions?	34	31	7	0	0
Interaction Aspects						
P3	Does the information provided by the chatbot match the expected information?	28	32	11	1	0
P4	Is accessing Dharmagita information through the chatbot easier than through a web browser?	18	38	8	7	0
System Aspects						
P5	Is accessing Dharmagita information through the chatbot more interesting than through a web browser?	27	31	12	2	0
P6	Are you satisfied with the performance of the chatbot?	36	30	5	0	0

Table 6. UAT Value Calculation

No	Question	Usability Aspects					Qty/Total
		VG x 5	G x 4	N x 3	PG x 2	NG x 1	
1	P1	205	112	9	0	0	326
2	P2	170	124	21	0	0	315
3	P3	140	128	33	2	0	303
4	P4	90	152	24	14	0	280
5	P5	135	124	36	4	0	299
6	P6	180	120	15	0	0	315

Table 7. Analysis of Results

Questions	Score			AVG
	Qty	Qty/Respondents	%	
User Aspect				
P1	326	4,527777778	90,6%	89,05%
P2	315	4,375	87,5%	
Interaction Aspect				
P3	303	4,208333333	84,1%	80,95%
P4	280	3,888888889	77,8%	
System Aspect				
P5	299	4,152777778	83,1%	85,3%
P6	315	4,375	87,5%	

Result Analysis

a. The analysis of the first question indicates that based on Table 7, the total score obtained from 72 respondents is 326. The average score is 326/72 = 4.527777778. The percentage is calculated by dividing the average score by the total number of answer choices, which is 4.527777778/5 x 100 = 90.6%.

b. Analysis of the second question shows that the total score obtained from 72 respondents is 315. The average score is 315/72 = 4.375. The percentage is 4.375/5 x 100 = 87.5%.

c. Analysis of the third question shows that the total score obtained from 72 respondents is 303. The average score is 303/72 = 4.208333333. The percentage is 4.208333333/5 x 100 = 84.1%.

d. Analysis of the fourth question shows that the total score obtained from 72 respondents is 280. The average score is 280/72 = 4.208333333. The percentage is the average score divided by the total number of answer choices, which is 4.208333333/5 x 100 = 77.8%.

e. Analysis of the fifth question shows that the total score obtained from 72 respondents is 299. The average score is 299/72 = 4.152777778. The percentage is the average score divided by the total number of answer choices, which is 4.152777778/5 x 100 = 83.1%.

f. Analysis of the sixth question shows that the total score obtained from 72 respondents is 315. The average score is 315/72 = 4.375. The percentage is the average score divided by the total number of answer choices, which is 4.375/5 x 100 = 87.5%.

g. The average score for each aspect is calculated by summing up the percentages of all questions within that aspect and dividing by the number of questions. The results are as follows: User Aspect receives a score of 89.5%, Interaction Aspects receives a score of 80.95%, and System Aspects receives a score of 85.3%.

CONCLUSION

Based on this research, it can be concluded that the key component in the Dharmagita chatbot is the Natural Language Processing model. This model enables the chatbot to understand and respond to user queries accurately.

In the conducted tests, the Dharmagita chatbot model correctly predicted 22 out of 26 actions tested. The F1-Score obtained was 91,1%, Precision was 88,4%, and Accuracy was 86,7%. The User Acceptance Test (UAT) questionnaire received responses from 72 individuals, with User Aspect scoring 89.05%, Interaction Aspect scoring 80.95%, and System Aspect scoring 85.3%. The UAT questionnaire results indicate that the chatbot performs well and is acceptable to users.

Overall, the tests conducted show that although the chatbot still has room for improvement, it has provided good responses to user interactions. Based on these results, it is evident that User Aspects received the highest score, while Interaction Aspects received the lowest score. This suggests that future research should focus on improving the accuracy of the model so that the chatbot can better predict user preferences and provide more accurate answers, thereby enhancing the user interactif experience.

The positive reception and performance of the Dharmagita chatbot underscore its potential to contribute to the preservation and promotion of religious ceremony traditions in Bali. By captivating the interest of the younger generation in learning about Dharmagita, the chatbot serves as a promising tool in safeguarding cultural heritage and traditions, highlighting the role of technology, particularly chatbots, in this endeavor.

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