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The KSII Transactions on Internet and Information Systems (TIIS.ISO Abbreviation: KSII T Internet Info) is online scholarly journal indexed in **SCIE (Clarivate Analytics)** and **SCOPUS (Elsevier)** and published by **KSII (http://www.ksii.or.kr/)** and supported by **KETI (http://www.keti.re.kr/e-keti/)**. The TIIS Journal has been published since Dec., 2007 The Transactions is published every month.This is an Open-Access journal. The Transactions is designed to allow readers to obtain the most state of the art in a number of focusing areas related to **wired & wireless internet and information systems**. The technologies and applications of IT are very rapidly changing and updating. Thus quick publication and distribution to researchers, developers, deployment engineers, technical managers, and educators are crucial. Our most important aim is to publish the accepted papers **quickly** after receiving the manuscript. The Transactions consists of regular and special issue papers. The papers are strictly peer-reviewed. Both theoretical and practical contributions are encouraged.

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Multi Parameter Design in AIML Framework for Balinese Calendar Knowledge Access

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Abstract

Balinese calendar is defined as a unique calendar system for combining solar-based and lunar-based system and assuming local system. It is considered as guidance of Balinese societies' activities management, starting from meeting arrangement, wedding ceremony, to religious ceremonies. Practically, it has developed in the form of printed Balinese calendar and electronic Balinese calendar, either web or mobile application. The core of the function is to find out the day with its various characteristics in the Balinese Calendar. In general, society usually asks the religious leader to find out the day in detail. The technology of NLP combined with models of pattern discoveries supports the arrangement of the interaction model in searching the good day in Balinese Calendar to equip the conventional searching system in the previous applications. This study will design a dialog model with AIML method in multi-parameter basis; therefore, the users will be dynamically able to use the searching content in various ways by chatting in similar with consulting to a religious leader. This model will be applied in a chatbot basis service in telegram machine. The addition of the context recognition section into 4 paterns has been successfully improve the ability of AIML to recognize input patterns with many criteria. Based on the testing with 50 random input patterns obtained a success rate of 92.5%.

Keywords: Balinese Calendar, Wewaran, Dewasa Ayu, Chatbot, Natural Language Processing

1. Introduction

Calendar is defined as the naming system of time period including day, month, year, and the others. The period naming might be based on the solar system such as the movement of the sun and the moon. Hindu society in Bali assumes *Saka* Calendar as the calendar system. Balinese *Saka* Calendar also provides access to the Hindu in finding out a day of *piodalan* and *pedewasan.*

Hindus in Bali generally use the printed *Saka* Calendar and it is used in traditionally. As the technology is developing, Balinese Calendar is modernized, for instance, a web basis Balinese Calendar has been discovered and can be accessed online. In addition, there is also Android basis Balinese Calendar, in which the users can access the Balinese Calendar in their smartphone.

The usage of Balinese Calendar is currently considered less interactive when the users would like to find out the red-letter day and *dewasa ayu* (certain days that is believed as good days in Bali). This problem has led the researcher to the solution of the more interactive application in order to have the society find an easier way of finding out a red-letter day and *dewasa ayu.*

Chabot is a program that interacts with users by using natural language [1, 2]. Chatbot is the most popular example and the most popular among the Human Computer Interaction (HMI) [3]. Chatbot can provide chatting access by either audio or textual method [4]. Chatbot is made for humans in order to get them believe that they are talking to human although they are actually talking to machine [5].

Based on that, *chatbot* can be used to find out a red-letter day or *dewasa ayu* in more convenient and more interactive way; therefore, this kind of *chatbot,* Calendar Bali chatbot, is designed to find out the day of *piodalan,* Balinese Hindus ceremony that is celebrated every six-month or year, and *dewasa ayu.*

To make dialogue can occur using a variety of everyday conversations with natural language, then AIML is used in this modeling. Because of the data search on the Bali calendar cannot be completed with 1 parameter, therefore in this study, AIML is designed to be able to work with multiple criteria that can be set dynamically.

2. Related Work

In 2014, Pradnyani developed the Balinese calendar in the platform of android, starting from calculating the Balinese calendar attributes or symbols such as *wewaran, pawukon, sasih,* and others. In the same year Suwintana also developed Balinese calendar in the platform of android that is able to provide information regarding *wariga* (calendar system in Balinese Hindu) such as *wuku, wewaran, sasih, ingkel, pananggal, panglong, purnama, tilem* and *rerahinan,* in which the data are stored in SQLite [6]. It has also been developed in the form of engine PL SQL in order to make it enable to provide service in term of application features development based on the users' needs [7].

Chatbot recently develops in various methods. In 2016, Saptaji tried to develop chatbot on the basis of pattern matching that uses SQL in matching the pattern stored in the database [8]. In 2017, Suryani developed the chatbot by AIML method in order to provide information regarding tourist destination or object in East Java [9]. In the same year, Kulkarni used Natural Language Processing and Machine Learning as a solution for bank customer information issues [10]. Natural Language Processing (NLP) is considered as the appropriate way in developing chatbot of Balinese calendar with dynamic multi-parameter. The most recent study

tried to develop framework of which the name is ISONER in order to build access model in term of information system in the basis of chat with NLP [11] and it has been improved in order to handle advanced business service by building extended integrated module in the machine of PL SQL [12].

AIML models that work only with sentence pattern recognition or combined with steaming models, generally work without using parameters. Research conducted by [5, 13, 14] all focus on matching input patterns with master patterns that are stored on a knowledge base. A similar focus was also found in research on the use of AIML in the Indonesian language domain [9, 15]. Not yet found the application of AIML which includes the introduction of parameters as additional criteria in pattern matching, including in solving the problems of searching *dewasa ayu* on the Bali calendar.

3. Literature Review

3.1 Definition of Saka-Bali Calendar

Calendar is definend as a number of days and dates those are arranged as the guidance of periodic humans' activities. Hindus in Bali uses the calendar system of which the name is "Kalender Saka-Bali" or Saka-Bali Calendar. It is really important for society in Bali [16]. A year has 12 months, and they are called *sasih* [7].

Table 1. Sasih in Balinese Calendar

No	Sasih	Gregorian Calendar
1	Kasa	Juli-Agustus
2	Karo	Agustus-September
3	Katiga	September-Oktober
4	Kapat	Oktober-November
5	Kalima	November-Desember
6	Kaenam	Desember-Januari
7	Kapitu	Januari-Februari
8	Kawulu	Februari-Maret
9	Kasanga	Maret-April
10	Kadasa	April-Mei
11	Jyesta	Mei-Juni
12	Sadha	Juni-Juli

A *sasih* in Saka-Bali Calendar covers 30 days. There 2 phases in a *sasih, penanggal* and *pangelong*. The day, 15 days before the full moon, is assumed as *penanggal*, and the day, 15 days before the new moon (*tilem*) is assumed as *pangelong*. The 12 *sasih*(s) of Saka-Bali Calendar are presented in **Table 1**.

3.2 Pawukon Calendar

Pawukon is defined as an arithmethic calculation or arrangement in a calendar. A phase of *pawukon* consists of 210 days, and there are 30 *wuku*(s) (week) in a *pawukon* [17]. The names of the *pawukon*(s) are presented in **Table 2**.

Table 2. Wuku in Balinese Calendar

No	Named of Wuku	No	Named of Wuku
1	Sinta	16	Pahang
2	Landep	17	Krulut
3	Ukir	18	Mrakih
4	Kulantir	19	Tambir
5	Tolu	20	Medangkungan
6	Gumbreg	21	Matal
7	Wariga	22	Uye
8	Warigadean	23	Menail
9	Julungwangi	24	Prangbakat
10	Sungsang	25	Bala
11	Dungulan	26	Ugu
12	Kuningan	27	Wayang
13	Langkir	28	Klawu
14	Medangsia	29	Dukut
15	Pujut	30	Watugunung

The word *wuku* or *pawukuan* derive from word *buku* or *slice,* of which the meaning is 'slice. A phase of *wuku* consists of 7 days, starting from *redite* (Sunday), *soma* (Monday), *anggara* (Tuesday), *budha* (Wednesday), *wrespati* (Thursday), *sukra* (Friday), and *saniscara* (Saturday) [7]. Most of the red-letter and ceremonial days of Hindu in Bali are based on the *pawukon* cycle [18].

3.3 Wewaran

Different from the international day that starts at 00.00 midnights, the day in Bali starts when the sun rises at 6.00 [18]. The grouping of day in international way is known as a week, which consists of 7 days in a week. *Wewaran* is the system of days-grouping in Saka Calendar [7]. There are 10 groups of *wewaran*, starting from 1 (*ekawara*), 2 (dwiwara), 3 triwara, 4 (caturwara), 5 (pancawara), 6 (sadwara), 7 (saptawara), 8 (astawara), 9 (sangawara), and 10 (*dasawara*).

Table 3. Wewaran in Balinese Calendar

No	Name of *wewaran*	Name of the day	No	Name of *wewaran*	Name of the day
1.	*Ekawara*	*1. Luang*	6.	*Sadwara*	*1. Tungleh* *2. Aryang* *3. Urukung* *4. Paniron* *5. Was* *6. Maulu*
2.	*Dwiwara*	*1. Menga* *2. Pepet*	7.	*Saptawara*	*1. Redite* *2. Soma* *3. Anggara* *4. Buda* *5. Wrespati* *6. Sukra* *7. Saniscara*
3.	*Triwara*	*1. Pasah* *2. Beteng* *3. Kajeng*	8.	*Astawara*	*1. Sri* *2. Indra* *3. Guru* *4. Yama* *5. Ludra* *6. Brahma* *7. Kala* *8. Uma*
4.	*Caturwara*	*1. Sri* *2. Laba* *3. Jaya* *4. Menala*	9.	*Sangawara*	*1. Dungu* *2. Jangur* *3. Gigis* *4. Nohan* *5. Ogan* *6. Erangan* *7. Urungan* *8. Tulus* *9. Dadi*
5.	*Pancawara*	*1. Umanis* *2. Paing* *3. Pon* *4. Wage* *5. Kliwon*	10.	*Dasawara*	*1. Pandita* *2. Pati* *3. Suka* *4. Duka* *5. Sri* *6. Manuh* *7. Manusia* *8. Raja* *9. Dewa* *10. Raksasa*

3.4 The Utility of the Balinese Calendar System

Balinese society is considered as a cultural society those are based on values and philosophies of Hindu [19]. The Hindus have a philosophy of which the name is *Tri Hita Karana,* the harmony of the relationship among human beings, humans and environment, and humans and God. Paying attention to the good day when doing activities is the way to keep harmony [20].

Table 4. Ceremonial Days and Dewasa Ayu

Ceremonial Days	Wuku/Wewaran/Sasih
Pagerwesi	*Saptawara = Buda, Pancawara = Kliwon* dan *Wuku = Sinta*
Tumpek Landep	*Saptawara = Saniscara, Pancawara = Kliwon* dan *Wuku = Landep*
Galungan	*Saptawara = Buda, Pancawara = Kliwon* dan *Wuku = Dungulan*
Kuningan	*Saptawara = Saniscara, Pancawara = Kliwon* dan *Wuku = Kuningan*
Saraswati	*Saptawara = Saniscara, Pancawara = Umanis* dan *Wuku = Watugunung*
Nyepi	*Penanggal 1 Sasih Kadasa*
Siwalatri	*Pangelong 14 Sasih Kapitu*
Dewasa Ayu for Married	*saptawara = soma, budha, wrespati,sukra* *sasih = katiga, kapat, kalima, kapitu, kadasa* *penanggal* = 1, 2, 3, 5, 7, 10, 13 **avoid** 1. *kajeng kliwon,* 2. *wuku = wariga, pujut, menahil, warigadean, pahang, prangbakat,* 3. pasah
Dewasa Ayu for Cutting Down Trees	1. *Sadwara = was, astawara=Guru* 2. *Saptawara= Redite, astawara= Indra* 3. *Saptawara= Soma, astawara= Uma* 4. *Saptawara= Anggara, astawara= Rudra* 5. *Saptawara= Budha, astawara= Brahma* 6. *Saptawara= Wrespati, astawara= Guru* 7. *Saptawara= Sukra, astawara= Sri* 8. *Saptawara= Saniscara, astawara= Yama* 9. *Saptawara= Soma, wuku=Krulut*

Every aspect of social and cultural activities of Balinese people is considered using the Balinese Calendar. It is also guidance in determining the days of activities such as Hindu ceremonial day, religious ceremonial day in the temples, good days in terms of agriculture, farming, fishery affairs, building a house, wedding, and others [18]. Every aspect of social and cultural activities of Balinese people is considered using the Balinese Calendar. It is also guidance in determining the days of activities such as Hindu ceremonial day, religious ceremonial day in the temples, good days in terms of agriculture, farming, fishery affairs, building a house, wedding, and others [15]. Those all are based on considering the arrangement of *Pawukon, Wewaran, Sasih.* Some ceremonial days and *dewasa ayu*(s) are presented in **Table 4**.

3.5 AIML Model

The components of the AIML are presented in the Figure. Artificial Intelligence Markup Language (AIML) is the sequel of the Extensible Markup Language (XML) that is established for creating an artificial chat. AIML basis Chatbot is easily configurated and easy in term of its use [21]. AIML consists of groups of patterns and responses used to find out responses of every comments, questions, and utterances given [9]. The parts of AIML are presented in **Fig. 1**.

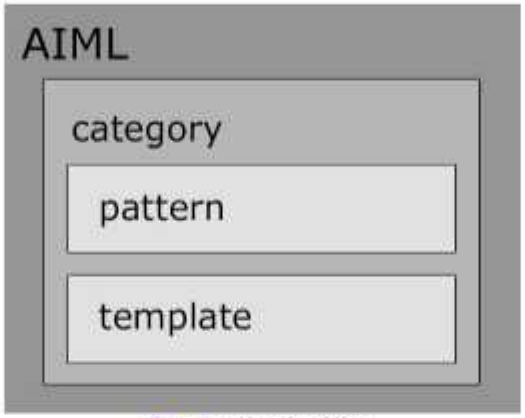

Fig. 1. Part of AIML

a. AIML
   Tag indicating the beginning and final AIML document
b. Category
   Category is the basic unit of knowledge. At least, category consists of two elements of AIML, pattern, and template.
c. Pattern
   Pattern is used to make simple patterns that are expected to correspond to the users' input.
d. Template
   Template determines the responses based on the corresponding pattern of the users' input.

3. Design System

3.1 Chatbot Architecture

Chatbot wariga information with this natural language processing approach provides the users access to ask for information regarding ceremonial days and *dewasa ayu* in Saka-Bali Calendar. The users can communicate in natural language regarding information of *wariga* that is implemented in the application of Telegram. The general description of *wariga* information chatbot is presented in **Fig. 2**.

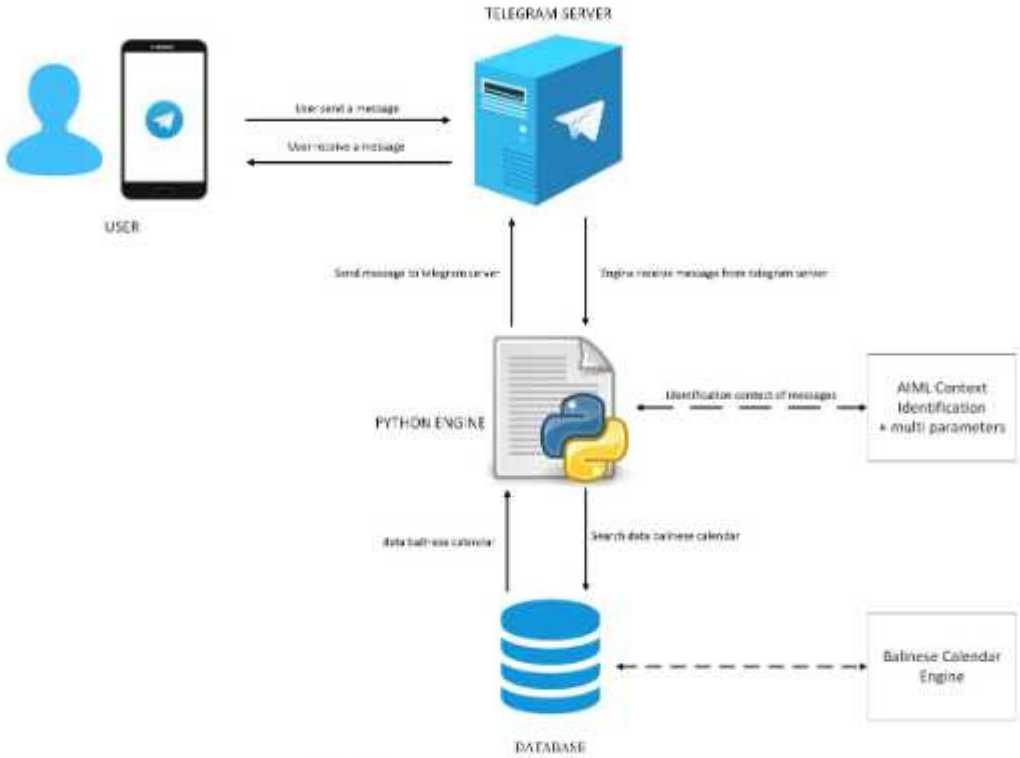

Fig. 2. General Description of The System

a. The user sends a message or asks for a question via Telegram by the username of info_wariga_bot.
b. Engine Python will receive message from the user, and it will be stored in the database.
c. The stored message will be processed by using NLP in order to recognize the context of the question.
d. The information searching is processed based on the users' message and the contexts of the message or question.
e. Engine Python will respond by providing answer or information to the user

The working principle and relationship of some basic AIML blocks with the addition of multi parameters can be explained in the input design in tables 4 to 7 and the flowchart in **Fig. 2**.

3.2 Design Input of Chatbot

Chatbot is designed to respond to a variety of messages sent by the users. The variety designed consist of descriptions regarding a ceremonial day, ceremonial day/ *dewasa ayu* without parameter and with multi-parameter searched, and ceremonial days/ *dewasa ayu*(s) asked in a message.

The first pattern is to ask for a description or information regarding a ceremonial day. It is presented in **Table 5**.

Table 5. Pattern of Ceremonial/Red-letter Day Description

Pattern	Example
Question word + ceremonial/red-letter day	Apa itu galungan?
	Kamu tau apa itu Nyepi?
	Deskripsikan tentang hari raya nyepi
	Tolong berikan deskripsi tentang hari raya Saraswati

Users are also able to search or find out a ceremonial day or good day in running certain activities as presented in **Table 6**.

Table 6. Pattern of Searching *Dewasa Ayu*/ Ceremonial Day without Parameter

Pattern	Example
Question word of time + ceremonial/red-letter day	Kapan nyepi?
	Kamu tau kapan hari raya galungan?
	Carikan saya hari raya kuningan dong!
ceremonial/red-letter day + question word of time	Galungan tanggal berapa?
	Hari siwalatri kapan ya?
	Apa kamu tahu, hari raya pagerwesi kapan?

A parameter can modify the ceremonial day or good day searching process. This parameter includes *ekawara, dwiwara, triwara, caturwara, pancawara, sadwara, saptawara, astawara, sangawara, dasawara, wuku,* months, and years as presented in **Table 7**.

Table 7. Pattern of Searching Dewasa Ayu/Hari Raya with Parameter

Pattern	Example
Question word of time + ceremonial/red-letter day + paremeter	Tanggal berapa galungan tahun 2020?
	Kapan hari baik untuk menikah tahun 2021 bulan november hari senin atau selasa?
	Carikan saya hari purnama saat kajeng kliwon!
parameter + ceremonial/red-letter day + question word of time	tahun 2021 nyepinya kapan?
	Bulan desember 2020, hari baik untuk ngaben kapan ya?
	Tahun 2020 yang bukan kliwon kapan saja hari purnamanya?
ceremonial/red-letter day + parameter + question word of time	Purnama kadasa kapan ya?
	Hari baik untuk menikah pada sasih kadasa tahun 2022 hari jumat tanggal berapa?
	Dewasa untuk menebang pohon wuku Sinta kapan ya?
parameter + question word of time + ceremonial/red-letter day	Tahun 2021 kapan siwalatri?
	Bulan Januari bukan hari Senin kapan dewasa ayu untuk membangun rumah?
	Hari senin, selasa, atau rabu tanggal berapa hari baik untuk menikah?

Users can find out more than one ceremonial day/ dewasa ayu with its parameter via message while the searching process as presented in **Table 8**.

Table 8. Pattern of Multi Ceremonial Days/ *Dewasa Ayu* Searching

Pattern	Example
Question word of time + ceremonial/red-letter day (1) + paremeter (1) + ceremonial/red-letter day (2) + paremeter (2) + ceremonial/red-letter day (n) + paremeter (n)	kapan galungan tahun 2020, tumpek landep bulan juni, dewasa menikah hari jumat?
	Tanggal berapa dewasa membangun rumah bulan januari hari senin, hari baik menikah tahun 2020, dan hari raya kuningan?
ceremonial/red-letter day (1) + paremeter (1) + ceremonial/red-letter day (2) + paremeter (2) + ceremonial/red-letter day (n) + paremeter (n) + question word of time	galungan tahun 2020, tumpek landep bulan juni, dewasa menikah hari jumat, kapan?
	dewasa membangun rumah bulan januari hari senin, hari baik menikah tahun 2020, dan hari raya kuningan, tanggal berapa?

3.3 Message Processing

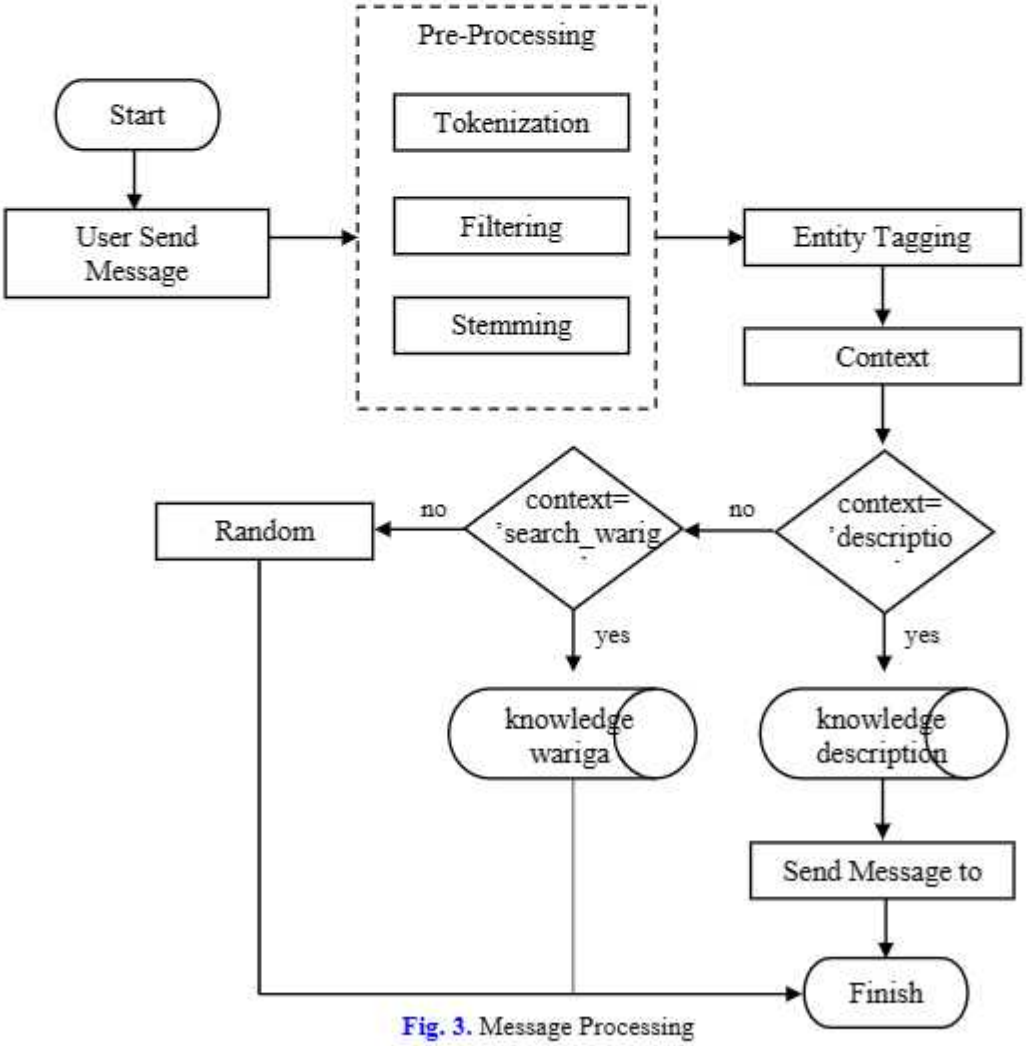

Fig. 3. Message Processing

Fig. 3 represents the messages processing run by the engine python. The pre-processing will be previously running; it involves tokenization, filtering, and stemming. The tokenization process will process the password into word part known as a token. Filtering which uses the wordlist method will recognize the important parts or words of the token such as *wuku, wewaran, ceremonial day, sasih,* and others. The stemming process will process the word to be a root word by omitting suffixes containing algorithm of Nazief and Adriani. Each word then will be labeled (tag) in order to identify the context of a message.

If the contexts take the form of description, data will be taken from the table of description in the database. If the context is considered as ceremonial day/ *dewasa ayu* searching result, data will be taken from the table of a calendar with its additional parameter. If the context of the message is unknown, there will be a random message "Mohon maaf, saya tidak mengerti" or "Sorry, I don't understand".

Results and Analysis

3.4 Chatbot Interface

Chatbot is designed with instant messaging Telegram. The users can start interacting with the bot after adding bot to their contact with username @info_wariga_bot. **Fig. 4** presents the bot searching process that has been running.

Fig. 4. Bot Searching

In order to get access in communicating with a bot, the Telegram users can process the searching by inputting the username of the bot in the application of search bar. The users can start communicating after clicking "start interface pesan". The bot can provide information regarding the ceremonial day/ *dewasa ayu* asked by the users as presented in **Fig. 5.**

Fig. 5. Chatbot Interface

The users will interact with bot by this interface, in which the users will send and receive messages. Chatbot will reply to the message based on the pattern determined.

3.5 Testing Scenario

10 respondents will take part in the test, those are chosen from society who use this Balinese Calendar. Each respondent will get chances to ask 5 questions for each category including ceremonial day description, ceremonial day/ *dewasa ayu* searching without parameter, ceremonial day/ *dewasa ayu* searching with parameter, and multi ceremonial day/ *dewasa ayu* searching. Each user is asked to make questions for each pattern as explained in **Tables 4** to **7** according to the language habits of each respondent. Because respondents are selected from various education classes that reflect variations in potential real users in the field, therefore, the resulting combination of questions is expected to represent the opportunities for questions that can arise in daily practice. The result of the test recapitulation is presented in **Table 9**.

Table 9. Recapitulation of The Testing

Nama Responden	Pattern I		Pattern II		Pattern III		Pattern IV	
	c	i	c	i	c	i	c	i
Responden 1	5	0	5	0	5	0	3	2
Responden 2	5	0	4	1	5	0	4	1
Responden 3	5	0	5	0	4	1	5	0
Responden 4	4	1	3	2	4	1	5	0
Responden 5	5	0	5	0	5	0	1	4
Responden 6	5	0	5	0	5	0	5	0
Responden 7	5	0	5	0	5	0	5	0

Responden 8	5	0	5	0	5	0	5	0
Responden 9	5	0	5	0	5	0	4	1
Responden 10	5	0	4	1	5	0	5	0

Table 9 shows the recapitulation of the chatbot. There are some mistakes found in the responses of the chatbot in each pattern. There is 1 mistake in patter I. There are 4 mistakes in pattern II. There are 2 mistakes in pattern III. There are 8 mistakes in pattern IV. The result of the recapitulation is presented in a bar graph in **Fig. 6**.

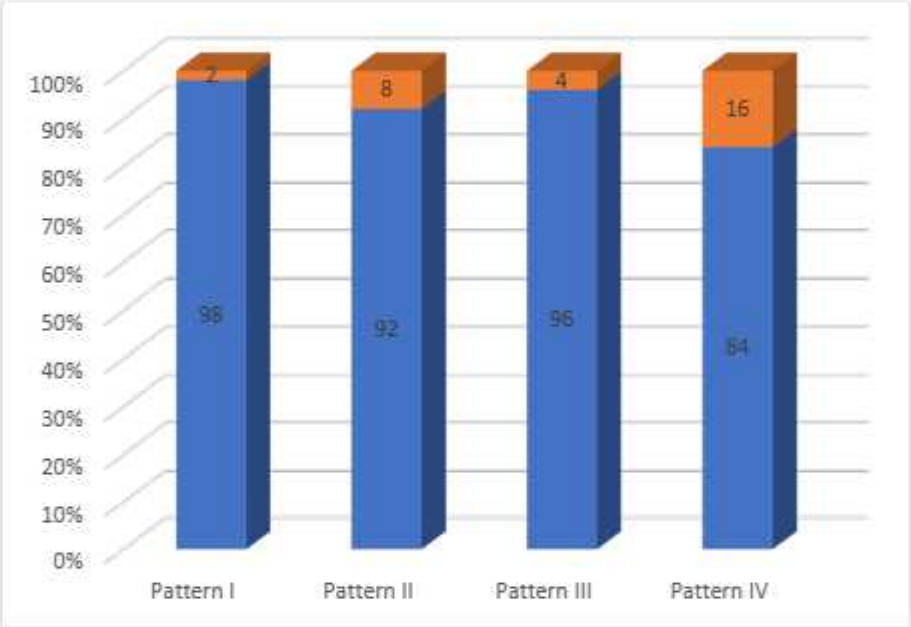

Fig. 6. Chart of the Testing

Each pattern in chatbot has been tested. In descriptive pattern, it is found 98% correct answers from 50 questions. In the pattern of the ceremonial day searching without parameter, there are 92 % correct answers from 50 questions. In the pattern of ceremonial searching with parameter, there are 96% correct answers from 50 questions. In multi ceremonial days/ *dewasa ayu* searching there are 84% correct answers from 50 questions. If averaged on each pattern, 92.5% of the answers from the bot are correct.

3.6 Response Error on Chatbot

There are several causes that cause the chatbot not to respond correctly. The first cause is specific description questions, for example asking what god is worshiped at the ceremony. The next cause is an unknown ceremonial day. The third cause is an unspecified time statement, such as next month, next two years, etc. The next cause is to ask how many days to the ceremony. The next cause is to ask the month of the ceremony. The last cause is an abbreviation of a word.

Table 10. Response Error on Chatbot

Cause	Example
Specific description questions	a. Apa makna memotong babi dan ayam pada hari penampahan galungan? b. Dewa apa yang dipuja pada hari raya saraswati?
Unknown ceremonial days	a. Kapan dilaksanakannya hari raya Tawur Agung? b. Kapan diadakannya mecaru?
Unspecified time statement	a. Kapan galungan 2 tahun lagi? b. Kapan purnama bulan depan?
How many days to ceremony	a. Berapa hari lagi hari raya purnama?
Asking the month of ceremony	a. Bulan apa galungan?
Abbreviation	a. Kpn galungan? b. Tgl brp galungan tahun 2020?

Solutions that can be offered for the first cause is add a specific knowledge base of a ceremonial days. Likewise the cause of the second error is by completing the knowledge base of the ceremonial days. Solutions for the third, fourth and fifth problems is create a new pattern to handle the message. The last problem for abbreviations can be to use the N-Gram algorithm.

3.7 Comparison with the N-Gram Algorithm

The engine that was created will be compared with the N-Gram algorithm. The test is done in description pattern (I). The result of the test is presented in **Table 11**.

Table 11. Testing on N-Gram Algorithm

Messages	Threshold		
	0.1	0.5	0.7
Apa itu Galungan?	correct	correct	incorrect
Kamu tau apa itu hari raya galungan?	correct	incorrect	incorrect
Tolong berikan deskripsi mengenai hari raya galungan?	correct	incorrect	incorrect
Jelaskan pada saya tentang hari raya galungan?	correct	incorrect	incorrect

Beri tahu aku deskripsi hari raya galungan dong!	correct	incorrect	incorrect
Tolong berikan pengertian mengenai hari raya galungan	correct	incorrect	incorrect
Deskripsikan tentang hari raya galungan	correct	incorrect	incorrect
Tolong deskripsikan apa sih hari raya nyepi itu?	correct	incorrect	incorrect
Berikan deskripsi tentang hari raya nyepi dong!	correct	incorrect	incorrect
Segera berikan saya deskripsi mengenai apa itu hari raya nyepi	correct	incorrect	incorrect

The result of the test using NGram algorithm are 100% on threshold 0.1, 10% on threshold 0.5, dan 0% on threshold 0.7. This value is smaller than using the AIML method with multi parameters. This method also has drawbacks that require many patterns so it will be difficult to do a multi-parameter search.

5. Conclusion

Chatbot that is designed in Telegram instant messaging uses the method of Natural Language Processing; it can provide information regarding the ceremonial day and *dewasa ayu* based on Balinese Calendar. AIML with NLP method becomes a good choice when the users send dynamic message. NLP supports the development of the chatbot in terms of receiving multi parameters input in ceremonial days/*dewasa ayu* such as *ekawara, dwiwara, triwara, caturwara, pancawara, sadwara, saptawara, astawara, sangawara, dasawara, wuku*, months, and years.

The addition of several matching parameters to the NLP algorithm enables the recognition capabilities of AIML to support pattern recognition with various criteria that can be determined dynamically according to needs. Of the 50 questions tested in each pattern, an average percentage of success was obtained at 92.5%. Further research is needed to enable the discovery of answers according to the user's wishes when AIML produces many options for 1 pattern.

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