



Semantic-Based Chatbot Application Development to Improve Online Store User Service

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Abstract. The use of chatbot applications as virtual customer service can help potential online store visitors before making transactions due to time constraints in serving customers, ordinary humans cannot answer questions or serve customer requests at any time. Prospective visitors can communicate with the seller about the product to be purchased with virtual customer service. This technology is very supportive to answer various types of questions or problems faced by customers quickly and accurately. Chatbot application developed through A.L.I.C.E (Artificial Internet Linguistic Computer Agency) knowledge based on AIML (Artificial Intelligence Markup Language) equipped with artificial intelligence using a semantic-based ontology. The online shop chatbot application used in this research is batik cloth that sells Malang batik products because the demand for batik from Malang is very high and there are no online stores that provide services by utilizing virtual customer service (chatbot). The development of a chatbot equipped with semantics uses an ontology to process questions that have a more specific meaning, obtaining an accuracy of about 92% from 15 types of relevant questions and answers, then 10 questions answered according to frequently asked questions developed by potential buyers. The use of semantics using ontologies in virtual customer service applications (chatbots) helps in answering questions that have the same word or meaning so as to produce answers that match the question.

Keywords: Online store · Visitors · Artificial intelligence · Ontology · Semantic

1 Introduction

Semantic-based chatbot applications are computer programs based on Artificial Intelligence or artificial intelligence using the semantic web that can simulate conversations or chats with other users, such as humans through conversation applications. This technology is known as a digital assistant that can understand and process questions from potential online shop buyers, and provide relevant answers quickly. Semantic-based chatbot applications are often described as one of the sophisticated expressions of interaction between humans and machines using semantic ontologies. An online store is a medium in digital form to sell goods or services electronically via the internet so that sellers and buyers do not meet in person. So it takes customer service that is ready at any time to serve potential buyers.

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Online stores currently demand changes in sales models to improve services to prospective buyers, such as the use of virtual customer service applications to meet service needs at online stores, where customers get information on goods to be purchased through online shop chatbot services. Customers still ask about the products they want to buy in online stores, such as prices, models, motifs, materials, sizes and quality of goods. Online stores require customer service that is equipped with a semantic web in order to assist customers in finding information on the goods they want to buy so as to provide convenience to potential buyers. To be able to serve all potential buyers at an online store, a semantic-based virtual customer service application is needed so that the answers from the chatbot application are relevant to the questions of potential buyers. The semantic web using ontology is a technology where this question will be processed first to understand if the intent of the question has a broad meaning so that it produces answers that are relevant to the question. Therefore we need a virtual customer service that is equipped with a semantic web to answer questions from potential buyers to improve services at online stores.

In this study, a prototype customer service application based on a semantic web-based virtual customer service was developed which is a technology that can answer questions by providing answers from A.L.I.C.E. database. Knowledge of chatbot applications equipped with semantic web using ontologies provides answers that are more relevant because they can understand the intent of questions written by potential buyers in online stores. a chatbot that can understand prospective buyers' questions in the form of text and voice so that a conversation will be created between potential buyers and Virtual Customer Service equipped with Semantics using Ontology based on answers stored in the database. If the answer from the database is not found, the system will add it by searching for new knowledge from a predetermined website and then adding a new answer to the chatbot database.

In the previous research [1] entitled Use Of Chatbot On Online Store Website as Virtual Customer Service to Improve Sales, the researcher wanted to develop so that the search process becomes more complex where questions from prospective buyers are carried out by means of expanding the meaning using ontology so that the answers generated become more relevant. In previous research, the search process was only based on keywords from potential buyers, if the keywords used were not in the database, the answers were not found. Researchers will develop a chatbot using a semantic web using an ontology, where if there are questions by users that do not match those in the database, the chatbot will look for answers that match the questions, if the answers do not match, they will look for answers from a predetermined website.

Chatbot application equipped with artificial intelligence and the addition of ontology-based semantic web, Ontology is a way to represent knowledge in the information domain that makes it easy for potential buyers to get answers from relevant databases in fast time. In this study, the results of testing the level of accuracy produced were 92% from questions that have similarities and correspondence with chatbot answers. This research is expected to help the manager of a typical Malang batik online shop in providing services to prospective buyers to increase the level of public trust [2].

Chatbot is a computer application that utilizes artificial intelligence and is equipped with an ontology capable of answering questions quickly. Chatbot acts as a virtual

customer service that is integrated into online store services, which can provide benefits for answering questions from potential buyers in choosing the desired product. The use of chatbots in online store services is a demand for the development of information technology because there are many potential buyers who ask about the desired product so that it is not wrong to buy [3].

Alicebot or Alice is a chatterbot is a natural language processing program equipped with artificial intelligence that engages in conversation with humans by applying several pattern matching rules to human questions and in online form so that conversations become easier [4].

Artificial Intelligence Markup Language is an artificial intelligence-based language that is used to determine between relevant questions and answers. AIML is a language used by chatbots equipped with artificial intelligence with the aim of responding to questions and determining answers that have similarities [5, 6].

A web crawler, also known as a web spider, is a computer program used by search engines to index web pages and the content of individual websites. A web crawler is used when a question does not find an answer that matches the question by browsing from a predetermined website and then adding it to the chatbot database. This method is used to add new knowledge so that the answer results from search engines become more relevant. This web crawler technique is the best method for browsing websites and looking for suitable information to then save it as a knowledge database [7].

A typical Malang batik shop is a place to sell Malang batik products that sells products either directly or through online sales, but takes place online. Online stores that provide virtual customer service (chatbots) can help potential buyers if they have problems or need help [8].

Utilization of chatbots that have been added with artificial intelligence to produce answer information that is relevant to questions from potential buyers quickly and accurately. Chatbot applications are very important to answer many questions from potential buyers so as to provide services to all potential buyers who need information.

2 Methods

A virtual customer service application (chatbot) equipped with an ontology-based semantic web is a service on an online store so that potential buyers can get information on the products to be purchased at the typical Malang batik online shop. Chatbot facilities are provided because potential buyers can interact anytime and anywhere regarding the products to be purchased. Thus, potential buyers will be more satisfied with the product of their choice (Fig. 1).

2.1 Data Training

2.1.1 Database

In this study, the training data used are various types of questions that are often asked by prospective buyers of a typical Malang batik online shop. Research parameters are products sold in online stores such as product name or category, price, material and quality of typical Malang batik. The collected question data set is stored in the chatbot database and then adjusted with the relevant answers.

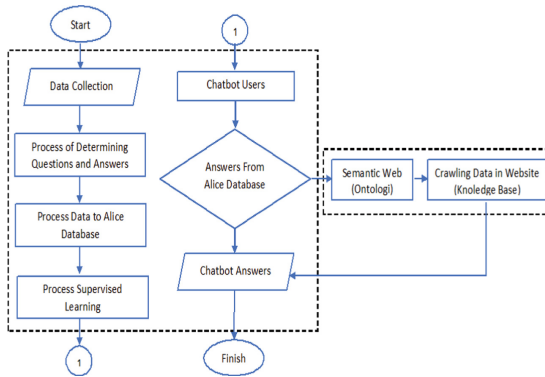


Fig. 1. Flowchart Of Virtual Customer Service (Chatbot) Application With Ontology

2.1.2 Information Source

The data set used in this study comes from a website that has been determined to obtain information that is used to answer questions. The parameters needed are about the products sold in online stores, including: batik cloth, typical Malang batik and types of batik, because around the Malang batik online shop there is no one that provides virtual customer service (chatbot) while there are quite a lot of potential buyers [9].

2.2 Test Data

At this stage is the process of collecting data that is used to conduct research that is used for knowledge databases in virtual customer service applications. Questions are carried out as basic knowledge in AIML, the process is to divide sentences into sub-sentences that can be processed, word equations, meaning expansion, spelling and grammar correction text question [10].

2.3 The Process of Adjusting Questions and Answers

The stage for adjusting the relevant questions and answers is a continuation of the previous process. At this stage, the selection of appropriate or relevant question sentences and answers in the database will be carried out before the process of expanding the semantic meaning using ontology is carried out.

2.4 Stages in ALICE on the Chatbot Database

Processing data from questions and answers into a chatbot application. The next process is adjusted first with the aim that it can be adapted to the knowledge database that is in accordance with the AIML standard, then the meaning expansion process is carried out so that the answers are relevant to the questions using the ontology [11].

2.5 Questions from Users

At this stage, testing is carried out on the chatbot as a virtual customer service with a number of inputs in the form of questions from users, namely prospective online shop buyers, then processed the questions with words that have a broader meaning and then adjustments are made to the answers that already exist in the database.

2.6 Answer Results from Virtual Customer Service

At this stage, input variations of questions from chatbot users are used to obtain answers and for a database of new knowledge obtained from the learning model process from chatbots from various types of questions from previous users, then the process of expanding meaning using ontology is carried out. to get the most relevant answer choices.

2.7 Semantic Search (Ontology)

Searches that consider various possibilities, including contexts that have similar meanings, intentions, word variations, synonyms, more general and specific questions, are searched in the ontology.

2.8 Expansion of Meaning to Increase Knowledge on Chatbot

If the entered question does not get a relevant answer in the ALICE database, a meaning expansion process will be carried out using an ontology then perform an automatic data search, perform a crawler on the specified website and add new knowledge [12].

3 Results and Discussion

The results of the research conducted from the system development model platform as a communication medium, in this case a virtual customer service chatbot at an online shop that sells batik typical of Malang. The stages of the research carried out began with the implementation, discussion and testing of chatbots testing to measure the level of accuracy of success. The stages of system development are as follows.

3.1 ALICE Database Structure

The chatbot application database structure is the structure and data storage area that is used as knowledge in the chatbot application, which includes a predefined set of questions and answers. The structure of the chatbot engine is as in Fig. 2.

The chatbot application database structure is used to store predefined questions and answers. This database is used as a basis for chatbots to answer questions from prospective online shop buyers.

3.2 Define a Keyword Pattern

See Table 1.



Fig. 2. ALICE database structure.

Table 1. Keyword Pattern Malang Batik

No	Pattern	Hatpattern	Template	Topic	Rekomendasi
1	batik khas malang		Batik gantring khas malang		Batik khas malang
2	_batik khas malang		<srail> batik khas malang </srail>		
3	batik khas malang *		<srail> batik khas malang </srail>		
4	batik khas malang *		<srail> batik khas malang </srail>		

```

PREFIX chatbot:
http://www.semanticweb.org/chatbot/ontologies/2021/5/batik-ontology-malang#
PREFIX rdf: <http://www.w3.org/2021/06/22-rdf-syntax-ns#>
PREFIX owl: <http://www.w3.org/2021/06/owl#>
PREFIX xsd: <http://www.w3.org/2021/XMLSchema#>
PREFIX rdfs: <http://www.w3.org/2021/01/rdf-schema#>;
SELECT ?subject
WHERE {
    ?subject rdfs:subClassOf ta:".$.subject.".
}
    
```

Fig. 3. Query process SPARQL.

3.3 Query Process SPARQL

SPARQL is a query that is used to perform searches in the ontology. The SPARQL design is used to limit which data will be searched so that the search does not widen and can produce relevant data. Figure 3 is the SPARQL design used in the search process.

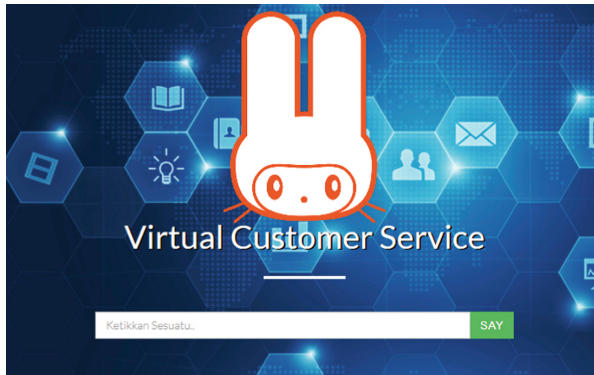


Fig. 4. Interface design virtual customer service.

```
function crawl($url) {  
    // start inialisasi curl dan setting curl  
  
    $ch = curl_init();  
    curl_setopt($ch, CURLOPT_SSL_VERIFYHOST, 0);  
    curl_setopt($ch, CURLOPT_SSL_VERIFYPEER, 0);  
    curl_setopt($ch, CURLOPT_FOLLOWLOCATION, 0);  
    curl_setopt($ch, CURLOPT_RETURNTRANSFER, 1);  
    curl_setopt($ch, CURLOPT_URL, $url);  
    // settingan ini bisa beda, ada yang diubah ada yang d  
    // end inialisasi curl dan setting curl  
  
    $proses_curl = curl_exec($ch); // melakukan curl  
    curl_close($ch); // menutup proses curl  
  
    $html = str_get_html($proses_curl); // str_get_html()
```

Fig. 5. CURL process.

3.4 Implementation of the Virtual Customer Service Application Interface Design

A virtual customer service application interface that will connect users in terms of prospective online shop buyers with a chatbot application as a medium for communicating. The virtual customer service interface can receive questions from online store users and provide relevant answers to users. Display chatbot applications equipped with ontologies (Fig. 4).

3.5 Web Crawling Process to Add New Knowledge

The web crawling process is a method for browsing data on websites to obtain information to be used for adding new knowledge to virtual customer service applications. Use cURL to crawl the specified website (Fig. 5).

```

require_once('simple_html_dom.php');

function crawl($url) {

    $ch = curl_init();
    curl_setopt($ch, CURLOPT_SSL_VERIFHOST, 0);
    curl_setopt($ch, CURLOPT_SSL_VERIFYPEER, 0);
    curl_setopt($ch, CURLOPT_FOLLOWLOCATION, 0);
    curl_setopt($ch, CURLOPT_RETURNTRANSFER, 1);
    curl_setopt($ch, CURLOPT_URL, $url);

    $proses_curl = curl_exec($ch); // melakukan curl
    curl_close($ch); // menutup proses curl

    $html = str_get_html($proses_curl);

    $ambil_produk = $html->find('.product-grid-item');
    $produk = array();
    foreach ($ambil_produk as $list_kategori) {
        $nama_produk = $list_kategori->find('.product-title a', 0)->plaintext;
        $url_produk = $list_kategori->find('.product-title a', 0)->href;
        $foto_produk = $list_kategori->find('img', 0)->getAttribute('src');
        $produk[] = array('nama_produk' => $nama_produk, 'url' => $url_produk, 'foto' => $foto_produk);
    }

    return $produk;
}

```

Fig. 6. Program to browse Websites.

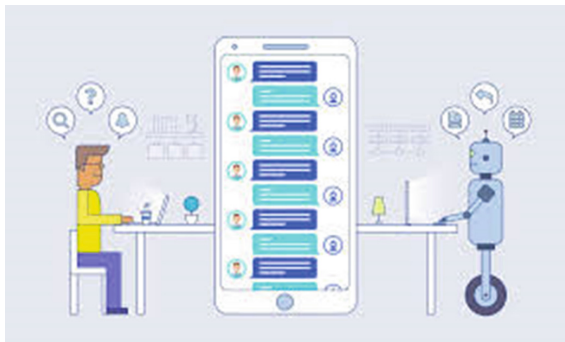


Fig. 7. Web artificial intelligence-based chatbot application

Then browse from the site or website you want to retrieve data to add new knowledge. To browse data from a website, you need the Simple HTML DOM library to read and pull data. The program to process web crawling data is as in Fig. 6 and 7.

3.6 Testing Scenario

The test scenario is a process of testing stages from the beginning to the end so that accurate test result data is obtained (Fig. 8).

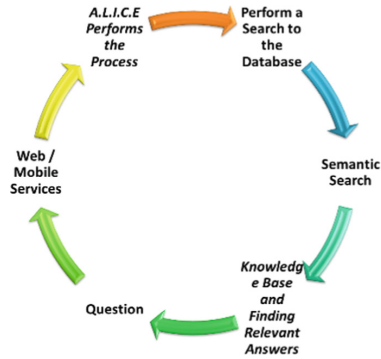


Fig. 8. Testing scenario.

3.7 Validation Testing

The validation testing process is needed to show the results of the comparison of the results of the response responses given by the virtual customer services application with the responses given by the user regarding the topic of questions about typical Malang batik (Table 2).

1. The topic of the typical Malang batik character is between questions from online shop users and the responses from the answers given by the virtual customer service application.
2. The results of the response from the answers given by the virtual customer service application

The tests that have been carried out conclude that the chatbot application with web semantics is good because the answers are relevant to the question. However, there is still a chance that the question does not find the answer in the virtual customer service application database because it does not match the keywords entered.

3.8 Precision Testing

Precision Test Results to measure the accuracy or suitability of virtual customer service applications as a result of answers to relevant questions. Tested using 15 variations of keywords using the ontology that has been made (Table 3).

The tests that have been carried out in Table 2 show that the web-based semantic virtual customer service application uses an ontology at a typical Malang batik online shop. From the questions entered, it shows that the results of a good answer are close to a perfect score or are relevant to the answers given. The test is carried out using 15 types of keywords that have an average precision value of 92%.

Table 2. Validation of testing results from expert

No	Keyword	Expected Response	Results Evaluation
1	Motif batik malang	1. Motif Bunga Teratai 2. Motif Tugu Malang 3. Motif Rumbai Singa 4. Motif Sulur-sulur 5. Motif Mahkota	Corresponding
2	Motif Batik malangan	1. Motif Hias Tumbuh-tumbuhan/Flora 2. Motif Hias Manusia 3. Motif Binatang/Fauna 4. Motif Benda Alam 5. (Motif sapu ular) 6. Motif Sosial (Motif Kembang Api)	Corresponding
4	Warna apa saja yang digunakan	1. Merah 2. Jingga 3. Kuning-jingga 4. Kuning 5. Kuning-hijau 6. Hijau 7. Hijau-biru 8. Biru 9. Biru-ungu 10. Ungu 11. Merah-ungu 12. Coklat 13. Abu-abu 14. Putih 15. Hitam	Corresponding
5	Apa saja karakter batik malang	1. Batik Singosasi 2. Batik Celaket 3. Batik Druju	Corresponding
6	Apa saja motif batik singosari	1. Motif Pending 2. Motif Parijoto 3. Motif Padma 4. Motif Renggo 5. Motif Candi Singosari 6. Motif Langsep 6. Motif Kendedes.	Corresponding
7	Apa saja motif batik celaket	1. Motif rambut singa 2. Motif tugu yang melambangkan semangat perjuangan. 3. Motif batik Celaket didominasi motif flora berwarna ceria sebagai simbol Malang kota bunga.	Corresponding

(continued)

Table 2. (continued)

No	Keyword	Expected Response	Results Evaluation
8	Apa saja motif batik Druju	<ol style="list-style-type: none"> 1. Motif bunga bamboo 2. Mawar pupus 3. Motif garis 4. Anggur 5. Motif kerrang 6. Motif bola-bola 7. Motif pulau sempu 8. lainnya 	Corresponding
9	Bagaimana proses produksi batik malang	<ol style="list-style-type: none"> 1. Mencanting 2. Menyolet 3. Nembok 4. Pewarnaan 5. Pencelupan 6. Pelorodan 	Corresponding
10	Apa saja model batik malang	<ol style="list-style-type: none"> 1. Baju Wanita 2. Baju Pria 3. Baju anak - anak 	Corresponding

Table 3. Precision test results on chatbot

No	Keyword	The results obtained are relevant	Total results obtained	Precision (%)
1	Baju	89	89	100
2	Motif Batik	28	30	93
3	Warna	12	12	100
4	Ukuran	16	18	88
5	Model Batik	16	19	84
6	Motif Singosari	6	6	100
7	Motif Celaket	27	27	100
8	Motif Druju	3	3	100
9	Karakter Batik	22	22	100
10	Proses Produksi	23	24	95
11	Modek Batik	17	18	94
12	Janis Batik	6	6	100
13	Ukuran Batik	22	24	92
14	Variasi Batik	21	21	100
15	Bahan Batik	9	11	82
Average				92

4 Conclusions

Web-based semantic chatbot applications use ontologies to find answers to virtual customer service applications according to user questions. The chatbot application will search for data on the website and add new knowledge if the desired question is not found. The Chatbot application for various types of questions about products sold at the typical Malang batik online shop produces relevant answers with an average precision value of 92% of the 15 types of keywords tested and declared appropriate for 10 questions with correct answers. It is hoped that a virtual customer service (Chatbot) equipped with an ontology can provide the right answer to potential buyers in online stores.

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