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# PRODAMAS chatbot: Aflask and support vector machine based implementation

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## ABSTRACT

*In accelerated and equitable development in the Kediri City, the Kediri City Government launched the Community Empowerment Program called Prodamas. Prodamas aims to develop and encourage community participation in development at the Neighbourhood Level. To increase the dissemination of information about Prodamas, digital technology can be used as an information service provider. One of them is Chatbot. To develop Chatbots, Natural Language Processing, which is a branch of Artificial Intelligence, has become the most frequently used computer program. This Prodamas chatbot development uses the pattern matching method as an answer search algorithm and Support Vector Machine (SVM) classification as a method to see the machine's level of accuracy in answering questions given by users. Furthermore, the chatbot will be connected to WhatsApp so that it is expected to be able to provide and provide information about Prodamas. The results of testing the chatbot response with new questions provide an accuracy of 79%. Then testing the classification of the new question text with SVM. Obtained an accuracy of 88% with a precision value of 91% and a recall of 88%.*

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## INTRODUCTION

Kediri, the third-largest city in East Java, is a modest yet prosperous metropolis with enormous potential across the board. In order to spur economic development, the Kediri City Government has been steadily upgrading the city's infrastructure (Pemerintah Kota Kediri, 2018). According to C.B.S. data, Kediri's city economy grew faster than the country's overall economy between 2016

and 2019 (Badan Pusat Statistika Kota Kediri, 2020).

The Community Empowerment Program is an initiative of the Kediri City Government aimed at promoting rapid and equitable growth in the Kediri City neighborhood (Prodamas). Aiming to foster and stimulate community participation in development, Pro-damas (also known as the 50 million per RT program) was established. Community

feedback was gathered through online forums in each RT, and those ideas were used to shape the final product. After that, the money will be put to good use improving physical and social infrastructure. Kediri's municipal government has decided to take action in 2019 to maximize the benefits of Prodamas by launching Prodamas Plus, a program with a budget of Rp100 billion (\$1 million) that focuses on improving the city's infrastructure, culture, economy, health care, and youth opportunities (Pemerintah Kota Kediri, 2020).

There has been a recent surge in digital activity, which some have labeled a disruptive era. Being prepared for the technical advances of the future requires, in a roundabout way, that people today be adept at using electronic gadgets. To realize good governance, or the administration of government that is effective, efficient, transparent, and responsible, the City of Kediri is among those prepared to deal with technological advancements by creating a technologically-based integrated service system (Dinas Komunikasi dan Informatika Kota Kediri, 2022).

There are a wide variety of situations that call for someone to be technologically inventive. The government can benefit from digital technology in the realm of public services in areas where engagement with the public is required. PricewaterhouseCoopers (PwC) published a paper titled Future of Government, in which they claimed that the government has improved public services with the use of digital technology and is able to adapt and develop to suit the demands of the people. In addition, digital technology provides new ways for people to collaborate on the development of approaches, designs, and the provision of services that address local needs (Pricewaterhouse Coopers, 2013). The employment of chatbots is an example of

how technology can be applied to government work.

A chatbot, sometimes known as a chatterbot, is a type of computer program that mimics human conversation by providing predetermined responses to user-entered keywords. Natural language processing is commonly used in the development of chatbot technology (NLP). Natural language processing (NLP) is a subfield of AI concerned with translating between human and computer speech. This allows websites or chat apps like WhatsApp, Line, Telegram, and others to implement chatbots that may simulate human conversations in a natural way through text, voice, or both (Adamopoulou & Moussiades, 2020; Al Maksur & Muhajir, 2021; Juhn & Liu, 2020).

The Kediri City Prodamas WhatsApp bot is an example of how natural language processing (NLP) technology is being put to use. WhatsApp is the most widely used messaging service in Indonesia right now. WhatsApp's average monthly usage in Indonesia in 2021 was 31.4 hours, as reported by the Kepios and We Are Social reports in January 2022 (Data Reportal, 2022).

When the WhatsApp bot code is complete, it will be put to the test to see if it can actually do its intended job of responding to users' inquiries. categorization is one of the outcomes of natural language processing. Predictions can be made based on the characteristics of a predefined data class using a classification approach. Classification is utilized to evaluate the chatbot's response quality in this example.

Support Vector Machine is a popular tool for analyzing and categorizing textual information especially on WhatsApp bot implementations because it has several advantages including Good class separation, Good performance with unstructured data, Overfitting tolerance, Support for high-dimensional feature spaces, and Computational efficiency

(Dharwadkar & Neeta, 2018; Niranjan et al., 2019; Tjiptomongsoguno et al., 2020).

The goal of this research was to develop a chatbot system for the Prodamas programming language that could be used with the popular messaging app WhatsApp. You can use the bot to learn more about Kediri and Prodamas. In addition to its primary function, the chatbot serves as a suggestion box for bettering the city of Kediri's Prodmas implementation. The purpose of this chatbot is to help users learn more about Prodamas and the City of Kediri by facilitating conversation and providing answers to their queries; while it cannot fully replace a human, it is hoped that it will be very helpful in these regards.

**METHOD**

**Dataset**

This study has two datasets. Secondary data about Kediri and Prodamas is the first dataset. The 2020 Kediri City Government documents and Kediri Mayor Regulation on Prodamas technical implementation provided the data. The City of Kediri and Prodamas Plus websites provide additional information. The City of Kediri's official website, <https://www.kedirikota.go.id/>, provided further data. The second dataset is primary data: user-submitted queries concerning Kediri and Prodamas obtained by researchers when testing system replies. In this study, the first data is used

to develop a chatbot as a reference or database for the chatbot system, and the second data is utilized to test the chatbot's question-answering abilities.

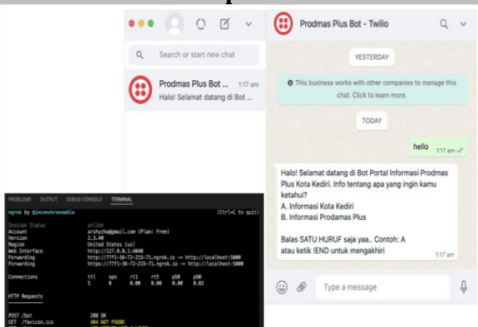
**Chatbot System Description**



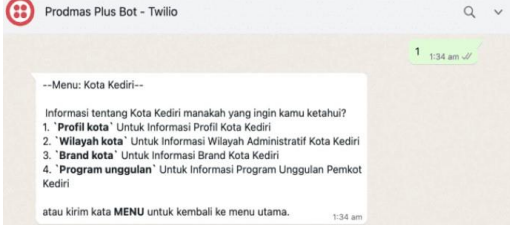
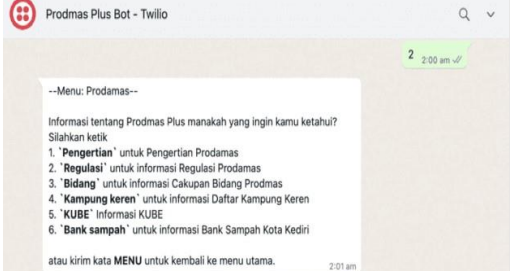
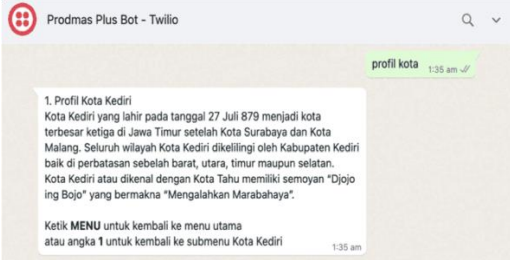


Natural Language Processing is used in the chatbot design, along with the string matching approach, which will be implemented by the WhatsApp platform. A string matching algorithm compares two strings in search of a match. The matching process is carried out by the string matching algorithm using a string that is similar to the input string or a writing error occurs, namely the string that is matched for the degree of arrangement similarity different characters which the strings share (Ng et al., 2020; Paul et al., 2019; Qaffas, 2019).


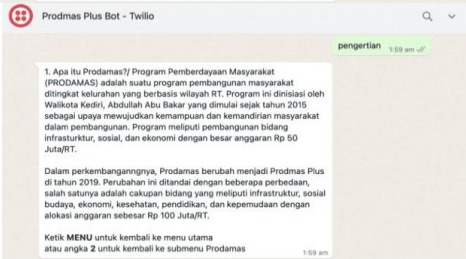





This chatbot system was designed to make it simpler for the public to learn about Prodamas and the City of Kediri (Daniel et al., 2020). In the chatbot, there are two primary menus: City of Kediri and Prodmas. There is a sub-menu in this menu that includes the necessary information. In this scenario, chatbots are used to provide information about the meaning, laws, fields, and other aspects of Prodamas.

The acquired data is used to create a chatbot system as well as a knowledge base. Table 1 is a description of the information contained in the knowledge base:

**Table 1. Chatbot Knowledge Base**

No	Input	Response
1	'hello'	

No	Input	Response
2	'menu'	 <p>Prodmass Plus Bot - Twilio</p> <p>menu 1:34 am ✓</p> <p>--MENU UTAMA--</p> <p>Informasi apa nih yang ingin kamu ketahui? Silahkan ketik angka</p> <ol style="list-style-type: none"> <li>1. Untuk Informasi Kota Kediri</li> <li>2. Untuk Informasi Prodmass Plus</li> </ol> <p>Pilih salah satu ANGKA saja yaa.. Contoh: 1 atau ketik !END untuk mengakhiri 1:34 am</p>
3	'!END'	 <p>Prodmass Plus Bot - Twilio</p> <p>tend 2:00 am ✓</p> <p>Prodmass Plus - Beranda prodmassdev.kediri.kota.go.id</p> <p>Terima kasih telah mengakses chatbot Prodmass Plus Kota Kediri! Untuk tahu lebih lanjut tentang Prodmass Plus, silakan akses <a href="https://prodmassdev.kediri.kota.go.id">https://prodmassdev.kediri.kota.go.id</a> Untuk ikuti perkembangannya, follow Instagram <a href="https://www.instagram.com/prodmassplus/">https://www.instagram.com/prodmassplus/</a></p> <p>2:00 am</p>
4	'1'	 <p>Prodmass Plus Bot - Twilio</p> <p>1 1:34 am ✓</p> <p>--Menu: Kota Kediri--</p> <p>Informasi tentang Kota Kediri manakah yang ingin kamu ketahui?</p> <ol style="list-style-type: none"> <li>1. "Profil kota" Untuk Informasi Profil Kota Kediri</li> <li>2. "Wilayah kota" Untuk Informasi Wilayah Administratif Kota Kediri</li> <li>3. "Brand kota" Untuk Informasi Brand Kota Kediri</li> <li>4. "Program unggulan" Untuk Informasi Program Unggulan Pemkot Kediri</li> </ol> <p>atau kirim kata MENU untuk kembali ke menu utama. 1:34 am</p>
5	'2'	 <p>Prodmass Plus Bot - Twilio</p> <p>2 2:00 am ✓</p> <p>--Menu: Prodmass--</p> <p>Informasi tentang Prodmass Plus manakah yang ingin kamu ketahui? Silahkan ketik</p> <ol style="list-style-type: none"> <li>1. "Pergertian" untuk Pergertian Prodmass</li> <li>2. "Regulasi" untuk informasi Regulasi Prodmass</li> <li>3. "Bidang" untuk informasi Cakupan Bidang Prodmass</li> <li>4. "Kampung keren" untuk informasi Daftar Kampung Keren</li> <li>5. "KUBE" Informasi KUBE</li> <li>6. "Bank sampah" untuk informasi Bank Sampah Kota Kediri</li> </ol> <p>atau kirim kata MENU untuk kembali ke menu utama. 2:01 am</p>
6	'profil kota'	 <p>Prodmass Plus Bot - Twilio</p> <p>profil kota 1:35 am ✓</p> <p>1. Profil Kota Kediri Kota Kediri yang lahir pada tanggal 27 Juli 879 menjadi kota terbesar ketiga di Jawa Timur setelah Kota Surabaya dan Kota Malang. Seluruh wilayah Kota Kediri dikelilingi oleh Kabupaten Kediri baik di perbatasan sebelah barat, utara, timur maupun selatan. Kota Kediri atau dikenal dengan Kota Tahu memiliki semboyan "Djojo ing Bojo" yang bermakna "Mengalahkan Marabahaya".</p> <p>Ketik MENU untuk kembali ke menu utama atau angka 1 untuk kembali ke submenu Kota Kediri 1:35 am</p>
7	'wilayah kota'	 <p>Prodmass Plus Bot - Twilio</p> <p>wilayah kota 1:35 am ✓</p> <p>2. Wilayah Administratif Kota Kediri Kota Kediri memiliki luas sebesar 63.404 km2 terdiri dari 3 kecamatan dan 46 kelurahan.</p> <ol style="list-style-type: none"> <li>Kecamatan Mojojoto: 14 kelurahan, 100 RW, dan 486 RT</li> <li>Kecamatan Kota: 17 kelurahan, 101 RW, dan 489 RT</li> <li>Kecamatan Pesantren: 15 kelurahan, 129 RW, 496 RT</li> </ol> <p>Ketik MENU untuk kembali ke menu utama atau angka 1 untuk kembali ke submenu Kota Kediri 1:35 am</p>
8	'brand kota'	 <p>Prodmass Plus Bot - Twilio</p> <p>brand kota 1:35 am ✓</p> <p>3. Brand Kota Kediri Pada 2016, Walikota Kediri Abdullah Abu bakar mengenalkan brand kota kediri sebagai "Harmoni Kediri The Service City" Brand ini menegaskan bahwa Kota Kediri merupakan Kota Pelayanan dan juga sebagai Kota Jasa dan Perdagangan.</p> <p>Ketik MENU untuk kembali ke menu utama atau angka 1 untuk kembali ke submenu Kota Kediri 1:35 am</p>

No	Input	Response
9	'program unggulan'	 <p>4. Program Unggulan Pemerintah Kota Kediri Untuk mendukung percepatan pertumbuhan di bidang ekonomi, sosial, Pendidikan, kesehatan, dan bidang lainnya, Pemerintah Kota Kediri meluncurkan 10 program yang menjadi Program Unggulan Wali Kota Kediri:</p> <ol style="list-style-type: none"> <li>i. Prodamas Plus</li> <li>ii. Service City Card (Kartu Melayani)</li> <li>iii. Open and Clean Government</li> <li>iv. Asuransi Kesehatan Universal (UHC)</li> <li>v. Home Care Kondisi Darurat, Lansia, dan Balita</li> <li>vi. Pendidikan Gratis Dan Berkualitas</li> <li>vii. Pengembangan Usaha Milik Rw (Koperasi Rwi)</li> <li>viii. Pencapaian 15.000 Wirausaha Baru</li> <li>ix. 1 Kelurahan 1 RTH</li> <li>x. Kampung Keren (Kreatif dan Independen)</li> </ol> <p>Ketik MENU untuk kembali ke menu utama atau angka 1 untuk kembali ke submenu Kota Kediri</p>
10	'pengertian'	 <p>1. Apa itu Prodamas? Program Pemberdayaan Masyarakat (PRODAMAS) adalah suatu program pembangunan masyarakat tingkat kelurahan yang berbasis wilayah RT. Program ini diinisiasi oleh Walikota Kediri, Abdulah Abu Bakar yang dimulai sejak tahun 2015 sebagai upaya mewujudkan kemampuan dan kemandirian masyarakat dalam pembangunan. Program meliputi pembangunan bidang infrastruktur, sosial, dan ekonomi dengan besar anggaran Rp 50 Juta/RT.</p> <p>Dalam perkembangannya, Prodamas berubah menjadi Prodamas Plus di tahun 2019. Perubahan ini ditandai dengan beberapa perbedaan, salah satunya adalah cakupan bidang yang meliputi infrastruktur, sosial budaya, ekonomi, kesehatan, pendidikan, dan kepemudaan dengan alokasi anggaran sebesar Rp 100 Juta/RT.</p> <p>Ketik MENU untuk kembali ke menu utama atau angka 2 untuk kembali ke submenu Prodamas</p>
11	'regulasi'	 <p>2. Regulasi Prodamas Hal-hal yang mengatur Prodamas telah tercantum dalam Perwali dan telah mengalami beberapa kali perubahan. Untuk Prodamas Plus 2021, pelaksanaan program diatur dalam Peraturan Walikota Kediri Nomor 32 Tahun 2021 tentang Pedoman Teknis Program Pemberdayaan Masyarakat Plus Tahun Anggaran 2022. Apabila ingin melihat pedoman teknis pelaksanaan Prodamas tahun-tahun sebelumnya dapat mengunjungi laman <a href="https://prodmasdev.kedirkota.go.id/tenant">https://prodmasdev.kedirkota.go.id/tenant</a>.</p> <p>Ketik IMENU untuk kembali ke menu utama atau angka 2 untuk kembali ke submenu Prodamas</p>
12	'bidang'	 <p>3. Cakupan Bidang Prodamas Prodamas Plus mencakup 6 bidang, yaitu:</p> <ol style="list-style-type: none"> <li>i. Ekonomi</li> <li>ii. Sosial Budaya</li> <li>iii. Kesehatan</li> <li>iv. Pendidikan</li> <li>v. Kepemudaan</li> <li>vi. Infrastruktur</li> </ol> <p>Ketik MENU untuk kembali ke menu utama atau angka 2 untuk kembali ke submenu Prodamas</p>
13	'kampung keren'	 <p>4. Daftar Kampung Keren Kampung Keren Prodamas merupakan salah satu program unggulan Wali Kota Kediri. Program ini memicu tumbuhnya kreativitas dan kemandirian masyarakat di Kota Kediri untuk memunculkan karakteristik kawasan, keunikan, budaya, keterampilan dan peningkatan potensi ekonomi di kelurahannya. Saat ini ada 10 Kampung Keren di Kota Kediri, yaitu:</p> <ol style="list-style-type: none"> <li>i. Kampung Harmoni Beta (Ikan Cupang)</li> <li>ii. Kampung Herbal</li> <li>iii. Kampung Heritage</li> <li>iv. Kampung Pecut</li> <li>v. Kampung Seni</li> <li>vi. Kampung Tahu</li> <li>vii. Kampung Wisata Kuliner (Winer)</li> <li>viii. Kampung Tenun Ikat</li> <li>ix. Kampung Wisata Air Sumber Banteng</li> <li>x. Kampung Tani</li> </ol> <p>Ketik MENU untuk kembali ke menu utama atau angka 2 untuk kembali ke submenu Prodamas</p>
14	'kube'	 <p>5. Informasi KUBE KUBE atau Kelompok Usaha Bersama merupakan program Pemkot Kediri untuk memberdayakan kelompok masyarakat di tingkat RT dalam upaya realisasi Prodamas.</p> <p>Untuk melihat persebaran KUBE di Kota Kediri, kamu bisa mengunjungi laman <a href="https://prodmasdev.kedirkota.go.id/peta">https://prodmasdev.kedirkota.go.id/peta</a></p> <p>Ketik MENU untuk kembali ke menu utama atau angka 2 untuk kembali ke submenu Prodamas</p>
15	'bank sampah'	 <p>6. Informasi Bank Sampah Kota Kediri Hingga saat ini, sudah tersebar 23 bank sampah di Kecamatan Mojoarjo, 18 bank sampah di Kecamatan Pesantren, 30 bank sampah di Kecamatan Kota, 15 bank sampah di sekolah, dan 5 bank sampah di pasar Kota Kediri.</p> <p>Pada tahun 2022 dua bank sampah Kota Kediri, Dewi Sekartaji dan Hijau Daun, sudah berbasis digital. Kamu dapat memantau data sampah secara real time dan menggunakan layanan digital bank sampah melalui website dan aplikasi.</p> <p>Kamu dapat memantau laporan setoran sampah dan harga jual sampah melalui website <a href="https://prodmasdev.kedirkota.go.id/banksampah">https://prodmasdev.kedirkota.go.id/banksampah</a>, Aplikasi E-Bank Sampah Kota Kediri dapat diunduh di Google Playstore atau tekan link berikut <a href="https://play.google.com/store/apps/details?id=com.ebanksampah.kedirkot...">https://play.google.com/store/apps/details?id=com.ebanksampah.kedirkot...</a> Read more</p>

### Chatbot System Diagram

The system is divided into three major components: input, input processing, and output. Users can initiate a discussion with the chatbot by saying 'hi' to it. The input will then be evaluated and searched for patterns that fit the chatbot's

knowledge base. If the algorithm has discovered the correct pattern, the bot will seek replies from that input (Oguntosin & Olomo, 2021). The bot will then react with the proper answer after the solution has been located, chatbot system flow can be seen in Figure 1.

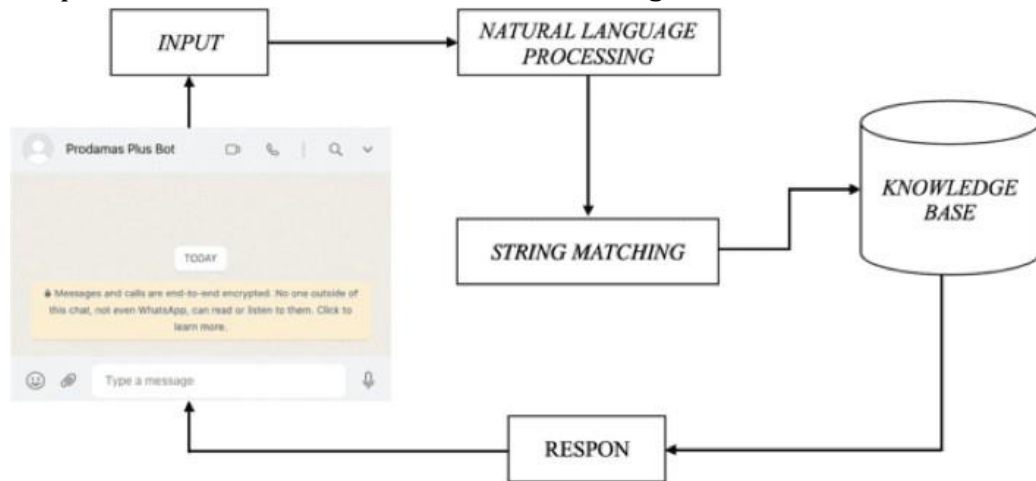


Figure 1. Chatbot system flow

### Support Vector Machine

Support Vector Machine (SVM) is a classification analysis that classifies using a field separator (hyperplane). Any hyperplane in a space of dimension  $p-1$  will also have dimension  $p-1$ . A wide range of hyperplanes can be generated via SVM. The most distinguishing field with the greatest margin is the one to use (maximal margin hyperplane). The margin is the average distance detected between the training data and the Hyperplane. The closest observations to the hyperplane are referred to as support vectors (Cervantes et al., 2020; Saraswati & Indradewi, 2022; Styawati et al., 2022).

Using kernel functions, SVM can be adapted to work with non-linear text data. To put it simply, the kernel is a function that transforms data features from their original (lower) dimensions to higher features (even much higher). This method deviates from the standard classification procedure by avoiding the reduction of the starting dimension in favor of a more straightforward computational process and improved prediction accuracy (Gowthul Alam & Baulkani, 2019; Wang et al., 2021). Here's

an illustration for  $n$  data samples:  $((\phi(x_1), y_1); (\phi(x_2), y_2); \dots; (\phi(x_n), y_n))$  dot product of two vectors  $(x_i)$  and  $(x_j)$  are denoted as  $\phi(x_i) \phi(x_t)$ . Without knowing the transformation function  $phi$ , the dot product value can be computed using the components of the two vectors in the origin dimensional space, as shown in Equation (1) (Dewi & Chen, 2019; Ghosh et al., 2019).

$$K(x_i, x_t) = \phi(x_i) \phi(x_t) \quad (1)$$

$K(x_i, x_t)$  is a kernel function with a non-linear mapping in feature space. The following are the dataset predictions using the newly developed features, as shown in Equation (2):

$$\begin{aligned} f(\phi(x)) &= \text{sign}(w \cdot \phi(x_t) + b) \\ &= \text{sign} \left( \sum_{i=1}^{ns} \alpha_1 y_i \phi(x_i) \phi(x_t) + b \right) \\ &= \text{sign} \left( \sum_{i=1}^{ns} \alpha_1 y_i K(x_i, x_t) + b \right) \quad (2) \end{aligned}$$

With:

$ns$  = The amount of data that is a support vector

$x_i$  = Support Vector

$x_t$  = Predicted Testing data

The algorithm for PRODAMAS WhatsAppbot using Flask and Support Vector Machine (SVM) can be seen in Figure 2.

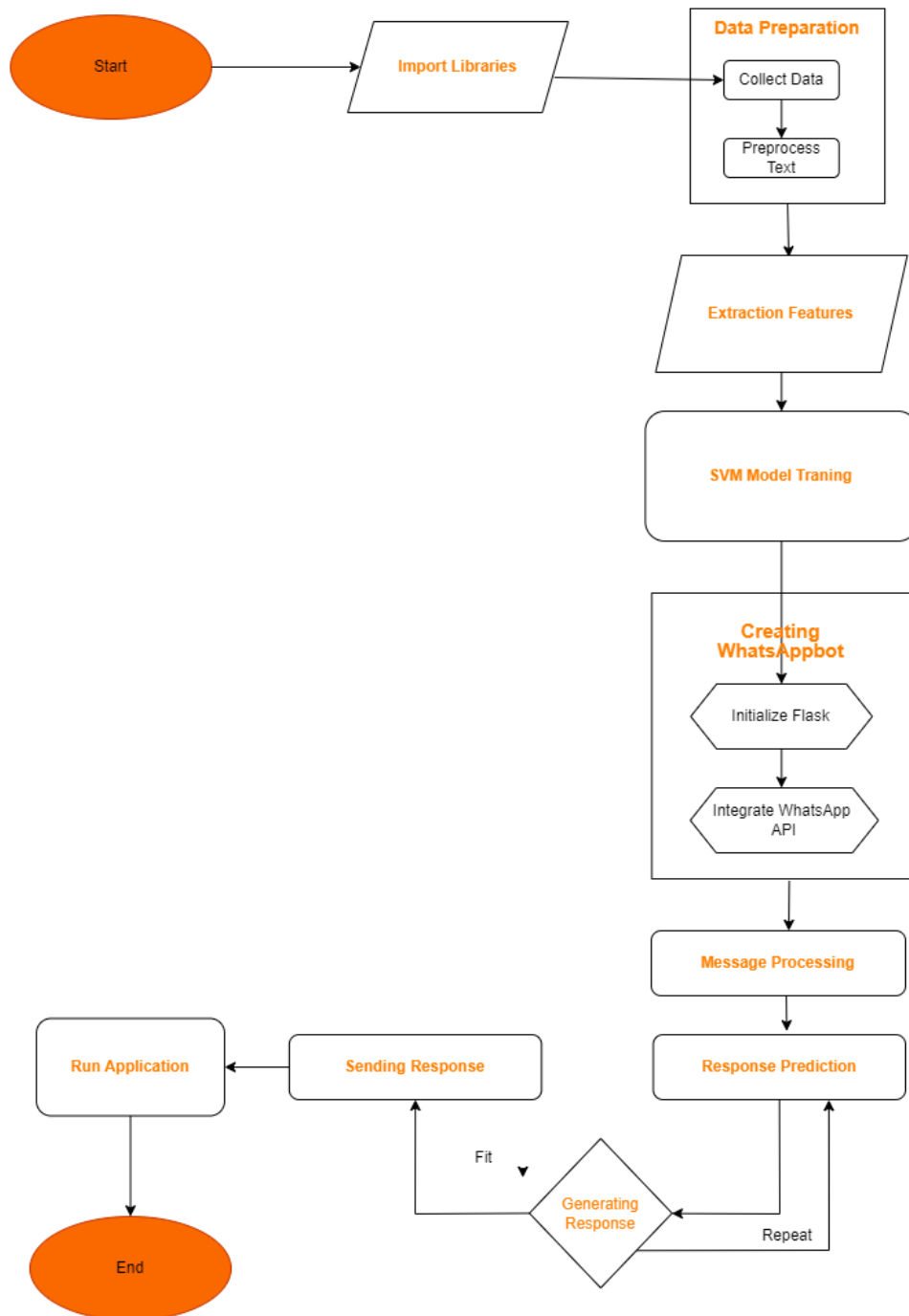


Figure 2. The Algorithm PRODAMAS WhatsAppbot

## RESULTS AND DISCUSSION

### Chatbot System Implementation

This chatbot program works as a machine that answers WhatsApp user questions about Prodamas and the City of Kediri. The source code snippet in Figure 3 is used to create a chatbot program in

Python that is connected to Flask, Twilio, and Ngrok for receiving, processing, and replying to WhatsApp messages.

```

1 from flask import Flask, request
2 import requests
3 from twilio.twiml.messaging_response import MessagingResponse
4
5 # Init Flask App
6 app = Flask(__name__)
7
8 @app.route('/bot', methods=['POST'])
9 def bot():
10     # GET user message
11     user_msg = request.values.get('Body', '').lower()
12     # Init bot response
13     bot_resp= MessagingResponse()
14     msg = bot_resp.message()
15     # Applying bot logic
16     if 'hello' in user_msg:
17         msg.body("Halo! Selamat datang di Bot Portal Informasi Prodamas")
18     elif 'menu' in user_msg:
19         msg.body("—MENU UTAMA— An yoInformasi apa nih yang ingin ka

```

Figure 3. Source code snippet

WhatsApp bot application features two primary menus, City of Kediri and Prodamas, which will develop into lessons or modules. There is a specific section devoted to Kediri and Prodamas in each menu. Table 2 provides an overview of the available menus and their associated information.

Table 2. List of Chatbot Menus and Sub-menus

Menu	Sub-Menu	Description
KEDIRI	Profil Kota	Provides a quick overview of the City of Kediri
	Wilayah Kota	This page contains information about the administrative area of the City of Kediri
	Brand Kota	Providing Kediri with information about municipal branding
	Program Unggulan	Providing information on the leading programs of the Kediri City Government
PRODAMAS	Pengertian	Give some background information on Prodamas
	Regulasi	Provide basic legal information about Prodamas implementation
	Bidang	Prodamas Plus's areas of focus are listed here
	Kampung Keren	Provide information and a list of Kediri's Cool Villages
	KUBE	Give information on KUBE Kediri
	bank Sampah	Give details about the Kediri Garbage E-Bank

### Observing the Reaction Time of a Chatbot System

Functional testing is performed to determine whether the process of operating the Prodamas Plus chatbot system is working properly and capable of providing a suitable answer or reply. Chatbot testing makes use of input that is comparable to knowledge base word input. WhatsApp bot users provided 54 queries. The answers to all 54 exam questions are available at <https://bit.ly/userquestion>.

Based on the results of evaluating the response of the present system, it is clear that the bot is functionally sound since it has been able to receive and reply to messages provided to the system. Of the 54 queries asked by the user, 43 were successfully replied with the information required, while 11 were answered with error warnings. As a result, the achieved accuracy value is 79.76%.

The Prodamas category makes up 56% of the 54 questions. The remaining

44% are in the Kediri category. In other words, there are 30 Prodamas questions and 24 City of Kediri questions. The question's words are visualized using wordcloud in Figure 4. The visualization results show larger words with more words.



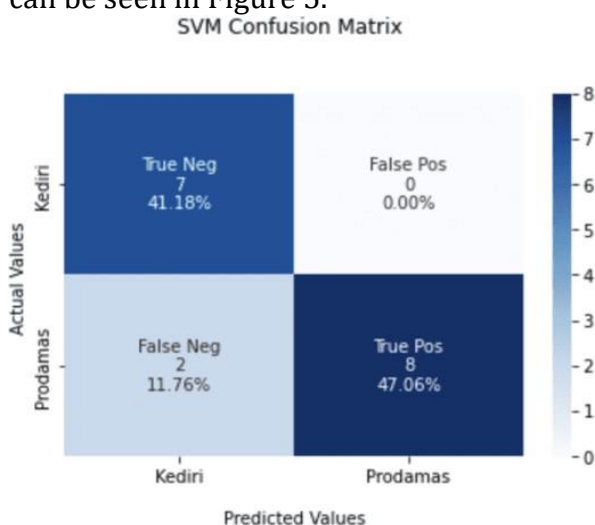
Figure 4. WordCloud visualization

Figure 4 displays the City of Kediri word cloud in blue and the Prodamas question in red. "Program," "City," "Kediri," "Pemkot," "Region," and "Info" occur most commonly in the Kediri category. Prodamas, kediri, kota, kube, village, and cool are common terms in the category.



## Classification

Training and testing data are separated before classification. Data testing tests classification models, while training data studies patterns and builds them. The system randomizes data 70:30. 37 data will be utilized for training, while 17 data will be used for testing. Support Vector Machines classified question texts in this study. The system creates an SVM classification model using identified training data. Predicting testing data will test the model. SVM classification results can be seen in Figure 5.



**Figure 5.** Confusion matrix of svm

The confusion matrix Figure 5. calculations are carried out to determine the accuracy value. An accuracy value of 88.24% was obtained where 7 data predicted as Kediri category questions were classified correctly as Kediri and not Kediri category question data predicted as Prodamas. Then, there are 8 data in the Prodamas category which are correctly predicted as Prodamas and 2 data in the Prodamas category which are predicted to be Kediri.

## CONCLUSIONS AND SUGGESTIONS

The WhatsApp chatbot system including information on Prodamas and the city of Kediri, which employs a string matching algorithm, was successfully developed with the help of sixteen input keywords from the knowledge base. The

chatbot system can receive and answer to questions that are identical to or not identical to those in the knowledge base. The algorithm answered 54 questions with an accuracy of 79.63%. The chatbot program classified user questions with an accuracy of 88.24%, precision of 91%, and recall of 88% based on the Support Vector Machine classification findings.

Researchers can improve the accuracy of SVM in future research by exploring various techniques and approaches. Several studies have proposed methods to improve SVM accuracy, such as feature selection, kernel selection, and parameter optimization. Additionally, combining ensemble techniques such as bagging or boosting with SVM can also result in performance gains.

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