Enhancing Citizen Wellbeing through Interactivity in Semarang Virtual Assistant (SAVIRA)

Justine Hezekiel Ramli[1], Ridwan Sanjaya[2], Bernardinus Harnadi[3]
[1.2.3]Department of Information Systems, Computer Science Faculty,
Soegijapranata Catholic University
Jl. Pawiyatan Luhur IV No.1, Bendan Duwur, Kota Semarang, Jawa Tengah 50234
[1]21n10004@student.unika.ac.id, [2]ridwan@unika.ac.id, [3]bharnadi@unika.ac.id

Abstract— Massive and rapid development in the digital era, has necessity effective and efficient virtual assistant, specially for support daily activities and implement for public services. Established on 2nd may 2024, SAVIRA was launched at the same day of semarang anniversary. The first version of the virtual assistant SAVIRA has little to no interactivity to answer users requests or question. Applying AIML to SAVIRA'S system will help SAVIRA understand and respond to user in a more interactive and relevant. This development hopes to increase the potential abilty of SAVIRA itself towards its interactivity to users. Also supports further development of AI.

Keywords— AIML, AI, chatbot, virtual assistant, WhatsApp

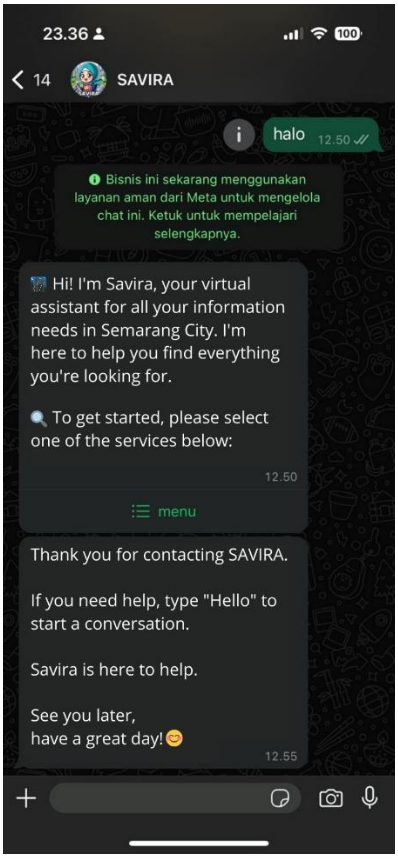
I. INTRODUCTION

In the digital age, technical advancement has been massive and rapid. This innovation has caused changes in many aspects of our lives, including how we communicate, work, and obtain information. Artificial intelligence [1], the Internet of Things (IoT) [2], and big data technologies have all had an impact on several industries, including government services. The application of these technologies may be seen in Semarang, the capital of Central Java province and one of Indonesia's largest cities. Semarang has kept up with the latest advances in information and communication technology. Semarang's city government actively monitors and utilizes technological breakthroughs to improve public service quality. One such technological project is SAVIRA, a virtual assistant [3].

SAVIRA, or Semarang Virtual Assistant, is a WhatsApp-based artificial intelligence [4] chatbot [5] that was built and deployed on May 2, 2024, to help Semarang people access public services. SAVIRA provides menus for obtaining information such as property tax bills, hospital information, health center queues, population services, health worker permissions, and administrative contacts. SAVIRA was first developed to deliver various information about the city of Semarang via WhatsApp. SAVIRA, an artificial intelligence-based chatbot, is a program that uses text to replicate human communication. Chatbot technology is a legitimate use of artificial intelligence. Originally, chatbots could only manage simple interactions, but they have now grown to deliver more useful responses [6].

However, the use of menus in SAVIRA has made WhatsApp conversation less adaptable and dynamic. The introduction of Artificial Intelligence Markup Language (AIML) could significantly increase SAVIRA's ability to respond interactively to citizens' inquiries [7].

By utilizing AIML, SAVIRA will be further developed with the goal of producing a chatbot that will improve residents' experiences by providing more interactive and meaningful responses. SAVIRA in Figure 1 is anticipated to be a full AI technology deployment in public service facilities in this regard, going beyond static menus to immediately provide timely and pertinent information.



halo 12.50

Bisnis ini sekarang menggunakan layanan aman dari Meta untuk mengelola chat ini. Ketuk untuk mempelajari selengkapnya.

Hi! I'm Savira, your virtual assistant for all your information needs in Semarang City. I'm here to help you find everything you're looking for.

🔍 To get started, please select one of the services below:

12.50

Thank you for contacting SAVIRA.

If you need help, type "Hello" to start a conversation.

Savira is here to help.

See you later,
have a great day!😊

12.55

Figure 1. Savira-Virtual Assistant

Well-being has been defined as the combination of feeling good and functioning well; the experience of positive emotions such as happiness and contentment as well as the development of one’s potential, having some control over one’s life, having a sense of purpose, and experiencing positive relationships [8][9].

II. METHOD

AIML is a markup language developed for use in AI-powered chatbot systems. Dr. Richard Wallace first developed AIML for the ALICE (Artificial Linguistic Internet Computer Entity) project in the 1990s [10]. Using a simple yet effective XML structure, this language allows for systematic interactions between chatbots and users.

1) Basic Structure of AIML

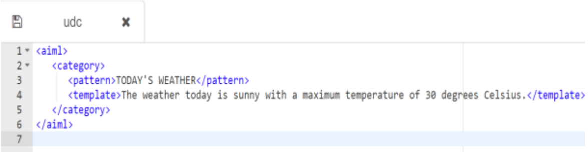
AIML includes fundamental elements like *<aiml>*, *<category>*, *<pattern>*, and *<template>*. These pieces explain how the chatbot understands users input and responds appropriately. The **<*aiml*>** element is the root element that contains the whole AIML category. All AIML code must be contained within the *<aiml>* element. The **<category>** elements are made up of two elements: <pattern> and <template>. This category is the foundation of chatbot knowledge, where input patterns and answer templates are organized. The **<pattern>** element is used to define the type of input that a chatbot will recognize. This is usually made up of keywords or phrases that people use frequently. The **<template>** element is used to specifies the response that will be sent by the chatbot when a correct pattern is identified. This response could be text, a link, or other interactive elements.

2) AIML Capabilities for increasing Interactivity

AIML enhances chatbots by enabling them to provide more interactive and relevant responses through various capabilities. Chatbots can recognize and respond to diverse user input patterns, such as common questions, information requests, or specific commands. AIML also allows for the creation of dynamic responses using variables and conditionals, tailoring replies to the discussion context or individual user information. Additionally, AIML's ability to manage contextual conversations ensures that chatbots deliver more consistent and pertinent responses by referencing previous interactions.

3) Example of AIML Implementation

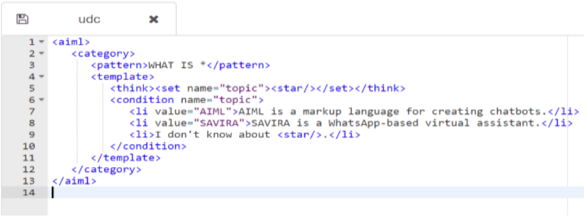
Implementing AIML in the construction of a chatbot like SAVIRA includes many important technical steps first thing first is Creating AIML Categories Each AIML category is formed by defining the necessary patterns and templates. To answer a weather query, the AIML category is defined as shown in Figure 2.



```
<aiml>
   <category>
      <pattern>TODAY'S WEATHER</pattern>
      <template>The weather today is sunny with a maximum temperature of 30 degrees Celsius.</template>
   </category>
</aiml>
```

Figure 2. Defining the Categories in AIML

AIML enables more dynamic responses through the use of variables and conditional expressions. For instance, the utilization of the variable to collect user input is shown on Figure 3.



```
<aiml>
   <category>
      <pattern>WHAT IS *</pattern>
      <template>
         <think><set name="topic"><star/></set></think>
         <condition name="topic">
            <li value="AIML">AIML is a markup language for creating chatbots.</li>
            <li value="SAVIRA">SAVIRA is a WhatsApp-based virtual assistant.</li>
            <li>I don't know about <star/>.</li>
         </condition>
      </template>
   </category>
</aiml>
```

Figure 3. The Variables and Conditional expressions

4) AIML's Advantages and Challenges

AIML features a basic and easy-to-learn framework, which makes it easier for developers to construct and manage chatbot interaction patterns. AIML may be integrated with a wide range of platforms and computer languages, giving it a high degree of implementation freedom.

As the number of patterns and templates grows, maintenance and scalability may become difficult. Developers must ensure that the AIML structure remains orderly and manageable. Limitations in Dynamic replies: While AIML allows variables and conditionals, developing highly dynamic and contextual replies frequently necessitates integration with machine learning techniques or more complicated AI algorithms. With a solid understanding of AIML and its applications, SAVIRA can be transformed into a more dynamic and responsive chatbot, resulting in a better user experience and effective support for public services.

Table 1............

Font Size	Appearance (in Time New Roman or Times)		
	Regular	Bold	Italic
10	table caption (in Caps), figure caption, reference item		reference item (partial)
12	author email address, cell in a table	abstract body	abstract heading (also in Bold)

III. RESULTS AND DISCUSSION

In this section, we'll go over how we built SAVIRA with AIML and integrated it with Fonnte's WhatsApp API service [11]. The primary goal is to improve SAVIRA's interactivity and reactivity when offering public services to Semarang citizens.

1) Technical Architecture Overview

To further understand how SAVIRA was created, it is essential to consider its technological architecture composed of various fundamental elements. The AIML engine is responsible for analyzing and matching user input patterns with appropriate AIML categories. This engine uses predefined rules to process user input and provide relevant responses, equipped with learning capabilities that allow for continual improvement and adjustment of answers based on ongoing user interactions[12].

Fonnte's WhatsApp API service in Figure 4 connects the chatbot to the WhatsApp platform. SAVIRA can utilize this API to receive and send messages via WhatsApp, allowing users to communicate with SAVIRA directly. This API service also includes features like media delivery (pictures, videos, etc.), message tracking, and interaction with other WhatsApp services, all of which increase the chatbot's flexibility and functionality[13][14].

Figure 4. Fonnte WhatsApp API service

2) Enhancing Citizen Wellbeing

The implementation of AIML allows SAVIRA to respond to numerous user requests faster and more relevantly, increasing the efficiency of public service delivery and improving the user experience. SAVIRA's integration into the WhatsApp platform allows residents to access public information and services at any time and from any location, offering greater accessibility, even for those who may struggle to access services directly. AIML's capacity to manage contextual discussions enables SAVIRA to provide more personalized services, allowing individuals to obtain information and support tailored to their specific needs, boosting their sense of control and satisfaction with public services[15][16].

3) SAVIRA Chatbot Development Workflow

To build the SAVIRA chatbot, first gather the necessary requirements. At this point, SAVIRA will determine the public services it will provide and describe common discourse subjects between the public services and the residents of Semarang. The AIML category generation procedure continues with the creation of patterns and answer templates for each detected conversation scenario. AIML elements, including <category>, <pattern>, and <template>, are used to define conversation structures. Following that, AIML code is developed using the established patterns and templates, and testing is performed to ensure that the results are as intended.

The integration with the WhatsApp API is accomplished by registering the SAVIRA application with Fonnte's WhatsApp API service and establishing the API endpoints on the backend server to receive and send WhatsApp messages. All user messages are routed to the AIML engine for processing, with appropriate responses returned to the user via the WhatsApp API. The final stage involves deployment and maintenance. The backend server and database have been installed in the production environment. The chatbot's performance is monitored, and it receives frequent maintenance to update conversation patterns and solve errors.

4) Development Flowchart

The flowchart on Figure 5 illustrates the SAVIRA chatbot development process.

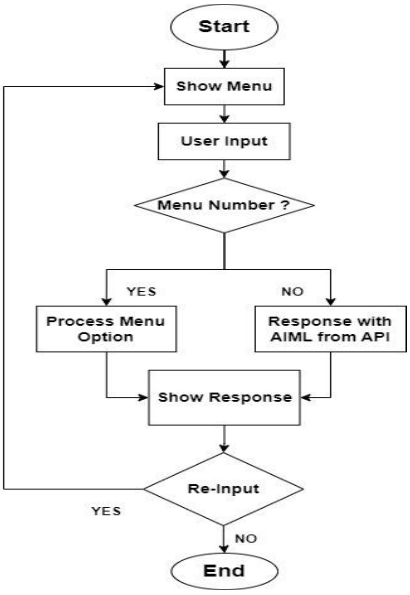


Figure 4. The flow of menus on SAVIRA

5) Case Study

This case study will examine the successful implementation of SAVIRA in the city of Semarang, as well as user feedback and results. We will also go over a few sample user-SAVIRA interactions to demonstrate how AIML has improved responsiveness and interactivity.

IV. IMPLEMENTATION

In this chapter, we will look at the technical procedures involved in developing and implementing SAVIRA using AIML, as well as its interaction with Fonnte's WhatsApp API service. The primary purpose is to increase SAVIRA's interactivity and reactivity when offering public services to Semarang residents.

1) Technical Architecture

To understand how SAVIRA was formed, consider the technological architecture. This architecture is composed of several key elements:

a. *AIML Engine: Analyzes and matches user input patterns to the appropriate AIML categories.*
b. *Fonnte's Whatsapp API Service: Connects the chatbot to the WhatsApp platform, allowing users to engage directly with SAVIRA through WhatsApp messages.*
c. *Database: A data storage system that stores user data, chat patterns, and AIML-based answers.*
d. *Backend Server: Handles Business logic and authentication while also facilitating communication between the AIML engine, the WhatsApp API, and the database.*

2) Development Phases

The initial step is to gather the requirements. At this point, SAVIRA decides the public services it will offer and specifies frequent conversation subjects between the public services and Semarang residents. The process of constructing AIML categories include developing patterns and response templates for each detected conversation scenario. Conversation structures are defined using AIML elements, including <category>, <pattern>, and <template>.

Following the requirement gathering, AIML categories are generated. The technique entails creating patterns and response templates for each detected conversation event. AIML features like <category>, <pattern>, and <template> are used to specify discussion frameworks. These features contribute to the methodical organization of talks, ensuring that the chatbot can efficiently manage a variety of interactions.

Once the patterns and templates have been created, the AIML code is developed and tested. This stage is crucial for ensuring that the chatbot performs as planned. The AIML code must be rigorously constructed to match the discovered patterns and templates, and considerable testing is carried out to ensure the chatbot's responses are accurate and efficient.

The next stage is to integrate with the WhatsApp API. This integration is accomplished by registering the SAVIRA app with Fonnte's WhatsApp API service. Setting up API endpoints on the backend server is also required for receiving and sending WhatsApp messages. This integration enables the chatbot to interact with people over WhatsApp, making it more accessible and user-friendly.

The final phase is deployment and maintenance. This entails deploying the backend server and database in the production environment. Once launched, the chatbot's performance is constantly evaluated to ensure that it runs smoothly. Regular maintenance is carried out to update conversation patterns and correct any mistakes that may develop. This stage is critical to the chatbot's long-term performance and reliability, since it ensures that it is functional and up to date.

3) Development Flowchart

A flowchart of the complete development process for SAVIRA is provided in Figure 6.

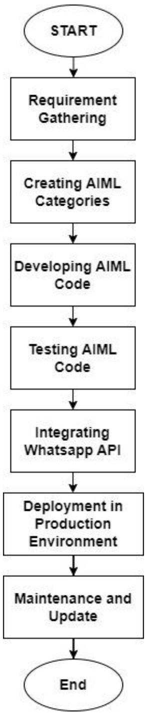


Figure 5. The Final Development of SAVIRA Process

4) Challenges and Solutions

Several issues arose throughout the creation and implementation of SAVIRA and addressing them was critical to ensure the chatbot's operation and user happiness. One key technological problem was ensuring that the AIML engine could correctly comprehend and respond to a variety of user inputs. This necessitated considerable testing and improvement of AIML categories, patterns, and templates. To solve this, the development team devised an iterative testing method that involved constantly altering the AIML code based on test findings to increase accuracy and reliability. Integrating SAVIRA with Fonnte's WhatsApp API presented its own set of issues. Ensuring smooth connection between the AIML engine, the WhatsApp API, and the backend server necessitated thorough setup and configuration.

Maintaining performance and responsiveness became increasingly difficult as the number of users grew. The basic infrastructure needed to be scaled to handle larger loads without sacrificing performance. After the initial deployment, user feedback identified areas for improvement in SAVIRA's answers and interaction flows. Common concerns included misunderstandings of specific inquiries and slower-than-expected responses. This iterative method ensured that SAVIRA kept improving in line with user expectations.

5) Testing

Testing was an important element of SAVIRA's development process to guarantee that the chatbot works as planned and responds accurately to user queries. The system's functioning was validated via black-box testing on Table 1, which did not involve studying its internal code structure. This method focuses on input-output validation, ensuring that the chatbot responds appropriately to a wide range of user inputs.

Table 1. The Result of Blackbox Testing

Test Case ID	Test Scenario	Input	Expected Output	Actual Output	Status
T-01	Greeting Response	“Hello”	"Hello! How can I assist you today?"	"Hello! How can I assist you today?"	Pass
T-02	Inquiry about Health Services	"What health services are available?"	"Semarang offers various health care services including general check-ups, specialist	Semarang offers various health care services including general check-	Pass

Test Case ID	Test Scenario	Input	Expected Output	Actual Output	Status
			consultations, and emergency services."	ups, specialist consultations, and emergency services.	
T-03	General information query	"What is the population of Semarang?	"As of the latest data, the population of Semarang is approximately 1.6 million people."	"As of the latest data, the population of Semarang is approximately 1.6 million people."	Pass
T-04	Feedback and Suggestions	"I have a suggestion to improve park facilities."	"Thank you for your feedback"	"Thank you for your feedback! suggestion."	Pass
T-05	Unrecognized Input	"Tell me a joke.	"I'm here to assist with public services. How can I help you today?"	"I'm here to assist with public services. How can I help you today?"	Pass
T-06	Humanize - Empathy Response	"I'm feeling a bit down today."	"I'm sorry to hear that. If there's anything I can do to help or if you need information on support services, please let me know."	"I'm sorry to hear that. How can I assist you with public services today?"	Pass
T-07	Humanize - Sympathy Response	"I lost my wallet."	"I'm sorry to hear that. I hope you find it soon. Let me know if you need any assistance."	"I'm sorry to hear that. I hope you find it soon. Let me know if you need any assistance."	Pass
T-08	Humanize - Encouragement	"I'm nervous about my exam."	"It's normal to feel nervous, but I'm sure you'll do great. Good luck with your exam!"	"It's normal to feel nervous, but I'm sure you'll do great. Good luck with your exam!"	Pass
T-09	Humanize - Compliment Response	"You are very helpful."	"Thank you! I'm here to assist you with anything you need."	"Thank you! I'm here to assist you with anything you need."	Pass

V. CONCLUSION

AIML was used in the development of the Semarang Virtual Assistant (SAVIRA), which was combined with the Fonnte WhatsApp API service. This shows promise for enhancing citizen well-being and fostering interactivity in Semarang. SAVIRA interprets user inquiries and provides more interactive and pertinent responses by utilizing AIML technology. In addition to increasing the effectiveness of public services, this improvement provides a more pleasurable and rewarding user experience. SAVIRA's enhanced interaction offers significant benefits for citizen well-being, including increased responsiveness, better accessibility, personalized service, and stress reduction. Its ability to respond to requests promptly and effectively increases user experience, while the WhatsApp platform's 24-hour availability makes public services more accessible to a wider audience. AIML enables SAVIRA to provide more relevant and tailored user experiences, allowing seamless and efficient interactions with public services and lowering citizen stress.

SAVIRA's implementation revealed various technical challenges, including ensuring that the AIML engine could accurately comprehend and respond to a diverse variety of user inputs and enabling seamless connection with the WhatsApp API. The development team overcome these challenges via iterative testing and ongoing improvement, guaranteeing that SAVIRA provides dependable and effective service.

Overall, the creation and implementation of SAVIRA demonstrate that AIML-based chatbot technology has enormous promise for improving the quality of public services and citizen well-being. As it is updated and adjusted based on user feedback, SAVIRA is projected to become a more complex and valuable instrument for providing responsive and high-quality public services.

ACKNOWLEDGMENT

This research is the result of the alternative final project (ALTA) at the Department of Information Systems, Faculty of Computer Science, Soegijapranata Catholic University.

REFERENCES

[1] S. A. Oke, “A literature review on artificial intelligence,” *Int. J. Inf. Manag. Sci.*, vol. 19, no. 4, pp. 535–570, 2008, doi: 10.32350/air.11.01.

[2] K. Rose, S. Eldridge, and L. Chapin, “The Internet of Things (IoT): An Overview,” *Int. J. Eng. Res. Appl.*, vol. 5, no. 12, pp. 71–82, 2015, [Online]. Available: https://crsreports.congress.gov

[3] R. Gubareva and R. P. Lopes, “Virtual assistants for learning: A systematic literature review,” *CSEDU 2020 - Proc. 12th Int. Conf. Comput. Support. Educ.*, vol. 1, no. Csedu, pp. 97–103, 2020, doi: 10.5220/0009417600970103.

[4] A. Holzinger, G. Langs, H. Denk, K. Zatloukal, and H. Müller, “Causability and explainability of artificial intelligence in medicine,” *Wiley Interdiscip. Rev. Data Min. Knowl. Discov.*, vol. 9, no. 4, pp. 1–13, 2019, doi: 10.1002/widm.1312.

[5] B. J. Cahn, “CHATBOT : Architecture , Design , & Development,” 2017.

[6] G. Battineni, N. Chintalapudi, and F. Amenta, “AI Chatbot Design during an Epidemic like the,” *Healthcare*, pp. 1–8, 2020.

[7] M. Graças Bruno Marietto *et al.*, “Artificial Intelligence Markup Language: A Brief Tutorial,” *Int. J. Comput. Sci. Eng. Surv.*, vol. 4, no. 3, pp. 1–20, 2013.

[8] M. Fisher, “A theory of public wellbeing,” *BMC Public Health*, vol. 19, no. 1, pp. 1–12, 2019, doi: 10.1186/s12889-019-7626-z.

[9] A. Maccagnan, S. Wren-Lewis, H. Brown, and T. Taylor, “Wellbeing and Society: Towards Quantification of the Co-benefits of Wellbeing,” *Soc. Indic. Res.*, vol. 141, no. 1, pp. 217–243, 2019, doi: 10.1007/s11205-017-1826-7.

[10] B. A. Shawar and E. Atwell, “ALICE chatbot: Trials and outputs,” *Comput. y Sist.*, vol. 19, no. 4, pp. 625–632, 2015, doi: 10.13053/CyS-19-4-2326.

[11] A. Franz, E. Junirianto, and Suswanto, “Web Design and Application Programming Interface (API) Smart Farming Application,” *Tepian*, vol. 2, no. 1, pp. 33–37, 2021, doi: 10.51967/tepian.v2i1.267.

[12] J. Kawijaya, “Penggunaan Artificial Intelligence Markup Language (AIML) Untuk Menganalisa Kesalahan Menulis Bahasa Arab di MTs Bilingual Batu,” *J. Jendela Pendidik.*, vol. 3, no. 03, pp. 352–362, 2023, doi: 10.57008/jjp.v3i03.569.

[13] Y. N. Dalimonthe, A. D. Kalifia, and S. Diwandari, “Pemanfaatan API (Aplication programming Interface) untuk pengembangan sistem pelayanan dinas kependudukan dan pencatatan sipil,” *J. Tek. Inf. dan Komput.*, vol. 6, pp. 760–772, 2023, doi: 10.37600/tekinkom.v6i2.1053.

[14] S. E. E. Profile and S. E. E. Profile, “Mobile instant messaging services in the local governments : citizens ’ uses of the WhatsApp services of the Spanish City Councils,” no. June, 2024, doi: 10.15847/obsOBS18220242366.

[15] P. C. Smith and A. Street, “Measuring the efficiency of public services: The limits of analysis,” *J. R. Stat. Soc. Ser. A Stat. Soc.*, vol. 168, no. 2, pp. 401–417, 2005, doi: 10.1111/j.1467-985X.2005.00355.x.

[16] I. Irsyadinnas, “JPPI (Jurnal Penelitian Pendidikan Indonesia)

Development of the implementation of public information disclosure by regional governments in Indonesia: a systematic literature review Irsyadinnas 1 , Sinta Ningrum 2 , Centurion Chandratama Priyatna-NC-SA li," vol. 9, no. 2, pp. 1091–1103, 2023