
Implementation Of A WhatsApp Chatbot To Automate Population Administration Information Services In Tuntang District, Semarang Regency

Tegar Diyan Sandika¹⁾, Cherlina Helena Purnamasari Panjaitan²⁾, Candra Supriadi³⁾

^{1,2,3)} Department of Informatics, University of Computer Science and Technology Semarang, Indonesia

*Corresponding Author

Email: tegardian74@gmail.com

Abstract

Population administration services at the sub-district level still largely rely on direct interaction between citizens and officers at the sub-district office, creating distance and time barriers for residents who live far from the administrative center merely to inquire about document requirements. This study aims to design and implement an automated WhatsApp chatbot as a means of delivering administrative information in Tuntang Sub-district, Semarang Regency, covering services such as electronic ID cards, Family Cards, Child Identity Cards, Domicile Transfer Letters (internal, incoming, outgoing), and Certificates of Underprivileged Status. The study applies a Research and Development (R&D) approach using the Waterfall development model, using Font as the WhatsApp webhook gateway, Google Apps Script as the backend logic processor through the doPost function, and Google Sheets as the keyword-and-answer database. Testing was conducted using Black-Box Testing on all menus and sub-menus, supported by an analysis of Google Apps Script execution logs to measure system stability and response speed. The results show that all functional scenarios performed as expected, with consistently successful execution status and an average response duration of approximately 2.17 seconds. The study concludes that a chatbot implementation built on free cloud services can serve as an efficient, low-cost, and easily replicable solution for other sub-district government agencies seeking to improve public information accessibility.

Keywords: WhatsApp ChatBot, Google Apps Script, Font, Public Services, Waterfall

INTRODUCTION

Public services at the sub-district level are the spearhead of interaction between the government and the community, particularly in the processing of population administration documents such as electronic Resident Identity Cards (KTP-el), Family Cards (KK), Child Identity Cards (KIA), Moving Letters, and Certificates of Poverty (SKTM). Tuntang Sub-district, Semarang Regency, encompasses a number of villages scattered across hilly terrain and relatively long distances from the sub-district office. This situation means that residents, especially those residing in the most remote villages, must spend considerable time and money just to obtain basic information regarding the requirements and procedures for document processing, before truly knowing whether their files are complete.

This problem is compounded by limited sub-district office hours, while citizen inquiries regarding document requirements are repetitive and can occur at any time, including outside of business hours. As a result, the workload of service officers increases, requiring information that could be answered with standardized answers. Furthermore, WhatsApp has a high penetration rate among Indonesians, including in rural areas, and has become a familiar communication channel for nearly all age groups.

Based on these conditions, a technological solution is needed that can bridge residents' information needs quickly, cheaply, and can be accessed anytime without having to come directly to the sub-district office. WhatsApp-based chatbots are seen as a relevant solution because they utilize a platform that is already widely known by residents, so they do not require additional application installation or special training, as has been proven effective in research on the provision of chatbot-based public service information services at the sub-district level (Safitri & Rosadi, 2021) and in village-level public information service initiatives (Michala et al., 2025). This study addresses the issue of the efficiency of administrative information delivery by designing and implementing an Automatic Public

Service WhatsApp Chatbot system for Tuntang Sub-district, which is built on a combination of Fonte webhook services, Google Apps Script, and Google Sheets as a low-cost yet reliable technology architecture.

The objectives of this research are: (1) to design a WhatsApp chatbot system architecture that is capable of automatically answering citizen questions regarding population administration document requirements; (2) to implement the system using the Waterfall development model so that each development stage is documented and tested systematically; and (3) to test the performance and reliability of the system through functional testing and execution log analysis, so that it can be determined to what extent this system is suitable for sustainable implementation as part of efforts to digitize public services at the sub-district level.

RESEARCH METHODS

This research uses a Research and Development (R&D) approach, a research method used to produce a specific product and test its effectiveness. The software development model used is the Waterfall model, which consists of the stages of requirements analysis, system design, implementation (coding), testing, and maintenance, carried out sequentially and linearly (Anis et al., 2023).

Needs Analysis

At this stage, the information needs of Tuntang District residents regarding administrative services were identified, including the requirements and procedures for processing e-KTP (Electronic ID Card), Family Card, Child ID Card (KIA), Moving Letter (both internally between villages within the district, for incoming and outgoing transfers), and SKTM (Certificate of Residence Certificate). The system's functional requirements were formulated so that the chatbot could recognize keywords typed by residents and provide automatic replies in the form of relevant administrative information.

System Architecture Design

The system architecture is designed by utilizing three main components that are integrated with each other through an Application Programming Interface (API) mechanism. Fonte acts as a webhook gateway that bridges incoming and outgoing WhatsApp messages, as a WhatsApp API gateway service based on WhatsApp Web that provides webhook features and keyword-based auto-replies (Fonte, 2024; Waton et al., 2025). Google Apps Script, through the doPost function, acts as a backend logic processing engine that receives payloads from webhooks, performs keyword matching, and compiles responses. Google Sheets acts as a database that stores pairs of keywords and administrative answers.

The system workflow proceeds as follows: (1) a citizen sends a text message via WhatsApp; (2) the message is received by the Fonte server and forwarded as JSON data to the Google Apps Script Web App URL via a webhook mechanism; (3) the doPost function in Apps Script extracts the sender's number and message content, then matches the text against a list of keywords stored in Google Sheets; (4) if a keyword is found, the system retrieves the corresponding answer text in the same row in the answer column; (5) the answer is then sent back to the citizen via a call to the Fonte messaging API (sendWhatsApp function), so that the citizen receives a reply in the same WhatsApp conversation. The entire process takes place automatically without manual intervention from officers. The flow is illustrated in Figure 1.

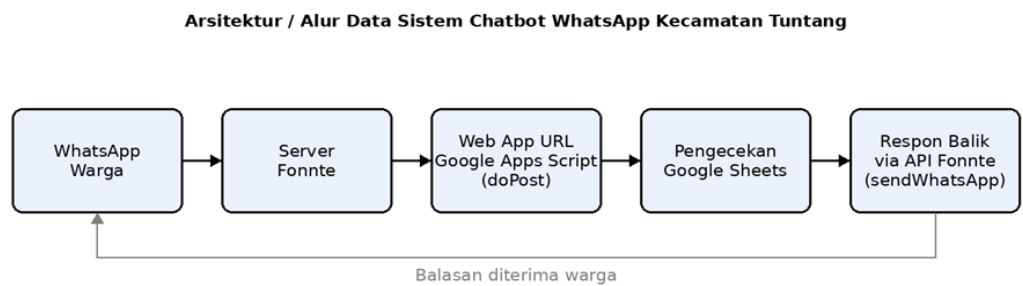


Figure 1. Architecture and Data Flow of the Tuntang District WhatsApp Chatbot System

Implementation

The implementation was done by writing JavaScript code in the Google Apps Script environment. The doPost function handles incoming requests from the Fonnte webhook, parses the payload, and runs keyword search logic using a range read operation in Google Sheets. In its implementation, the doPost function also synchronizes with Fonnte's official default parameters (message, sender, name) and validates the sender's name. If the sender's name is blank or only a phone number, the system automatically replaces it with the generic title "Sedulur Tuntang" to maintain a personalized response. The sendWhatsApp function handles sending replies by calling the Fonnte API endpoint using the Google Apps Script built-in UrlFetchApp method. A screenshot of the Google Apps Script working environment where the code was developed is shown in Figure 2.

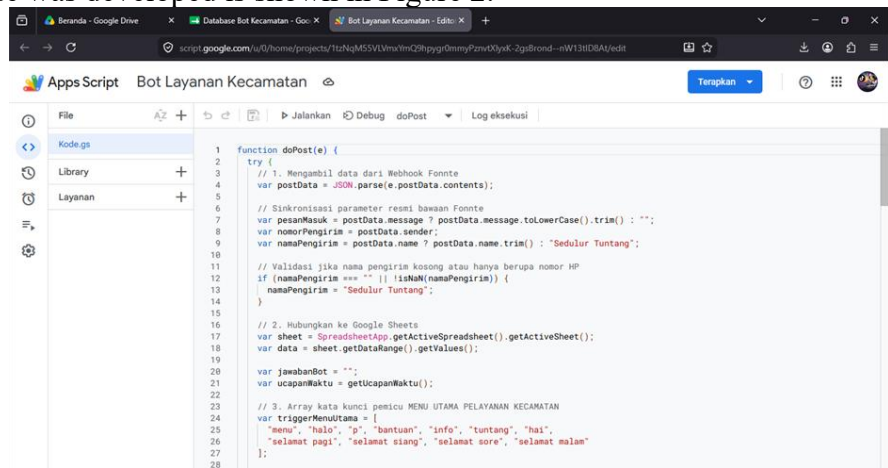


Figure 2. Google Apps Script Working Environment (doPost function)

The database structure in Google Sheets is arranged in two main columns, namely column A containing keywords and column B containing answer text in the form of sub-district administrative service information, as shown in Figure 3. This two-column structure allows sub-district admins to update information content independently through a spreadsheet interface without the need to change the program code.

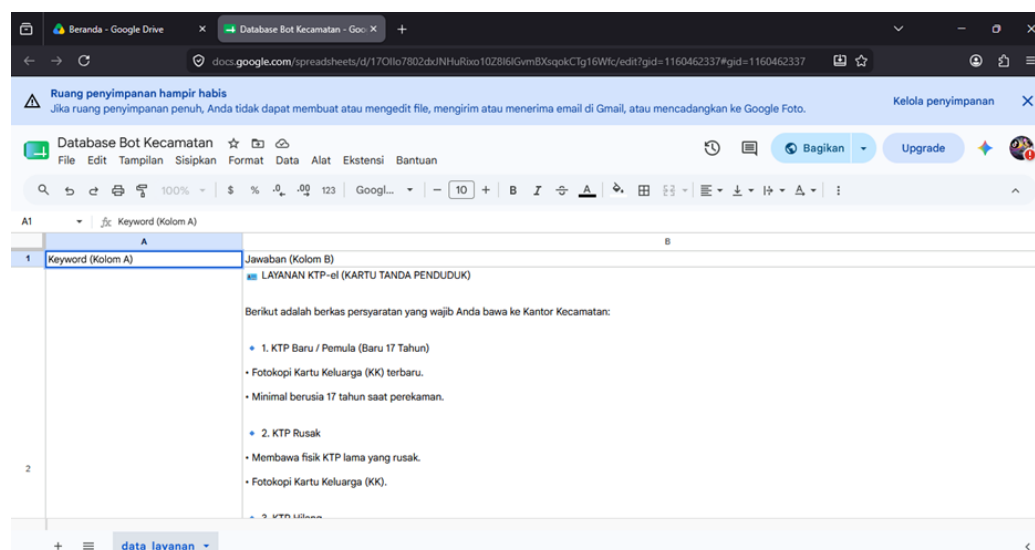


Figure 3. View of the Keyword and Answer Database in Google Sheets

Testing

System testing was conducted using two approaches. First, functional testing used the Black-Box Testing method, which focuses on the system's output to input without examining the underlying code structure. This testing ensured that each keyword in the main menu and submenus produced the appropriate response (Febriyanti et al., 2021). Second, performance testing was conducted by analyzing the execution log history in Google Apps Script, which records the success status of execution and the processing time of each request. This allowed for an objective picture of the system's stability and response speed under real-world conditions.

RESULTS AND DISCUSSION

System Implementation Results

The developed chatbot system was successfully integrated with the Tuntang District WhatsApp service number. Residents who send keywords such as "menu" or "p" will receive an automatic reply in the form of a list of main services in the format "TUNTANG DISTRICT DIGITAL SERVICES", which contains administrative service options to choose from. Next, residents can select a sub-menu according to their needs, for example, requirements for processing an e-KTP, Family Card, Child ID Card (KIA), Internal Transfer Letter, Incoming Transfer Letter, Outgoing Transfer Letter, or SKTM, and the system will reply with information on the requirements and procedures that have been compiled by the district admin in a Google Sheets database. An example of the chatbot's reply display in a resident's WhatsApp conversation, for the e-KTP sub-menu, is shown in Figure 5.

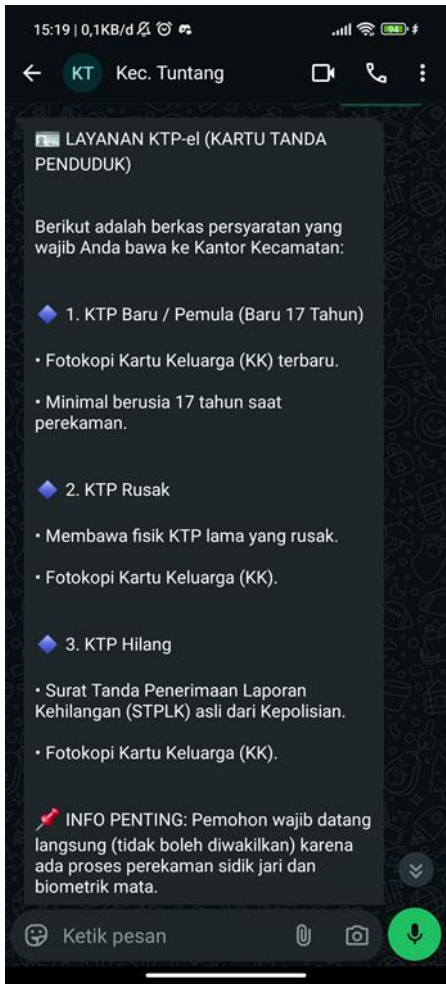


Figure 4. Chatbot Reply Display on WhatsApp (e-KTP Service Sub-menu)

System Stability and Performance Analysis

Based on the execution log history (Executions) on the Google Apps Script dashboard during the trial period (a sample of 6 executions of the doPost function in the last observation period), all requests processed by the system were recorded with a status of "Completed" without any failures (errors), as shown in Figure 4. This consistency of success status indicates that the integration between the Fonte webhook, the doPost function, and data reading on Google Sheets runs stably and reliably on Google's cloud infrastructure.

Penerapan	Fungsi	Jenis	Waktu Mulai	Durasi	Status
Versi 11	doPost	Aplikasi Web	24 Jun 2026, 09:38:58	2,386 dtk	Selesai
Versi 11	doPost	Aplikasi Web	24 Jun 2026, 09:38:25	2,616 dtk	Selesai
Versi 11	doPost	Aplikasi Web	24 Jun 2026, 07:12:24	2,65 dtk	Selesai
Versi 11	doPost	Aplikasi Web	24 Jun 2026, 07:11:18	1,947 dtk	Selesai
Versi 11	doPost	Aplikasi Web	24 Jun 2026, 07:10:56	1,72 dtk	Selesai
Versi 11	doPost	Aplikasi Web	24 Jun 2026, 07:08:15	1,691 dtk	Selesai

Figure 4. Google Apps Script Execution Log History

In terms of duration, the six execution samples in the log show a processing time range between 1.691 seconds and 2.650 seconds, with an average execution time of approximately 2.17 seconds per request. This duration is slightly higher than the ideal threshold of 1.5 seconds commonly used as a reference for comfortable instant messaging application responses, so it can be identified as an area that can still be optimized further, for example by simplifying the number of rows of data scanned (data range) in Google Sheets or implementing a caching mechanism in Apps Script. Nevertheless, the average duration of two seconds is practically still within a reasonable range and does not feel disruptive to users, considering the asynchronous nature of WhatsApp communication and does not require instant responses like voice or video calls.

This stability and speed of response directly impact the user experience, as residents sending messages don't have to wait long for a response, making the chatbot experience comparable to a typical WhatsApp conversation. This is crucial given that instant messaging users generally expect a quick response, and delays in responses can potentially undermine public trust in the digital services provided by the sub-district government.

Black-Box Testing Results

Functionality testing was performed on all keywords in the main menu and service submenus. The test results are presented in Table 1 below.

Table 1. Black-Box Testing Results

Testing Scenario	User Input	Expected results	Status
Main Menu ("menu"/"p")	Sending a message "menu" or "p"	The system replies to the list of services of TUNTANG DISTRICT DIGITAL SERVICES	Finished
e-KTP sub-menu	Select the e-KTP option	The system responds to the terms and procedures for processing an e-KTP	Finished
Family Card Sub-menu	Select the Family Card option	The system responds to the terms and procedures for processing the KK	Finished
KIA sub-menu	Selecting the KIA option	The system responds to the terms and procedures for managing KIA	Finished
Internal Transfer Letter Sub-menu	Select the Move Internal option	The system responds to the conditions for moving within one sub-district.	Finished
Sub-menu Letter of Transfer Incoming	Select the Move In option	The system responds to the terms and conditions of the move-in procedure.	Finished
Outgoing Transfer Letter Sub-menu	Select the Move Out option	The system responds to the terms and procedures for moving out	Finished
SKTM sub-menu	Selecting the SKTM option	The system responds to the terms and procedures for processing SKTM	Finished
Keyword not recognized	Send random words outside the keyword list	The system replies to the default message/direction back to the main menu.	Finished

Based on Table 1, all test scenarios, both at the main menu and sub-menu levels, as well as the unknown keyword scenario, showed results consistent with the expected results. No discrepancies were found between the system output and the functional design established during the design phase. Therefore, in terms of functionality, the chatbot system is deemed suitable for use in supporting administrative information services in Tuntang District.

Handling unrecognized keywords is also a key aspect of testing, as it ensures the

system doesn't "hang" when receiving input outside the registered keyword list, but instead continues to redirect users to the appropriate menu. This negative case handling mechanism contributes to the system's overall reliability across a wide range of user interaction scenarios.

Discussion

The results of functional testing and execution log analysis together indicate that the Fonte, Google Apps Script, and Google Sheets-based architecture, despite utilizing services that are largely freely available, is capable of delivering a stable and responsive information service system. This finding aligns with previous research that also shows that the combination of WhatsApp Gateway with a spreadsheet database can produce a stable, low-latency automation system in the context of institutional information services (Waton et al., 2025; Amalia & Wibowo, 2019). This approach is relevant for sub-district-level government contexts that generally have limited information technology budgets, as it does not require server investment or paid software licenses. Utilizing Google Sheets as a database also offers the advantage of ease of content management, as sub-district administrators without a programming background can still update document requirements information independently.

From a public service efficiency perspective, this system directly addresses the geographic distance issue raised in the introduction, as residents no longer need to visit the sub-district office to inquire about document requirements; instead, they can simply send a WhatsApp message whenever needed. This has the potential to reduce queues and the workload of service officers for informational and repetitive questions, freeing them to focus on administrative processes that require face-to-face interaction, such as file verification and document signing.

CONCLUSION

This research successfully designed and implemented an Automatic Public Service WhatsApp Chatbot system in Tuntang District, Semarang Regency, by utilizing Fonte webhook, Google Apps Script, and Google Sheets as the main technology architecture, developed through a structured Waterfall model starting from requirements analysis to testing. The results of Black-Box Testing showed that all main menu and sub-menu scenarios functioned as expected, while the execution log analysis showed high stability with a consistent "Completed" execution status without failure and an average response duration of around 2.17 seconds.

The implementation of this system has had a positive impact on the efficiency of public services in Tuntang District, as residents can obtain information on the requirements and procedures for population administration documents at any time without being constrained by geographical distance or sub-district office operating hours, while also reducing the workload of officers for repetitive informative questions. The low-cost technological approach used in this study also opens up opportunities for replication in other sub-districts or government agencies with similar budget constraints. Further research can be developed by adding natural language processing capabilities to enable the system to understand a wider variety of citizen questions, as well as integration with official population databases to support more personalized services.

REFERENCES

- Anis, Y., Mukti, AB, & Rosyid, AN (2023). Application of the Waterfall model in the development of a website-based tourist destination asset information system. *KLIK: Scientific Review of Informatics and Computers*, 4(2), 1134–1142.
- Annur, CM (2022). WhatsApp, the most widely used instant messaging application in the world. *Databoks*. <https://databoks.katadata.co.id/datapublish/2022/04/18/whatsapp-aplikasi-pesan-instan-paling-banyak-digunakan-di-dunia>
- Bariah, SH, Pratiwi, W., & Imania, KAN (2022). Development of a WhatsApp-based virtual assistant chatbot at the student information service center of the Indonesian Institute of Education–Garut. *PETIK: Journal of Information and Communication Technology Education*, 8(1), 66–79.
- Choirunnisa, L., Oktaviana, THC, Ridlo, AA, & Rohmah, EI (2023). The Role of Electronic-Based Government Systems (SPBE) in Improving Accessibility of Public Services in Indonesia. *Sosio Yustisia: Journal of Law and Social Change*, 3(1), 71–95. <https://doi.org/10.15642/sosyus.v3i1.401>
- Damara, RG, Fitriani, AS, & Eviyanti, A. (2024). Designing a chatbot application via WhatsApp in a grocery store. *Indonesian Journal of Applied Technology*, 1(2), 1–15. <https://doi.org/10.47134/ijat.v1i2.3050>
- Djabbari, MH, Sulfa Saguni, D., Nugroho, TC, Amiruddin, I., & Yanto, E. (2024). Implementation of e-government in website-based public services in Tondowolio Village, Kolaka Regency. *Collaboration: Journal of Public Administration*, 10(2), 158–170. <https://doi.org/10.26618/kjav.v10i2.15588>
- Fontte. (2024). WhatsApp gateway API documentation. <https://fonnte.com>
- Guntoro, G., Costaner, L., & Lisnawita, L. (2020). A chatbot application for campus information and academic services based on Artificial Intelligence Markup Language (AIML). *Digital Zone: Journal of Information and Communication Technology*, 11(2), 291–300. <https://doi.org/10.31849/digitalzone.v11i2.5049>
- Huda, M., & Oktavianto, D. (2022). Implementation of WhatsApp Gateway using Fonte API in academic service information system. *Journal of Computer Technology and Systems*, 10(1), 77–83.
- Michala, M., Abdullah, DS, Rofiqoh, H., Maula, N., Rofiqoh, R., Sugiono, S., & Hariyanto, A. (2025). Village digital innovation: Implementation of WhatsApp chatbot for public information services. *BERNAS: Journal of Community Service*, 6(3), 2914–2925. <https://doi.org/10.31949/jb.v6i3.14607>
- Nadzif, AM, Saefurrohman, & Soelistijadi, R. (2024). The use of natural language processing technology in a chatbot system to improve public administration information services. *Indonesian Journal of Computer Science*, 1227–1242.
- Rohmawati, L., Nugroho, MA, & Wagito. (2023). Chatbot implementation on WhatsApp for server resource monitoring. *Journal of Information System Management (JOISM)*, 4(2), 107–112.
- Safitri, DN, & Rosadi, I. (2021). Design and construction of a public service information provider for the Pandaan District Office using a chatbot. *Journal of Computer Science and Visual Communication Design*, 6(2), 74–84.
- Watson, IMB, Weking, AN, & Deta, B. (2025). Application of the Fonte WhatsApp API for a web-based student final assignment guidance schedule reminder system. *Journal of Mechanical, Electrical and Computer Engineering*, 5(2), 229–241. <https://doi.org/10.55606/teknik.v5i2.7614>