

SIAKIF-BOTS: GEMINI AI FOR ACADEMIC SERVICE CHATBOTS

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ABSTRACT

Academic services are an important element in education, as they provide students with access to information and support. At Telkom University Purwokerto, there are obstacles to the efficiency of academic services, especially due to information delays and the high burden of onsite services. To overcome this challenge, a Telegram-based chatbot, "SiAkif," was developed using the Large Language Model (LLM) model from Gemini AI. Gemini AI's selection is based on its ability to understand complex conversational contexts and generate accurate and relevant responses. This research aims to implement the Telegram chatbot that utilizes Gemini AI for Indonesian-language academic services. The implementation showed satisfactory results, with the chatbot "SiAkif" recording an average BLEU score of 0.88, which reflects good performance and response. This chatbot effectively reduces information delays, expands service accessibility, and improves student experience in interacting with institutions. Through "SiAkif," the institution is expected to strengthen the interaction between students and academic services, making it a potential solution for digital transformation in education.

Keywords: Academic services, Artificial Intelligence, chatbot, educational technology, Gemini, LLM, Telegram.

1. Introduction

Academic services are an important aspect that affects student satisfaction and experience while undergoing higher education (Bakti et al., 2024). Educational institutions are required to respond to the various academic needs of students quickly and efficiently in order to create an optimal learning environment (Prahesti et al., 2021). Academic services at Telkom University Purwokerto have several service tasks such as the management of Study Plan Cards (KRS), the Independent Campus program, the management of Final Projects (TA) and other administrations. The service is carried out through two methods, namely, onsite and online. Onsite services require students to come directly to the academic room, which could be more efficient in terms of time and energy. Meanwhile, online services through WhatsApp are more flexible, but they often experience delays in response, especially during registration periods and important announcements. The results of the student satisfaction survey with the institution showed that the responsiveness aspect, which includes satisfaction with academic services, only reached 58.5%, with an indicator of "good" on average. However, many students gave input that academic services at Telkom University Purwokerto need to be improved, especially in terms of responsiveness.

In a study on chatbots for educational services (Qalimaturrahmah & Santoso, 2024), the implementation of chatbots is a suitable way for academic services because it can overcome the problem of response delays that often occur in online services. Chatbots are automated conversational agents that are capable of interacting with users through text or voice and can help handle various requests quickly without direct human involvement (Mulyono & Sumijan, 2021). Academic chatbots can be designed to provide information related to schedules, administration, and other services automatically so that it can increase efficiency and effectiveness in meeting student needs. Academic services using chatbots generally use the Telegram platform (Lubis et al., 2024; Nosenko et al., 2022). Telegram offers the ability to create automated bots, which allow real-time information to be sent to students (Nosenko et al., 2022). In addition, Telegram bots can also be integrated with various existing systems, making it easier to manage information (Wijaya & Achlaq, 2023).

Several previous studies have successfully applied Natural Language Processing (NLP) in the development of academic chatbots. For example, an academic chatbot with an accuracy of

92.5% in the use of chatbots for online academic services (Mulyono & Sumijan, 2021), and using Rasa NLU for the admission process chatbot achieved an accuracy of 97.1% (Nguyen et al., 2021). However, these NLP-based chatbots still need to improve in dealing with a variety of more complex questions (Kavaz et al., 2023), as specific language comprehension capabilities usually limit traditional NLP models. With the advancement of technology, the Large Language Model (LLM) method is now a stronger choice in chatbot development. LLMs use neural networks trained with large amounts of data so they are able to understand human language more deeply and flexibly (Hassanin et al., 2024). One of the most recent examples of LLMs is Gemini AI, which Google developed. Gemini AI has generative and multimodal capabilities (Rachmat & Kesuma, 2024), which allows chatbots to not only understand text but also be able to process information in various formats, such as images, audio, and code (Kishore & Shaik, 2024). This technology allows chatbots to provide more accurate, relevant and efficient responses than traditional AI models.

This research aims to develop a Telegram chatbot that utilizes Gemini AI for academic services at Telkom University, Purwokerto. With the integration of Gemini AI, this chatbot is expected to be able to provide fast, accurate, and relevant responses to various student questions and be able to be accessed at any time through the Telegram platform. At Telkom University, Purwokerto itself, the Telegram platform is mandatory for students because almost all groups, both study program groups and courses, use Telegram, making it a natural and integrated choice for academic services. The use of Gemini AI as the language processing base in this chatbot offers significant improvements in terms of context understanding, flexibility, and generative capabilities, allowing it to handle various academic needs more effectively.

This research is prepared systematically. First, the background and importance of efficient academic services in higher education are discussed, followed by an analysis of problems that exist in the current service system, such as delayed response and inconvenience for students. Furthermore, this study describes chatbot technology and the application of Natural Language Processing (NLP) in academic services, including the challenges faced by traditional NLP models. Then, the researcher outlined the advantages of using Large Language Models (LLMs), especially Gemini AI. Researchers will also include how LLM technology can improve chatbot interaction and responsiveness. Finally, this research will conclude with a discussion about the implementation of chatbots on the Telegram platform.

2. Literature Review

Academic chatbots can be categorized based on platform (Telegram-based, web-based), function (FAQs, academic advisement, document assistance), and level of intelligence (rule-based vs. generative). Chatbots are computer programs designed to simulate human conversation through natural language processing (Mulyono & Sumijan, 2021; S et al., 2023). Chatbots are designed to interact with users through text or voice, allowing for efficient and interactive communication (Lubis et al., 2024; Singh & Singh, 2024). In recent years, the development of chatbot technology has involved the use of artificial intelligence and more advanced language models, such as Large Language Models (LLMs), which allow for more natural and contextual responses (Wijaya & Achlaq, 2023). Today, chatbots have been deployed in various sectors, including customer service, education, and healthcare, to improve user experience and operational efficiency.

In improving academic services, chatbots offer solutions to the problem of delayed responses and inefficient access to information. Previous studies have shown the potential of chatbots to improve interaction between students and institutions. Research (Jhaerol & Sudioanto, 2023) using Long Short-Term Memory (LSTM) for academic service chatbots shows the effectiveness of LSTMs. However, it does not utilize modern Large Language Model (LLM) technology that offers more natural responses. Research (Mulyono & Sumijan, 2021; Naufal et al., 2023) with Natural Language Processing (NLP) achieving 92.5% accuracy but limited to website-based systems. Then, the NLU Rasa in the student admissions chatbot reached an accuracy of 97.1% (Nguyen et al., 2021) but did not use a generative model. Chatbots that use AIML and Cognitive Behavioral Therapy (CBT) can provide personalized interventions for mental health issues such as depression and anxiety (Omarov et al., 2023). While AIML can

achieve high accuracy, such as 100%, it is less flexible and does not support continuous learning or dynamic response to various user contexts.

Recent research (Abdulridha & Mohamed, 2024) and (Rachmat & Kesuma, 2024) adopt Gemini AI, but it has yet to be directed specifically to academic services. Research (Saputra et al., 2024) using GPT-3.5 for the Qur'an chatbot on Telegram showed high accuracy but not for academic contexts. Based on these loopholes, the study chose to use LLMs with Gemini AI for the Telegram-based chatbot "SiAkif". This decision is based on Telegram's ease of access and flexibility, which allows its use without the need for additional website infrastructure.

Based on these gaps, the study chose to use LLM with Gemini AI to develop the Telegram-based chatbot "SiAkif." This decision is based on Telegram's ease of access and flexibility, which allows it to be used without the need for additional website infrastructure. Several global universities have adopted AI-driven academic assistants. MIT, for example, uses web-based AI tutors, while NUS leverages chatbots for course registration. This study aims to bring such innovation into a local Indonesian context. With this approach, this research is expected to make a significant contribution to improving the quality of academic services through more modern and responsive chatbot technology.

3. Research Methods

The stages to complete this research can be seen in Figure 1.

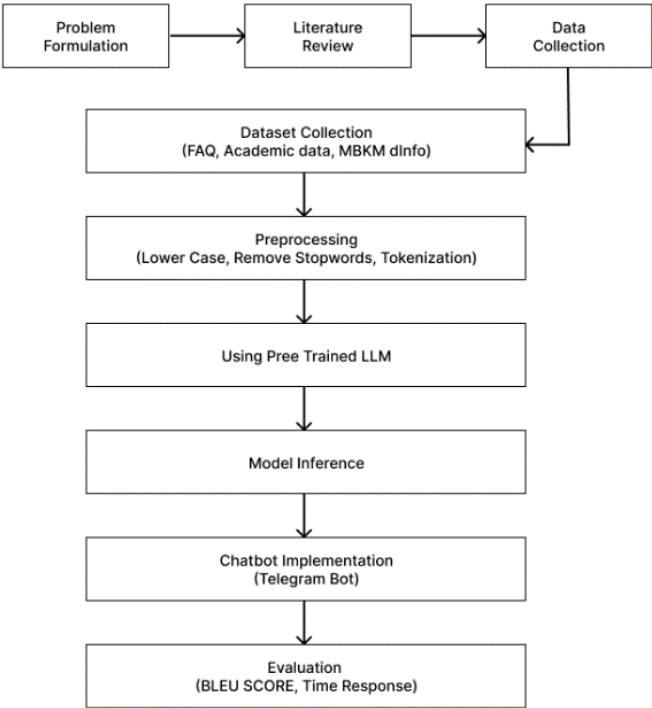


Fig. 1. The flow of SiAkif Chatbot Implementation.

In Figure 1, this research begins with the identification and formulation of problems in the academic environment at Telkom University, Purwokerto, where services take care of all students' academic needs. The problems identified included a slow response from staff to student questions that caused delays in the delivery of information. This problem was formulated to find the right solution, namely through the development of a generative chatbot based on Gemini AI implemented in the form of a Telegram Bot. After determining the problem and the solution, the researcher continues to conduct a literature review to support the selection of appropriate technology. In addition, interviews with academic staff are conducted to dig up information about frequently asked questions by students, as well as collect other relevant academic documents as part of data collection.

3.1 Data Collection

After conducting interviews and collecting data, the researcher grouped the data to become the data set of the chatbot 'SiAkif'. The data sources in this study include questions that students and academic data often ask. The following is a sample of questions from the data used, as shown in Table 1.

Table 1 - Sample Data Questions about Academics.

Questions	Answer
Apakah toefl harus 450 untuk ikut yudisium?	Salah satu syarat untuk mengikuti Yudisium adalah mendapat skor TOEFL minimal 450. TOEFL harus dari instansi resmi, baik dari dalam kampus maupun luar kampus. Jika kamu sudah mengikuti Toefl sebanyak 3 kali dan masih belum memenuhi minimal skor kamu dapat berkoordinasi ke pusat Bahasa di rektorat 401.
Panduan TA/PA Igracias	Untuk panduan TA/PA igracias dapat di buka di link berikut: https://fif.ittelkom-pwt.ac.id/wp-content/uploads/2023/09/Panduan-TA-PA-Igracias.pdf
Dimana Ruang Akademik FIF?	Ruang Akademik FIF ada pada Gedung DC -205
Apakah boleh mengajukan 2 surat pengantar magang untuk tempat yang berbeda?	Surat pengantar magang dapat hanya diajukan untuk 1 tempat saja. Silahkan ajukan kembali surat pengantar magang jika sudah mendapat balasan dari tempat magang sebelumnya.
Dimana saya bisa mendapat TTD atau tanda tangan dekan FIF?	Kamu dapat langsung datang ke ruang DC-206 dan menyerahkan dokumen yang perlu di ttd oleh dekan kepada sekretaris dekan. Atau jika urgent kamu bisa langsung menghubungi dekan FIF untuk janji temu

3.2 Preprocessing

In general, when using LLM (Large Language Model) models such as Gemini AI, the input preprocessing process is usually done automatically by the model. Preprocessing in Gemini AI automatically handles tasks such as tokenization, normalization, and encoding text in a form that can be processed by the model (Kishore & Shaik, 2024). However, even so, to get a more accurate model for generating messages, researchers still do some preprocessing. The preprocessing done by the researcher to the Gemini model is the same as the preprocessing for BERT. Here are some of the Preprocessing steps carried out:

- a) Tokenization: Breaking down text into smaller units such as words or sub-words (tokens). Example: "Where is the academic room?" becomes ["Room", "academic", "where", "?"] (Kusuma et al., 2023; Parhusip et al., 2023; Sudianto, Masheli, et al., 2022).
- b) Lowercase conversion: Converting all text to lowercase to maintain uniformity (Sudianto, 2022; Sudianto, Masheli, et al., 2022).
- c) Remove Punctuation: Remove punctuation that may not be relevant for a particular analysis.
- d) Text Encoding: Converts text into numerical shapes. Each token is represented as a vector in high-dimensional space, known as embeddings. Embeddings capture semantic relationships between words (e.g., "king" and "queen" may have similar vectors) (Afandi et al., 2022; Sudianto, Sripamuji, et al., 2022).

3.3 Pre-Trained Model LLM

Pre-trained Model LLM (Large Language Models) are large language models that have gone through an intensive training process using a very wide and diverse dataset (Devlin et al., 2019; Hassanin et al., 2024; Khennouche et al., 2024). This model is designed to understand and produce text with high accuracy thanks to deep learning on various types of text data. This training process covers a wide range of language domains and styles, allowing the model to capture complex patterns in language and provide contextual responses (Imamura & Sumita, 2019; Pratama & Rjito, 2021). The two main examples of this pre-trained model are Gemini and BERT. Gemini itself has several model options, such as 'Gemini-1.0-pro', 'Gemini-1.5-flash', and 'Gemini-1.5-pro'. The selection of this model can be adjusted to the needs of the researcher

(Table 2). Table 2 summarizes the advantages and limitations of each based on Google AI's documentation.

Table 2 - Considerations for Determining the Chatbot Model.		
Models	Advantages	Limitations
Gemini 1.0 Pro	Good for basic questions	Difficulty understanding complex contexts
Gemini 1.5 Pro	More relevant and accurate responses	Still limited in context variation
Gemini 1.5 Flash	High generative and multimodal capabilities	Requires greater resources
BERT	Strong in context understanding	Less flexible for dynamic questions

To support the above theory, the researcher also compared the accuracy of the model in solving the case of academic Chatbots. The test was conducted using the Pre-Trained Gemini and BERT models, which can be seen in Figure 2.

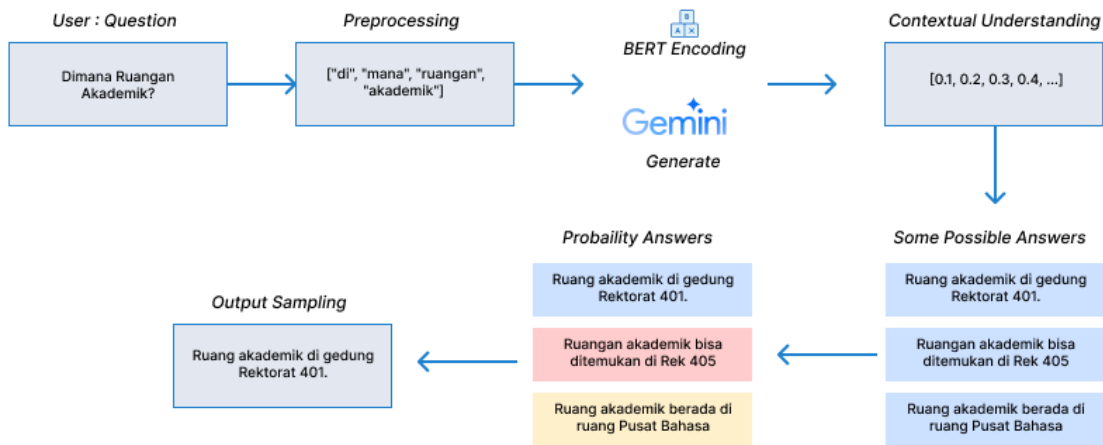


Fig. 2. LLM Pre-Trained Flow.

The process of answering the question "Where is the academic room?" begins with the Preprocessing stage, where the user input is tokenized into a more structured form, namely ["in", "where", "room", "academic"]. Furthermore, the model will perform context understanding using attention mechanisms to understand the relationships between tokens (Farquhar et al., 2024). In this stage, the model identifies the context and meaning of each token so it can generate several possible answers with high probability, such as "Academic room in Rectorate building 401" and "Academic room can be found in Rec 405." After that, the model performs a Prediction Task to look for the relevant token index in context. In the Output Sampling stage, the model can create a variety of answers, including "The academic room is in the Language Center room." From a set of possibilities, the model concludes the most accurate and relevant answer to be presented to users, namely "Academic space in the Rectorate 401 building". This process reflects the model's ability to filter and sort information based on relevance and probability (Ahmed & Islam, 2024), resulting in answers that are informative and contextually appropriate to the question.

3.4 Model Inference

Model Inference is the stage where a trained model is used to make predictions or generate outputs based on new inputs (Lin et al., 2024). Gemini and BERT performed Inference models (such as Figure 3 and Figure 4) to obtain more accurate answers (Khennouche et al., 2024; P. J. Liu et al., 2018). This process involves:

- 1) *Data Input*: When a user asks a question or command to the chatbot, this data is sent as input to the model.
- 2) *Inference Process*: The model processes those inputs based on what has been learned during training. At this stage, the model uses the knowledge gained from the training data to generate responses that match the context of the question or command.
- 3) *Output*: The result of inference is the response or prediction given by the model. In the context of a chatbot, this is text generated in reply to user input.

	Question	Expected Answer	Generated Answer	Tokenized Question	Question Embedding
0	Siapa kamu?	Saya adalah Akif, chatbot akademik Universitas ...	Siapa kamu?	[si, ##apa, kam, ##u, ?]	[0.02865227684378624, -0.2932122051715851, -0....
1	Bagaimana Tahap Bimbingan?	Bimbingan tugas akhir dapat mulai dilakukan se...	Bagaimana Tahap Bimbingan?	[bag, ##ai, ##mana, ta, ##ha, ##p, bi, ##mb, #...	[-0.13692046701908112, -0.04692506790161133, -...
2	Dimana Ruangan akademik	Ruang akademik di gedung DC It 205	Dimana Ruangan akademik	[dim, ##ana, ru, ##anga, ##n, aka, ##de, ##mi, ...]	[0.2830476462841034, -0.05043090879917145, -0....
3	Bagaimana meminta acc TAK/SKPI?	Untuk mendapat ACC TAK kamu dapat memilih tert...	Bagaimana meminta acc TAK/SKPI?	[bag, ##ai, ##mana, me, ##min, ##ta, acc, tak, ...]	[-0.06276736408472061, -0.24195070564746857, -...
4	Dimana saya bisa mendapat TTD atau tanda tanga...	Kamu dapat langsung datang ke ruang DC-206 dan...	Dimana saya bisa mendapat TTD atau tanda tanga...	[dim, ##ana, say, ##a, bis, ##a, men, ##da, ##...	[0.101198710501194, 0.06667675077915192, -0.64...
5	Apa saja website untuk cek turnitin yang di re...	Kamu bisa melakukan turnitin di perpus telkom ...	Maaf Saya Tidak Dilatih Untuk Itu	[ap, ##a, sa, ##ja, website, un, ##u, ##k, ce...	[0.18690210580825806, -0.05455853369426727, -0....
6	Jumlah fakultas dan prodi di Telkom University...	Ada 4 fakultas dan 14 Prodi	Maaf Saya Tidak Dilatih Untuk Itu	[ju, ##ml, ##ah, fa, ##ku, ##ta, ##s, dan, pr...	[0.18809518218040466, -0.022883404046297073, -...

Fig. 3. Results of the BERT Inference Model.

	Question	Expected Answer	Generated Answer	Tokenized Question
0	Siapa kamu?	Saya adalah Akif, chatbot akademik Universitas ...	Saya adalah Akif, chatbot akademik Universitas ...	Siapa, kamu?
1	Bagaimana Tahap Bimbingan?	Bimbingan tugas akhir dapat mulai dilakukan se...	Bimbingan tugas akhir dapat mulai dilakukan se...	Bagaimana, Tahap, Bimbingan?
2	Dimana Ruangan akademik	Ruang akademik di gedung DC It 205	Ruang akademik di gedung DC It 205	Dimana, Ruangan, akademik
3	Bagaimana meminta acc TAK/SKPI?	Untuk mendapat ACC TAK kamu dapat memilih tert...	Untuk mendapat ACC TAK kamu dapat memilih tert...	Bagaimana, meminta, acc, TAK/SKPI?
4	Dimana saya bisa mendapat TTD atau tanda tanga...	Kamu dapat langsung datang ke ruang DC-206 dan...	Kamu dapat langsung datang ke ruang DC-206 dan...	Dimana, saya, bisa, mendapat, TTD, atau, tanda...
5	Apa saja website untuk cek turnitin yang di re...	Kamu bisa melakukan turnitin di perpus telkom ...	Sorry, an error occurred while accessing the I...	Apa, saja, website, untuk, cek, turnitin, yang...
6	Jumlah fakultas dan prodi di Telkom University...	Ada 4 fakultas dan 14 Prodi	Telkom University Purwokerto memiliki 1 fakult...	Jumlah, fakultas, dan, prodi, di, Telkom, Univ...

Fig. 4. Results of the Gemini Inference Model.

3.6 BLEU-Score Evaluation

Chatbot Evaluation is the process of assessing the performance of chatbots to determine how well the model meets user needs and achieves goals (Heryanto et al., 2024). One of the commonly used evaluation methods is the Bilingual Evaluation Understudy (BLEU). BLEU measures the similarity between chatbot responses and reference responses based on n-grams, i.e. sequential word sequences in the text (Papineni et al., 2002, 2002; Wolk & Marasek, 2014). The BLEU score ranges from 0 to 1, where 1 indicates a perfect match. Here are the steps for BLEU score:

1) Calculate Precision

It measures the proportion of n-grams in the generated text that also appears in the reference text. For example, if there are 10 bigrams in the generated text and 6 of them also appear in the reference text, the precision for the bigram is 0.6. The method of calculating precision is in Equation 1.

$$Precision = \frac{\text{Count of matching } n\text{-grams}}{\text{Count of candidate } n\text{-grams}} \quad (1)$$

2) Brevity Penalty (BP)

Penalties for the resulting text if it is too short compared to the reference text, as very short text may have high precision but is not informative. BP calculation can be seen in Equation 2.

$$BP = \begin{cases} 1, \\ e^{\left(1 - \frac{\text{length of candidate}}{\text{length of reference}}\right)} \end{cases} \quad (2)$$

If length candidate > length reference

3) N-gram Weight

N-gram weights give different levels of importance to different n-gram sizes. Typically, the same weight is assigned for each n-gram size. For example, for a 2-gram, the weight can be (0.5, 0.5), and for a 3-gram, the weight can be (0.33, 0.33, 0.33).

4) BLEU Score

The BLEU score combines n-gram precision with a conciseness penalty to get the final score. Their respective weights, weight precision, and a conciseness penalty are applied; the BLEU score calculation is in Equation 3.

$$BLEU = BP \times \exp(\text{sum}(\text{Bobot tiap precisions}))$$

(3)

4. Results and Discussions

4.1 Comparison of LLM Models

In this study, experiments have been carried out using several LLM models, including the BERT model and three Gemini variants, namely Gemini 1.0 Pro, Gemini 1.5 Flash, and Gemini 1.5 Pro. At this stage, the chatbot was tested with a total of 15 questions divided into three categories: five questions contained in the dataset, five questions that are outside the dataset but still relevant to Telkom University, and five questions that are completely outside the dataset and irrelevant to Telkom University, Purwokerto. Using the BLEU score test scheme, the evaluation results related to accuracy and response time are obtained, as presented in Table 3.

Table 3 - Results of Comparison of LLM Models.

Models	Accuracy (%)	Response Time (s)
BERT	27	12.3
Gemini 1.0 Pro	48	8.7
Gemini 1.5 Pro	88	7.2
Gemini 1.5 Flash	47	6.5

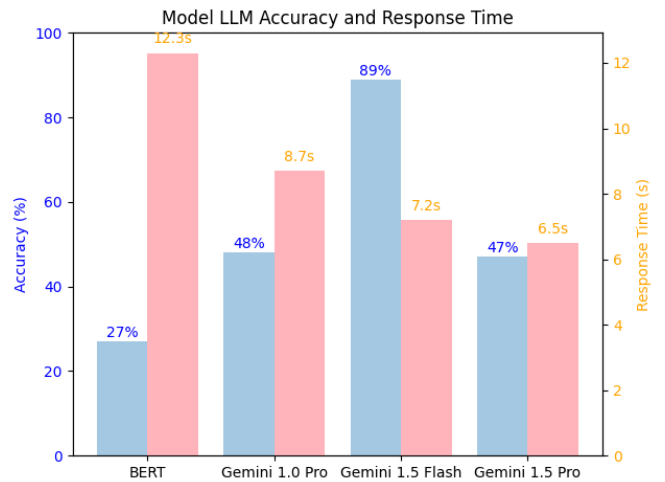


Fig. 5. LLM's Model Accuracy Graph and Response Time.

Based on Figure 5, the results of tests conducted on various LLM models, it can be concluded that the Gemini 1.5 Flash model shows the best performance with an accuracy of 88% and the fastest response time of 7.2 seconds. Meanwhile, the BERT model has the lowest accuracy, at 27%, with a relatively slow response time of 12.3 seconds. From all the models tested, it can be seen that when the questions asked are contained in the dataset, the accuracy achieved is very high, even close to perfect. On the other hand, for questions that are outside the dataset but still within the scope of Telkom University, Purwokerto, the accuracy varies and tends to be lower. The models are also able to provide appropriate responses when faced with questions outside the dataset and those that are not related to Telkom University, with appropriate answers such as "maaf, saya tidak dilatih untuk itu." This shows the model's ability to handle unfamiliar questions, even if it cannot provide accurate answers.

4.2 Chatbot Performa Testing

The chatbot developed was tested using several metrics to measure accuracy, response speed, and answer quality. The following table summarizes the results of the evaluation:

Testing based on Dataset Questions

The chatbot with the Gemini 1.5 Flash model has been tested using questions that match the dataset. It was chosen as the dominant model to be implemented as a Chatbot. The following are the results of the evaluation of the tests shown in Table 4 and Figure 6.

Table 4 - Results of Dataset-based Question Testing.

Questions	Expected Answer	Response Bot	BLUE Score	Response Time (s)
Siapa kamu?	Saya adalah Akif, chatbot akademik Universitas Telkom Purwokerto	Saya adalah Akif, chatbot akademik Universitas Telkom Purwokerto.	1.0	7.55
Bagaimana Tahap Bimbingan?	Bimbingan tugas akhir dapat mulai dilakukan setelah proses penentuan pembimbing utama. Mahasiswa diharapkan melakukan konsultasi secara intensif, baik dengan pembimbing utama maupun pendamping. a. Pembimbing utama memiliki wewenang untuk memberikan penilaian bimbingan serta wajib mengisi Formulir Penilaian Bimbingan, berhak menentukan pertemuan atau waktu bimbingan untuk semua mahasiswa bimbingannya jika diperlukan, dan juga memberikan persetujuan kepada mahasiswa apakah layak untuk melanjutkan pada tahap sidang proposal. b. Pembimbing pendamping dapat diusulkan oleh mahasiswa dengan mengajukan Formulir Usulan Pembimbing ke calon pembimbing, dapat berasal dari dosen institusi, dosen luar institusi maupun praktisi industri yang terkait dengan TA mahasiswa yang bersangkutan. c. Bagi mahasiswa yang mengulang Tugas akhir 1, dapat melanjutkan topik/judul sebelumnya dengan pembimbing yang sama selama tidak ada catatan khusus dari hasil Seminar proposal.	Bimbingan tugas akhir dapat mulai dilakukan setelah proses penentuan pembimbing utama. Mahasiswa diharapkan melakukan konsultasi secara intensif, baik dengan pembimbing utama maupun pendamping. * **Pembimbing utama** memiliki wewenang untuk memberikan penilaian bimbingan serta wajib mengisi Formulir Penilaian Bimbingan, berhak menentukan pertemuan atau waktu bimbingan untuk semua mahasiswa bimbingannya jika diperlukan, dan juga memberikan persetujuan kepada mahasiswa apakah layak untuk melanjutkan pada tahap sidang proposal. * **Pembimbing pendamping** dapat diusulkan oleh mahasiswa dengan mengajukan Formulir Usulan Pembimbing ke calon pembimbing, dapat berasal dari dosen institusi, dosen luar institusi maupun praktisi industri yang terkait dengan TA mahasiswa yang bersangkutan. * Bagi mahasiswa yang mengulang Tugas akhir 1, dapat melanjutkan topik/judul sebelumnya dengan pembimbing yang sama selama tidak ada catatan khusus dari hasil Seminar proposal.	0.93	8.37
Dimana Ruang akademik	Ruangan akademik di gedung Rektorat 401	Ruang akademik di gedung Rektorat 401.	0.75	4.59
Bagaimana meminta acc TAK/SKPI?	Untuk mendapat ACC TAK kamu dapat memilih terlebih dahulu 5 poin TAK terbaik, kemudian kamu dapat mengajukan ke dosen wali untuk minta approval atau acc. Jika dosen wali belum	Untuk mendapat ACC TAK, kamu dapat memilih terlebih dahulu 5 poin TAK terbaik, kemudian kamu dapat mengajukan ke dosen wali untuk minta approval. Jika dosen wali belum merespon	0.88	9.51

	merespon atau mengalami kendala kamu dapat langsung ke ruang akademik di Rek 401	atau mengalami kendala kamu dapat langsung ke ruang akademik di Rek 401		
Dimana saya bisa mendapat TTD atau tanda tangan dekan FIF?	Kamu dapat langsung datang ke ruang DC-206 lalu menyerahkan dokumen yang perlu di ttd oleh dekan kepada sekretaris dekan. Atau jika mendesak kamu bisa langsung menghubungi dekan FIF untuk janji temu.	Kamu dapat langsung datang ke ruang DC-206 dan menyerahkan dokumen yang perlu di ttd oleh dekan kepada sekretaris dekan. Atau jika urgent kamu bisa langsung menghubungi dekan FIF untuk janji temu.	0.82	8.59
Average			0.88	

	Question	Expected Answer	Generated Answer	Tokenized Question	Total BLEU
0	Siapa kamu?	Saya adalah Akif, chatbot akademik Universitas...	Saya adalah Akif, chatbot akademik Universitas...	Siapa, kamu?	1.000000
1	Bagaimana Tahap Bimbingan?	Bimbingan tugas akhir dapat mulai dilakukan se...	Bimbingan tugas akhir dapat mulai dilakukan se...	Bagaimana, Tahap, Bimbingan?	0.937068
2	Dimana Ruangan akademik	Ruangan akademik di gedung Rektorat 401	Ruang akademik di gedung Rektorat 401.	Dimana, Ruangan, akademik	0.759836
3	Bagaimana meminta acc TAK/SKP?	Untuk mendapat ACC TAK kamu dapat memilih ter...	Untuk mendapat ACC TAK, kamu dapat memilih ter...	Bagaimana, meminta, acc, TAK/SKP?	0.885205
4	Dimana saya bisa mendapat TTD atau tanda tanga...	Kamu dapat langsung datang ke ruang DC-206 lal...	Kamu dapat langsung datang ke ruang DC-206 dan...	Dimana, saya, bisa, mendapat, TTD, atau, tanda...	0.823233
Rata-rata Skor BLEU Total: 0.88					

Fig. 6. Test Results through Functions in the System.

In addition to automated testing using the BLEU Score, researchers also perform manual calculations to assess the chatbot's performance. This method aims to provide a more in-depth picture of the accuracy of the chatbot's response to the questions asked. The results of this manual test include a more detailed evaluation of the fit between the chatbot's given response and the expected answer, as well as highlighting the strengths and weaknesses of the response. Table 5 presents the results of the manual test, which includes the precision value for each n-gram analyzed, as well as the final value of the BLEU score for each category.

Table 5 - Test results are based on Formula.

Labels	Precision/n-gram	BLUE Score	Total
(1.0), (1.0), (1.0), (1.0)	$BLEU = 1.0 \times \exp((1/4) \times (\log(1.0) + \log(1.0) + \log(1.0) + \log(1.0)))$	1.0	(1.0), (1.0), (1.0), (1.0)
(1.0), (0.97), (0.94), (0.92)	$BLEU = 0.97 \times \exp((1/4) \times (\log(1.0) + \log(0.97) + \log(0.94) + \log(0.92)))$	0.92	(1.0), (0.97), (0.94), (0.92)
(0.83), (0.80), (0.75), (0.66)	$BLEU = 1.0 \times \exp((1/4) \times (\log(0.83) + \log(0.80) + \log(0.75) + \log(0.66)))$	0.75	(0.83), (0.80), (0.75), (0.66)
(0.93), (0.91), (0.89), (0.86)	$BLEU = 0.97 \times \exp((1/4) \times (\log(0.93) + \log(0.91) + \log(0.89) + \log(0.86)))$	0.86	(0.93), (0.91), (0.89), (0.86)
Average		0.86	

In Figure 6 and Table 5, the test results of the Gemini 1.5 Flash chatbot show good performance in answering questions according to the dataset. The average BLEU score for automated testing is 0.88, while manual testing yields 0.86. This small difference means consistency in response quality. Manual testing revealed that the chatbot was able to provide relevant answers with the highest precision on label 0 (BLEU score 1.0). Although, there are labels with a value below 1, which indicates that the score value needs to be improved.

Testing based on Relevant Questions

In this section, the evaluation will continue with testing on questions that are not included in the dataset but are still relevant to the context of Telkom University, Purwokerto, as shown in Table 6 and Figure 7.

Table 6 - Test Results Based on Relevant Questions.

Questions	Expected Answer	Response Bot	BLUE Score	Response Time (s)
Apa saja website untuk cek turnitin yang di rekomendasikan?	Kamu bisa melakukan turnitin di perpus telkom university purwokerto, turnitin di internet yang kredibel. Berikut website yang Direkomendasikan untuk Cek Turnitin:** * **Turnitin** ([15]): Situs web resmi Turnitin yang menawarkan layanan cek plagiarisme mendalam. Dibutuhkan berlangganan untuk menggunakan layanan ini. * **Unicheck** (https://unicheck.com/): Alternatif Turnitin yang populer yang menawarkan fitur-fitur canggih dan laporan plagiarisme yang komprehensif. * **Grammarly** (https://www.grammarly.com/): Alat tata bahasa dan pemeriksaan ejaan yang juga dilengkapi dengan fitur cek plagiarisme. * **Scribbr** (https://www.scribbr.com/plagiarism-checker/): Alat cek plagiarisme gratis yang memberikan laporan terperinci tentang sumber yang dicurigai mirip. * **Duplichecker** (https://www.duplichecker.com/)	Berikut adalah beberapa website yang direkomendasikan untuk cek Turnitin: **Situs Resmi:** * **Turnitin:** https://www.turnitin.com/ - Situs web resmi Turnitin yang menawarkan layanan cek plagiarisme mendalam. Dibutuhkan berlangganan untuk menggunakan layanan ini. **Alternatif Populer:** * **Unicheck:** https://unicheck.com/ - Alternatif Turnitin yang populer yang menawarkan fitur-fitur canggih dan laporan plagiarisme yang komprehensif. * **Grammarly:** https://www.grammarly.com/ - Alat tata bahasa dan pemeriksaan ejaan yang juga dilengkapi dengan fitur cek plagiarisme. **Alat Gratis:** * **Scribbr:** https://www.scribbr.com/plagiarism-checker/ - Alat cek plagiarisme gratis yang memberikan laporan terperinci tentang sumber yang dicurigai mirip. * **Duplichecker:** https://www.duplichecker.com/ - Alat cek plagiarisme gratis lainnya yang memberikan persentase kemiripan dan menyoroti teks yang dicurigai mirip. * **Check-Plagiarism:** https://www.check-plagiarism.com/ - Alat cek plagiarisme gratis yang memberikan laporan komparatif yang menyoroti teks yang dicurigai mirip. **Alat Berbayar:** * **WriteCheck:** https://writecheck.com/ - Alat cek plagiarisme yang dapat disesuaikan yang memungkinkan pengguna memeriksa sumber tertentu atau seluruh basis data. * **Copyscape:** https://www.copyscape.com/ - Alat cek plagiarisme yang mengkhususkan diri dalam mendeteksi duplikasi di web dan menawarkan pemindaian berbayar dan gratis. * **PlagScan:** https://www.plagscan.com/ - Platform cek plagiarisme yang menawarkan fitur lanjutan seperti deteksi ulang kutip dan pemeriksaan tata bahasa. * **Viper:** https://viper.scanmyessay.com/ - Alat cek plagiarisme akademis yang dirancang khusus untuk siswa dan akademisi.	0.29	7

		Tips: * Gunakan beberapa alat cek plagiarisme untuk mendapatkan hasil yang lebih akurat. * Pastikan untuk membaca kebijakan plagiarisme dari institusi Anda. * Hindari plagiarisme dengan menulis karya Anda sendiri dan memberikan kredit yang tepat kepada sumber yang Anda gunakan.		
Jumlah prodi di Telkom University Purwokerto	Ada 11 Prodi yaitu Sistem Informasi, S1 Teknik Informatika, Rekayasa Perangkat Lunak, Sains Data, Teknik Elektro, Teknik Industri, S1 Teknik Logistik, S1 Teknik Telekomunikasi, D3 Teknik Telekomunikasi, Desain Komunikasi Visual dan Bisnis Digital	Semoga informasi ini bermanfaat! Telkom University Purwokerto memiliki **11 program studi** yang terbagi dalam 3 fakultas: **Fakultas Informatika:** * Sistem Informasi * Teknik Informatika * Rekayasa Perangkat Lunak * Sains Data **Fakultas Teknik:** * Teknik Elektro * Teknik Industri * Teknik Logistik * Teknik Telekomunikasi * D3 Teknik Telekomunikasi **Fakultas Desain dan Komunikasi:** * Desain Komunikasi Visual * Bisnis Digital	0.29	5.37
Ruangan pusat bahasa dimana?	Pusat Bahasa berada di Gedung Rektorat Lantai 4, ruangan 401	Semoga informasi ini membantu! Ruangan Pusat Bahasa Telkom University Purwokerto berada di **Gedung Rektorat, lantai 4, ruangan 405**.	0.47	7.32
apa boleh naskah TA2 nya plagiatnya melebihi 20%?	Tidak boleh. Batas maksimal plagiarisme untuk naskah TA2 adalah 20%, jika melebihi maka tidak dapat mengikuti sidang TA2	Tidak boleh. Batas maksimal plagiarisme untuk naskah TA2 adalah 20%. Jika melebihi batas tersebut, maka mahasiswa tidak akan diizinkan untuk mengikuti sidang TA2.	0.33	7.59
Bagaimana cara membayar BPP?	Untuk membayar BPP di Telkom University Purwokerto, kamu bisa mengikuti langkah-langkah berikut: 1. **Akses Portal Igracias:** Buka website Igracias Telkom University Purwokerto di https://igracias.telkomuniversity.ac.id/. 2. **Login:** Masukkan NIM dan password kamu untuk masuk ke akun Igracias.	Untuk membayar BPP di Telkom University Purwokerto, kamu bisa mengikuti langkah-langkah berikut: 1. **Akses Portal Igracias:** Buka situs web Igracias Telkom University Purwokerto: https://igracias.telkomuniversity.ac.id/ 2. **Login:** Gunakan akun mahasiswa Telkom University Purwokerto kamu untuk masuk ke portal Igracias. 3. **Pilih Menu Pembayaran:** Cari menu "Pembayaran" atau "BPP" di portal Igracias. 4. **Pilih Metode Pembayaran:** Pilih metode pembayaran yang ingin kamu gunakan. Telkom University Purwokerto	0.23	11

3. ****Menu Keuangan:****
Pilih menu "Keuangan" atau "Pembayaran".
4. ****Pilih Jenis Pembayaran:**** Pilih jenis pembayaran yang ingin kamu lakukan, seperti BPP, UKT, atau biaya lainnya.
5. ****Pilih Metode Pembayaran:**** Pilih metode pembayaran yang tersedia, seperti transfer bank, virtual account, atau kartu kredit.
6. ****Konfirmasi Pembayaran:**** Setelah memilih metode pembayaran, kamu akan diarahkan ke halaman konfirmasi pembayaran. Pastikan semua informasi yang tertera sudah benar.
7. ****Lakukan Pembayaran:**** Ikuti instruksi yang diberikan untuk menyelesaikan pembayaran.
8. ****Simpan Bukti Pembayaran:**** Simpan bukti pembayaran sebagai bukti transaksi.
- biasanya menyediakan beberapa pilihan, seperti:
- * ****Transfer Bank:**** Pilih bank yang kamu inginkan dan salin nomor rekening tujuan.
 - * ****Virtual Account:**** Pilih bank yang kamu inginkan dan dapatkan nomor virtual account.
 - * ****E-Wallet:**** Pilih e-wallet yang kamu gunakan dan ikuti instruksi pembayaran.
5. ****Lakukan Pembayaran:**** Lakukan pembayaran sesuai dengan metode yang kamu pilih. Pastikan untuk mencantumkan nomor referensi yang diberikan oleh sistem Igracias.
6. ****Konfirmasi Pembayaran:**** Setelah melakukan pembayaran, konfirmasi pembayaran melalui portal Igracias. Unggah bukti pembayaran yang kamu miliki.
- **Penting:****
- * Pastikan kamu membayar BPP sesuai dengan jumlah yang tertera di portal Igracias.
 - * Simpan bukti pembayaran sebagai arsip.
 - * Jika kamu mengalami kendala dalam melakukan pembayaran, hubungi bagian keuangan Telkom University Purwokerto untuk mendapatkan bantuan.

Semoga informasi ini membantu!

	Question	Expected Answer	Generated Answer	Tokenized Question	Total BLEU
0	Apa saja website untuk cek turnitin yang di re...	Kamu bisa melakukan turnitin di perpus telkom ...	Berikut adalah beberapa website yang direkomen...	Apa, saja, website, untuk, cek, turnitin, yang...	0.298501
1	Jumlah prodi di Telkom University Purwokerto	Ada 11 Prodi yaitu Sistem Informasi, S1 Teknik...	Telkom University Purwokerto memiliki **11 pro...	Jumlah, prodi, di, Telkom, University, Purwokerto	0.292893
2	Ruangan pusat bahasa dimana?	Pusat Bahasa berada di Gedung Rektorat Lantai ...	Ruangan Pusat Bahasa Telkom University Purwoke...	Ruangan, pusat, bahasa, dimana?	0.478554
3	apa boleh naskah TA2 nya plagiatnya melebihi 20%?	Tidak boleh. Batas maksimal plagiarisme untuk...	Tidak boleh. Batas maksimal plagiarisme untuk ...	apa, boleh, naskah, TA2, nya, plagiatnya, mele...	0.333363
4	Bagaimana cara membayar BPP?	Untuk membayar BPP di Telkom University Purwok...	Untuk membayar BPP di Telkom University Purwok...	Bagaimana, cara, membayar, BPP?	0.237108
Rata-rata Skor BLEU Total: 0.33					

Fig. 7. The Results of the Relevant Question Test.

Testing based on Irrelevant Questions

In addition to testing the chatbot's ability to answer questions that are in accordance with the training data, tests are also carried out on questions that are not relevant to the information in the data set. Table 7 and Figure 8 summarize the results of testing on out-of-context questions.

Table 7 - Question testing is irrelevant.

Questions	Expected Answer	Response Bot	Status	Response Time (s)
Jumlah prodi di Telkom University Bandung	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.	Valid	7.55
Jumlah prodi di Telkom University Surabaya	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.	Valid	4.37
Apa makanan khas	Maaf Saya Tidak	Maaf, Saya Tidak	Valid	5.59

purwokerto	Dilatih Untuk itu	Dilatih Untuk Itu.		
Rektor UMP siapa?	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.	Valid	6.20

	Question	Expected Answer	Generated Answer
0	Jumlah prodi di Telkom University Bandung	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.
1	Jumlah prodi di Telkom University Surabaya	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.
2	Apa makanan khas purwokerto	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.
3	Rektor Unsod siapa?	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.
4	Syarat TA Unsoed	Maaf Saya Tidak Dilatih Untuk itu	Maaf, Saya Tidak Dilatih Untuk Itu.

Fig. 8. Question Test Results are Irrelevant.

The test results show that the chatbot built with the Gemini 1.5 Flash model is very effective in answering questions related to academic services at Telkom University, Purwokerto. An average BLEU score of 0.88 in automated testing and 0.86 in manual testing indicates consistency in response quality. While chatbots can handle relevant questions well, there is room for improvement in handling questions outside of the dataset. The responses given to irrelevant questions, such as "Maaf, saya tidak dilatih untuk itu" reflect the model's ability to manage unfamiliar information. The temperature settings used in the model, namely 0.7 and 0.64, also contribute to the quality of the response. This setting keeps answers relevant and not redundant, improving the user experience.

Overall, the development of academic chatbots using Gemini 1.5 Flash shows great potential in improving the accessibility of academic information and facilitating interaction between students and institutions. These results confirm the importance of natural language processing in improving the user experience in the context of academic services. Further testing is needed to improve the accuracy and relevance of the chatbot, especially in handling queries that are not included in the dataset. With the right improvements, this chatbot can be a very useful tool for students in getting the academic information they need.

4.3 Implementation of Telegram Chatbot

In implementing the chatbot using the Gemini model with the new input data inference, the researchers performed several technical steps, including configuring the model to generate more accurate answers. This process involves using API Keys from Google AI Studio and Telegram Tokens that can be generated through *BotFather* on the Telegram platform. After preparing these two materials, researchers will configure the model to optimize the chatbot's performance. The configuration is used in the Gemini model in Figure 9.

```
generation_config = {
    "temperature": 0.7,
    "top_p": 0.75,
    "top_k": 64,
    "max_output_tokens": 8192,
    "response_mime_type": "text/plain",
}
```

Fig. 9. Gemini Configuration.

One of the configurations carried out is to set the temperature at a value of 0.7, which aims to regulate the level of response variation (J. Liu et al., 2021). This value ensures that the resulting responses are creative enough without deviating too much from the training pattern. A temperature of around 0.7 is often used in NLP because it can produce a balanced response between creativity and relevance (Based on Gemini's documentation). In addition, the *top-p* is set at 0.75, allowing the model to select only words that fall within the highest 75% of

cumulative probability. This ensures that responses are more varied yet still relevant. *Top-k* is also set at 64, limiting the number of tokens the model selects to only from the top 64 options. This allows for flexibility in word selection without compromising the quality of responses. Furthermore, *max_output_tokens* is set on 8192, which allows the model to generate a long response when needed, which is especially useful for more complex contexts. Meanwhile, *response_mime_type* is set to "text/plain", ensuring that the chatbot's responses remain in the form of simple text that is easy to integrate with the Telegram platform.

Overall, this configuration aims to strike a balance between creativity and control, ensuring that the responses generated by the Chatbot are accurate, relevant, and tailored to the user's needs. According to research (Haque et al., 2022), the use of *top-p* and *top-k* techniques allows the model to generate more flexible and contextual text, making this configuration ideal for Chatbot applications. The following is the flow of the implementation of Chatbot as an academic service, as shown in Figure 10.



Fig. 10. SiAkif Chatbot Work Flow.

In this study, the development of a Telegram chatbot for academic services at Telkom University, Purwokerto was carried out by choosing the Gemini version 1.5 Flash model. This model was chosen because it showed a higher accuracy score compared to other models during the testing process. The chatbot has been successfully implemented as a Telegram application, which includes integration with the Telegram platform, natural language processing, and responses generated by Gemini AI. Here is a look at the Telegram chatbot 'SiAkif', as shown in Figure 11.

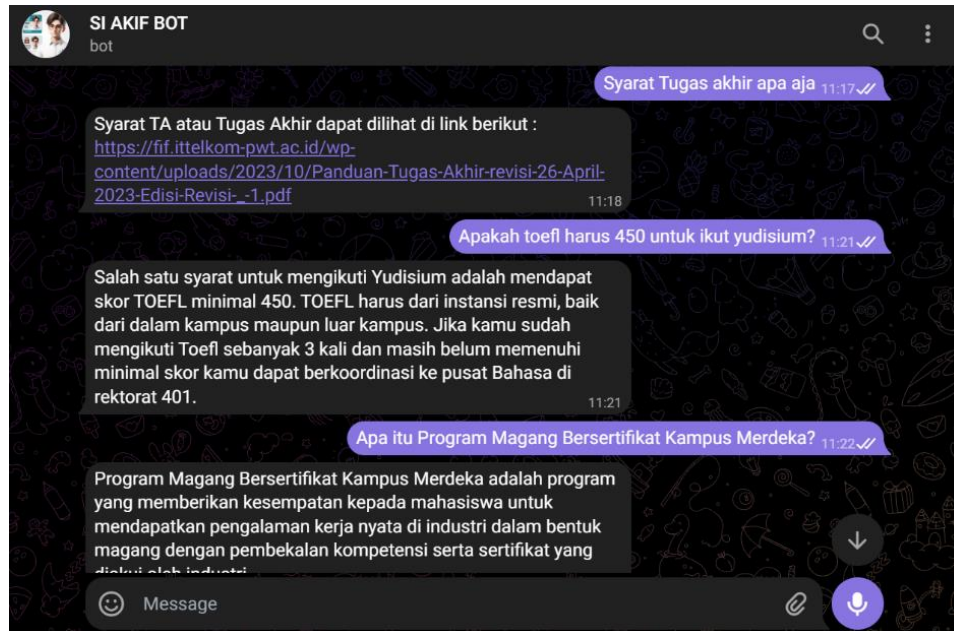


Fig. 11. SiAkif Telegram Chatbot Interface.

5. Conclusion

This research successfully developed an academic chatbot called "SiAkif" using the Gemini 1.5 Flash model, which showed a high accuracy of 88% in answering questions relevant to the academic context at Telkom University, Purwokerto. The test results indicate that this chatbot is effective in understanding and providing appropriate responses, as well as increasing the accessibility of academic information for students. However, the study also identified some limitations, especially related to the relatively small size of the training dataset, which could limit the chatbot's ability to handle a wider variety of questions. Future work should include

developing a more comprehensive and ethically guided dataset, implementing multilingual support, cost-efficiency simulations, and integrating with other university systems such as LMS and ERP. Therefore, it is recommended that the dataset be expanded and more advanced training techniques be applied in future research in order to improve the accuracy and relevance of chatbot responses. With the right improvements, "SiAkif" has the potential to become a very useful tool in supporting interaction between students, and Institutions.

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