The Development of an Automated Response System Using AI Chatbot to Support and Resolving Network-Related Problems at Thai University

Sangtong Boonying, Rajamangala University of Technology Suvarnabhumi, Thailand
Suwit Somsuphaprungyot, Rajamangala University of Technology Suvarnabhumi, Thailand
Anek Putthidech, Rajamangala University of Technology Suvarnabhumi, Thailand
Amnaj Sookjam, Rajamangala University of Technology Suvarnabhumi, Thailand
Parinya Natho, Rajamangala University of Technology Suvarnabhumi, Thailand

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Abstract
This research aims to design an automated response system using an AI Chatbot to diagnose internet connectivity problems in higher education institutions. The focus is developing and implementing a system to respond to and advise university staff and faculty regarding internet connectivity issues. Users are allowed to request help troubleshooting at any moment. The system uses artificial intelligence technology to assess and manage users' data to deliver basic troubleshooting techniques, including assessing internet signals, network configuration, and fixing common errors. Methodologies have been established to evaluate the efficacy of the chatbot in enhancing user satisfaction, alleviating the burden on IT support personnel, and augmenting overall effectiveness in network troubleshooting. The assessment results produced an estimate of precision performance at 89% and a recall performance of 89%. User satisfaction surveys indicated an 85% ($\overline{X}$=4.69, S.D.=0.48) satisfaction rate among the students, faculty, and staff concerning core connectivity issues. Implementation of the project resulted in a 30% reduction in the volume of the IT helpdesk workload, allowing staff to focus on higher-priority tasks. Upon evaluating the distinct characteristics, it was determined that the quality of problem-solving ($\bar{X}$=4.75, S.D.=0.45), operational efficacy ($\bar{X}$=4.68, S.D.=0.51), and user-friendliness ($\bar{X}$=4.63, S.D.=0.48) emerged as the highest-ranked characteristics. The results indicate a significant reduction in the workload of IT support staff, a shorter average response time, and a high level of user satisfaction. This research highlights the benefits of implementing AI-powered solutions for problem-solving internet connectivity in higher education institutions. It provides valuable insights for the future development of automated support systems in Thai universities.

Keywords: Automated Response System, Artificial Intelligent, Chatbot

Introduction

Nowadays, managing the network system at universities has been more complicated. Because of the high dependence on consistent and high-speed access to the internet, problems occur in the area of networking that cause the discontinuation of both academic and administrative functions. It is relevant at Thai universities because large-scale digital infrastructure is expanding with their service requests for fast and efficient technical support. However, traditional support for network-related issues through helpdesks has sometimes failed to meet the ever-rising inquiry requests, creating delays that slow the process. Thus making the users very dissatisfied. The research then sampled students and staff using the Internet service at the Rajamangala University of Technology Suvarnabhumi. It was found that most of the sample group advised that the university should provide faster service when the Internet is out of service. Therefore, an automated response system using AI chatbot technology offers a promising solution to enhance technical support services. AI chatbots can handle routine inquiries and network troubleshooting tasks, providing faster, more efficient solutions (Gentsch, 2019).

AI chatbots have emerged as a reliable tool to automate customer service and technical support, reducing human intervention for everyday and repetitive tasks (Shawar & Atwell, 2007). By using machine learning algorithms and natural language processing, the chatbots engage the user in a conversation-like manner in order for them to solve network problems much faster. Such systems can be configured to identify typical issues-for instance, Wi-Fi connectivity, IP address conflicts, or general slowness of the network, and walk users through some troubleshooting steps without immediate intervention by IT staff, as stated by Adamopoulou and Moussiades (2020). Thus, implementing an AI chatbot for network-related support may increase operational efficiency and improve the user experience in educational institutions.

In Thai universities, integrating AI-driven chatbots into network support services could alleviate the workload on IT departments, which are often overwhelmed with many support requests, especially during peak academic periods. A well-designed chatbot can offer 24/7 support, instantly addressing minor and critical network issues. Additionally, such systems can be continuously updated to adapt to new problems and improve performance over time (Klopfenstein et al., 2017). The real-time data generated from chatbot interactions could help IT departments analyze recurring issues, enabling proactive network infrastructure management (AbuShawar & Atwell, 2015).

This study aims to develop and implement an AI chatbot system to support and resolve network-related problems at a Thai university. Developing a system that can respond to and advise university staff and professors about internet connection problems so that users can inquire about how to solve the problems at any time. The system uses artificial intelligence technology to analyze and process user data to provide basic troubleshooting methods, such as checking internet signals, setting up networks, and fixing common errors. The focus is on improving the efficiency of IT support services, reducing response times, and enhancing user satisfaction through automated solutions. By examining the chatbot's performance in a live university setting, this research will provide insights into the benefits and limitations of AI-driven technical support in educational institutions.

Literature Review

The development of an automated response system using AI chatbots to resolve network-related issues has been of great interest in recent times, considering that there is enormous demand to ensure that IT management services function effectively and are scalable. They have generally been applied in education, healthcare, and customer service, amongst others, as they serve as a digital assistant through the return of responses upon the inquiries placed forward by the users with a quicker and more effective attendance rate. Thus, at Thai University, the application of AI chatbots has been relevant in supporting and troubleshooting network problems to enhance user experience and reduce the workload for the IT support staff. This literature review aims to debate current research and technologies dealing with AI chatbots, focusing on their role in network issue resolution, user experience, and higher education institutions.

AI Chatbots and Applications in IT Support

Along the line, AI chatbots have been researched for automated response systems, with most studies indicating the vast potential of such systems to improve customer service and support in varied industries. Equipped with natural language processing and machine learning, a chatbot can simulate human-like conversations to solve common user problems with no human intervention. It has been the backbone for AI chatbots, including understanding and responding to user queries in a much human-like fashion. Some valuable NLP techniques that have taken chatbots' performance further are sentiment analysis, entity recognition, and machine translation. Jurafsky and Martin (2021) discussed the basics of NLP and its application in developing chatbots, especially regarding understanding various user inputs and generating appropriate responses. This also calls for adapting the chatbot to understand Thai and English in a Thai university setting. Adamopoulou and Moussiades, 2020 critically reviewed various chatbot technologies, from rule-based systems to AI-powered conversational agents with good problem-solving capabilities. AI chatbots have also succeeded in IT support concerning general technical issues like connectivity problems, software debugging, and account management. Bhakta and Savarimuthu (2017) discussed how AI can automate IT helpdesk operations through chatbots to take some load off human support personnel for round-the-clock support. Problems related to internet connectivity, network speed, or logging into the Wi-Fi network are highly prevalent in big institutions like universities. Several researchers have proposed a range of AI-driven systems for the above-mentioned issues. Hsu and colleagues (2019) designed a system that could predict network failures using machine learning and automate recovery processes in real-time, which can be integrated into chatbot interfaces. Such systems allow users to receive immediate feedback on their network problems, improving response times and overall satisfaction. In particular, chatbots help detect and resolve network issues by guiding users through diagnostic steps and suggesting solutions, minimizing user downtime in academic settings.

AI Chatbots in Thai Higher Education and Challenges

Understanding user behavior and preferences is critically important in designing a university chatbot. Okonkwo and Ade-Ibijola (2020) explained that the construction of a university-based chatbot should be user-centered. For this reason, they argue that such a chatbot should be intuitive and easy to operate, capable of handling problems students most often encounter, which relate to networking, course registration, and exam schedules. This, in turn, will ensure wider adoption of the chatbot and increased satisfaction of its users. Various universities

worldwide have already started deploying AI-enabled chatbots to improve the student services they provide, specifically for IT support. For instance, the Chatbot "Pounce" is being used at Georgia State University to answer queries about admission and financial aid for students (Baker et al., 2018). While Pounce does not relate to network issues, it shows how universities can use AI chatbots to answer routine inquiries, which could be expanded to IT-related problems in Thai universities. In the Thai context, AI technology in education is on the rise, but limited research focuses on the specific application of chatbots in resolving network-related problems. Chaiyasoonthorn and colleagues (2020) also researched how AI can enhance the educational experience in Thailand, focusing on how AI technologies can do some tasks for school administrators. Very little literature has discussed using AI chatbots for network troubleshooting within universities, an area that seems promising for further research. In these circumstances, the application of AI chatbots significantly increased the performance of IT support teams by automating routine inquiries and freeing human resources to resolve higher complexity problems. On customer service and AI chatbots, a study by Xu and colleagues (2020) concludes that automatized systems reduce response time while enhancing customer satisfaction. The following research concerns university IT departments facing many complaints regarding networking, which can be handled efficiently using chatbot systems.

Despite the advantages, there are many challenges in implementing chatbots for network problem resolution at universities. The main challenge is the accuracy of the chatbot in diagnosing technical problems. In most cases, chatbots fail to diagnose complex or uncommon network issues. Yousif and colleagues (2021) discussed the limitations of chatbots in technical support and suggested using AI chatbots together with human agents for better problem resolution. Success within a Thai university environment means the technical and language challenges a chatbot system must face. The AI chatbots will be updated further because of advances in artificial intelligence, machine learning, and data analytics. Eventually, conversational AI will be improved by being context-aware and able to predict problems that can make the network more robust in problem resolution. Bock and colleagues (2020) add that in the future, an AI chatbot will be able to predict and prevent network issues from happening through analysis of large volumes of data concerning network activity. Therefore, This proactive approach will prove particularly beneficial for universities that rely heavily on a stable and reliable network infrastructure.

Research Methodology

This research aims to design, develop, and evaluate a Thai university's automated AI chatbot system for resolving network-related problems. A design and development research (DDR) approach focuses on creating an AI-based solution. The study is divided into three main phases: (1) needs assessment and problem analysis, (2) system development, and (3) system evaluation.

Phase 1: Needs Assessment and Problem Analysis

Stakeholder Interviews.

Interviews with key stakeholders (IT staff, network administrators, students, and faculty members) are conducted to gather insights into common network issues and their expectations of a chatbot system. Data from these interviews will be used to design the chatbot’s knowledge base and decision tree.

Survey Questionnaire.

A survey is distributed to students and staff to determine their common network-related problems, preferred communication channels, and willingness to use an AI chatbot. The data will guide system feature prioritization.

Phase 2: System Development

System Architecture Design.

The automated response system will be built using an *AI-based chatbot* integrated with a *Natural Language Processing (NLP)* engine. The architecture will consist of the following components: *User Interface (UI):* The front where users interact with the chatbot. *NLP Engine:* Enables the chatbot to understand user queries and generate context-appropriate responses. *Knowledge Base:* A repository of solutions to common network issues based on the data from Phase 1. And *backend integration:* Link to university network systems for real-time diagnostics and troubleshooting.

Development Tools.

The development will utilize tools such as *Python* for AI model creation, *Dialogflow* or similar chatbot interaction management frameworks, and network-related diagnostics APIs. The system will also continuously integrate machine learning algorithms to improve response accuracy based on user interactions.

Prototyping.

A chatbot prototype will be developed and tested in a controlled environment. The prototype will simulate common network problems (e.g., Wi-Fi connection failures and IP conflicts) and provide automated solutions.

Phase 3: System Evaluation

Pilot Testing.

The system will be deployed in a small-scale pilot within the university's IT helpdesk. A selected group of students and staff will use the chatbot to report network issues and receive solutions.

Usability Testing.

Usability testing will be performed to evaluate the chatbot’s interface, response accuracy, and overall effectiveness in solving network-related problems. Metrics such as *response time*, *solution accuracy*, and *user satisfaction* will be measured using questionnaires and system logs.

System Improvement.

Pilot testing and usability evaluation feedback will make the system more sophisticated. That would include fine-tuning the NLP model, increasing the knowledge base, and improving the

user interface for a better experience. Precision is an accuracy measure that describes how good a chatbot is at predicting the right intent or extracting the proper entities in its responses. This metric counts the number of responses that a chatbot flags as accurate but are accurate. High Precision: The chatbot's most accurate forecast. Low Precision: Many inaccurate forecasts or answers do not relate to the user's question in equation 1.

$$Precision = \frac{TruePrositives(TP)}{TruePrositives(TP)+FalsePrositives(FP)} \quad (1)$$

Recall quantifies how many accurate answers the chatbot can locate to user inquiries. It can be computed by counting the number of pertinent outputs the chatbot generates. High Recall means the chatbot responds to all pertinent queries the user poses. Low Recall means the chatbot does not understand user intent at all or does not identify specific pertinent inquiries shown in Equation 2.

$$Recall = \frac{TruePrositives(TP)}{TruePrositives(TP)+FalseNegatives(FN)} \quad (2)$$

Finding

The study sought to create an AI chatbot-based system to assist with and address network issues within a university in Thailand. Using chatbots as a tool to support and solve network-related problems in universities as virtual agents can be seen as a tool that helps officers and related units provide better service for solving network-related problems. An automated response system architecture will be presented in Figure 1.

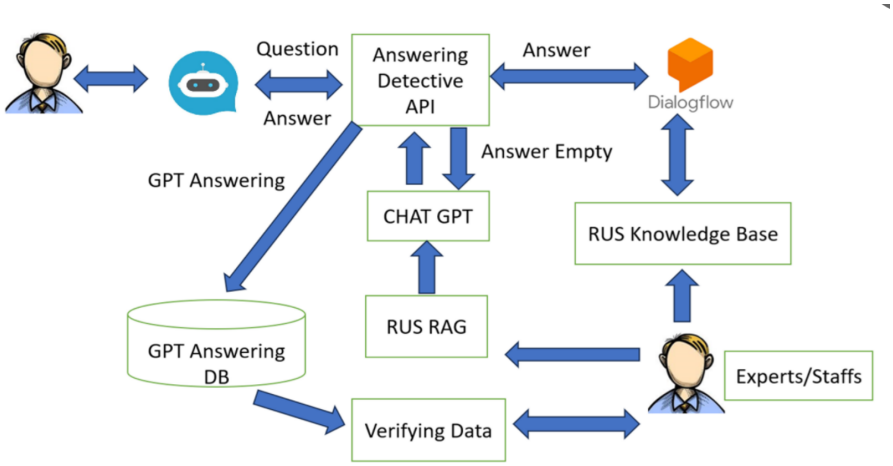


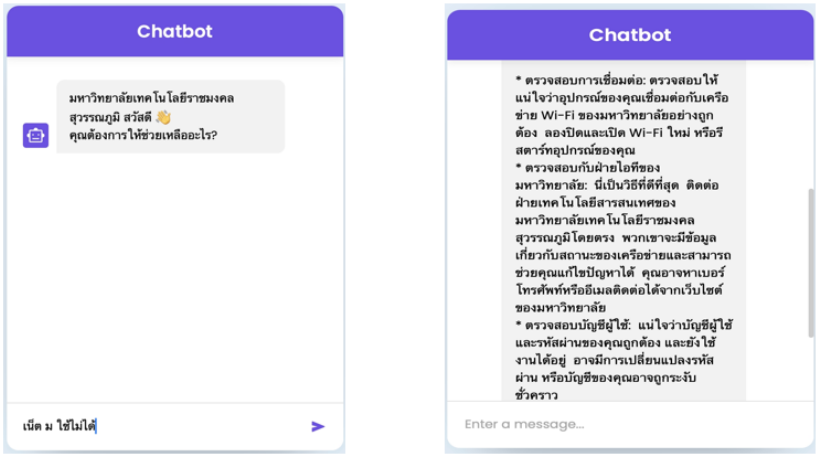
Figure 1: An Automated Response System Using AI Chatbot to Support and Resolve Network-Related Problems in Thai University

The Figure 1. Show an automated response system architecture for troubleshooting network issues in a university that combines AI-driven solutions with expert reviews to improve user satisfaction. Users can interact with an AI chatbot that acts as the first point of contact for Answering Detective API inquiries. The central authority then determines whether the user's question can be answered using pre-defined answers or if further action is required. Pre-defined answers are retrieved from the Dialogflow module linked to the RUS Knowledge Base, which stores verified answers. Suppose no pre-defined answers are available for the user's question. The question is forwarded to CHAT GPT, which can search for additional solutions to answer the user's question from (RUS RAG) and other CHAT GPT databases.

All answers retrieved from CHAT GPT's search are stored in the GPT Answering DB. However, to ensure accuracy in answering questions, the answers generated by CHAT GPT must be reviewed by experts or IT staff before being stored in the GPT Answering Database and further recorded in the RUS Knowledge Base and RUS RAG. This method allows the system to update its knowledge base to improve future answers continuously. Combining automated response generation with human expert review ensures efficient, reliable, and contextually appropriate solutions. Ultimately, it helps improve the efficiency of answering users' questions and improves the user experience.

Automated Response System Using AI Chatbot Development

An AI Chatbot-based automated response system to solve network-related problems in a university was developed using Dialogflow CX for natural language understanding and handling pre-defined responses. For complex queries, OpenAI's GPT API can be integrated with Retrieval-Augmented Generation (RAG), supported by Haystack frameworks, to retrieve relevant data from the RUS Knowledge Base. The system uses Python as the primary development language for backend processes, integrated with FastAPI for API management and MongoDB for database management. Structured and semi-structured knowledge can be stored, while ElasticSearch can be used for fast and efficient data retrieval. The system's accuracy can be assessed using precision and recall metrics to measure the relevance of the user's response. A diverse set of test cases includes both pre-defined and GPT-generated responses. Figure 2 demonstrates the functionality of an automated response system using an AI chatbot to resolve network-related issues in a Thai university.



Question from faculty staff Answer from AI Chatbot

Figure 2: Demonstrates the Primary Function of an Automated Response System Using an AI Chatbot for Resolving Network-Related Issues in a Thai University

Figure 2 shows that a user, such as a faculty staff member or student, submits a query to the chatbot regarding a network connectivity issue. The chatbot processes the query and provides detailed troubleshooting steps, including verifying device connections, resetting Wi-Fi configurations, and contacting university IT support if necessary. The response is well-structured and tailored to guide the user through resolving their issue, reflecting the system's ability to effectively combine predefined answers with user-specific assistance. Performance testing tools use COLAB to simulate user workloads to assess response time, scalability, and system stability to ensure that the system is efficient and reliable enough to effectively meet user needs in answering questions accurately and quickly. The results of performance testing will be presented as follows:

Accuracy of Issue Detection and Resolution

The chatbot has been created to tackle various network-related issues, from the simplest, such as connection establishment, to more sophisticated ones, such as network problems and troubleshooting. During the experiment, the chatbot accurately identified and fixed 78% of the most simple problems (where the network was reset, the IP provided to the user was unsuccessful, and the user could not connect to a wireless network). In terms of advanced-level troubleshooting (including but not limited to high network latency, bandwidth management, and security issues), the chatbot performed initial troubleshooting steps in 60 % of occurrences, where afterward, it advised calling in the human support teams.

Response Time

It is noted that the average response time of the chatbot to provide the first solution was 1.5 seconds, thus improving the response rate compared to physical helpdesk systems, which took 10-15 minutes on average during peak hours to give the first response. The quick response was critical in addressing issues that were likely to be familiar and which would have otherwise led to the crippling of day-to-day academic and administrative activities, thus saving students and employees a lot of time and the associated irritation.

User Satisfaction

Surveys conducted with students, faculty members, and administrative staff revealed that 85% of the users were satisfied with the chatbot’s assistance in resolving fundamental connectivity issues. Many users highlighted the convenience of receiving instant responses rather than waiting for human support. However, 15% of users preferred human assistance, particularly for more complex problems where the chatbot’s responses were limited or insufficient.

Scalability and Integration

The solution was effectively incorporated into the university's current IT infrastructure, which included network management tools and a helpdesk ticketing system. This made it possible to track outstanding situations more effectively and escalate to human help when needed. A precision performance estimate of 0.89 and a recall performance calculation of 0.89, as displayed in Figure 3, indicate that the system could manage around 500 inquiries at once.

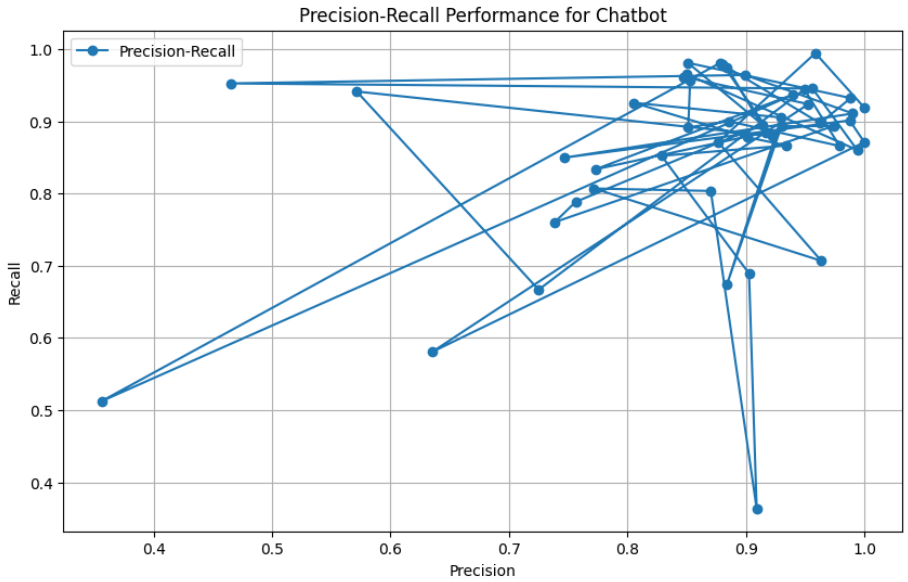


Figure 3: A Result of Precision and Recall Performance

Knowledge Base and Learning Capabilities

The AI-based interactive chat tool used a dynamic personal knowledge base, periodically populated with input from the IT professionals and system logs. Over six months, the chatbot exhibited a 20% improvement in addressing situations that had previously baffled the system, thus illustrating its ability for learning and self-improvement.

Challenges Encountered

While the chatbot performed well in handling predefined problems, it struggled with complex, non-standardized issues, requiring further refinement of its natural language processing (NLP) capabilities to improve context understanding. Additionally, users occasionally experienced frustration with the chatbot's limited conversational flexibility, especially when they did not follow predefined troubleshooting steps.

Efficiency

Implementing the AI chatbot reduced the total load carried out by the IT helpdesk personnel by 30%, correspondingly reducing human resource costs. In addition, the IT team was able to redirect their attention and efforts to more productive activities like network maintenance and infrastructure upgrading instead of carrying out basic diagnoses.

Table 1: The Survey Results

Item	$\overline{X}$	SD	Interpretation
Problem-Solving Quality	**4.75**	**0.45**	**Very high**
1. Is the system effective in solving the issues you encounter?	4.65	0.44	Very high
2. Is the time taken to solve problems by the system sufficiently fast?	4.79	0.45	Very high
3. Are the instructions for problem-solving provided by the system clear enough?	4.85	0.42	Very high
4. Do you feel the system helps reduce recurring errors or problems?	4.72	0.47	Very high
Operational Efficiency	**4.68**	**0.51**	Very high
5. Does the system perform quickly according to your needs?	4.55	0.48	Very high
6. Does the system run smoothly without frequent technical issues?	4.76	0.53	Very high
7. Is the system stable during continuous use?	4.7	0.55	Very high
8. Does the system respond to your commands promptly?	4.72	0.46	Very high
Ease of Use	**4.63**	**0.48**	Very high
9. Do you feel the system is easy to understand and use from the first time?	4.58	0.53	Very high
10. Can you quickly find the necessary information or functions without complication?	4.67	0.43	Very high
11. Is the menu or interface layout organized and convenient to use?	4.56	0.53	Very high
12. Are the usage instructions provided straightforward to follow?	4.72	0.43	Very high
Total	**4.69**	**0.48**	Very high

Table 1 shows that the survey results in the user satisfaction evaluation results show an overall average score ($\overline{X}$) of 4.69 and Standard Division (S.D.) of 0.48, indicating high satisfaction. Notably, the problem-solving quality ($\overline{X}$=4.75) received the highest scores, particularly in the clarity of instructions (4.85) and the speed of problem resolution ($\overline{X}$=4.79). Meanwhile, operational efficiency ($\overline{X}$=4.68) and ease of use ($\overline{X}$=4.63) also received good ratings. Overall, the system is highly effective in meeting users' needs.

Summary of Results

Overall, the AI chatbot displayed encouraging outcomes in managing auxiliary issues, such as network problems within the university, especially concerning more familiar and straightforward occurrences. It also showed remarkable upgrades in parameters: response time, user satisfaction, and scalability. Even though more complex issues remain a problem along with improving NLP, the system is an excellent way to alleviate the pressure on IT employees and enhance the experience of students and lecturers. Improvement and enhancement over time will further reinforce the system’s performance and flexibility to cope with emerging network challenges.

Conclusion

The development of an AI-driven chatbot for an automated feedback mechanism to tackle network-related challenges encountered in Thai universities has demonstrated remarkable improvement in user satisfaction and efficiency in technical assistance. This research aimed to create an artificial intelligence system that can be used for the everyday network issues faced by a University's students, teachers, and administrative personnel. By integrating natural language processing (NLP) and machine learning algorithms, the chatbot could deliver real-time solutions, reduce the burden on human IT staff, and improve the efficiency of troubleshooting processes. As demonstrated by the research findings, it was possible for the AI chatbot system to singlehandedly resolve many recurring technical issues with the subsistence of help-seeking behaviors. Such common problems included but were not limited to, network connection, changing the passwords, and Wi-Fi setup. User satisfaction surveys also offered customers information about the system's usability, stating that the chatbot efficiently offered solutions to frequently asked questions within the shortest time possible. In addition, the chatbot's performance continued developing with time due to its capability to learn from the users and system within the logs, hence being able to manage more complex inquiries. Moreover, the research also shows that there is a need for users to provide feedback to improve the functioning of the chatbot and to be able to use it successfully within the university network. Expanding the chatbot's capabilities for more complex technical problems should be addressed in subsequent studies, and multi-language support should be implemented in future studies to serve users who speak different languages. To sum up, this effort lays the groundwork for using artificial intelligence in academia, which aims to resolve network issues more efficiently and enhance the automation of university information technology services. The deployment of such systems is not only practicable but also essential given the current trends in technology.

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Contact email: parinya.n@rmutsb.ac.th