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Chatbots Workflow Automation Using N8N (*Node Automation*) as an Innovation in Digital Academic Services in Higher Education

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Abstract

Improving the quality of digital academic services in higher education requires systems that are fast, responsive, structured, and accountable. While chatbots are commonly used as digital service tools, their implementation often focuses on conversation rather than effective management of service processes. This study develops workflow automation using n8n, a node automation tool, to support academic service tasks. Employing the Design Science Research (DSR) methodology, the research includes problem identification, solution design, artifact development, and system evaluation. The result is a modular, reusable, node-based workflow automation model that manages academic service processes. Evaluation across four different service scenarios demonstrated that the workflows operated as intended, enhancing service accessibility, process clarity, and consistency in service delivery. This model offers a practical framework for higher education institutions to adopt and implement efficient digital academic services.

Keyword: Academic Chatbot; Digital Academic Service; DSR; Node Automation; N8N; Workflow Automation.

Abstrak

Meningkatkan kualitas layanan akademik digital di perguruan tinggi memerlukan sistem yang cepat, responsif, terstruktur, dan akuntabel. Meskipun chatbots umum digunakan sebagai alat layanan digital, implementasinya sering kali hanya fokus pada percakapan, bukan pengelolaan proses layanan secara efektif. Penelitian ini mengembangkan otomatisasi workflow menggunakan n8n, sebuah alat node automation, untuk mendukung tugas layanan akademik. Menggunakan metodologi Design Science Research (DSR), studi ini mencakup identifikasi masalah, perancangan solusi, pengembangan artefak, dan evaluasi sistem. Hasilnya adalah model otomatisasi workflow berbasis node yang mengelola proses layanan akademik secara modular dan dapat digunakan kembali. Evaluasi terhadap empat skenario layanan menunjukkan bahwa workflow berjalan sesuai rencana, meningkatkan akses layanan, kejelasan proses, dan konsistensi penyampaian.

Kata Kunci: Chatbot Akademik; Layanan Akademik Digital; DSR (Penelitian Desain); Otomatisasi Node; N8N; Otomatisasi Workflow.

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1. Introduction

Higher education institutions are continually encouraged to accelerate their digital transformation to provide faster, more accurate, and more accessible academic services. Every year, the number of interactions between students and academic units increases, ranging from questions about class schedules and faculty information to administrative guidance. On many campuses, this service process still relies on manual communication through counters or private messages to staff via email, WhatsApp or Telegram. This pattern often leads to service backlogs, uneven responses and reduced administrative work efficiency. Chatbots are becoming a widely adopted solution as an entry point for digital services. However, most chatbots operate as simple question and answer systems, without optimizing the underlying workflows. In fact, the effectiveness of a chatbot depends heavily on how its logical flow or workflow handles user requests. Chatbot functionality extends beyond answering questions, but they can also manage service processes through workflow automation. This automation enables chatbots to disseminate information, provide step by step guidance for administrative tasks, implement conditional rules and decrease the burden on academic staff. Adamopoulou and Moussiades (2020) said that chatbots can help make information easier to get and assist with automatic interactions between users. Kohnke (2023) also pointed out how chatbots are becoming more important in helping with education services and school management tasks in colleges and universities. Zhang (2021) said that conversational agents can work well as help desk if they are connected with the organization's processes.

Event though, most chatbots used in universities mainly deal with conversations and answering questions. In many conditions, chatbots are used just to get information, but the actual services the handle still require people to do the work or rely on separate software rules. Recent research shows that using workflow automation can help organizations perform better by handling repetitive tasks automatically and making sure services are delivered in a consistent way. Misbahuddin (2023) showed that using a workflow approach for service automation can make service easier to reach in schools and learning places. Many research papers have looked into how chatbots can be connected with automation systems and AI tools. Ramadhani *et al.* (2025) used chatbot automation with n8n and artificial intelligence to help with data analysis and reporting. Purwanto *et al.* (2025) said that combined n8n with generative chatbot technology to assist with student admission services. Most current research focuses on conversational intelligence and system integration. This gap leads to the current study, which is concentrated on design and setting up workflow automation for academic services using n8n. this research isn't about making chatbots better at conversation like most studies are, it focuses on creating a workflow automation system that can manage academic service processes using a structure based on connected nodes that carry out actions step by step. In this setup, a chatbot can act as the way people interact with the system, while workflow automation takes care of handling the service rules, running the processes and making decisions. This research uses the Design Science Research approach to create, build and test a tool that automates workflows for academic services. This study introduces a flexible, adjustable and repeatable workflow based service model that can help with future academic chatbot projects and larger digital service systems in universities.

2. Research Methodology

According to Dumas *et al.* (2018), workflow automation allows activities within a process to be executed automatically by rule based and event driven systems. Each activity in the workflow is represented as a logically connected component controlled by a process execution engine (workflow engine). The node based workflow approach models process as a collection of interconnected nodes. Each node represents activities, data processing, and decision making. According to Weske (2019), node based process modelling facilitates flow visualization, system maintenance, and the evaluation of process logic.

Nodes can be trigger nodes, action nodes, or decision nodes that determine the next execution flow. According to Pautasso *et al.* (2017), low code and visual workflow approaches are highly effective for service integration and automation systems, as they accelerate development and minimize implementation errors. N8N supports APIbased integration and event-driven workflows. According to Fielding (2000), Representational State Transfer (REST) architecture enables distributed systems to communicate efficiently through standardized interfaces. Weske (2019) in: Concepts, Languages, Architectures, business processes are modelled as interconnected networks of activities. Each activity or decision is represented as a node with: input (data/event), processing rules, and output (action/transition to the next node). This research used a method called Design Science Research, which was introduced by Hevner *et al* (2024). This method is all about

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creating, building and testing solutions to real world problems through the development of tools or systems. In this case, the study looked at how academic services work in a university in Indonesia. The researchers focused on the everyday academic services that student often ask for, like information about subjects, class schedules, detail about lecturers, step for administrative tasks and general question about academics.

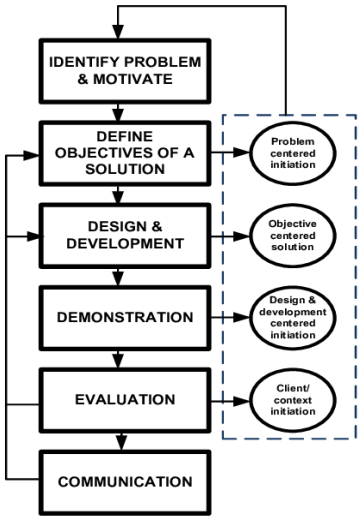

Figure 1. DSR methodology

Data was gathered by reviewing exiting literature, observation directly and had conversations with open ended question. The literature review examined previous research about workflow automation, business process management, digital academic services, conversational system and workflow based services architectures. Reference were gathered from journals, conference papers and academic books that were published from 2019 and 2025. The observation period took place over 4 weeks in the academic service unit. The goal was to find out the current service steps, the ways people communicate, the questions students ask frequently, there the service gets stuck and which steps can be made more efficient with automation. The result from observations were used to record the service activities and determine what steps are needed in the workflow. Three academic service staff, who were directly involved in managing student inquiries and administrative services was interviewed. Each interview lasted approximately 25-30 minutes. The interview process was designed to find out which services are often asked for, which tasks are done, challenges in information delivery, reason for service delays and ways to use automation to improve the process. The result from the interview were turned into a specific steps and rules that the new system would need to follow.

Based on the collected data, created a workflow automation tool with n8n (Node Automation) as the system that manages the workflow. The artefact shows how academic services work by connecting different parts that represent starting points, choice, steps taken and results. In the suggested design, a chatbot acts as a possible way for users to interact while workflow automation handles the running of service, process control and decision logic. The DSR process consisted of four stages. The first stage was figuring out the problem by looking at existing research, observation and interviews. The second stage was about designing the workflow architecture which involved in workflow modelling and specifying the service processes. The third stage included develop the artefact using n8n and API based integration methods. The last stage involved checking the artefacts by running the workflow and quality checking. Evaluation was conducted using four academic services scenarios: the subject information, general academic questions, test consistency the workflow and error handling validation. Each scenario was executed repeatedly to check the workflow was correct, consistent in response and the process worked reliably every time. In addition, the academic service staff conducted a qualitative assessment based on four criteria: service efficiency, service accessibility, process transparency and consistency of the response. The result from the evaluation helped determine whether automating workflows cloud effectively support digital academic services in higher education.

3. Result and Discussion

3.1 Results

This research resulted in an academic chatbot based on workflow automation, using n8n (node automation) as its primary workflow engine. The system was developed to support digital academic services in higher education environments, particularly recurring and rule-based academic information services. The chatbot serves as a user (student) interface, while n8n manages the academic service process flow. Each user request is processed through a series of nodes that have been designed according to service requirements, so that the chatbot's responses are not static, but follow a predetermined workflow. The chatbot workflow is designed using a node-based automation approach, with each node representing one academic service activity or decision. In general, the workflow consists of: a Trigger node, which receives input from users; a Decision node, which determines the type of service based on the context of the question; an

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Action node, which executes services such as data retrieval or information presentation; and a Response node, which sends the results to users via the chatbot. The integration of chatbots with n8n is via an API. Chatbots send user messages to the n8n workflow endpoint, then n8n processes the request based on a predetermined node flow. The results of each workflow are returned to the chatbot as structured responses. This pattern shows that chatbots do not work independently, but are part of a broader workflow automation ecosystem.

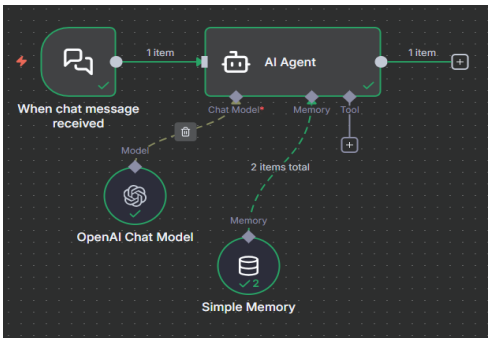

Figure 2. Chatbot integration using N8N

Workflow automation-based chatbot flow on n8n:

1) The flow begins when the user (student) sends a message through the chatbot interface. At this stage, the chatbot serves only as an input channel, without directly processing service logic.
2) The user's message is then forwarded to n8n via a webhook or API mechanism. The user's message is received by the webhook node on n8n as a workflow trigger with input data generally including: the content of the user's message, the user's identity (if available), and the access time.
3) This webhook marks the start of workflow execution and serves as the central integration point between the chatbot and the system. Once the webhook is active, the workflow enters the pre-processing stage, where user messages are simplified, for example, converting letters to a standard format and removing irrelevant characters.
4) The workflow then directs the message to a decision node (Switch/IF Node) to determine the requested service type. Unlike complex NLP, classification is based on simple rules or keywords that are considered more stable and easier to control.
5) Once the service type is identified, the workflow is routed to the appropriate sequence of nodes. At this stage, n8n will execute the data retrieval node (e.g., from a database), process the data according to service rules, and prepare the results for return to the user.
6) The results of the service process are then formatted into messages that are easy for users to understand. The stages include compiling response text, combining dynamic data, or selecting answer templates.
7) The compiled message is sent to the chatbot via the HTTP response node or outbound API. The chatbot then conveys the results to the user. Output with chatbot:

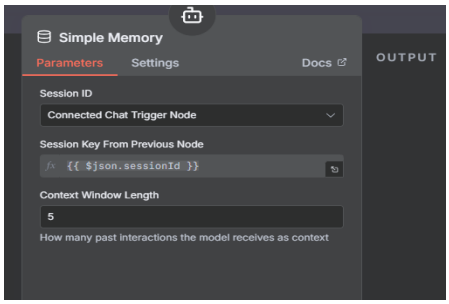

Figure 3. Simple memory parameters

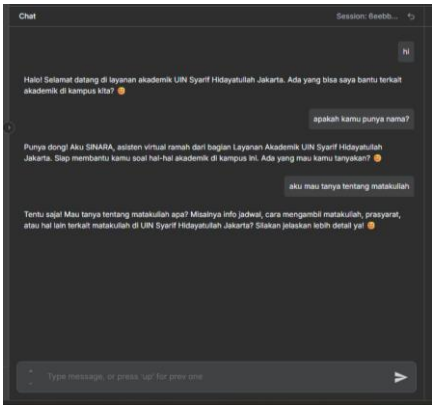

Figure 4. Chatbot dialog box using N8N

Table 1. The table of flow summary

No	Process	N8N Role
1	Input user text	Receive data
2	Trigger workflow	Webhook
3	Pra-process	Normalization input
4	Service classification	Decision node
5	Service execution	Workflow node
6	Response compilation	Formatting output
7	Chatbot output	API/HTTP Response

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The main result of this study is an automation tool created with n8n (Node Automation) to support academic services in higher education. The artefact was created using information gathered from reading existing studies, observation and interviews with academic staff. Instead of focusing on setting up a chatbot, the suggested approach centres on organizing workflows using automated nodes, where academic service request are handled based on set rules and decision making steps. The developed workflow architecture consist of interconnected nodes representing triggers, decision points, actions and response generation process. This design allows academic service tasks to be executed systematically and consistently. In the proposed model, a chatbot could be used as a future interaction layer. However, the work done in this study looked at how well the workflow automation part can handle academic service processes. To assess the artefact, four academic services situation were created based on the usual service tasks that were found during the data collection. These scenario include subject information, general question about academics, workflow consistency testing and error handling validation. Each scenario was executed repeatedly to verify the correct of the workflow, consistency of response and the process war reliable. This flowchart or visual chart illustrates the sequence of steps, decisions, and logical flow in the chatbot process.

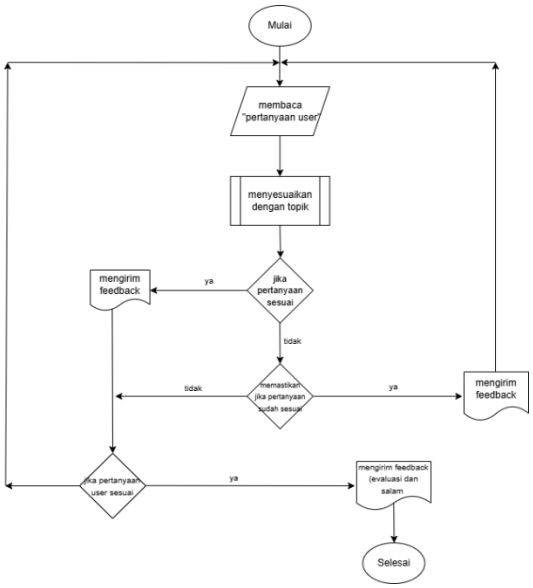

Figure 5. Workflow Flowchart

The use case diagram shows that all services are accessed through a single chatbot interaction point, while internal processes are controlled by workflow automation.

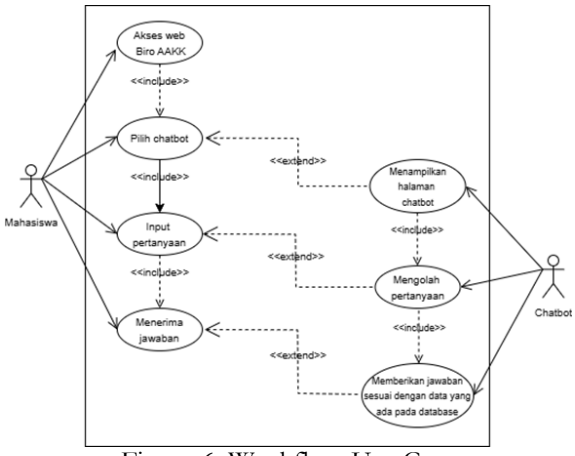

Figure 6. Workflow Use Case

A Sequence diagram illustrates the chronological sequence of interactions between system components. The flow begins when the user sends a message to the chatbot, which is then forwarded to n8n via a webhook mechanism as a workflow trigger.

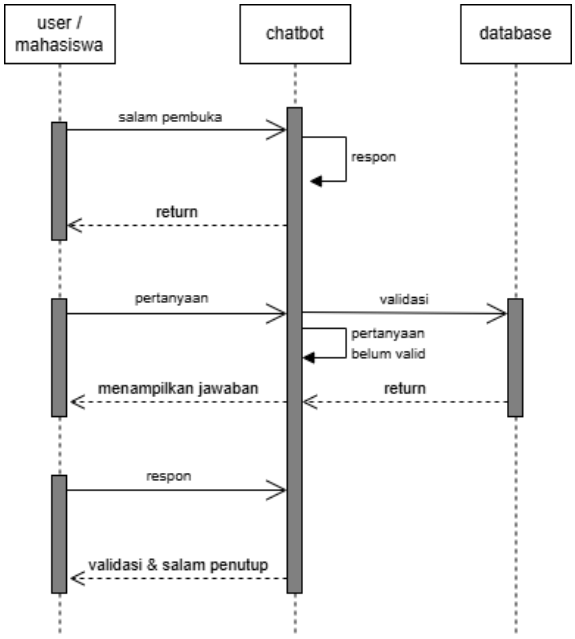

Figure 7. Workflow Sequence Diagram

An Activity diagram illustrates the flow of system activities, starting with the user sending a message, then the chatbot receiving it, and finally the chatbot responding. At the decision-making stage, the chatbot determines whether the user's request matches the database. If "no," the chatbot will respond to the user. If "yes," the chatbot will display the response and forward it to the user.

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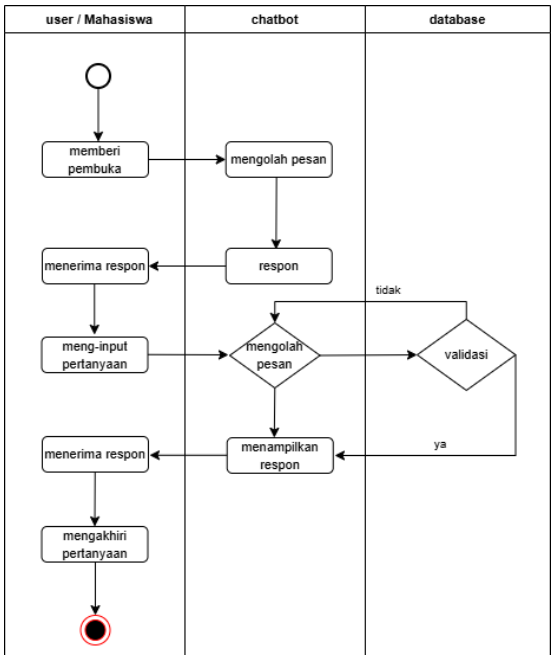

Figure 8. Workflow Activity Diagram

This study results confirm that node based design can serve as a new paradigm for designing intelligent systems that are flexible, modular, and easy to expand as organizational needs evolve. The implementation of workflow automation based in chatbots enables educational institutions to create more efficient, integrated, and user oriented service systems in the operational efficiency, system management and development, and user experience contexts. All test scenarios confirm that the chatbot workflow automation using n8n runs as specified. Each user request is processed through the appropriate series of nodes, from the trigger node to the response node.

Scenario test
Scenario test 1 : Subject information
User input : 5th grades subject
Workflow/ execute node : Trigger Node → Decision Node → Action Node (Query Subject Data) → Response Node
Output : List of 5th grades subject has showed
Test results : Success
Description : Consistent and accurate response

Scenario test 2 : General academic question
User input : Schedule academic service
Workflow/ execute node : Trigger Node → Decision Node → Action Node (general information) → Response Node
Output : Time information has showed
Test results : Success
Description : Suitable for FAQ services

Scenario test 3 : Test loop flow
User input : Same question has resend
Workflow/ execute node : Trigger Node → same workflow
Output : The output consistent
Test results : Success
Description : Show the consistent of the workflow

Scenario test 4 : Data failure
User input : Data not available
Workflow/ execute node : Trigger Node → Action Node (Query) → Error Handling Node
Output : Error message has showed
Test results : Success
Description : Active error handling node

Efficiency and consistency of service are the most prominent aspects, as the service process is automated and structured. This evaluation also shows that the workflow automation approach not only affects technical aspects but also organizational ones, particularly by reducing the workload of manual services. Although the system remains rule based and straightforward, the qualitative evaluation indicates that the chatbot can make a real contribution to improving the quality of academic services.

Table 2. The table of the evaluation

No	Evaluation Aspect	Evaluation Criteria	Observation Result	Evaluation Findings
1	Service efficiency	Ability to obtain academic information through automated processes	Positive	Information could be deliver-ed immediately through work-flow execution without requiring manual intervetion
2	Services Accessibility	Availibility of service regardless of staff availability	Positive	Service request could be process-ed consistently through automa-ted workflows
3	Process Transparency	Clarity of workflow structure and service procedures	Positive	Workflow execution paths and decision logic were clearly defined and trace-able

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4	Response Consistency	Consistency of outputs for identical request	Positive	Repeated work-flow executions generated stable and predictable responses

The quality check showed that the proposed workflow automation model helps in organizing and delivering academic services in a clear and systematic way. Participants said that improvements in service accessibility, process transparency and response consistency, while repetitive manual activities could be handled through automated workflow execution. The evaluation results show that using n8n workflow automation can help academic service processes more dependable and set up a good base for connecting with chatbot interfaces and academic information systems in the future. The evaluation result shows that using n8n for workflow can help manage academic service processes in a clear and reliable way. The successful completion of all workflow scenarios shows that using a node based approach for workflow modelling can handle service logic, decision control and process execution. These results match up with Business Process Management (BPM) principles, which emphasize process standardization, automation and transparency. The findings support the work of Misbahuddin *et al* (2023), who found that workflow automation can cut down on repetitive manual tasks and improve service execution. The suggested workflow model formalizes academic service procedures through using clear rules and decision logic. The result also complement Ramadhani *et al* (2025), who used n8n based automation along with artificial intelligence thechnologies. However while earlier research focused on conversational capabilities and intelligent processing, this study emphasizes workflow organizing tasks and services process management.

Compared to regular academic chatbot system, this new method keeps the part where users interact separate from the part that handles the actual services. In this model, a chatbot may function as a communication interface, while workflow automation takes care of running services and making decisions. This design allows for more flexibility, easier maintenance and clearer understanding when managing academic services. From a practical point of view, the suggested workflow model can help higher education institutions make their services processes more consistent, cut down on repetitive manual work and enhance the reliability of their services. The node based architecture also makes it easier to connect with academic information system and other digital services in the future. This study has several limitations. The evaluation focuses at a workflow automation tool instead of a complete chatbot system and included a small number of service situations and people involved. Besides that, quantitative performance indicators such as response time reduction and user satisfaction were not measured directly. Future studies should combine the workflow model with existing academic information system, evaluate its performance in real academic environments and explore the integration of workflow automation with generative AI technologies.

3.2 Discussion

The results of this study demonstrate that workflow automation based on n8n can significantly improve the efficiency and consistency of academic services in higher education institutions. The developed system is capable of processing user requests automatically through a series of structured nodes, thereby reducing reliance on manual procedures and accelerating information delivery. These findings align with those of Misbahuddin *et al.* (2023), who also confirmed that workflow-based automation can streamline service processes and lessen manual workload. Furthermore, this research reinforces the findings of Ramadhani *et al.* (2025), who successfully integrated n8n with AI technologies for service automation, although their focus was primarily on conversational intelligence. Consequently, this study underscores that node-based approaches and workflow automation not only enhance service reliability and speed but also provide a solid foundation for developing more integrated and adaptive digital service systems in the future. Additionally, this approach offers advantages in terms of ease of maintenance and scalability, as the node-based structure facilitates customization according to institutional needs.

4. Conclusion

This research shows that using n8n for workflow automation can be a useful method to help with digital academic services in higher education. Using the DSR approach, a workflow automation tool was successful designed, implemented and evaluated academic services task by using a node based system for running workflows. The model is designed to handle workflow coordination, decision management and automated processes, instead of focusing on conversation features. The evaluation results showed that every tested workflow scenario worked exactly as it was planned and the qualitative assessment found that

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service accessibility, process transparency and the consistency of service delivery all improved. These results show that using automation in workflows can support more structured, reliable, maintainable academic service processes and decreases the need for repetitive manual task. The key of this study is creating a flexible and reusable workflow based service model that can be used in different academic settings. By keeping the service process management separate from the interaction part, the architecture allows for easier connection with chatbot systems and other digital services platforms in the future. Future studies should aim to connect the workflow model with existing academic information systems so that automatic service such as registering for classes, getting student records and handling administrative tasks can be supported. The new workflow model needs to be evaluated in real academic environments where students, lecturers and administrative staff are involved. It's help to check how the effectiveness, usability and the affects for the organization. Further research may also explore the integration of workflow automation with generative AI technologies to improve how system interact while keeping the workflow organized and controlled.

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