**HANOI UNIVERSITY OF SCIENCE AND TECHNOLOGY  
SCHOOL OF ELECTRICAL & ELECTRONIC ENGINEERING**

**Ảnh có chứa biểu tượng

Mô tả được tạo tự động**

**AC4150E – HUMAN MACHINE INTERACTION**

**ASSIGNMENT**

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**final project’s report of HUMAN MACHINE INTERACTION**

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# Project Name & Value Proposition

## Project Name

“CAIN” means...

🔍 Clarifying complexities in your documents

🤖 Adapting to your questions with smart, relevant responses

🌐 Interacting seamlessly to meet your needs

🤝 Navigating you through knowledge effortlessly

## Value Proposition

CAIN is a revolutionary chatbot designed to simplify document management by offering precise summaries, accurate queries, and effortless navigation. It transforms how you interact with and understand your documents, saving time and enhancing productivity.

# Team Member Names and Roles

Phung Minh Chien (20213565): *Designer + Developer*

Nguyen Danh Huy (20213571): *Designer + Developer*

Ma Khoa Hoc (20210388): *Designer + Developer*

# Problem/Solution Overview

## Problem

* Difficulty retrieving specific information in large documents.
* Uncomfortable experience while working with only 1 document in a chat.
* Lack of user-friendly and accessible interface.

## Solution

Our solution offers a chatbot equipped with natural language query capabilities, enabling quick and efficient searches. It includes powerful tools for document summarization, allowing users to gain deep insights and understanding of the content. With an intuitive and accessible design, the platform caters to diverse user needs, ensuring a seamless and user-friendly experience for everyone.

# Needfinding

## Interviews

**Who, Why, When, Where?**

* General Users (1 participants)
* Advanced Users (1 participant): They can provide in-depth feedback on optimizing the chatbot’s functionality, develop the functions related to extracting information from documents in a more convenient way.
* Inexperienced Users (1 participant): They can provide critical feedback on the way to approach our application for new users.

The interview was held on MS team and Discord platform from 9 to 11 pm on Tuesday October 21, 2024.

For our first round of needfinding interviews, we interviewed 3 people:

* Sang (21 years old): 4th year student from EE-EP of SEEE; Rarely use Chat GPT or chatbot to analyze documents
* Thanh (21 years old):4th year student from SEEE; Working with Chat GPT regularly but not using Document chatbot to analyze documents
* Nghia (20 years old): 3th year student from SEEE; Must work with digital documents regularly and use Chat GPT and Document chatbot to analyze documents

## Synthesis

Coming into these three interviews with the confidence of already having conducted four, we gained many new insights. In order to format our analysis, we took to using empathy maps. We created empathy maps for each interview below

A white square with black text

Description automatically generatedA diagram of a chat

Description automatically generatedA diagram of a user

Description automatically generated with medium confidence

After analysis, we found that users need a flexible chatbot that balances simplicity with advanced features. It should handle complex document tasks, offer customization options, and support effective document summarization and querying to meet diverse user needs.

# POVs & Experience Prototypes

After identifying these preliminary needs, we began the process of developing user "Point of Views" and experience prototypes to gain a clearer understanding of how we could assist chatbot users effectively. We developed the following POVs for our three interviews and formulated "How Might We" questions to guide our solution brainstorming:

## Nghia’s POV

**We Met**: Nghia - 3rd year student from SEEE; Must work with digital documents regularly and use Chat GPT and Document chatbot to analyze documents.

**We Were Amazed to Realize**: Nghia finds current solutions too generic or cumbersome, leading to frustration when seeking accurate answers or trying to organize files independently of conversations.

**It Would Be Game-Changing To**: Provide Nghia with a chatbot that excels in document understanding, delivers precise responses to his queries, and manages files separately, ensuring a seamless and efficient workflow.

**How Might We’s**:

* How might we design a chatbot that delivers highly accurate and context-aware responses from uploaded documents?
* How might we streamline the process of uploading, managing, and retrieving files independently of conversations?
* How might we incorporate advanced features like document comparison and summarization to meet detailed-oriented needs while keeping the interface user-friendly?
* How might we ensure the chatbot’s natural language processing aligns with user expertise and expectations?

## Sang’s POV

**We Met:** Sang - 4th year student from EE-EP of SEEE; Rarely use Chat GPT or chatbot to analyze documents.

**We Were Amazed to Realize:** Sang avoids using advanced functionalities due to a lack of confidence and clear instructions, and he highly values an interface that minimizes eye strain for prolonged usage.

**It Would Be Game-Changing To**: Provide Sang with a chatbot that delivers concise and clear responses, offers intuitive guidance on advanced features, and includes an eye-friendly design to enhance usability.

**How Might We’s:**

* How might we create a chatbot interface that reduces eye strain and promotes visual comfort during extended use?
* How might we design clear and engaging tutorials to help Sang confidently explore advanced features?
* How might we ensure the chatbot provides succinct and easy-to-understand responses to improve user experience?
* How might we make advanced functionalities feel as intuitive and approachable as basic chatting?

## Thanh’s POV

**We Met:** Thành - 4th year student from SEEE; Working with Chat GPT regularly but not using Document chatbot to analyze documents.

**We Were Amazed to Realize:** Thành highly values the chatbot's role in his workflow but finds its lack of interface and feature personalization to be a barrier to maximizing its potential.

**It Would Be Game-Changing To:** Provide Thành with a chatbot that combines efficient information retrieval with advanced customization options, enabling a more tailored and user-friendly experience.

**How Might We’s:**

* How might we enable Thành to customize the chatbot interface to suit his personal preferences?
* How might we offer advanced feature customization for a more tailored experience?
* How might we streamline document searching and extraction to make information access quicker and more efficient?
* How might we balance a user-friendly default interface with flexibility for advanced personalization?

## Top 3 HMWs from across all three interviews

* How might we design a chatbot that delivers highly accurate and context-aware responses from uploaded documents?
* How might we streamline the process of uploading, managing, and retrieving files independently of conversations?
* How might we create a chatbot interface that reduces eye strain and promotes visual comfort during extended use?

## Top 3 Solutions

* **Context-Aware Chatbot Design:** Develop a chatbot with advanced NLP to provide accurate, context-aware responses based on uploaded documents, ensuring precise answers to user queries.
* **File Management and Streamlined Uploading:** Create a system that allows users to upload, organize, and manage documents independently from the conversation interface for seamless interaction.
* **User-Friendly and Intuitive Interface**: Design an interface prioritizing user comfort with adjustable text sizes, contrast control, and clear tutorials, making advanced features easy to use, especially for beginners.

## Experience Prototypes

**Prototype 1**: Chatbot for Document Understanding

Assumption: If the chatbot is able to deeply understand documents and provide accurate, context-aware responses, users will be able to work more efficiently with their documents.

Experience Prototype: We created a chatbot that can analyze and answer questions based on the documents uploaded by users. When users upload a document, the chatbot uses NLP (Natural Language Processing) to understand the content and answer specific questions about the document. We asked users to inquire about the document, such as: "How many pages are in this document?" and "What does this document say about environmental issues?"

What We Learned: Through testing, we found that the chatbot could accurately answer simple questions but struggled with more complex questions that required a deeper understanding of context. This showed us that while the chatbot can help understand documents at a basic level, further improvement is needed in context processing and providing more accurate responses.

**Prototype 2**: Chatbot for File Management

Assumption: Users want to manage their files independently of their conversations with the chatbot, and a streamlined process for uploading, organizing, and retrieving documents will improve their experience.

Experience Prototype: We designed a feature that allows users to upload, organize, and search for documents independently from the conversation. Users can easily drag and drop documents into the chatbot and then organize them into separate folders. The chatbot provides options to search for and retrieve documents based on criteria such as document name, upload date, or keywords within the document.

What We Learned: The results from the trial showed that users appreciated the file management feature but encountered confusion when searching for documents if there were too many in one folder. This indicated that a clearer document classification system and advanced search filters would help users easily find and manage their documents more effectively.

**Prototype 3**: Chatbot with Advanced Features for Document Analysis

Assumption: Users, especially those who need to analyze documents regularly, will benefit from advanced features like document comparison and summarization, improving their productivity.

Experience Prototype: In this trial, the chatbot was equipped with advanced features such as document comparison and summarization. Users could upload two documents and ask the chatbot to compare them and highlight differences or ask the chatbot to summarize the content of a document for quick insight. We also provided detailed analysis features to help users understand key topics within the document.

What We Learned: User feedback indicated that they liked the document comparison and quick summarization features, which saved time. However, some users felt that the summaries were occasionally too generic and lacked detail. This showed us that the summarization and comparison algorithms need to be fine-tuned to improve the accuracy and relevance of the provided information.

# Design Evolution

## Final solution

**Description:** Develop a system that allows users to upload one file at a time, either in PDF or DOCX format, and interact with it. The system will enable users to ask questions, receive answers, and generate summaries based on the uploaded document. Additionally, it will support multi-document interaction, allowing users to query and retrieve information across multiple files simultaneously, enhancing the ability to answer complex questions based on various sources.

**Rationale for the selected solution, grounded in evidence**: This solution is based on user feedback highlighting the need for a simple yet powerful document interaction system. Nghia expressed frustration with existing solutions being cumbersome for document management. By allowing users to upload a file easily (PDF or DOCX) and provide interactive features like summarization and question answering, this approach directly addresses the need for an intuitive system that can handle multiple documents. This solution enhances usability by allowing users to manage documents independently while still benefiting from advanced functionalities like multi-file querying.

## Tasks

**Simple Task – Search Notebook by Name:**

Task Description: This task allows users to quickly find a notebook by searching for its name within their account. The user simply needs to enter the name of the notebook they want to find, and the system will display matching results. This is a straightforward task with minimal effort needed from the user.

**Moderate Task – Chat to Ask About Chosen File:**

Task Description: After selecting a file, the user can initiate a chat with the system or a chatbot to ask questions related to the document. This task involves the user engaging in a conversation to get specific information or clarification about the file they’ve chosen. It requires interaction and understanding from the system to provide relevant answers based on the document.

**Complex Task – Upload Document File to Notebook:**

Task Description: This task allows users to upload a document (e.g., PDF, DOCX) into a specific notebook. The user will select a notebook, click the upload button, choose the document to upload, and confirm the action. This task requires more steps, including file selection, ensuring the file is compatible, and organizing it into the right notebook.

## Design evolution

### Low-fi Prototype/Initial Sketches

During the initial sketches stage, we brainstormed various design directions, including website, Voice-Activated device, mobile applications, wearables, and augmented reality. The two realizations that excited us the most were mobile applications and website

**Mobile application**

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**Website**

**A sketch of a website

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After analyzing the feasibility of each realization and voting on the idea we were most excited to design and build, we found that a website is the ideal choice because it offers easy accessibility—users only need a browser, with no installation required, making it perfect for both new and occasional users. The document upload process is straightforward and works seamlessly across all devices. Additionally, developing and maintaining a website is more cost-effective compared to an app. With its broad compatibility and ability to reach a wide audience, a website ensures an efficient, user-friendly experience.

**3 tasks**

**Search Notebook by Name**

**A drawing of a computer

Description automatically generated**

**Chat to Ask About Chosen File**

**A computer screen with a blue pen

Description automatically generated with medium confidence**

**Upload Document File to Notebook**

**A diagram of a computer system

Description automatically generated**

**Usability Testing**

With these low-fi prototypes, we began usability testing. We interviewed 3 college students, 1 HUST students, 1 HUCE student and 1 student from DAV. We were particular about finding students to test our prototypes with since CAIN is designed for students who work with digital documents regularly.

All participants:

* Found the chatbot easy to use
* Thought it would be better to use a different shaped button (not a circle) to select files to chat with.
* Confused between Searching notebook icon and notebook naming

2 participants:

* Found the chatbot easy to interact with and appreciated its user-friendly interface.
* Suggested adding a progress bar to track task completion, making the experience more transparent.

1 participant:

* Recommended including a feature to preview selected files before confirming the choice.

After having our final three students test the revised prototype, we cameaway with some big picture goals and implications.

* Change file selection icon from round button to square button
* Add a loading animation to track task completion, making the experience more transparent.
* Add a pop-up that disappears after 5 seconds to notify the user that the file was uploaded successfully.

Our big next steps going into the med-fi prototype were:

- More flexibility

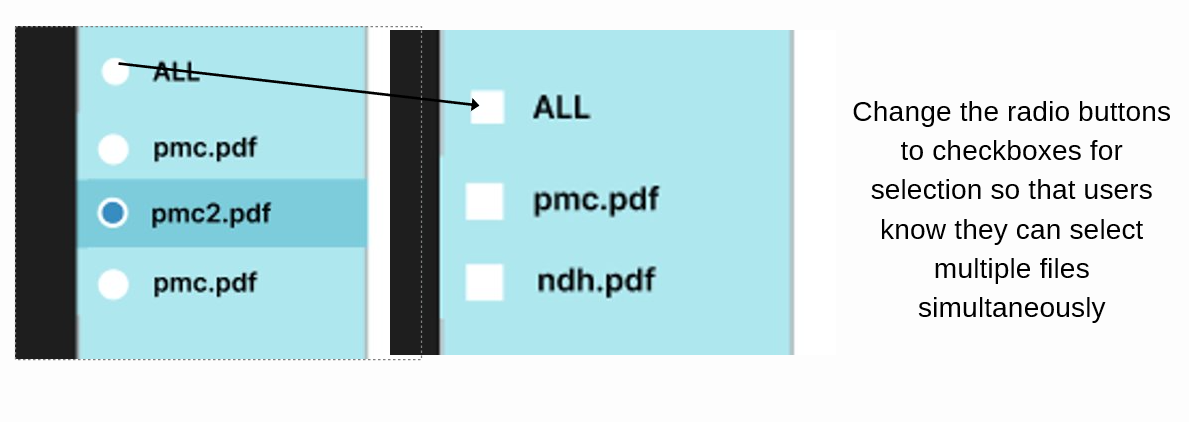
- More screens

- Add more usability goals

- Change file selection icon from round button to square button

### Med-fi Prototype

**Major design change #1**



**Major design change #2**

A blue and white box with black text

Description automatically generated

**Search Notebook by Name (Simple)**

**A screenshot of a computer

Description automatically generated**

**A screenshot of a computer

Description automatically generated**

**Chat to Ask About Chosen File (Moderate)**

**A screenshot of a computer

Description automatically generated**

**A screenshot of a computer

Description automatically generated**

**Upload Document File to Notebook (Complex)**

**A screenshot of a computer

Description automatically generated**

**A screenshot of a computer

Description automatically generated**

After making HEURISTIC EVALUATION SYNTHESIS, we decided to focus heavily on fixing the severity 3 and 4 violations. In total we had 14 violations, 2 from severity 3 and 1 from severity 4.

Severity 3:

H6: Recognition Rather Than Recall

- User is confused about the function of the "Plus" icon, not understanding whether it adds a new item or serves another purpose.

H1: Visibility of System Status

- Users are uncertain if the system allows uploading two document files simultaneously, leading to hesitation or trial-and-error attempts.

Severity 4:

H6: Recognition Rather Than Recall

- Users find it unclear how to select multiple files without selecting all files, causing confusion during the file selection process.

We took to the hi-fi prototype in order to fix these errors

# Values in Design

**Privacy**

The chatbot ensures user confidentiality by securely storing uploaded documents, encrypting sensitive files, and maintaining strict data privacy protocols, fostering trust in its usage.

**Productivity**

Batch uploads, instant summaries, and multi-document queries streamline tasks, enabling users to retrieve insights efficiently and save significant time during analysis.

**Customization**

Users can tailor their experience by organizing documents, adjusting visual themes, and setting preferences, ensuring the chatbot fits diverse workflows seamlessly.

**Accessibility**

Features like adjustable text sizes, contrast modes, and voice commands make the chatbot inclusive and effective for users with varying abilities or preferences.

# Final Prototype Implementation

A wide variety of tools were used to build and run our prototype. For the implementation of the med-fi prototype, we used Figma to design any additional graphics that went into our website. We continued to use and update our Figma prototype.

**Advantages**

Figma is ideal for chatbot interface design due to its real-time collaboration, cross-platform accessibility, and interactive prototyping capabilities. It also offers a robust plugin ecosystem and seamless version control, enabling efficient design workflows.

**Disadvantages**

However, Figma's reliance on stable internet, occasional performance issues on low-end systems, and limited advanced animation options can be drawbacks. Additionally, its learning curve for beginners and the cost for team features might pose challenges.

**Hard-Coded Data & Limitations**

Our chatbot website prototype, currently designed on Figma, focuses on simulating core functionalities for user interaction. Since the implementation is not yet functional, we rely on static designs to represent the user experience. These include:

* File management interface, showing preloaded sample files with metadata like file name, type, and upload date.
* User profile page, featuring placeholder images, usernames, and mock recent interactions with the chatbot.
* Chat history section, displaying pre-designed conversations with simulated document-based queries and responses.
* Document preview interface, showcasing placeholder summaries and file details.

These hard-coded components allow us to illustrate the intended user experience while acknowledging that dynamic functionalities have yet to be developed.

**Wizard of Oz Techniques**

Our Figma prototype leverages Wizard of Oz techniques to simulate advanced chatbot features:

* Dynamic recommendations: Suggested documents based on user queries are statically designed to appear as if tailored, but they are fixed in the prototype.
* Summarization and Q&A responses: Simulated outputs are pre-scripted to showcase the chatbot's intended capabilities.
* Multi-document queries: Responses for questions spanning multiple documents are designed as mockups to represent functionality that will be developed later.

This approach ensures we can validate design choices and user flows before transitioning to full implementation.

# Summary & Next Steps

## Main Learnings

This quarter, we deepened our understanding of the design thinking process by exploring empathy-driven solutions, iterative prototyping, and feedback integration. The studio theme of creating user-centered tools allowed us to focus on addressing real-world challenges, particularly in managing and interacting with digital documents. Our project highlighted the importance of balancing functionality with user experience, teaching us how to design for accessibility, customization, and clarity.

## Future Additions

With more time, we would:

Develop Dynamic Features: Move beyond static prototypes by implementing functional uploading, summarizing, and multi-document querying features.

Enhance Personalization: Add user-specific customizations like file categorization, search optimization, and tailored responses.

Integrate Accessibility Options: Include voice interaction and multilingual support to expand usability.

Test and Iterate: Conduct broader usability testing with diverse users to refine the interface and functionality based on real-world feedback.

These steps will help bridge the gap between concept and implementation, ensuring a robust, user-centered chatbot solution.

# Final Remarks

Thank you for being a part of our chatbot design journey. This project has been an inspiring experience—from conducting insightful user interviews to brainstorming innovative solutions and refining our final prototype. For a closer look at our design process and to explore the final prototype, feel free to visit our website (https://dfa8336hgjz.github.io/hmi\_report/index.html).

A special thank you to Professor Tran Thi Thanh Hai and Nguyen Viet Tung for guiding us through an engaging and enriching quarter of learning.