01 INTRODUCTION

01. Introduction

- Today, interior design requires a significant investment of both **mental effort** and **financial resources**. Not everyone has the means to hire an architect or a professionally trained engineer to help them build their dream home.
- In light of this issue, our team proposes a **Minimum Viable Product (MVP)** starting with the development of a **chatbot** to provide guidance and support for customers to design their own dream homes.

02 PROBLEM STATEMENT

02. Problem Statement

About mental effort: In the context of interior design, "mental effort" refers to the cognitive and creative processes involved in envisioning and planning the layout, aesthetics, functionality, and overall design of a space. It requires careful consideration of various elements such as color schemes, furniture selection, lighting, materials, and spatial arrangement. Designing a space that reflects personal preferences, meets practical needs, and creates a harmonious atmosphere can be a complex and time-consuming task.

02. Problem Statement

About financial resources: On the other hand, "financial resources" refer to the funds required to bring the design vision to life. This includes the cost of purchasing furniture, fixtures, and materials, hiring contractors or professionals for renovations or installations, and covering any additional expenses related to the project. Interior design projects can range from modest budget-friendly makeovers to high-end luxury renovations, depending on the individual's financial capacity and desired level of customization.

02. Problem Statement

The combination of mental effort and financial resources highlights the challenges that individuals may face when attempting to design their dream homes. Not everyone has the expertise or financial means to engage professional assistance, making it important to explore alternative solutions such as the development of a chatbot to offer guidance and support in the design process.

02. Problem Statement

"Pain point" can be understood as the customer's point of frustration or dissatisfaction. This refers to the negative experiences that customers encounter throughout their customer journey, where they face challenges or difficulties while interacting with a product or service at various touchpoints.

02. Problem Statement

- **Budget considerations:** Clients often have a specific budget in mind for their interior design project. However, finding a designer who can work within their budget can be a challenge. Some clients may find it difficult to find designers who offer affordable services without compromising on quality.

02. Problem Statement

- **Limited options:** Clients may struggle to find interior designers that align with their specific style preferences or project requirements. It can be challenging to find designers who specialize in certain design styles or have experience in specific project types.

02. Problem Statement

- **Lack of transparency:** Clients may face difficulties in understanding the pricing structure, project timeline, and the overall process involved in working with an interior designer. Lack of transparency can lead to confusion and uncertainty, making it harder for clients to make informed decisions.
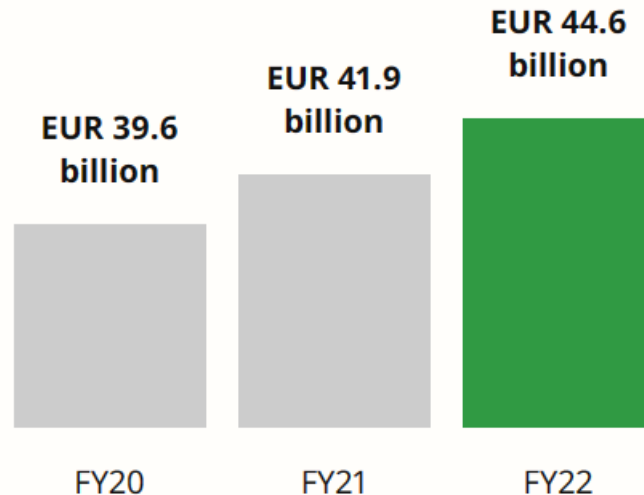
02. Problem Statement

- **Communication and collaboration:**
  Effective communication and
  collaboration between the client and the
  interior designer are crucial for a
  successful project. Clients may face
  challenges in finding designers who are
  responsive, attentive to their needs, and
  able to translate their ideas into a
  cohesive design plan.

02. Problem Statement

- IKEA rettail sales reached EUR 44.6 billion: IKEA retail sales benefited as the world re-opened after closures related to the pandemic. On the other hand, inflation and supply chain issues impacted FY22 sales and led to rising costs and higher prices. That means sales have grown in money, but sales quantities have not kept up.

EUR 39.6 billion — FY20
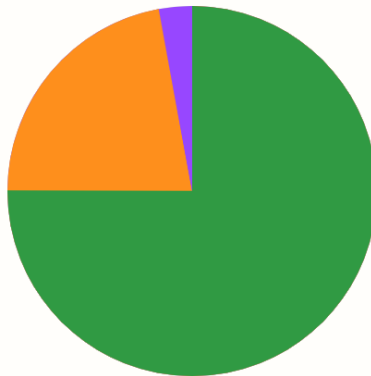EUR 41.9 billion — FY21
EUR 44.6 billion — FY22

02. Problem Statement

- New IKEA locations opened around the world:

02. Problem Statement

- Online and store sales:

🟩	FY22 products sold through stores	**75 %**
🟧	FY22 products sold online	**22 %**
🟪	FY22 services to customers	**3 %**

02. Problem Statement

- 231000 IKEA co-workers made it happen.

217,000	225,000	231,000
FY20	FY21	FY22
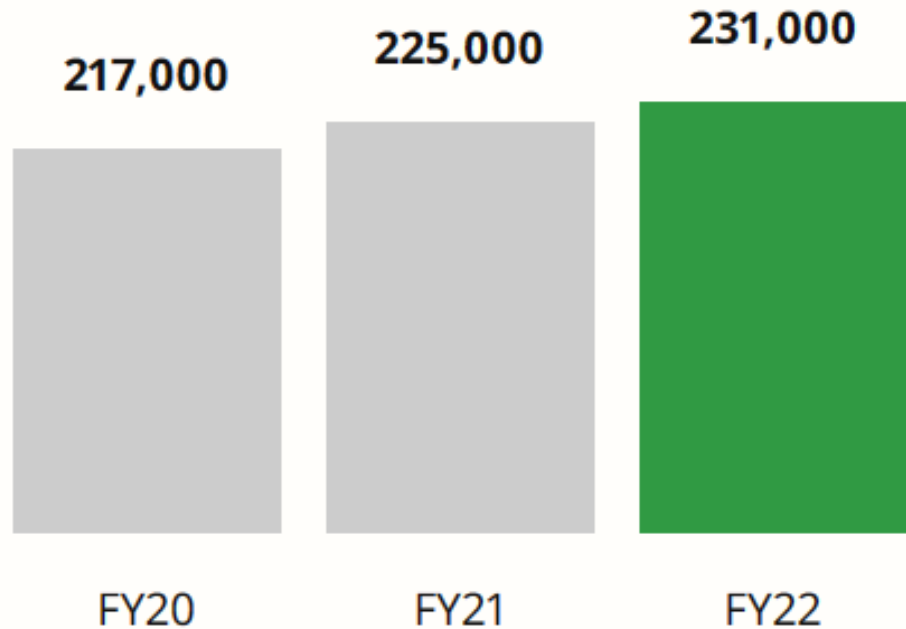
02. Problem Statement

- There are some competitors of IKEA:
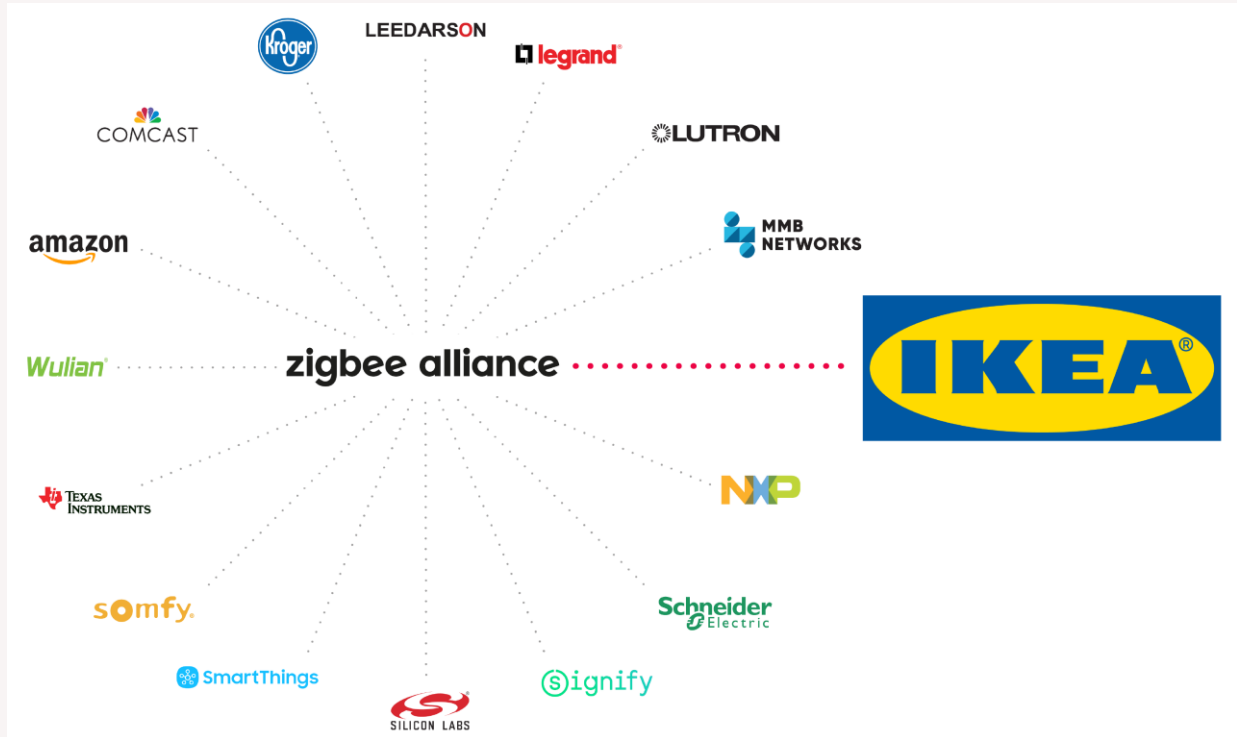
03 SOLUTION OVERVIEW

03. Solution Overview

In the MVP, we propose an AI-based solution leveraging AI techniques such as AI models and algorithms which is innovative and unique due to its integration of both text-based and visual components.

The chatbot, powered by **Llama 2**, will handle customer queries and responses based on text, while a visual generation model, utilizing **Stable Diffusion** technology, will convert customer descriptions into photorealistic images of customized furniture designs.

Llama 2

Stable Diffusion

03. Solution Overview

This holistic approach combines state-of-the-art AI technologies, including deep learning and NLP, to deliver a personalized and immersive experience to customers. The solution's novelty lies in its technical aspects, as it integrates visual and text-based interactions seamlessly, providing a unique and engaging customer experience.

Additionally, the solution's scalability and reliability will be ensured through either on-premises or cloud-based deployment options. Overall, this solution's fulfillment of business needs, such as providing personalized and immersive experiences to customers, makes it innovative and highlights its novelty in terms of both technical aspects and business value.

04 METHODOLOGIES

Description of the architecture of the LLAMA 2 model

- Llama 2 as a Large Language Model (LLM) using the Transformer architecture, particularly well-suited for natural language processing (NLP) tasks.
- This architecture relies on attention mechanisms, enabling the model to emphasize the most pertinent portions of input text when generating output.

Llama 2 is a decoder-only Transformer model, meaning it does not have an encoder. This simplifies the model architecture and makes training and deployment faster. The decoder component of the model consists of a stack of transformer blocks, each block containing a multi-head attention layer, feed-forward network, and a normalization layer.

Output Probability
(next token)

Softmax

Linear

Block 2 ... N

Block 1

Add & Norm

Feed Forward

Add & Norm

Masked Multi-Head Attention

Positional Encoding

Input Embedding

Input (prompt)
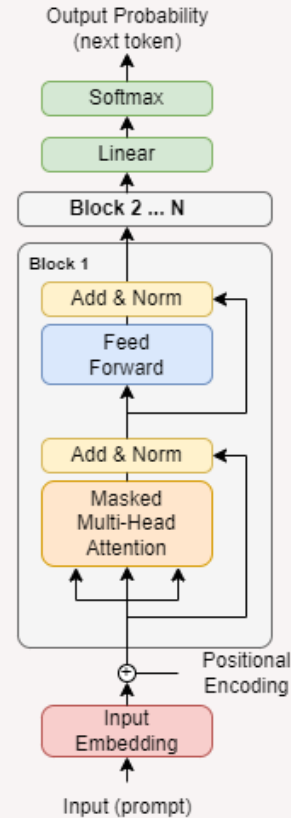
The basic architecture of Llama 2 is as follows:

Embedding layer — Takes input text and converts it into a sequence of vectors. Each vector represents a word or token in the text.

Transformer blocks — The core part of the model, performing attention and feed-forward data operations, allowing the model to learn deeper dependencies in the text.

Normalization layer — Applied to the output of each transformer block, it helps stabilize the training process and improve model performance.

Output Layer — Takes the decoder's output and converts it into a string of words or tokens, responsible for generating the final output of the model.

Key components, layers, modules of the LLAMA.

In addition to the main components listed above, the Llama 2 model also includes several other modules important for its operation

Positional encoding
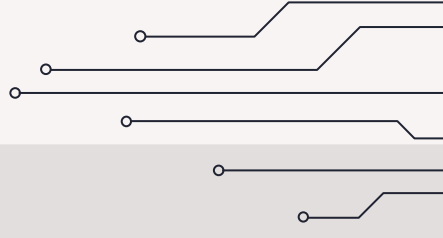
A technique used to encode the position of each word in the input text into the model's representation, crucial for the model to understand the order of words in the text.

Residual connections

A technique used to enhance the flow of information through the model, connecting the output of each transformer block to the input of the next transformer block.

Dropout

A technique used to prevent the model from overfitting on the training dataset, randomly eliminating a certain percentage of connections between the nodes of the model during training.

Working process of the Llama 2 model

HUMAN FEEDBACK

Human preference data

Safety Reward Model

Helpful Reward Model

PRETRAINING

Pretraining data

Self-supervised learning

Llama 2

FINE-TUNING

Rejection Sampling

Proximal Policy Optimization

RLHF

Supervised fine-tuning

Llama-2-chat
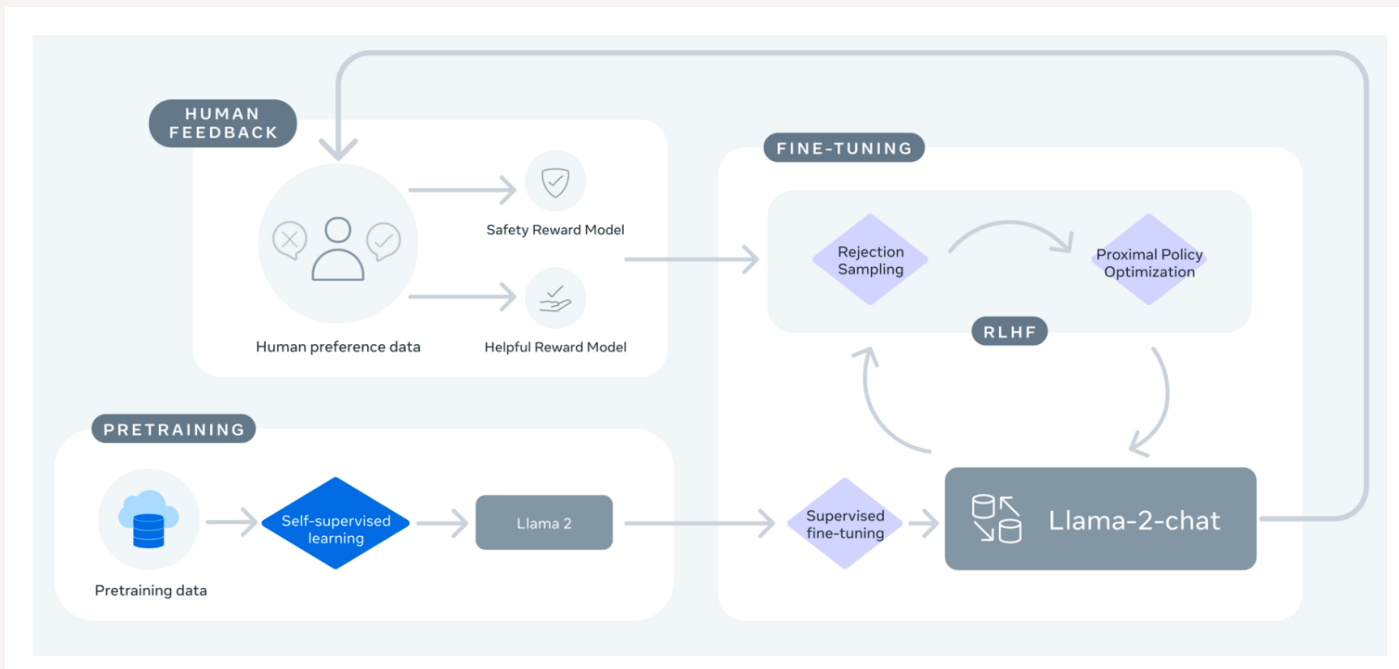
Description of the architecture of the Stable Diffusion model

Stable Diffusion is a latent diffusion model that generates images from textual descriptions. It is based on the U-Net architecture, a type of convolutional neural network (CNN) well-suited for image generation tasks, enabling the model to capture both high-level and low-level features in the data.

An image generated by Stable Diffusion based on the text prompt "a photograph of an astronaut riding a horse"

Key components, layers, modules of the Stable Diffusion model.

Variational Autoencoder (VAE)

Responsible for compressing images from the pixel space into a smaller latent space, capturing a more fundamental semantic meaning of the images, aiding the model in generating new images from textual descriptions more easily.

U-Net

Responsible for generating images from the latent space, consisting of an encoder-decoder architecture where the encoder samples down to represent the latent space, and the decoder samples back up to the original resolution of the image. The encoder and decoder are connected by skip connections, enabling the model to pass information between different scales.

Text Encoder

Responsible for converting textual descriptions into vector representations that the U-Net can utilize, often implemented as a transformer model, a type of neural network highly suitable for natural language processing tasks.

Working process of the Stable Diffusion model

The Stable Diffusion model generates images through the diffusion process, starting with a noisy image and gradually denoising it until it becomes a recognizable image. The denoising process is influenced by the textual description, aiding the model in creating images consistent with the text
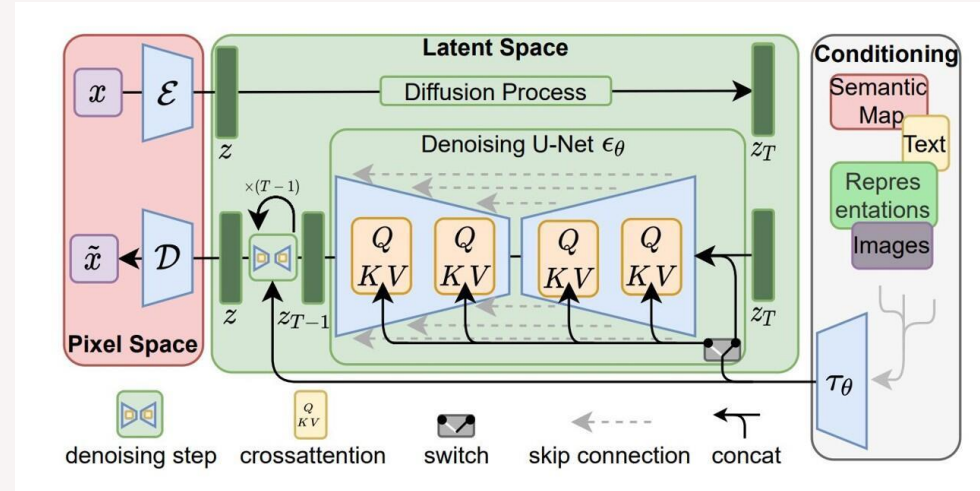
05 CORE FUNCTIONALITY

05.Core Functionality

1. Search Assist Bot

Input

Understand and respond to customer questions, and provide information based on specific product inquiries.

Output

Focus on providing answers based on available data, without considering personal opinions or reviews.

MVP

1	2	3	4
Search Assist Bot	Shopping Advisor Bot	Image Advisory Bot	Comprehensive Advisory Bot

05.Core Functionality

2. Shopping Advisor Bot

Input

Provide recommendations to customers based on store data, conduct surveys, and consider customer preferences

Output

Provide information closely related to store details, conduct surveys based on customer input or preferences, and offer specific recommendations.

MVP

1	2	3	4
Search Assist Bot	Shopping Advisor Bot	Image Advisory Bot	Comprehensive Advisory Bot

05.Core Functionality

3. Image Advisory Bot

Input

Provide advice based on customer-provided product descriptions.

Output

Generate new product representations in the form of images (which may not be available in stores) based on the descriptions provided by the customer to the chatbot.

MVP

1 — Search Assist Bot
2 — Shopping Advisor Bot
3 — Image Advisory Bot
4 — Comprehensive Advisory Bot

4. Comprehensive Advisory Bot

Input

Combine data-driven recommendations, surveys, and advice based on customer-provided product descriptions or images.

Output

Offer diverse and flexible recommendations, providing a comprehensive experience by integrating various types of advice.

MVP

1	2	3	4
Search Assist Bot	Shopping Advisor Bot	Image Advisory Bot	Comprehensive Advisory Bot

06 PERFORMANCE METRICS

06. Performance Metrics

Customer Statisfaction

Measure customer satisfaction through feedback surveys or ratings to evaluate their overall experience and satisfaction with the chatbot's assistance in the design process.

Response Time

Track the average response time of the chatbot to ensure it responds promptly and effectively to customer requests and inquiries.

Successful Interaction Rate

Measure the rate of successful interactions by considering the number of times the chatbot provides useful information or reasonable solutions to customers, compared to the number of times it fails to provide a solution or misunderstands customer requests.

06. Performance Metrics

Conversion Rate

Monitor the conversion rate from using the chatbot to completing a specific goal, such as completing an interior design or making purchases of products recommended by the chatbot.

User Base and Usage Frequency

Track the number of users utilizing the chatbot and the frequency of usage to measure user engagement and interest in the chatbot.

Successful Support Rate

Evaluate the rate of successful support and resolution of customer queries by considering the number of times the chatbot provides effective support compared to the number of times it fails to provide a solution or provides ineffective support.
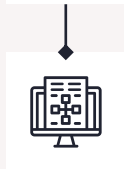
07 TIMELINE AND ROADMAP

07. Timeline and Roadmap

30/11 → **Search Assist Bot**

- Thu thập dữ liệu sản phẩm.
- Xây dựng mô hình NLP.
- Phát triển giao diện UI.
- Kiểm tra và điều chỉnh tính chính xác.

05/12 → **Shopping Advisor Bot**

- Phân tích dữ liệu cửa hàng.
- Xây dựng hệ thống khảo sát.
- Tạo gợi ý sản phẩm.
- Phát triển giao diện UI.

17/12 → **Image Advisory Bot**

- Thu thập dữ liệu hình ảnh.
- Xây dựng mô hình học máy.
- Phát triển giao diện UI.
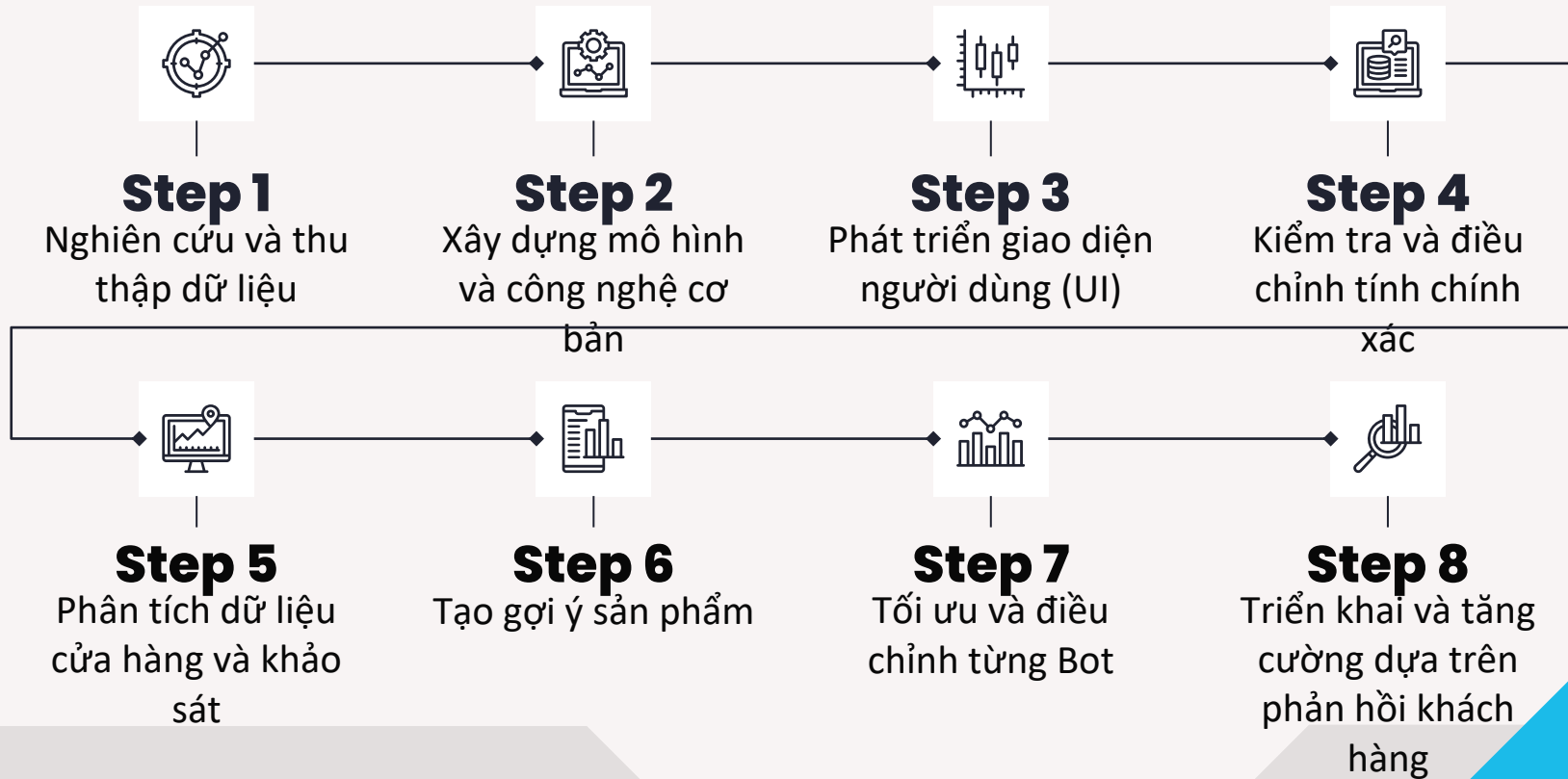- Kiểm tra và điều chỉnh tính chính xác.

17/12 → **Comprehensive Advisory Bot**

- Kết hợp dữ liệu từ các Bot trước đó.
- Phát triển hệ thống AI linh hoạt.
- Tối ưu giao diện UI.
- Kiểm tra và tăng cường tính chính xác.

07. Timeline and Roadmap

Step 1
Nghiên cứu và thu thập dữ liệu

Step 2
Xây dựng mô hình và công nghệ cơ bản

Step 3
Phát triển giao diện người dùng (UI)

Step 4
Kiểm tra và điều chỉnh tính chính xác

Step 5
Phân tích dữ liệu cửa hàng và khảo sát

Step 6
Tạo gợi ý sản phẩm

Step 7
Tối ưu và điều chỉnh từng Bot

Step 8
Triển khai và tăng cường dựa trên phản hồi khách hàng

08 User Interface (UI) or Interaction

08. User Interface (UI) or Interaction

Interaction components of the MVP

User Interface

The UI encompasses the visual and interactive elements of the product that users interact with. It includes screens, menus, buttons, forms, and other graphical components that allow users to perform actions, input information, and navigate through the product.

Input Mechanisms

These are the components that enable users to input data or provide instructions to the product. They can include text input fields, checkboxes, dropdown menus, sliders, or any other means through which users can provide input to the system.

08. Interaction

Interaction components of the MVP

Output Mechanisms

These components are responsible for presenting information or feedback to the users. This can include text-based responses, notifications, alerts, progress indicators, or any other visual or auditory cues that provide feedback or convey information to the user.

Navigation

The navigation components facilitate users' movement through different sections, screens, or features of the product. They can include menus, links, buttons, or gestures that allow users to navigate to different areas or access specific functionalities.

08. User Interface (UI) or Interaction

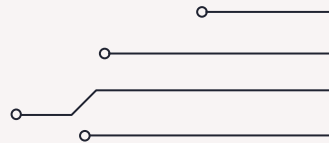## How user will interaction with the AI-powered feature

Text-based input

Users can enter queries, commands, or requests into a text input field, and the AI system processes the text to generate a response or take action.

Visual input

Users can provide input through images or videos. AI models analyze and interpret visual data, enabling applications such as image recognition, object detection, facial recognition, and video understanding.

08. User Interface (UI) or Interaction

How user will interaction with the AI-powered feature

Natural Language Processing

Users can engage in conversations with AI systems by asking questions, giving instructions, or having dialogue. The AI system understands and interprets human language to provide appropriate responses.

Recommendation - Suggestion

AI systems offer personalized recommendations and suggestions based on user preferences and behavior. Users can provide feedback, accept or reject recommendations, or rate items to help the system improve its understanding of their preferences.

09 **INTERACTION**

09. Interaction

Acknowledge any limitations or constraints of the MVP

1. Limited functionality: The MVP may not have all the desired features and capabilities of the final product. It focuses on delivering core functionality to demonstrate the concept and gather feedback.
2. Data limitations: The availability and quality of data can impact the accuracy and effectiveness of the Bot. Limited data may result in less accurate responses or limited coverage of specific use cases.
3. Scalability challenges: The MVP may not be designed to handle a large volume of users or complex scenarios. Scaling the Bot to accommodate a significant user base or high traffic may require additional development and infrastructure enhancements.
4. Performance constraints: The MVP might not be optimized for performance, and response times may be slower compared to the final product. Performance improvements may be necessary as the user base grows.
5. User interface limitations: The MVP's user interface may be basic or lack advanced design elements. It focuses on providing a functional interface for users to interact with the Bot, but it may not have the polished user experience of the final product.
6. Integration constraints: Integrating the Bot with existing systems or platforms may present challenges. Compatibility issues or technical limitations may need to be addressed to ensure smooth integration.
7. Resource constraints: There may be limitations in terms of time, budget, and available resources for developing the MVP. These constraints can impact the scope and depth of the initial release.

09. Interaction

Discuss potential future enhancements or additional features that could be incorporated.

1. Natural Language Understanding (NLU) improvements: Enhancing the NLP models to better understand and interpret user queries, including handling complex or ambiguous language, understanding context, and providing more accurate responses.
2. Multilingual support: Expanding the Bot's capabilities to understand and respond to queries in multiple languages, catering to a broader user base and improving accessibility.
3. Voice interaction: Integrating voice recognition and speech synthesis capabilities to enable users to interact with the Bot using spoken language, allowing for a more natural and hands-free experience.
4. Personalization and user profiling: Implementing user profiling and personalized recommendations based on user preferences, purchase history, and behavior patterns. This could improve the relevance and effectiveness of the Bot's suggestions.
5. Visual search: Adding the ability for users to perform visual searches by submitting images or taking photos of products, allowing the Bot to provide recommendations based on visual similarity.