Applied Project

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Synopsis

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Applied Project

by

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GENIA DYNAMICS

General Artificial Intelligence Dynamics

Professional assessment with applications that aim to the path of AGI (Artitial General Inteligence). We look for areas where AGI can be valuable to humanity in a controlled and safe environment.
This includes a lot of research areas which we will be focused on. For this specific assesment at some point we will show applications in the housing context.

HOUSIFY

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Chapter 1

Context

1.1 Business Description

We plan to build a service that allows a user, through a mobile application, the creation of his ideal home or preview changes that he may want to do in his housing space. The user can upload his own photos, or generate and edit an image of a house interior or exterior with the help of an A.I model.

Our target audience are those who wish to see their own ideas materialize into reality, those who wish for inspiration, amateurs or professionals, or any individual who just wishes to experiment with random creations for fun.

This project will be a subscription based A.I.service with multiple plans that allow for the creation and editing of images related to housing zones. It will be controlled by a simple interface that allows the user to write text prompts to edit and generate images. It will be possible to use images provided from the user's gallery or a photo directly from the camera, everything created or edited will be saved in an image history directly in the app.

To use the text based prompts, English is the only language supported but this may be expanded in the future. As far as the time required per edit or generation, it may vary depending on the complexity of the prompt or the server load, but it should take between 20sec and 20min per use. Every image generated or edited will be able to receive a rating and, if set to public, other users can also rate them. The best rated images will be highlighted on the front page.

1.2 Project's objectives

The main objective of this project is to create a mobile application that integrates an already existing A.I. model, allowing for our users and clients the ability to generate and edit custom images of housing spaces. More specifically, the project aims to reach the following objectives:

1. **Integration of an existing model:** Integrate, in an effective manner, the A.I. model with a mobile application.
2. **Interface:** Build an easy to use interface that allows the users to express their needs as well as receive and show images in a simple manner.

3. **Optimization for mobile devices:** Guarantee that the application runs and works smoothly in the majority of mobile devices.

1.3 Exposition to challenges

1.3.1 Challenges that we may face during this project

List of possible Challenges:

1. **Expression of needs** Our users may find it difficult to express what they want and obtaining unwanted/useless results.
2. **Optimization of the app** Our integration with the A.I. model may be inefficient and thus resulting in a slow and clunky mobile application.
3. **Complex interface** A complex and overcrowded interface may result in a negative and difficult experience for the users, resulting in a loss of value for both parties, the user and our company.

1.3.2 Examples of the referred challenges

Examples of the challenges referred above:

1. **Expression of needs** The user wants a modern kitchen, but has troubles expressing what he envisions. He ends up frustrated after receiving multiple generated images that do not correspond with his vision, due to his inability to use the right words or due to the vagueness of his description.
2. **Optimization of the app** The user tries to generate his ideal room, but the process is slow and clunky, resulting in a negative experience.
3. **Complex interface** The user downloads and install the app, but is quickly discourage due to an overwhelming and complex interface.

1.4 Project's benefits

Benefits that this project may result in:

1. **Portable Access** Users are able to use the app outside their home and workplace as long as they have internet connection.
2. **Enhancing user experience** Give the users an enhanced experience, allowing them to create and change their ideal homes in a simple and easy way.

3. **Reducing resources** The user is able to save up on time and money using our service to envision his ideas without having to go through expensive and lengthy design services.

1.5 System Context diagram

In the following diagram, Figure 1.1, we represent the core functionality of the housify system.

The user logs into the application through a smartphone, he then makes a request to create an image that goes to the WEB server through an API. The WEB server sends the data to the A.I. inference server that sends it back to perform the image creation. To end the process, the image created is sent to the application to be displayed to the client.

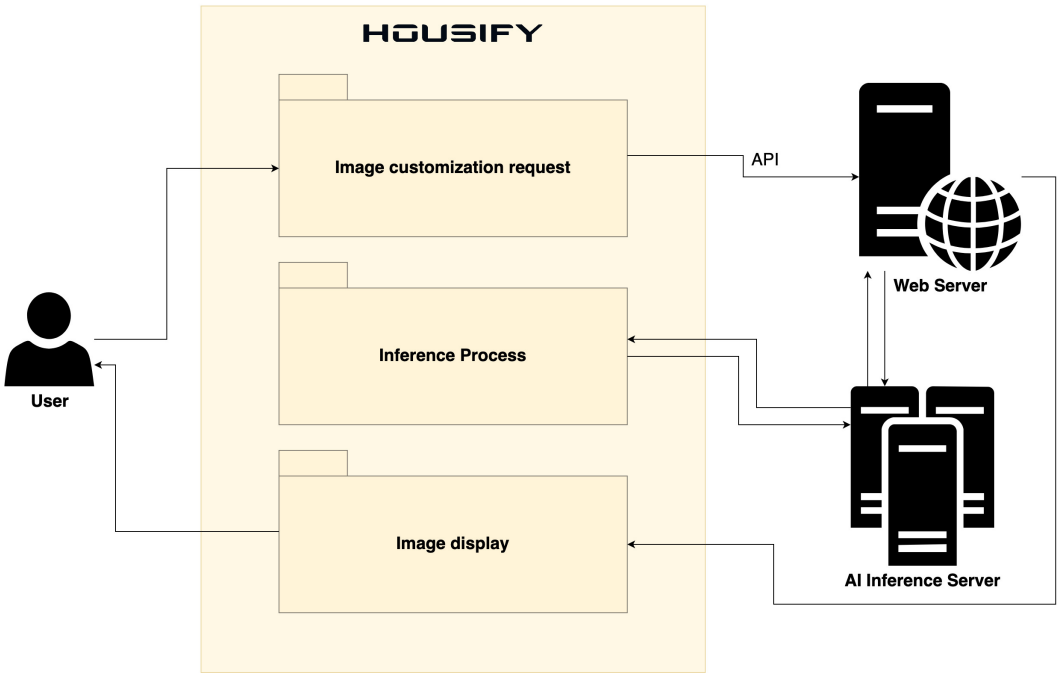

FIGURE 1.1: System Context Diagram

1.6 Stakeholders

1.6.1 Who are the stakeholders

The stakeholders can be:

1. **Individuals:** People interested in visualizing and experimenting with design ideas

2. **Professionals in the area:** Designers that want to use our service for ideas or a quick preview of what they are going to do.

1.6.2 Stakeholders necessities

The stakeholder necessities are:

1. **Easy to use interface** Users want an easy to use interface that does not require advanced technical abilities to use.
2. **Personalized prompts** Users want to be able to generate images with personalized prompts such as colour, texture, styles and lighting.
3. **Fast performance** Users want our service to have fast response times, they do not want to wait long periods of time in between generations or edits.
4. **Privacy and security** Our users have privacy concerns with their data since they could be using their current homes to preview changes using our services. The privacy and security of such data is critical for our users to trust us.

1.7 Functional and Non-Functional requirements

1.7.1 Functional Requirements

1. **Integration with the A.I. model:** Our system is capable of integrating, in an effective manner, with A.I. models, allowing for generation, editing and classification of custom images and objects in the image.
2. **Interface:** Our interface is simple and easy to use, allowing the users to express their preference in interior design through text or key words.
3. **Generation/Editing of images:** Our service allows the generation and editing of images of interior and exterior of housing zones.
4. **Image Classification/description:** The system is able to classify images and provide textual descriptions.
5. **Camera Integration:** The android application should integrate with the client's phone camera allowing for better usability.
6. **Gallery Integration:** The android application should ingrate with the client's phone gallery allowing for better usability.
7. **Image Storage:** The system should store a copy of all the images, both the original and the edited/generated, for the client to use as he sees fit.
8. **Rating:** The User should be able to rate the application's generations in the interface.
9. **Best-rated images:** The User should be able to get the best rated public images of the system.

1.7.2 Non-functional Requirements

1. **Subscription:** Our service allows for the change of subscription levels any time the client sees fit.
2. **Language:** Our services support only the English language.
3. **Model Independence:** The system should be able to incorporate various models independently, models of Text to Text, Text to Image, and Image to text, allowing better version control the ability to add features and customer satisfaction.
4. **Performance Requirements:**
   (a) **Response Time:** Our service has a response time for generating and editing images depending on the rate limit, the upload size, the parameters, and the resolution of the image the user can expect between 8 seconds to 20 minutes.
   (b) **Classification Response Time:** For image classification tasks our system should not require more than 5 seconds.
5. **System Requirements - Housify** Our service requires, on our end, the following:
   (a) - 20TB + 120GB/client(pro+) Storage of disk space
   (b) - 10TB Super Fast storage.
   (c) - 128GB + 8GB/client(pro+) of memory RAM
   (d) - 108TFLOPs(FP16)/Client(Pro+)*(limit usage) Processing power.
   (e) - Internal networking components (10GB inference system).
   (f) - Network symmetric speeds to WAN 2Mbps/Client(Pro+)
   (g) - A router connecting to WAN with high security standards, and redundant connection.
   (h) - 110 W/hour (Watts per hour) per client(Pro+), a peak in electricity usage is allowed as long as the stated limit is not surpassed.
   (i) - Redundant network connectivity + electricity.
6. **System requirements - User** The users of our service will require the following:
   (a) - An android phone version 7.0+
   (b) - 38MB Storage space (Application+cache).
   (c) - 2GB Memory RAM (minimum).
   (d) - Dual core Processing power (minimum).
   (e) - A stable internet connection (data or WiFi) with 2Mbps (recommended).
7. **Security requirements**
   (a) **Security:** Only the password hash is saved and all the communication between all agents is encrypted.
   (b) **Login information**: The User's password is only stored as a hash.

(c) **Communication**: All the communication is encrypted using TSLv1.2/1.3.

(d) **System's security:** The security of our internal system requires multiple firewalls, DMZ's, subnetworks, integrates with cloudflare's solutions, has prottection against Ddos, implements IP limit's and also uses data validation rules, hashing and encryption protocols, in combination with a stable Testing policy.

(e) **Update policy** Constant updates to our system's with safe rollbacks and user notifications to the android application on new updates are required.

8. **Legal requirements**

   (a) **General Data Protection Regulation (GDPR):** This system should comply with GDPR.

   (b) **Privacy Policy and Data protection:** User's have to accept privacy policy and data protection terms on Section 8.3.

   (c) **Subscription License Agreement:** Client's that have a subscription have to comply the Subscription License Agreement on Section 8.2.3.

9. **Compatibility:** Our services is compatible with only android and within the EU zone.

1.8 Comparing Similar Services

Advantages that our service has over the competition:

1. - **Interface**

   - **Responsive design:** Responsive interface that adapts to devices of different sizes.
   - **Easy to use:** Intuitive interface that allows for an easy to use application.

2. - **Mobile Optimization**

   - **Low end support:** A mobile app that is well optimized and works even in low end devices with limited resources.

3. - **Continuous support**

   - **Regular updates:** Our system is updated regularly to better improve it's performance or to add new sought after features.

4. **Cost**

   - **Monetization:** Our base service is free, but even our premium packages are cheaper than our competition.

Chapter 2

Business Process Management

This Section describes how the Business processes of the Housify system is managed.

This outlines designing, executing, monitoring, controlling, optimizing, and improvising cross-functional processes within Housify to enhance performance, productivity, and efficiency. It involves identifying areas for improvement, analyzing data, implementing new technologies or tools, streamlining workflows, setting benchmarks, and continuously evaluating results to ensure alignment with organizational goals and objectives while meeting customer needs effectively.

2.1 Business Process description

2.1.1 Image processing request

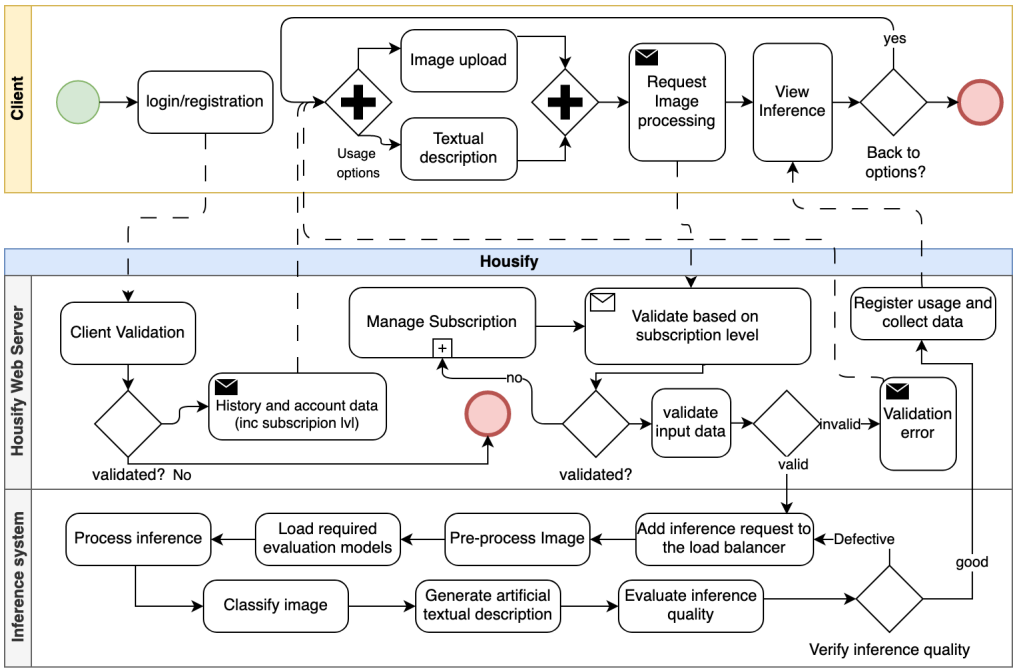

FIGURE 2.1: Business process for an image processing request.

The primary business process of this project outlines the interaction between the client and the Housify system, enabling the client to utilize the service to generate images and or descriptions within the housing context (Figure 2.1 Simplified representation of the

business process). The system accommodates multiple use cases, but the streamlined route of use is as follows:

1. The client initiates the user interface (currently available on Android), establishing communication with Housify servers, which requires a valid authentication token (JWT) for login.
2. The Housify Web server authenticates and validates the user's account and authorization token.
3. The Housify Web server sends the client's data, including but not limited to historical information, usage statistics, account details, and current subscription level.
4. The Housify user interface receives the necessary client data and enables the user to utilize the service according to defined business rules. Given the available options, the user can upload images, use the device's camera, specify textual descriptions for image generation, request classification, and provide textual descriptions of existing images. The user may also review historical usage data, including relevant information as outlined in the business rules.
5. The client uses the interface to generate data (textual or images) to initiate the request for image processing or description. The Housify Android application sends the related data to the server upon request.
6. The Housify Web servers receive the communication (service usage request), which is validated according to the business rules.
7. Internal servers act based on the validation result:
   - Validated: The system proceeds to the next step.
   - Invalidated: The system notifies the user that their current subscription level does not allow for the requested usage.
8. The inference request goes to a queuing system, which also serves as an application load balancer for AI inference requests.
9. The image is pre-processed to better fit the models and client expectations.
10. The necessary pre-trained AI models are loaded on demand.
11. The request is processed by the AI inference system.
12. The web server, awaiting the inference process, receives output from the inference; accordingly, user usage is registered, and data collected.
13. The client receives the requested output.

2.1.2 Subscription management

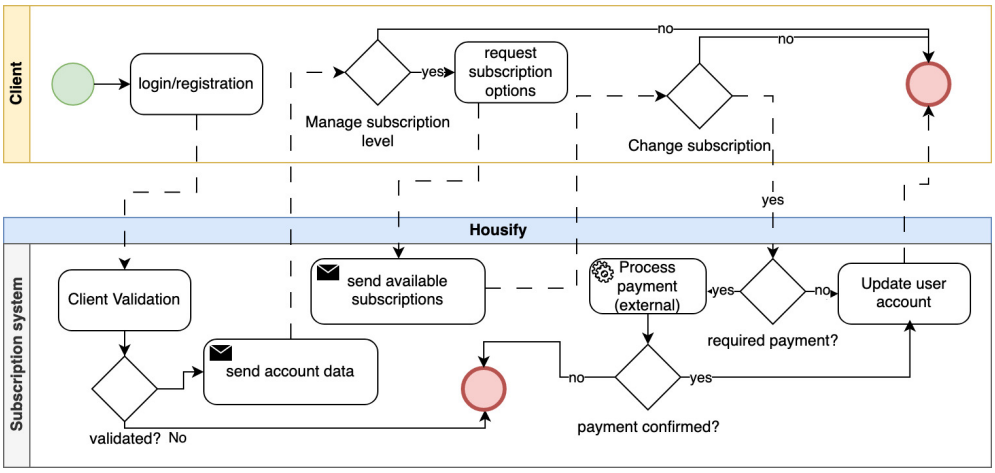

FIGURE 2.2: Business process for subscription management.

This business process is essential to provide the elements of subscription management to the client. He is entitled to these rights and we provide a concise interface for the client to use these services. The process is simply demonstrated in Figure 2.1 Business process for subscription management, it can be described in the following steps:

1. The client initiates the user interface (currently available on Android), establishing communication with Housify servers, which requires a valid authentication token (JWT) for login.
2. The Housify Web server authenticates and validates the user's account and authorization token.
3. The Housify Web server sends the client's data, including but not limited to historical information, usage statistics, account details, and current subscription level.
4. The Client uses the android interface to manage subscription level.
5. The Housify Web server sends available options and conditions to the Client.
6. The Clients reads the provided information and infers a decision about changing the subscription level.
7. In the case of subscription change the system receives the information and validates whether a payment if required:
   - Payment is required: The system processes the payment as informed in the previous step to the user, data is sent to the payment process service (external).
   - Payment is not required: The system proceeds to the next step.
8. The Housify web server validates payment and updates user account accordingly.

2.2 Business rules

2.2.1 Subscription levels and benefits

- Basic - Free tier, limited access and benefits.
- Pro - Monthly billed, Unlimited and full access to benefits.
- Enterprise - Inquire for pricing.

	Basic (free-tier)	Pro 20$ Monthly	Enterprise
Rate limit (hourly)	5 requests	20 requests	Custom
Speed limit (hourly)	3it/s	Unlimited	Unlimited
Image editing usage	8 requests	Unlimited	Unlimited
Image generation usage	10 requests	Unlimited	Unlimited
Image classification usage	26 requests	Unlimited	Unlimited
Watermark-free	-	✓	✓
Max upload size	1MB	40MB	Custom
Data access limit	100MB	100GB	Custom
API Key	1	1	Custom
FAQ Support	✓	✓	✓
Priority Email Support	-	-	✓

Table 2.1: Subscription tier table.

1. To create an account client has to supply email and phone number, billing information is optional, email and phone validation are required.
2. The software system is limited to be used in the European Union at the moment.
3. Client is able to manage subscription level at anytime.
4. Subscription payment is not refundable.
5. Client can provide textual descriptions for image editing/generation with a 400 character limit for the purpose of better inference.
6. Free tier inactive accounts will be deleted after 12 months.
7. A safe password is required (8 characters, ...)

8. User has to accept application permission requests.
9. Client has to accept privacy policy and data protection terms to use the application.

Chapter 3

Software Project Viability

Software project viability refers to the likelihood that our proposed software project will be successful in terms of meeting its intended goals, timeline, budget, and quality expectations. It involves evaluating various factors such as technical feasibility, market demand, competitive landscape, resource availability, and risk assessment to determine whether the project is worth pursuing. A viable software project should have a clear vision, realistic objectives, a well-defined scope, a solid development plan, and a dedicated team with the necessary skills and expertise. Additionally, we have considered factors such as market need, competition analysis, maintainability, and potential return on investment (ROI) to ensure that the project delivers long-term value for stakeholders.

3.1 Market Need

The ability of AI to create, modify, enhance, and interact with images can be harnessed in several ways to address market needs and provide innovative solutions in the housing industry. Here's how generative AI caters to some specific market demands:

- Accessibility and Remote Engagement
- Renovation and Restoration Projects
- Visualization before Construction
- Customization for Prospective Buyers
- Marketing and Advertising
- Reducing Time and Costs
- Experimentation

3.2 Competition Analysis

This analysis highlights the competitive landscape in utilizing generative AI for enhancing housing visuals. It underscores our main competitors, their offerings, and identifies our potential edge in this innovative arena.

3.2.1 Market Opportunity

- **Gap Identified:** A noticeable demand for cost-effective, ultra-realistic, and customizable housing visuals remains unmet.
- **Our Leverage:** AI technology enabling rapid creation/editing of hyper-realistic images, aligning with consumer preferences and industry standards.

3.2.2 Strategic Differentiation

Capitalizing on advanced AI algorithms, we aim to fill the market void by providing superior, customizable, yet affordable housing visuals, setting a new benchmark in the sector.

A strategic thrust in advanced generative AI positions us uniquely, ready to penetrate and cater to untapped demands within the housing imagery market, promising substantial business growth and market acquisition.

3.3 Financial Analysis

This section outlines the financial aspects of GeniaDynamics's upcoming project "Housify," with a focus on generative AI in the real estate sector. The goal is to provide a snapshot of the project's financial trajectory.

3.3.1 Initial Investment

The initial costs for setting up "Housify" are substantial, primarily due to the computationally intensive nature of the operations, especially the AI training component. Below is the breakdown of the initial investment:

- Software development: $120,000
- Infrastructure setup: $1,120,000
- Personnel costs: $180,000
- Marketing: $40,000
- Contingency fund: $160,000

This brings the total initial investment to $1,620,000.

Rationale for High Infrastructure Costs

A significant portion of the investment is dedicated to infrastructure setup, accounting for approximately $1,120,000. The reason for this substantial cost is largely due to the project's heavy reliance on advanced computational resources, specifically for Artificial Intelligence (AI) training, and inference.

AI training involves processing vast datasets to teach machines how to make decisions, predict outcomes, and understand patterns. This process requires powerful computing hardware. In the case of "Housify," the decision to invest in H100 enterpise GPU Nvidia, 2023 units significantly contributes to the costs. These units are some of the most advanced on the market for machine learning, offering exceptional performance that can drastically reduce the time required for AI model training and inference. However, this comes at a premium price.

The Nvidia HGX H100 units are designed to handle demanding computational tasks. With our budged we can get around 8 units in the initial investment. Their cost is justified by:

- **Speed and Efficiency:** They can process AI algorithms faster than standard computing units, around 7600TFlops(FP32)*8, 32PFlops, allowing for more rapid development and deployment of AI models.
- **Advanced Technology:** The latest in GPU architecture provides a level of performance unattainable with traditional hardware, especially in parallel processing and handling of complex neural networks.
- **Scalability:** As "Housify" grows, the infrastructure can efficiently scale with the increasing computational demand, thanks to the modular nature of these GPU units.
- **Energy Consumption:** Despite their power, they are designed for energy efficiency, which is crucial for maintaining lower operating costs in the long term. Consuming around 6Kw/h for an 8GPU server.

This strategic allocation toward high-performance computing resources is foundational to "Housify's" operational success, ensuring the project is equipped with the necessary tools from the outset.

3.3.2 Cost per Client

Each subscribed(Pro+) Client can use up to 108TFlops of the system's computational power for inference, limited to 110W/h of electricity usage (70% are GPUs) which is about 1.5% of the system's total computational power, for this reason inference has to be performed on CPU(slower) with some offloads to GPU on heavy computations, this allows for the cost of a client to be significantly lower. We can expect with an 8 unit GPU system with 192 core CPU combining 4TB of memory ram to allow for around 400 clients in parallel, since not all clients are using the system at the same

time and a good load balancer can be implemented, we can expect up to 2500 clients in this system without offload.

The cost is huge, 2500 clients on a $340,000 server is barely financially feasible. One server alone has an Operational cost of around $8k annually excluding any auxiliary hardware system.

In the early stages of the Project, its not financially feasible to train any AI models given the high computational and operational costs.

The cost of a pro client is expected to be around **$160** annually just in hardware and maintenance. The overall cost depends on the total number of Clients which would require a much more complex analysis.

With the initial investment, and the CPU offloading with the investment we can expect up to 4000 clients, without any system upgrades, maintaining a client annually should be around $42 annually.

3.3.3 Return on Investment

With total revenue projected at $360,000 for the first year, expecting 1500 average clients we calculate the net profit as follows:

$$\text{Net Profit} = \text{Revenue} - \text{Operational Cost} = \$360,000 - \$63,000 = \$297,000$$

$$\text{ROI 1 (\%)} = \left(\frac{\text{Net Profit}}{\text{Cost of Investment}}\right) \times 100 = \left(\frac{\$297,000}{\$1,620,000}\right) \times 100 \approx 0.183\%$$

With total revenue projected at $1,200,000 for the first two years, expecting 2500 average clients we calculate the net profit as follows:

$$\text{Net Profit} = \text{Revenue} - \text{Operational Cost} = \$1,200,000 - \$210,000 = \$990,000$$

$$\text{ROI 2 (\%)} = \left(\frac{\text{Net Profit}}{\text{Cost of Investment}}\right) \times 100 = \left(\frac{\$990,000}{\$1,620,000}\right) \times 100 \approx 0.61\%$$

With total revenue projected at $3,840,000 for the first tree years, expecting 4000 average clients we calculate the net profit as follows:

$$\text{Net Profit} = \text{Revenue} - \text{Operational Cost} = \$3,840,000 - \$672,000 = \$3,168,000$$

$$\text{ROI 3 (\%)} = \left(\frac{\text{Net Profit}}{\text{Cost of Investment}}\right) \times 100 = \left(\frac{\$3,168,000}{\$1,620,000}\right) \times 100 \approx 1.96\%$$

With this results we can expect this project to be profitable for long term only.

3.4 Technical Feasibility

Generative AI presents transformative potential in the housing sector, particularly in the realms of image generation and editing. The core of its feasibility revolves around the technological advancements in machine learning algorithms, and data availability, facilitating high-quality visual content production and manipulation, crucial for housing design, marketing, and renovations.

3.4.1 Open source Models

We rely on open source models for the initial phase of the project given the limited computing power for AI training.

3.4.2 Current Technological Landscape

The foundational technology for our service is Generative Adversarial Networks (GANs), which have shown promising results in image creation and alteration. By leveraging extensive datasets of housing images, the system can generate new, realistic visuals and modify existing ones. These capabilities are underpinned by substantial progress in AI training techniques, computational power, and graphical processing unit (GPU) advancements, which together enable the quick processing of high-resolution images. For NLP we use transformers.

3.4.3 Data Availability and Processing

Access to varied and extensive housing image databases is pivotal, as the quality of the generative AI's output is heavily reliant on the scope of its learning material. These databases encompass a spectrum of architectural styles, interiors, and furnishings, providing a holistic input that can be synthesized into unique image outputs. Our approach involves aggregating datasets from public sources, partnerships, and in-house data collection initiatives, ensuring a comprehensive library for the AI to draw upon.

3.5 Legal Compliance

In Section 8 we define all the legal documents required for our project, we comply with all laws and regulations. This is a critical part of this project's viability.

GeniaDynamics has the following legal documents:

- Privacy Policy and Data Protection.
- Subscription License Agreement.
- Company Policies and Procedures.
- License AGPLv3.

3.6 Risk Assessment

Implementing a generative AI service in the housing sector, particularly for image generation and editing, involves several risks that need to be identified, assessed, and managed. This risk assessment outlines the potential internal and external challenges that the project may encounter, offering strategies to mitigate these risks to ensure the project's smooth progression and success.

3.6.1 Identification of Risks

The risks associated with the project fall into various categories, including technological, legal, operational, and market-related risks. Each risk can have a substantial impact on the project's timeline, cost, and success.

Table 3.1: Project Risk Assessment

No.	Risk Description	Likelihood	Mitigation Strategy
1	Inadequate data quality or volume impacting the performance and reliability of the AI service	High	Establish data quality standards and pursue aggressive data collection and partnerships
2	Technological complexities and unforeseen operational challenges leading to increased development time and costs	Moderate	Invest in skilled human resources, proper planning, and allocate buffer resources
3	Legal and ethical concerns regarding AI-generated content and potential lawsuits or financial penalties	Moderate	Engage legal advice, adhere to AI ethics standards, and incorporate privacy by design
4	Market acceptance and competitive risks leading to low adoption rates	High	Conduct market research and build a strong unique selling proposition
5	Security breaches leading to compromised user data and potential legal consequences	Low	Implement advanced cybersecurity measures and continuous monitoring

3.6.2 Risk Prioritization

Post-identification, the risks are prioritized based on their impact on the project and the likelihood of their occurrence. High-impact and high-probability risks are given precedence in the allocation of resources for mitigation planning.

3.6.3 Mitigation Strategies

Proactive mitigation strategies are essential to address each identified risk. This involves the allocation of specific resources, developing alternative solutions, and preparing responsive methods that can minimize the potential negative effects on the project.

3.6.4 Conclusion

Recognizing and preparing for potential risks is crucial to the project's resilience and success. This risk assessment serves as a dynamic tool that will require updates and revisions throughout the project's life cycle, ensuring that emerging challenges are identified early and addressed promptly to secure the project's integrity and sustainability.

3.7 Scalability

The scalability of a generative AI service, particularly in the context of housing image generation and editing, determines its ability to handle growing amounts of work and its potential to be enlarged to accommodate that growth. This section assesses the scalability of our project, considering various dimensions such as performance, load, and functional scalability, and discusses strategies to enhance the system's expansibility.

3.7.1 Performance Scalability

Our generative AI service is designed to maintain a high level of performance even as demand increases. We consider the following:

- **Computational Efficiency:** Optimization of algorithms and underlying operations to ensure minimal latency and efficient use of computational resources.
- **System Architecture:** Utilization of a modular architecture that allows for components to be upgraded in response to increasing data processing requirements.
- **Resource Management:** Dynamic allocation and reallocation of resources (CPU, memory, storage) in real-time as per the workload, ensuring optimal performance levels.

3.7.2 Load Scalability

To accommodate a larger user base or increased service demand, our service incorporates:

- **Load Balancing:** Distribution of workloads across multiple computing resources to prevent any single resource from being overwhelmed.
- **Caching Mechanisms:** Implementation of effective caching to speed up data delivery during high-demand periods and reduce the burden on the databases.

3.8 Sustainability and Environmental Impact

The project is computationally intensive which implies high usages of electricity (103680Kw/h annually for 3k clients), We have a pledge to sustainability, so there is an effort to use renewable sources of energy.

Chapter 4

Architecture design and Technical Details

4.1 Technical Architecture high-level overview

The Housify system is designed to facilitate seamless communication between clients and various backend services. This architectural blueprint ensures high availability, security, and scalability to meet the demands of modern web applications.

1. **WAN Communication:** Clients can simultaneously interact with the Housify system over the WAN using Housify's mobile application, using TCP and UDP protocols, ensuring efficient and reliable data transmission.
2. **Main Router (pfSense) and Firewall:** At the network's edge, the system employs pfSense as the Main Router and Firewall to provide robust network security and management. This component handles IP filtering and integrates seamlessly with Cloudflare solutions for enhanced security and performance.
3. **Main Reverse Proxy (nginx):** The Main Reverse Proxy, powered by nginx, acts as an intermediary between clients and the backend services. It is responsible for terminating Transport Layer Security (TLS/SSL), supporting multiple HTTP versions (HTTP/1.1, HTTP/2, HTTP/3), and facilitating both UDP and TCP communication.
4. **Load Balancer (nginx):** Situated behind the Main Reverse Proxy, the Load Balancer efficiently distributes network requests based on predefined criteria. It ensures optimal resource allocation by balancing the traffic load across available servers.
5. **Web Servers:** Web servers, designed for low computational requirements, are responsible for establishing and maintaining client communication. These servers employ the ASGI (Asynchronous Server Gateway Interface) using Uvicorn and FastAPI, facilitating both RESTful API and WebSocket communication. They manage user data and service usage history efficiently.
6. **AI Inference Load Balancer:** To cater to AI-driven services, an AI Inference Load Balancer optimizes the allocation of inference requests to AI servers. This component helps ensure quick response times and efficient resource utilization.
7. **AI Servers:** The AI servers are organized in clusters and dedicated to performing AI inferences based on client requests. They utilize a microservices architecture and communicate with web servers through an internal API. The servers are equipped with FastAPI, Uvicorn, and TortoiseORM for seamless integration and efficient data management..

8. **Diffusers and LammaCPP:** These components play a crucial role in the AI inference process. Diffusers and LammaCPP are used for handling inference requests and processing AI-related tasks efficiently.

9. **Databases & File Storage:** Data storage is a critical aspect of the Housify system. This section encompasses user management databases, AI services databases, and a storage server for images and logs. Redis is utilized as an in-memory data store for enhancing data retrieval speed and efficiency.

10. **AI Models:** AI models are efficiently stored in a super fast file server to be used for inference tasks. The models are stored and managed to meet the technical demands of the system.

Housify system's technical architecture is designed with a focus on security, scalability, and efficiency. It employs a combination of networking components, web servers, load balancers, AI inference capabilities, and data management systems to ensure seamless communication and AI services for clients. This architecture is well-suited for modern applications requiring real-time communication and AI-driven functionalities. fffffff

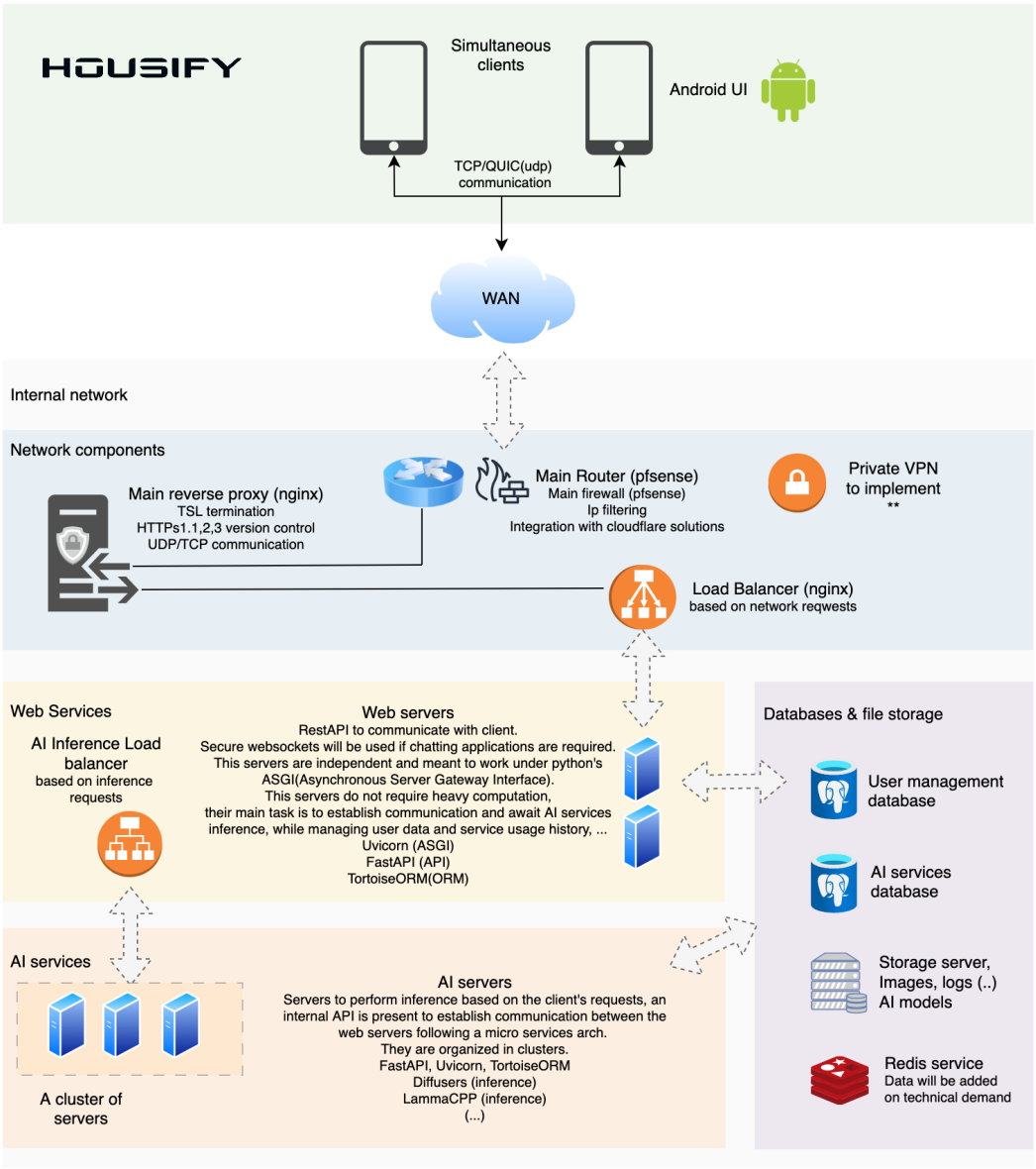

FIGURE 4.1: Technical architecture diagram

4.2 Information system overview

4.2.1 Operating Systems and Available Servers

In the context of the Housify system, various operating systems and servers are utilized to ensure robust functionality. These include Linux-based operating systems for server deployment and management, mostly nixos. Additionally, services such as Nginx, pfSense, Uvicorn, and others are employed to handle specific tasks within the system architecture. Pfsense acts as the network's entry point.

4.2.2 Android Interface

An android interface is an essential aspect of the Housify system. The functionality of the system is dependant on the mobile interface which initiates the communication with housify AI services.

4.2.3 Certificates Management

Certificate management is essential for maintaining secure communication within the Housify system. SSL/TLS certificates are carefully managed to encrypt data transmission between clients and servers, ensuring the confidentiality and integrity of information. This certificates are managed through LestEncrypt.

4.2.4 Database Management System

The system employs a robust database management system (DBMS) to store and manage various types of data. This includes user-related data, AI models(Link's to fast file servers only), service usage history, and more. Postgres is used as the main DBMS and TortoiseORM is utilized for ORM (Object-Relational Mapping) to interact with the database efficiently.

4.2.5 Asynchronous Server Gateway Interface (ASGI)

ASGI (Asynchronous Server Gateway Interface) is a key component of the Housify system architecture. It allows for asynchronous and non-blocking communication between clients and web servers, enabling real-time interactions and efficient resource utilization.

4.2.6 REST API

The Housify system incorporates a RESTful API to facilitate structured and standardized communication between clients and backend services. This API serves as a conduit for various functionalities, including user data management and AI service requests.

4.2.7 Additional Services

In addition to core components, the system leverages various additional services to enhance its functionality. These services include caching mechanisms, logging services, and monitoring tools, all of which contribute to system performance and reliability.

4.2.8 Secure Websockets

Secure Websockets are used to support real-time, bi-directional communication between clients and the system. This technology is essential for chat applications and other interactive features, ensuring secure and efficient data exchange, it's not clear wether this technology with be needed.

4.2.9 Key-Value In-Memory Database

To optimize data retrieval and storage for certain operations, a key-value in-memory database is employed. This database, powered by Redis, enhances the system's responsiveness by providing high-speed data access.

4.2.10 Reverse Proxy, Load Balancer, and HTTP Server

The Housify system employs a combination of reverse proxies (Nginx), load balancers, and HTTP servers to efficiently route incoming requests, balance server workloads, and serve web content. These components collectively contribute to system scalability and reliability.

4.2.11 Mail On-Premise Backend Server

For handling email communication and notifications within the system, an on-premise mail backend server is employed. This server ensures reliable email delivery and most importantly secure communication with users.

4.2.12 Hosted Documentation

Documentation plays a crucial role in system maintenance and development. Hosted documentation, accessible through a web interface and locally, provides comprehensive information about system components, APIs, and best practices for system administrators and developers.

4.2.13 Networking

Networking forms the backbone of the Housify system, allowing clients to communicate with backend services over a WAN. The network architecture includes security measures, routing configurations, and communication protocols (TCP/UDP) to ensure secure and efficient data transmission.

Chapter 5

Collaboration tools On-premises

5.1 Why we choose On-premise solutions

- **Data Control and Security:** Our company has sensitive data, we prefer on-premise solutions because it allows us to have full control over our data. This can enhance security and ensure compliance with industry regulations and data protection laws.
- **Customization and Flexibility:** On-premise solutions are tailored to meet the specific needs of our company. We can customize software and systems according to our unique requirements, allowing for greater flexibility and control over the technology stack.
- **Performance:** On-premise solutions can offer superior performance for certain applications, especially those that require high computing power and minimal latency.
- **Predictable Costs:** While on-premise solutions often involve significant upfront costs, we have a more predictable cost structure in the long term. Cloud-based services, on the other hand, operate on a subscription model, which might become more expensive over time.
- **Full Ownership:** When a company invests in on-premise solutions, they own the hardware and software outright. For our company, having full ownership of our IT resources is a strategic decision.
- **Network Independence:** Our company operating in areas with unreliable or limited internet connectivity finds on-premise solutions more reliable, as we don't depend on a constant internet connection to function.

5.2 Gitlab

GitLab is a powerful on-premises collaboration tool that can significantly improve your software team's workflow. With its robust features and intuitive interface, GitLab enables teams to streamline their development process, enhance communication, and increase productivity. Here are some ways in which GitLab can benefit your software team:

- **Version Control:** GitLab provides a centralized repository for storing and managing code changes, allowing developers to track the history of modifications and collaborate on different aspects of the project simultaneously. This

ensures that all team members have access to the most up-to-date version of the codebase, reducing conflicts and errors.

- **Agile Project Management:** GitLab offers built-in agile project management tools, including boards, lists, and graphs, which help teams plan, track, and visualize their work. This enables team members to prioritize tasks, identify bottlenecks, and make informed decisions about project timelines and resource allocation.
- **Code Review and Feedback:** GitLab's code review feature allows developers to evaluate each other's work, provide constructive feedback, and ensure that the code adheres to quality standards. This fosters a culture of collaboration, knowledge sharing, and continuous learning within the team.
- **Continuous Integration/Continuous Deployment (CI/CD):** GitLab provides robust CI/CD capabilities, enabling teams to automate testing, deployment, and monitoring processes. By integrating with other tools and services, GitLab helps teams deliver high-quality software faster and more efficiently.
- **Issue Tracking:** GitLab's issue tracking feature allows teams to log, categorize, prioritize, and resolve issues quickly. This ensures that problems are addressed promptly, reducing the likelihood of delays or negative impact on project timelines.
- **Collaborative Documentation:** GitLab enables teams to create and manage documentation collaboratively, using features like GitLab Pages and Wikis. This promotes knowledge sharing, transparency, and accountability within the team, making it easier for members to access the information they need to excel in their roles.

5.3 Nexcloud hub

NextCloud Hub offers features such as file sharing, collaborative editing, project management tools, an email interface, per user and shared calendars, video conferencing and screen sharing capabilities. By utilizing these functions, our team can streamline their workflow by having centralized access to necessary files and documents, the ability to simultaneously work on projects, and the capability to track progress and deadlines effectively. Additionally, NextCloud Hub's integration with other tools such as Google Drive, Microsoft Office, and Slack enables seamless collaboration and enhances productivity. Our team can benefit from improved communication, reduced email clutter, and increased mobility when working remotely or on-the-go. Overall, implementing NextCloud Hub On-premise can significantly boost our software team's efficiency and facilitate a more organized workflow.

5.3.1 Talk

Nextcloud Talk delivers on-premises, private audio/video conferencing and text chat through browser and mobile interfaces with integrated screen sharing and SIP integration.

5.3.2 Drive

Nextcloud Drive offers an on-premise Universal File Access and sync platform with powerful collaboration capabilities and desktop, mobile and web interfaces.

5.3.3 Groupware

Nextcloud Groupware integrates Calendar, Contacts, Mail and other productivity features to help our team get the work done faster, easier and on our terms.

5.3.4 Office

Nextcloud Office is a powerful LibreOffice-based online office suite with collaborative editing, which supports all major document, spreadsheet and presentation file formats and works in all modern browsers.

5.4 Jupyter Lab

- **Interactive Coding:** Jupyter Lab allows developers to write and run code in an interactive environment, making it easier to experiment with new ideas, test hypotheses, and visualize results. This feature enables real-time collaboration, as developers can share their work and receive feedback from colleagues instantly.
- **Data Visualization:** With Jupyter Lab's robust data visualization capabilities, our team can create interactive plots, charts, and graphs to better understand complex data sets. This facilitates more effective data analysis, enabling developers to identify patterns, trends, and insights that might have been missed using traditional methods.
- **Version Control:** Jupyter Lab integrates seamlessly with version control systems like Git, allowing developers to track changes, manage different code branches, and roll back if needed. This ensures that all team members are working with the most up-to-date codebase, minimizing conflicts and streamlining the development process.
- **Documentation:** Jupyter Lab enables developers to create documentation in tandem with their code. This feature helps maintain accurate, up-to-date documentation that is easily accessible by the entire team. Additionally, it simplifies knowledge sharing and onboarding processes for new team members.
- **Education and Training:** The tool offers an excellent platform for training and education. Jupyter Lab allows developers to create interactive tutorials, workshops, and guides, making it easier for team members to learn new technologies, tools, and methodologies. This feature promotes knowledge sharing within the team and helps maintain a consistent skill level across the board.

- **Flexibility:** Jupyter Lab supports various programming languages, including Python, R, Julia, and JavaScript. It also integrates with popular libraries like TensorFlow, PyTorch, and Scikit-Learn. This versatility ensures that your team can work with their preferred tools and technologies, maximizing productivity and efficiency.
- **Scalability:** Jupyter Lab is designed to scale seamlessly, allowing it to accommodate growing teams and large-scale projects. Its flexibility in terms of architecture and deployment (on-premises or cloud) ensures that it can adapt to your team's evolving needs.
- **Collaboration Features:** Jupyter Lab offers features like real-time commenting, feedback, and video conferencing integration. These capabilities enhance collaboration among team members, allowing them to work together effectively, discuss ideas, and share insights in real time.
- **Customization:** The tool allows developers to create custom extensions, plugins, and integrations tailored to their specific needs. This feature enables your team to adapt Jupyter Lab to their workflows, streamlining processes and boosting productivity.
- **Community Support:** Jupyter Lab has a vast and active community of users, contributors, and maintainers. This community provides valuable resources like documentation, tutorials, and forums where developers can ask questions, share knowledge, and learn from others' experiences.

By incorporating Jupyter Lab into our software team's workflow, we enhanced collaboration, streamlined development processes, improved data analysis, and increased productivity. Our team can leverage these benefits to deliver high-quality software more efficiently, accelerate project timelines, and maintain a competitive edge in the industry.

Chapter 6

Workflow methodologies and frameworks

6.1 Scrum

6.1.1 User Stories

As a user, I want to:

us01 - Quickly visualize changes in an image for experimentation according to my requirements.

us02 - Have a user-friendly interface that allows me to express my design preferences easily through text or images.

us03 - Utilize a service that can generate and edit images of housing interiors and exteriors with great detail according to my requirements.

us04 - Receive textual image descriptions and the classification to better understand how the system perceives the image.

us05 - Use my phone's camera to directly integrate pictures into the application for a more streamlined experience.

us06 - Have seamless gallery integration within the application to easily access and edit my images.

us07 - Store both original and edited/generated images within the system for future use or review.

us08 - Rate the image generations within the application to provide feedback.

us09 - Access the best-rated public images within the system for inspiration and ideas.

us10 - Review the generated images with related generation options, for advanced users only.

us11 - Receive decoration suggestions from the system.

6.1.2 Use Cases

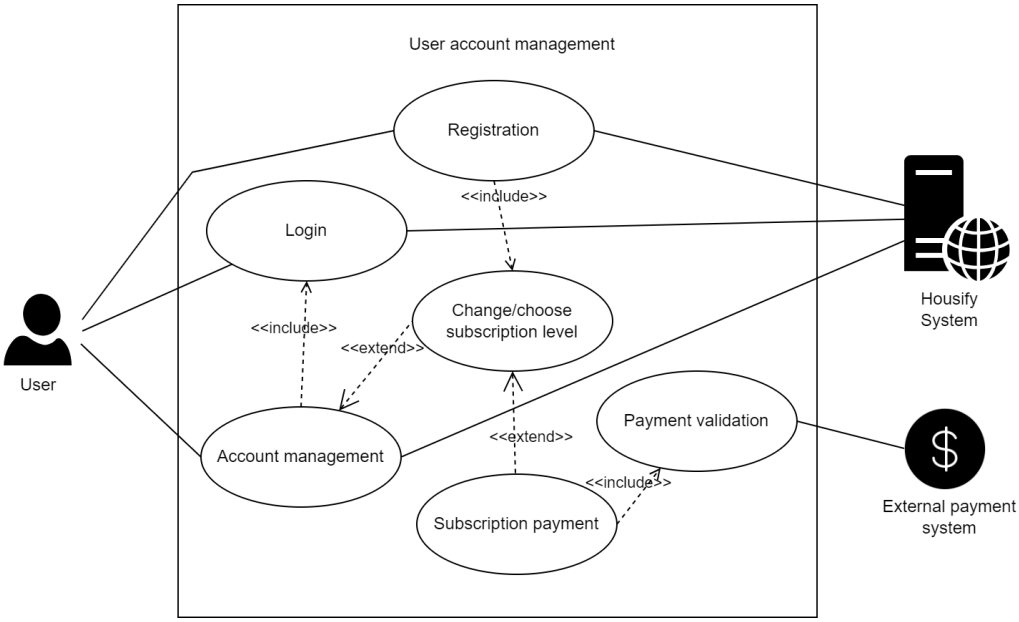

FIGURE 6.1: Use case diagram - Account management

The Figure 6.1: Use case diagram - Account management represents what the user can do to manage his account. All that entails is described below:

The user starts by either registering or logging in, depending if an account is already owned or not. In the case of a new account, the user chooses a subscription level to associate with the newly formed account. If he chooses a paid subscription, a payment will have to be completed with an external payment system and, after everything is complete, a validation of the payment is processed by the external system. All of the data associated with the new account is sent and stored to the housify systems.

If the user already has an account or wishes to change any information associated with it, he may do so after logging in and use the various account management features the system provides. All of the data that is changed will then be updated in the housify systems.

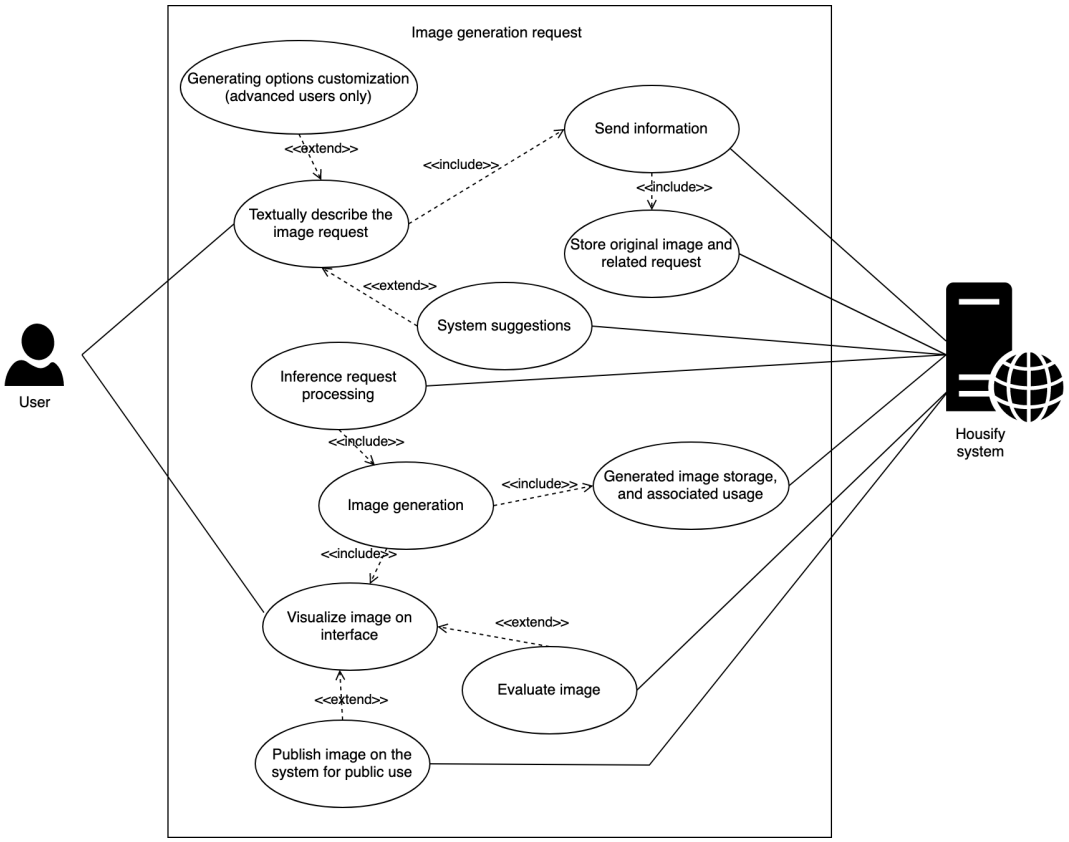

FIGURE 6.2: Use case diagram - Image generation

The Figure 6.2: Use case diagram - Image generation represents what the user can do to generate an image. This process is described below:

To start, the user has to describe via text the image he wants to visualize. If the user has some experience, he can utilize advanced options to enhance his experience. The housify system will also give some suggestions partaking to the prompt the user is writing.

After the user is done writing prompts, the information will be sent to the housify system to be processed, the original image and the request will be stored. This processing results in an image generation related to the prompt received, it also includes the storage of the generated image and the resources it uses/used during the inference and after being stored.

In the end, the user may visualize the image generated and either publish the image for public use, give and evaluation to the image or terminate the process and leave.

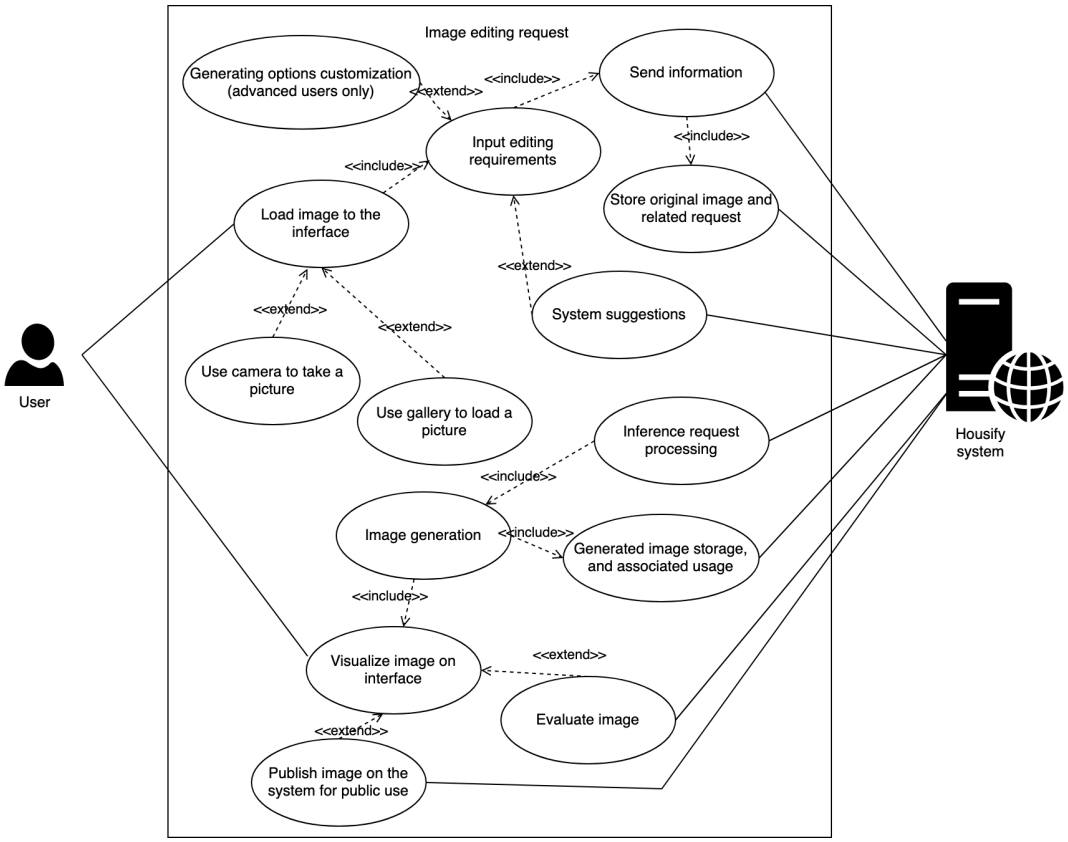

FIGURE 6.3: Use case diagram - Image editing

The Figure 6.3: Use case diagram - Image editing represents what the user can do to edit an image. The process is described below:

The user starts by loading an image to the interface, either by using his camera to take a picture or loading a picture from the gallery. The user then inserts editing prompts, receiving suggestions from the housify system, and, if he is an advanced user, can customize the generating options to enhance his work.

This information is then sent to the housify system, which stores the original image and the related request, that in turn processes it and generates an edited image with the standards given by the user. The new image is also stored with all the resources that it uses/used during the processing and storage.

The user can then visualize the new edited image and either publish the image for public use, evaluate the image or just terminate the process and leave.

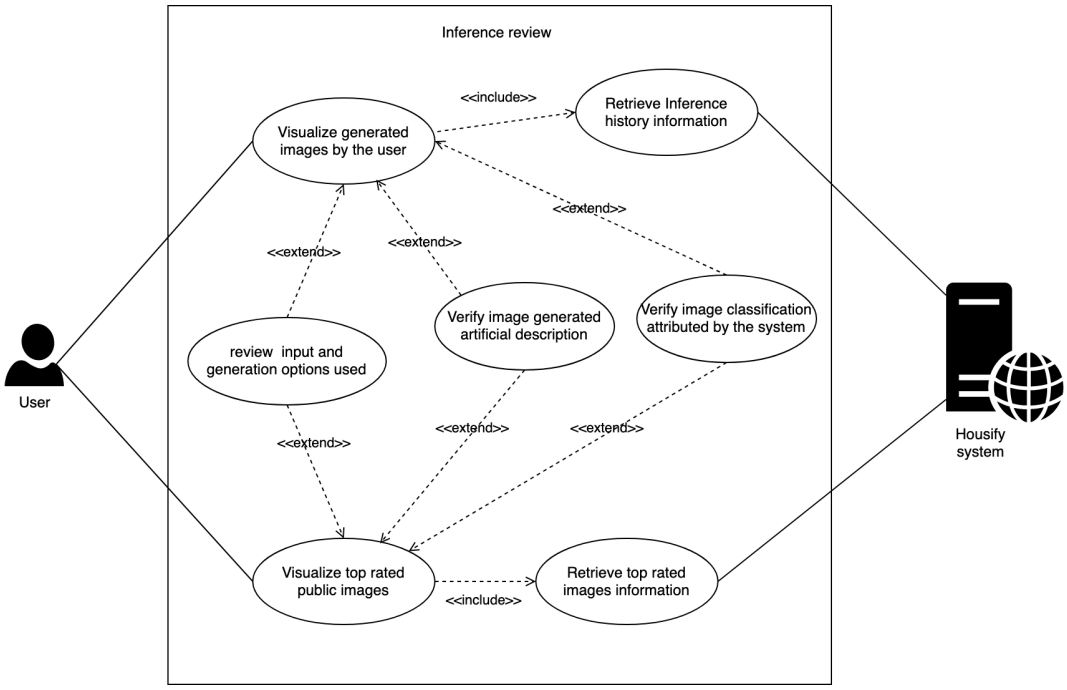

FIGURE 6.4: Use case diagram - Inference review

The Figure 6.4: Use case diagram - Inference review represents what the user can do to review past inferences done by him or others. This process is described below:

The user can start by visualizing images he generated in the past or images generated by other users that have been set to public. In both cases the user can review the input and generation options used, verify the generated artificial description and verify the image classification attributed by the system. In case of an image generated by the user, he can also retrieve inference history information stored in the housify systems and, in the case of a public image, the user can retrieve the information of top rated images in the housify systems.

6.1.3 Product Backlog

ID	Functional Requirement	Time to impl	Effort
1	Integration with A.I. model for image generation, editing, and classification.	Long	High
2	User-friendly interface for design preference expression through text or related images.	Long	Medium
3	Service for generation and editing of images of housing interiors and exteriors.	Normal	High
4	System ability for image classification and providing textual descriptions.	Normal	Medium
5	Camera integration with the Android application for improved usability.	Short	Low
6	Gallery integration with the Android application for improved usability.	Short	Low
7	Image storage for both original and edited/generated images for client use.	Normal	Medium
8	User ability to rate the application's image generations in the interface.	Short	Low
9	Access to best-rated public images by users.	Short	Low

Table 6.2: Product backlog table

6.2 Timeline

6.2.1 Sprint Timeline

In the following table 2.1 we outline the scheduled sprints of the project. By using Scrum we define clearly the Milestones of the Housify project.

Sprint	Version	Phase	Day	Month
Sprint 1	v0.11	Initial Development Phase	2-8	October
Sprint 2	v0.12	Early Stage Implementation	9-15	October
Sprint 3	v0.13	Progressive Improvement Sprint	16-22	October
Sprint 4	v0.2	Backend Stabilization Phase	23-29	October
Sprint 5	v0.3	Incremental Upgrade Phase	30-05	November
Sprint 6	v0.4b	Beta Preview Rollout	06-12	November
Sprint 7	v0.5m	Mobile Application Preview	13-19	November
Sprint 8	v0.6b	Second Beta Testing Phase	20-26	November
Sprint 9	v0.7	Pre-Launch Refinements	27-03	December
Sprint 10	v0.8b	Beta Version Release	04-10	December
Sprint 11	v0.9	Final Development Sprint	11-17	December
Sprint 12	v1.0pr	Pre-Release Polishing	18-24	December
Sprint 13	v1.0qa	Quality Assurance Focus	25-31	December
Sprint 14	v1.0.0	Official Product Launch	01-07	January

Table 6.3: Sprint timeline table

6.2.2 Sprint Meeting Timeline

In the following table 2.2 we outline the sprint meetings corresponding to every sprint, we define the goals and the necessity of the project manager presence.

Name	Agenda	PM	Day	Month
Meeting s1	Kick-starting the Project	✓	4	October
Meeting s2	Aligning Early Goals	✓	11	October
Meeting s3	Navigating Through Enhancements	-	18	October
Meeting s4	Solidifying Our Backend	✓	25	October
Meeting s5	Systematic Upgrades Discussion	-	1	November
Meeting s6	Preparing for Beta Reveal	-	8	November
Meeting s7	Mobilizing Our Efforts	✓	15	November
Meeting s8	Beta Testing Insights	-	22	November
Meeting s9	Refinement Strategies Before Launch	-	29	November
Meeting s10	Beta Release Debrief	✓	6	December
Meeting s11	Wrapping Up Development	-	13	December
Meeting s12	Pre-Release Review	✓	20	December
Meeting s13	Assuring Quality for Launch	✓	27	December
Meeting s14	Launch Sequence Discussions	✓	8	January

Table 6.4: Sprint Meeting Table

6.2.3 On Demand Meetings

We have on demand meetings to ensure the viability of the project, technical feasibility, and the milestones integrity.

This meetings aren't scheduled far in advance and are usually called for a specific, often immediate, need or concern. The project's manager presence depends on how far the project's vision is changing or compromised.

These meetings require participants to be flexible. Unlike scheduled meetings, on-demand ones can occur at any time, depending on the urgency of the matter. They challenge the traditional work structure, as they might happen outside of regular hours or during times allocated for individual work.

On-demand meetings are a critical component of modern, agile workplaces, where rapid response to change is required. They complement scheduled meetings by ensuring that urgent matters are addressed promptly and decisively, thereby maintaining the momentum of projects and the responsiveness of our team and organization.

6.3 DevOps

(next phase)

6.4 Software

Self Hosted GitLab serves as a comprehensive platform to manage tasks across team members utilizing an array of Agile tools. This includes the creation and categorization of issues, setting up milestones for sprint tracking, and the utilization of Issue Boards for visual workflow management. Weights are assigned to issues to quantify effort, and merge requests are linked for development tracking. Time tracking features aid in monitoring effort expenditure, while Burndown Charts visualize sprint progress. GitLab's expansive suite provides a cohesive environment for implementing Scrum methodology, ensuring structured and efficient team collaboration and project progress monitoring.

Chapter 7

Sprint Distribution

7.1 Sprint 1: v0.11 Initial Development Phase (2-8 October)

Goals

- Kick-start the project infrastructure setup.
- Lay down the groundwork for A.I. model integration.

User story focus

- US01
- US02
- US03

Backlog Items

1. Set up the project repository and define coding standards.
2. Establish initial project architecture and technology stack.
3. Setup inference models on local servers while testing basic generative features.
4. Begin development of the A.I. model integration layer.
5. Prototype the basic user interface design.
6. Design networking architecture.

Assignments

- Software Engineers, Software Developers 60h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 22h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Solutions architect 24h total estimated.
  - Diogo Antunes.
- Scrum Master, Technical writer 8h total estimated.

  - João Ribeiro, José Senra, Diogo Antunes.
- UX/UI Designer 8h total estimated.
  - João Ribeiro.

Meeting

- Meeting s1: Kick-starting the Project - 4 October.

7.2 Sprint 2: v0.12 Early Stage Implementation (9-15 October)

Goals

- Start implementing core features.
- Functional image generation/editing, including classification with textual description, all AI models should be functional.

User story focus

- US01
- US03
- US04
- US07

Backlog Items

1. Develop core functionalities for image generation.
2. Implement basic image editing capabilities using inference models, test pic2pic, Brooks, Holynski, and Efros, 2022, and Stable Diffusion, Rombach et al., 2022.
3. Implement Image classification and vision (generative textual description) capabilities using google vit-base-patch16-224,Wu et al., 2020, for classification, and Salesforce blip-image-captioning-large, Li et al., 2022 for image descriptions.
4. Implement Image pre-processing to better fit AI models.
5. Start implementation of ORM for user management, concluding data models.
6. Start implementation of ORM for AI service management, concluding data models.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s2: Aligning Early Goals - 11 October.

7.3 Sprint 3: v0.13 Progressive Improvement Sprint (16-22 October)

Goals

- Minimal micro services architecture.
- Defined functional layers, web servers, AI servers, and networking.

User story focus

- US01
- US03
- US04
- US07

Backlog Items

1. Refine the image generation process for better quality outputs.
2. Finalise networking layer, ensuring security standards and consistent communication according to business rules and requirements, implementing firewalls, load balancers, Tls termination and Https version control, redirections and static file hosting with nginx acting as both a reverse proxy and and Http server with load balancing.
3. Ensure communication is established between the Web services, AI services, and data Layers.
4. Implement internal APIs to call AI services.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s3: Navigating Through Enhancements - 18 October.

7.4 Sprint 4: v0.2 Backend Stabilization Phase (23-29 October)

Goals

- Stabilize the backend to support scaling.
- Ensure robust integration with A.I. models for increased load.

User story focus

- US01
- US03
- US04
- US07

Backlog Items

1. Implement caching and database indexing for performance optimization.
2. Establish a continuous integration/continuous deployment (CI/CD) pipeline.
3. Conduct thorough testing of A.I. model integration, confirming
4. Ensure data layer is capable of testing, do roll-backs, migrations and is production ready.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s4: Solidifying Our Backend - 25 October.

7.5 Sprint 5: v0.3 Incremental Upgrade Phase (30 October - 5 November)

Goals

- Implement incremental upgrades to the system.
- Enhance user experience with a working mobile interface.

Backlog Items

1. Upgrade user interface elements for a more intuitive experience.
2. Begin integration of gallery and camera functionalities in the app.
3. Finalise login components in the system.
4. Develop advanced image editing features.
5. Integrate user feedback mechanisms into the app.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s5: Systematic Upgrades Discussion - 1 November.

7.6 Sprint 6: v0.4b Beta Preview Rollout (6-12 November)

Goals

- Prepare for beta release of the product.
- Focus on system robustness and user engagement.

Backlog Items

1. Finalize beta version of the application for rollout.
2. Implement the rating system for images.
3. Stress test the system in preparation for public beta.
4. Optimize the application for better performance and stability.
5. Begin development of the rating and review system.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s6: Preparing for Beta Reveal - 8 November.

7.7 Sprint 7: v0.5m Mobile Application Preview (13-19 November)

Goals

- Showcase mobile application capabilities.
- Gather user feedback for improvements.

Backlog Items

1. Conduct user acceptance testing with a focus group.
2. Refine camera and gallery integration based on user feedback.
3. Improve image storage solutions for scalability and redundancy.
4. Develop a feature for users to access best-rated images.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s7: Mobilizing Our Efforts - 15 November.

7.8 Sprint 8: v0.6b Second Beta Testing Phase (20-26 November)

Goals

- Refine the product based on feedback from the first beta phase.
- Enhance system security and data protection measures.

Backlog Items

1. Analyze feedback from the first beta test and prioritize updates.
2. Implement additional security protocols for data protection.
3. Optimize system infrastructure for better load management.
4. Expand the classification and description capabilities of images.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s8: Beta Testing Insights - 22 November.

7.9 Sprint 9: v0.7 Pre-Launch Refinements (27 November - 3 December)

Goals

- Finalize feature set for pre-launch.
- Conduct intensive testing and bug fixing.

Backlog Items

1. Perform a security audit to ensure data protection standards are met.
2. Refine user interface and user experience based on the beta testing feedback.
3. Finalize the integration of the image rating feature.
4. Complete the implementation of best-rated images accessibility.
5. Conduct performance optimizations for a smooth user experience.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s9: Refinement Strategies Before Launch - 29 November.

7.10 Sprint 10: v0.8b Beta Version Release (4-10 December)

Goals

- Prepare for the release of the beta version.
- Ensure all features are operational and tested.

Backlog Items

1. Launch the beta version of the mobile application.
2. Monitor system performance and collect user feedback on the beta version.
3. Address any critical issues found during beta testing.
4. Enhance the overall stability of the application.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s10: Beta Release Debrief - 6 December.

7.11 Sprint 11: v0.9 Final Development Sprint (11-17 December)

Goals

- Address final development tasks before the official release.
- Polish user interface and iron out any remaining issues.

Backlog Items

1. Implement any remaining minor feature enhancements.
2. Focus on bug fixing and resolving any outstanding issues from the beta tests.
3. Polish the UI/UX for the official release.
4. Prepare marketing materials and documentation for the launch.
5. Ensure all legal and compliance checks are complete.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s11: Wrapping Up Development - 13 December.

7.12 Sprint 12: v1.0pr Pre-Release Polishing (18-24 December)

Goals

- Perform final checks and polish the product for pre-release.
- Ensure highest quality and performance standards.

Backlog Items

1. Execute final round of user testing to ensure usability and reliability.
2. Optimize application performance based on feedback and testing results.
3. Finalize all documentation for the product release.
4. Complete any last-minute feature tweaks and enhancements.
5. Ensure compliance with all legal and regulatory requirements.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s12: Pre-Release Review - 20 December.

7.13 Sprint 13: v1.0qa Quality Assurance Focus (25-31 December)

Goals

- Dedicate the sprint to rigorous quality assurance.
- Resolve any critical issues before the official launch.

Backlog Items

1. Conduct extensive quality assurance testing across all features.
2. Address any and all issues identified during QA testing.
3. Implement system backups and recovery processes.
4. Review security protocols and perform a final security audit.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s13: Assuring Quality for Launch - 27 December.

7.14 Sprint 14: v1.0.0 Official Product Launch (1-7 January)

Goals

- Launch the official product to the market.
- Ensure a smooth release with support structures in place.

Backlog Items

1. Coordinate the product launch event and marketing activities.
2. Monitor systems in real-time to address any immediate issues.
3. Engage with early users and collect initial feedback.
4. Establish a customer support process to handle inquiries and issues.
5. Review product performance metrics post-launch and plan for the next iteration.

Assignments

- Software Engineers, Software Developers 90h total estimated.
  - Diogo Antunes, João Ribeiro, Edgar Baptista.
- System Administrators, Database administrators 40h total estimated.
  - Diogo Antunes, Edgar Baptista.
- Scrum Master, Technical writer 8h total estimated.
  - João Ribeiro, José Senra, Diogo Antunes.

Meeting

- Meeting s14: Launch Sequence Discussions - 8 January (Post-launch meeting).

Chapter 8

Model Inference Preview

8.1 Image Generation, Text-to-Image

This section will preview the expected outcomes of the text-to-image generation model. It will illustrate how input text prompts are interpreted by the model to generate corresponding images.

Model used: stabilityai stable-diffusion-xlbase-1.0, Stability AI, 2023.

diffuser: stable-diffusion-xl-refiner-1.0.

1 - input: "create a modern kitchen"
negative-prompt: "unrealistic"

FIGURE 8.1: Example kitchen generation

2 - input: "create a modern house interior in Japan"
negative-prompt: "unrealistic"

FIGURE 8.2: Example interior generation 1

FIGURE 8.3: Example interior generation 2

8.2 Image Editing, Image-to-Image

In this section, the focus will be on the image-to-image editing model. Expected results will demonstrate how the model can transform input images based on specific editing tasks such as style transfer, object addition/removal, or color adjustment.

Model used: timbrooks instruct-pix2pix,Brooks, Holynski, and Efros, 2022.

Examples from Brooks, Holynski, and Efros, 2022:

FIGURE 8.4: Example image editing 1

FIGURE 8.5: Example image editing 2

FIGURE 8.6: Example image editing 3

FIGURE 8.7: Example image editing 4

FIGURE 8.8: Example image editing 5

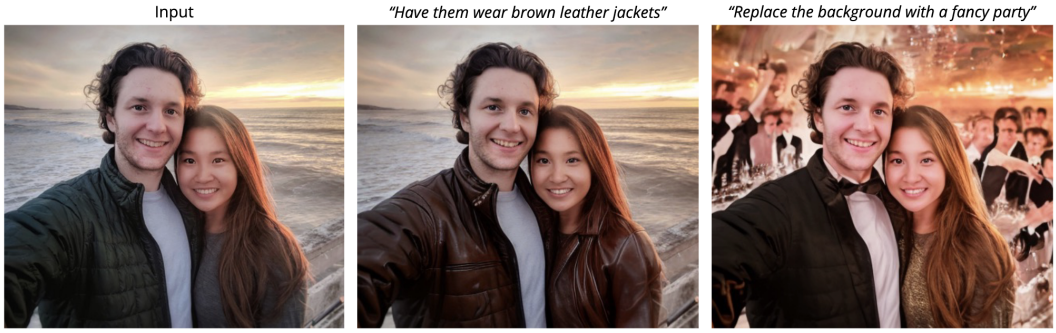

FIGURE 8.9: Example image editing 6

8.3 Image Classification

The image classification section will outline the expected accuracy and performance of the model in categorizing images into predefined classes. It will include an overview of the model's ability to handle varied and complex image datasets, its precision and recall rates, and its performance under different conditions and datasets. Illustrative examples of correct and incorrect classifications will be provided for clarity.

Models used:

- HHousen household-rooms, HHousen, 2023
- google vit-base-patch16-224,Wu et al., 2020

8.3.1 Room classification

Model used: HHousen household-rooms.

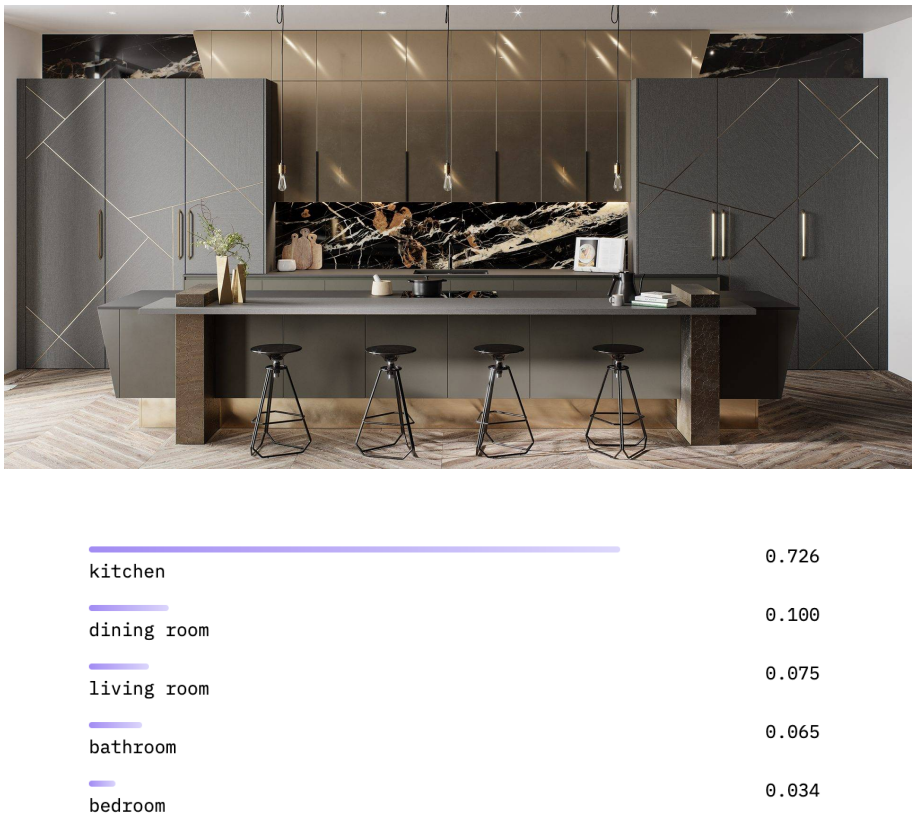

FIGURE 8.10: Example room classification

8.3.2 Generic classification

Model used: google vit-base-patch16-224.

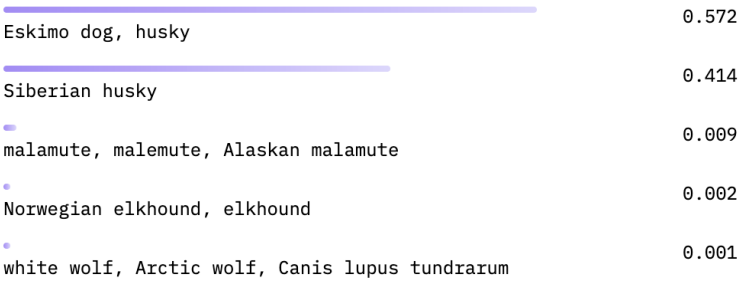

FIGURE 8.11: Example generic classification

8.4 Image Description, Image-Text

Finally, this section will discuss the expected results of the image-to-text description model. It will showcase how the model interprets visual content and generates descriptive text that captures the essence of the images. The focus will be on the model's accuracy in identifying key elements in images and its ability to generate coherent, detailed, and contextually relevant descriptions. Sample images paired with their generated textual descriptions will be included.

Model used: Salesforce blip-image-captioning-large,Li et al., 2022.

Generated description: there is a pool in front of a modern house with a glass railing.

FIGURE 8.12: Example image description 1

Generated description: a view of a large house with a pool and a patio.

FIGURE 8.13: Example image description 2

Generated description: there is a kitchen with a marble counter top and a bar.

FIGURE 8.14: Example image description 3

Chapter 9

Data Modeling

9.1 Entity Relationship

9.1.1 User management

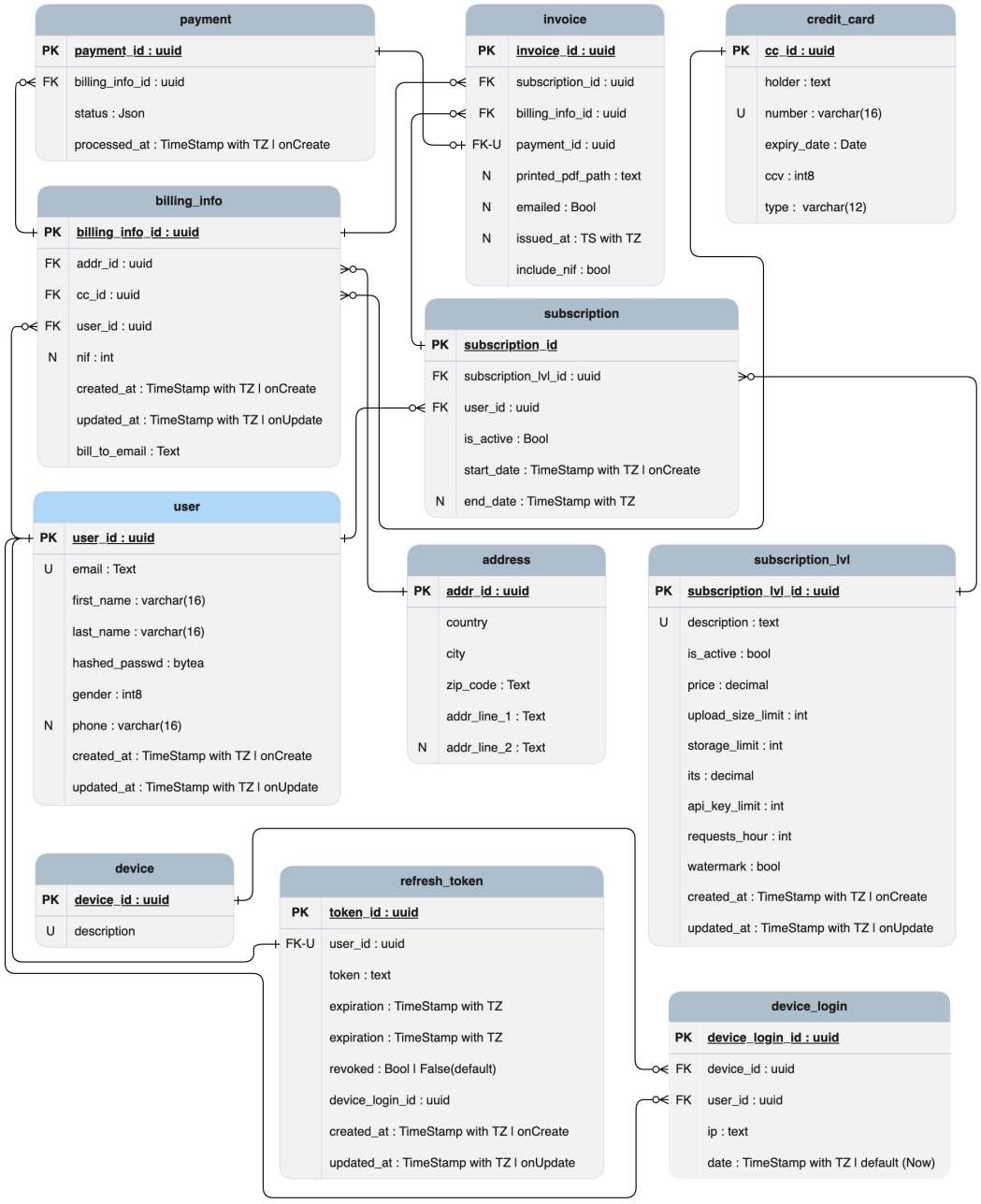

FIGURE 9.1: Entity relationship diagram - User management

- Entity - User
  - This is the central entity with attributes to store user information.
  - Each user is identified by a 'user_id' (UUID). It has relationships with 'billing_info', 'subscription', 'refresh_token', and 'device_login_id'.
  - Email attribute is unique and phone is optional.
- Entity - Billing info
  - This entity represents the billing information of a user.
  - A user can have various billing information.
  - Each billing information is identified by a 'billing_info_id' (UUID). It has relationships with 'payment_id', 'invoice_id', 'address', 'credit_card' and 'user_id'.
  - Nif attribute is optional.
- Entity - Payment
  - This entity represents a payment performed by a user.
  - A payment has a one to one relationship with invoice, a failed payment does not relate with invoice.
  - All attributes are required.
- Entity - Device
  - This entity represents a device used by an user to communicate with the system.
  - A 'device' has a one to many relations with 'device_login'.
  - A device description is unique.
- Entity - Refresh token
  - This entity represents a user refresh authentication token authorizing the login process after the access token expires, JSON Web Token (JWT) authentication is used for login and user login blacklisting control.
  - All fields are required and 'refresh_token' has a one to one relation with User.
- Entity - Address
  - This entity represents a user's address.
  - Address relates only to 'billing_information', an address can belong to multiple billing information since a user can decide to have multiple billing information with the same address changing only the credit card for example.
  - 'addr_line_2' attribute is optional.
- Entity - Subscription
  - This entity represents a subscription that a user had or has chosen.
  - A 'subscription' has a one to many relationship with 'invoice', a subscription can be in multiple invoices since a subscription can last multiple months.

  - A 'subscription' has a many to one relationship with 'user', since the user can have multiple subscriptions assyociated with him, past and present.
  - A 'subscription' has a many to one relationship with 'subscription_lvl', since there are multiple subscriptions with the same subscription level.
  - 'end_date' is an option attribute.

- Entity - Invoice
  - This entity represents an invoice that user receives after completing a payment of a subscription.
  - An 'invoice' has a one to one relationship with 'payment', since one payment only results in one invoice.
  - An 'invoice' has a many to one relationship with 'subscription', since a subscription may result in multiple invoices, for example a two month subscription results in two invoices.
  - An 'invoice' has a many to one relationship 'billing_info', since one billing info may appear in multiple invoices.
  - 'printed_pdf_path', 'emailed' and 'issued_at' are optional attributes.

- Entity - Credit card
  - This entity represents the credit card's information of the user.
  - A credit card has a one to many relationship with the billing info, one credit card can be in various billing info's.
  - Every attribute is mandatory, and the number attribute is unique.

- Entity - Subscription lvl
  - This entity represents the subscription level our service provides.
  - Subscription levels can be created/updated at any time.
  - Subscription level relates only with subscription having a one to many relationship.
  - All attributes are required, description is unique.

- Entity - Device login
  - This entity represents a login associated with a device performed by a user.
  - 'device_login' has a many to one relation with user.
  - 'device_login' has a many to one relation with device.
  - All attributes are required.

9.1.2 Request process

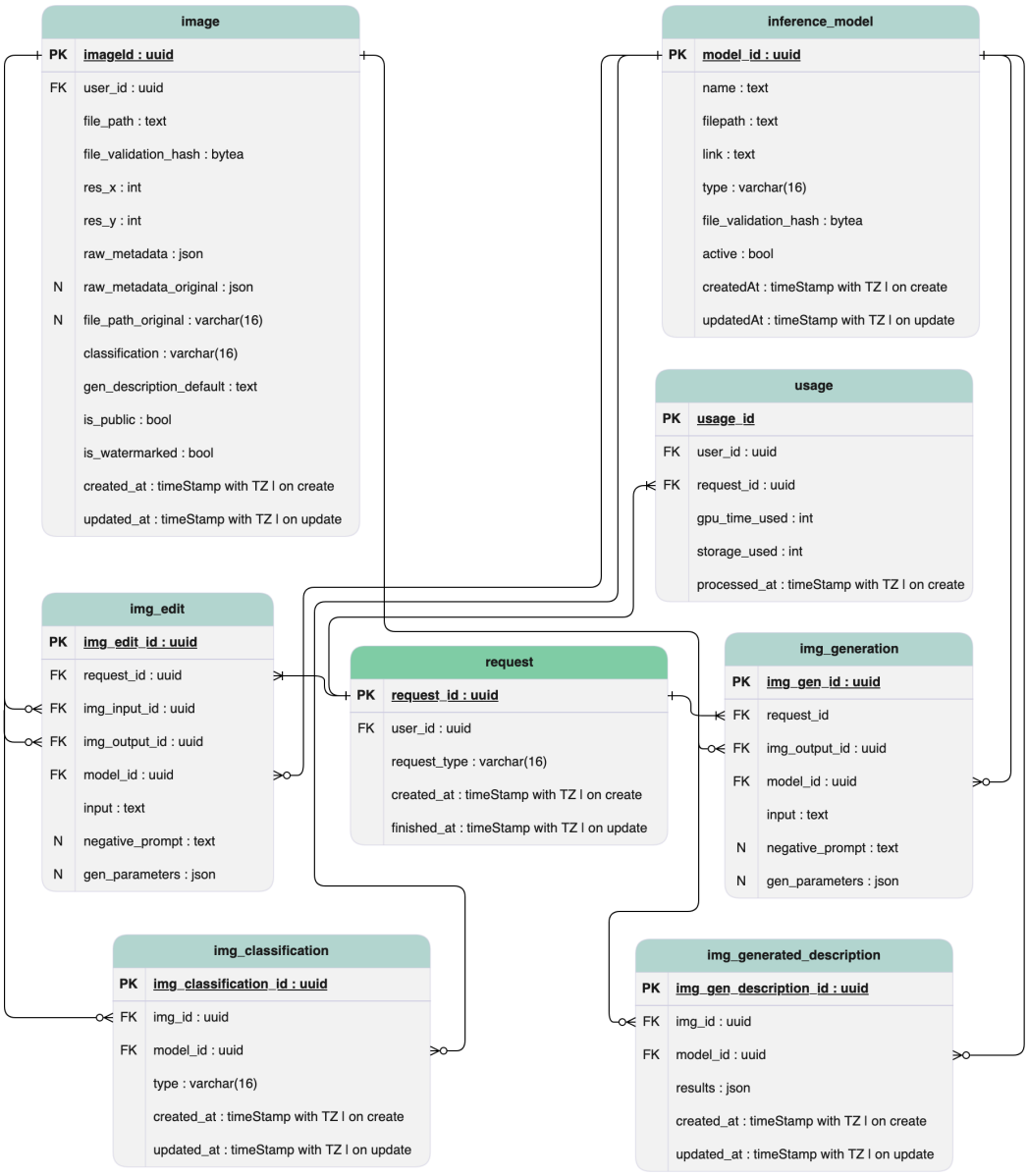

FIGURE 9.2: Entity relationship diagram - Request process

- Entity - Request
  - This is the entity that is responsible for initiating the request by the user.
  - Each request is identified by the "request_id" and has relationships with "Img_edit", "usage" and "Img_generation".
  - All attributes are required.
- Entity - Image
  - This entity represents an image with related information and metadata.
  - Each image is identified by the "imageid" and has relationships with "img_generated_description", "img_classification" and "img_edit".

  - "raw_metadata_original" and "file_path_original" are both optional only existing when there is an image being edited and not .generated

- Entity - Img Edit
  - Img edit is responsible for storing the data necessary for editing requests.
  - Each image edit is identified by the "img_edit_id" and has relationships with "image", "request" and "img_classification".
  - "negative_prompt" and "gen_parameters" are both optional seeing as restrictions and advanced options aren't always required.

- Entity - Img Classification
  - This entity has all the data related to the classifications performed in an image.
  - Each Img Classification is identified by the "img_classification" and has relationships with "image" and "inference_model".
  - All attributes are required.

- Entity - Img Generated description
  - This entity has all the data related to the descriptions our system artificially performs on images.
  - Each Img Generated description is identified by the "img_gen_description_id" and has relationships with "image", "inference_model".
  - All attributes are required.

- Entity - Img Generation
  - Img edit is responsible for storing the data necessary for generation requests.
  - Each Img Generation is identified by the "img_gen_id" and has relationships with "inference_model", "request", "image" and "img_generated_description".
  - "negative_prompt" and "gen_parameters" are both optional seeing as restrictions and advanced options aren't always required.

- Entity - Usage
  - Usage is the entity used to monitor the time and storage needed to edit/-generate an image in every request.
  - Each Usage is identified by the "usage_id" and has relationships with "request".
  - All attributes are required.

- Entity - Inference Model
  - Here are the various AI models alongside it's related data allowing the system to use different models.
  - Each Inference Model is identified by the "model_id" and has relationships with "img_generation", "img_gen_description" and "image".
  - All attributes are required.

9.2 Domain Model

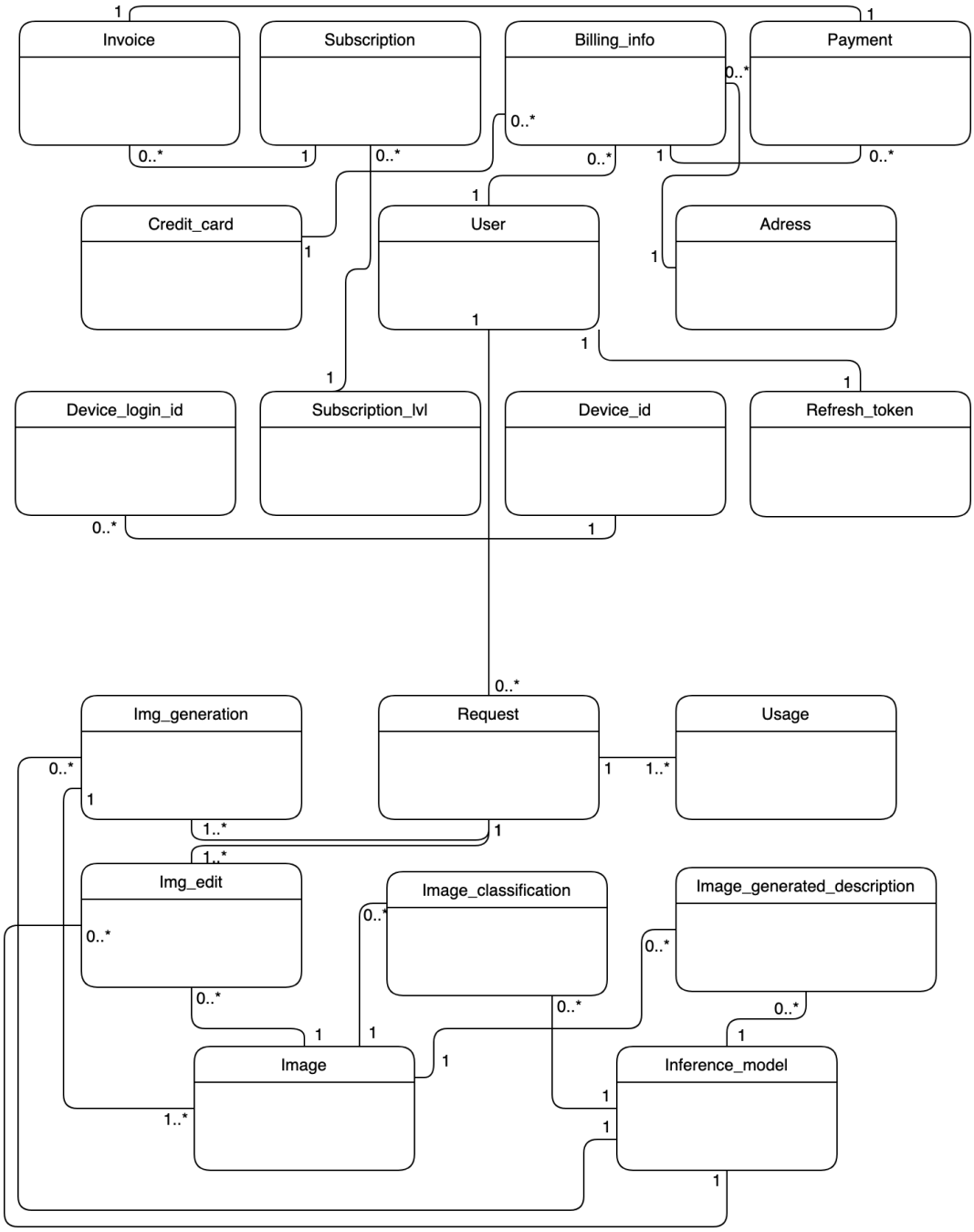

FIGURE 9.3: Domain model diagram

A simple domain diagram, Figure 9.3, representing 19 entities and their interconnections, serves as a key tool in understanding and visualizing the fundamental entities and relationships in our system. This diagram offers a clear depiction of the principal entities and their interactions. It acts as an effective communication medium among development team members and stakeholders. A domain diagram provides a visual language that aids in discussing and grasping our system's core elements. The creation of this diagram helped identifying critical system requirements and supports decision-making related to system design by offering a structured, organized view of

the main entities and relationships. It also serves as a form of visual system documentation. A well-crafted domain diagram is an invaluable tool for quickly understanding our system's essential structure, even for those not deeply involved in development.

Chapter 10

Unified Modeling Language

10.1 State Diagrams

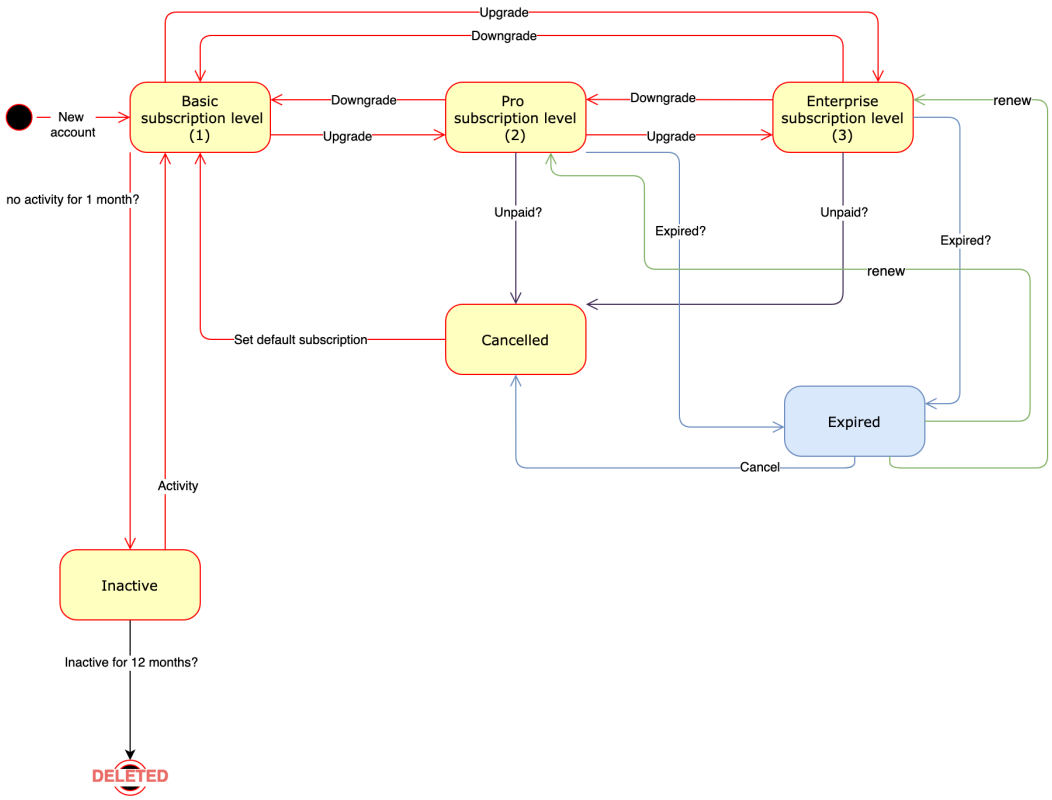

FIGURE 10.1: State diagram representing Subscription Management

The state diagram in the Figure 10.1 represents the various states that can occur when managing the susbcription. After a new account is created every account receives the Basic susbcription level state, this can be upgraded to Pro level and Enterprise level at any time, which in turn can be downgraded to any of the susbcription levels mentioned previously.

If the susbcription payment is left unpaid for a certain month, the state will shift to canceled and then return to the default subscription level, Basic level. If the susbcription expires, the state will change to expired until the user decides if he wishes to renew the subscription or not. If he wishes to renew, the state will return to the previous state before the expiration happened(Pro or Enterprise subscription level state), and if he does not wish to renew, it will change to canceled, which then

returns it to the default state.

Furthermore, if the user remain inactive for one month, the state will change to Inactive until he return activity(returning activity will change him back to the Basic state), if he does not return activity for 12 months, his account will be terminated.

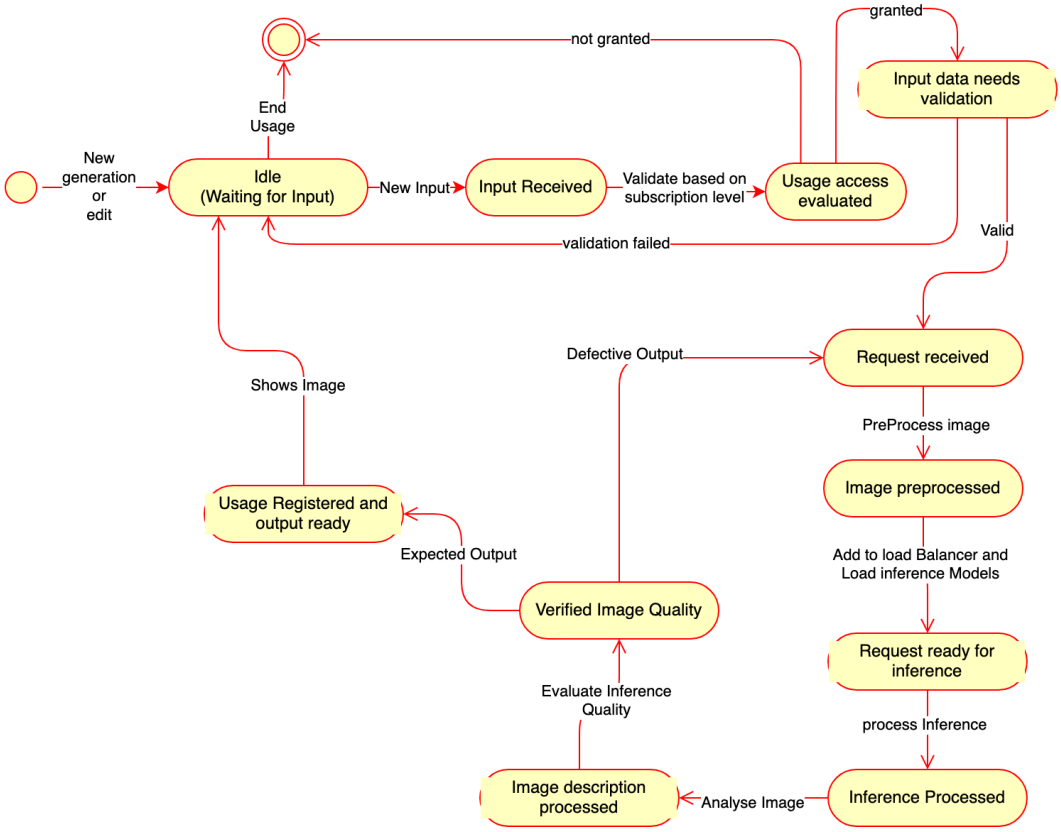

FIGURE 10.2: State diagram representing a Generation or Edit of an image

The state diagram in the Figure 10.2 represents all the states that are reached during a generation or edit of an image. After a new generation or edit is started, the state is idle(it waits for the users input). After a new input is sent, it first validates the subscription level, and it either is invalid and terminates the action or is valid and continues to next state, where it validates the input received. If the input is invalid it returns to the idle state waiting for a new input, and if its valid it starts the process to generate or edit an image.

First, it pre-processes the image until it reaches the Image preprocessed state, then it adds the pre-processed image to the load balancer and load inference models until it finally reaches the Request ready for Inference. Afterwards it processes the inference and reaches the Inference processed state and then heads to analyze the image until it arrives at the Image description processed state until it finally verifies the image quality, if the image is defective, it starts the process all over again from the Pre-processing function. If the image is up to standards then it saves the usage and the output, and shows the image to the user reaching the idle state again. If the user is done using this feature, he can exit and terminate the function.

10.2 Sequence Diagrams

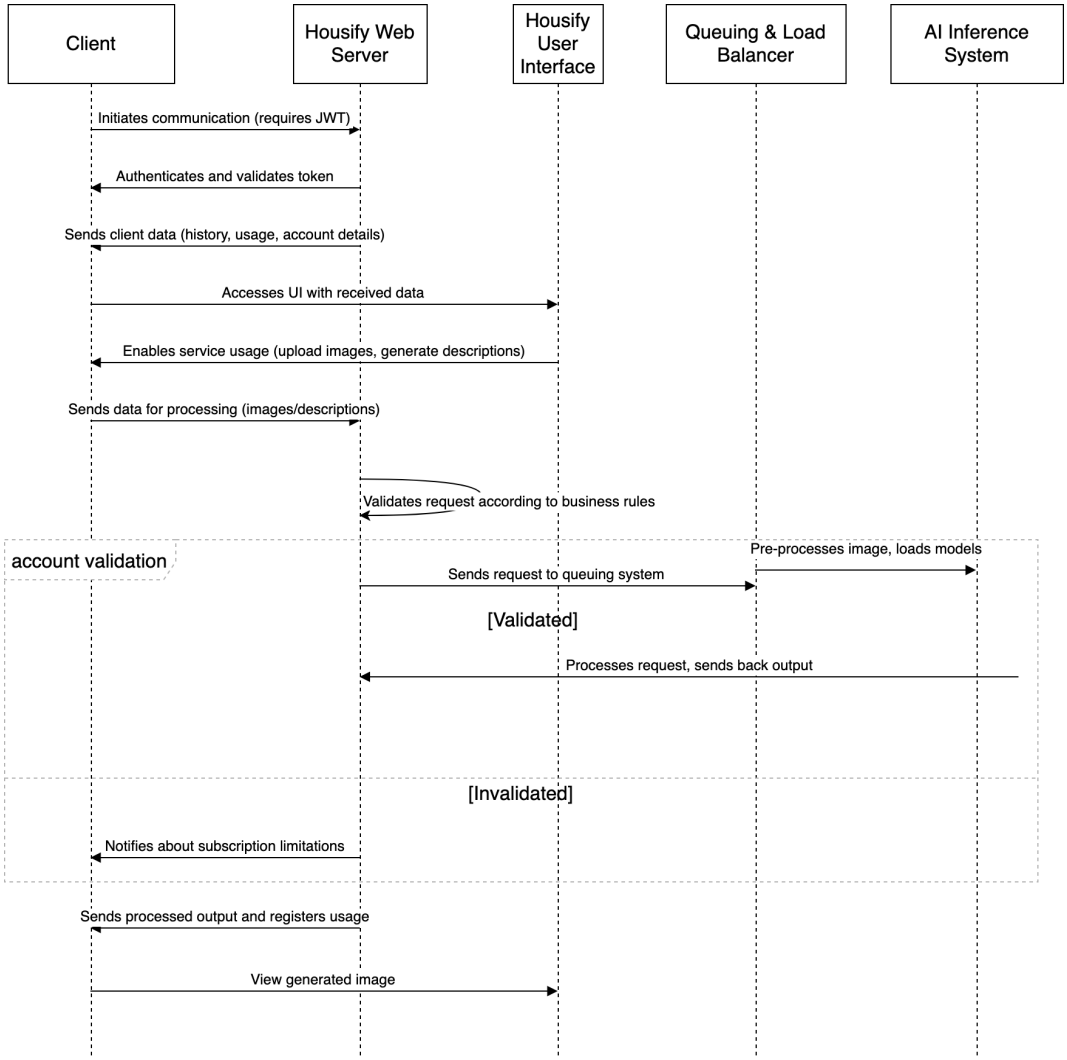

FIGURE 10.3: State diagram representing Subscription Management

Client to Housify Web Server: The client initiates communication with the Housify servers through the Android interface. This step requires a valid JWT (JSON Web Token) for login, if a valid access or refresh token are present the client needs to insert login credentials to generate a JWT token.

Housify Web Server to Client: The Housify Web Server authenticates and validates the user's account and authorization token.

Housify Web Server to Client: Once authenticated, the Housify Web Server sends back to the client a variety of data. This includes historical information, usage statistics, account details, and current subscription level.

Client to Housify User Interface: The client, now with the necessary data, accesses the Housify User Interface. The interface enables the client to utilize the service as per the defined business rules.

Housify User Interface to Client: The interface offers various options to the user. These include uploading images, using the device's camera, specifying textual descriptions for image generation, requesting classification, and providing textual descriptions of existing images. The user can also review historical usage data.

Client to Housify Web Server: The client uses the interface to generate data (textual or images) and initiates a request for image processing or description. The Housify Android application sends the related data to the server upon request.

Housify Web Server (Internal Processing): The Housify Web servers receive the communication and validate it according to the business rules. If the request is validated, it proceeds to the next step. If invalidated, the system notifies the user that their current subscription level does not allow for the requested usage.

Housify Web Server to Queuing System: For validated requests, the image editing request is sent to a queuing system, which also acts as an application load balancer for AI inference requests.

Queuing System to AI Inference System: The image is pre-processed to align with the models and client expectations. Then, the necessary pre-trained AI models are loaded on demand.

AI Inference System to Housify Web Server: The request is processed by the AI inference system, and the output is sent back to the web server.

Housify Web Server to Client: The web server, having received the output from the inference process, sends this output to the client. The usage is registered, and the relevant data is collected during this step.

Client Receives Output: Finally, the client receives the requested output, completing the interaction cycle.

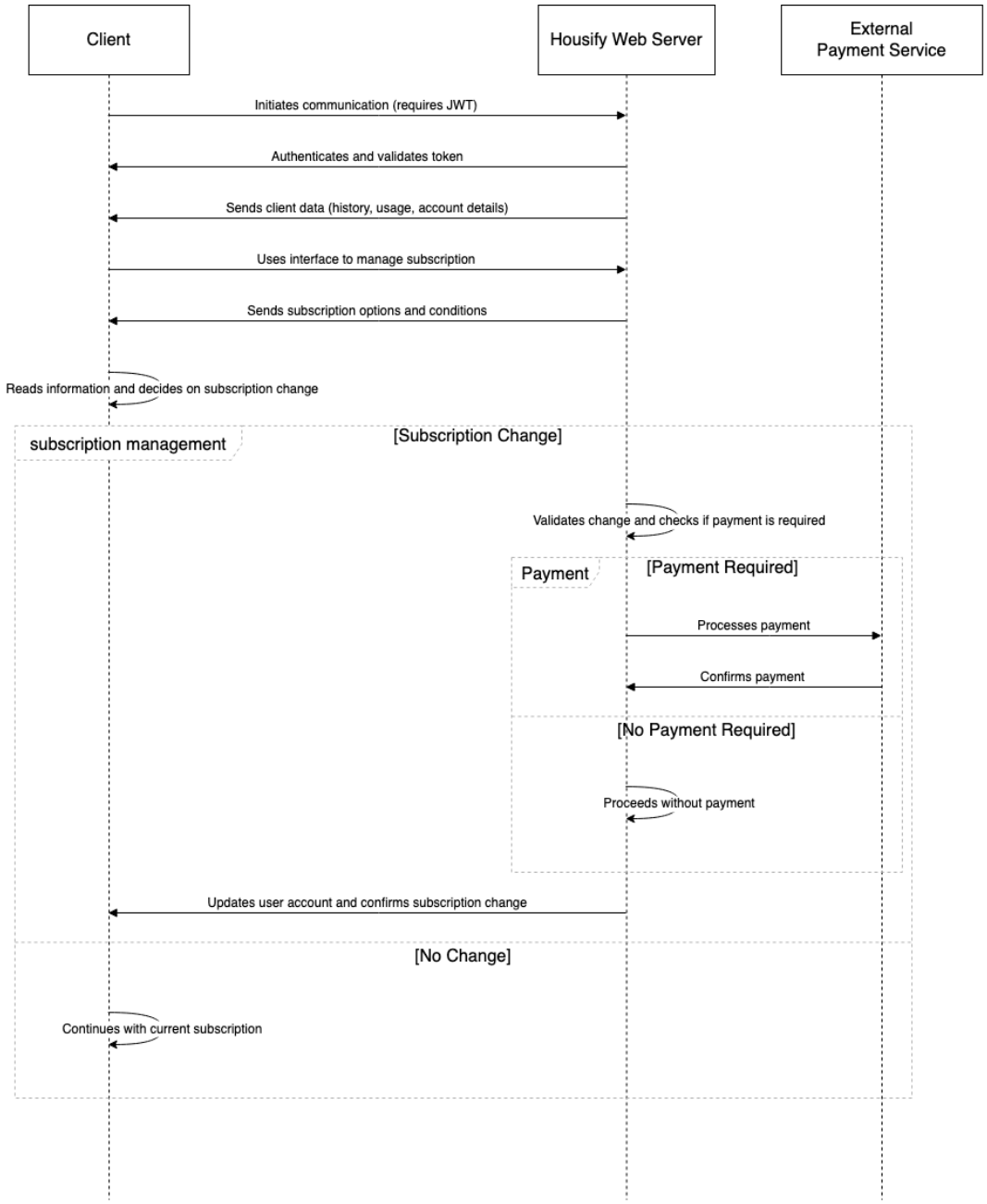

FIGURE 10.4: Sequence diagram representing Subscription Management

Client to Housify Web Server: The process begins with the client initiating communication with the Housify servers through the Android user interface. This step requires a valid JWT (JSON Web Token) for login.

Housify Web Server to Client: The Housify Web Server then authenticates and validates the user's account and authorization token.

Housify Web Server to Client: Once authenticated, the Housify Web Server sends back to the client a variety of data, including historical information, usage statistics, account details, and the current subscription level.

Client to Housify Web Server: The client uses the Android interface to manage their subscription level.

Housify Web Server to Client: The Housify Web Server provides the client with available subscription options and the conditions associated with them.

Client Decision-Making: The client reads the information provided and makes a decision regarding changing their subscription level.

Housify Web Server Internal Processing: If the client decides to change their subscription, the Housify Web Server validates the change. It checks whether a payment is required for the new subscription level.

- Payment Required: If a payment is necessary, the Housify Web Server processes the payment, sending the necessary data to an external payment processing service.
- No Payment Required: If no payment is needed, the system proceeds to the next step without engaging the payment service.

Payment Service to Housify Web Server (if Payment Required): The external payment processing service confirms the payment to the Housify Web Server.

Housify Web Server to Client: Finally, the Housify Web Server updates the user's account according to the new subscription level and confirms the subscription change to the client

10.3 Activity Diagram

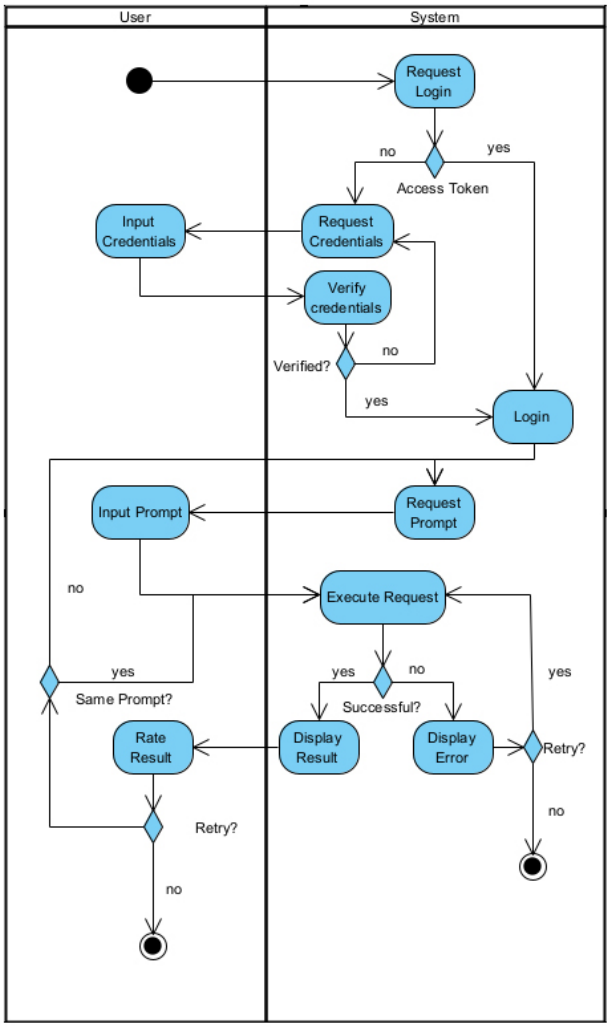

FIGURE 10.5: Activity Diagram

The process initiates when the user opens the application. Subsequently, the system commences the login procedure by verifying the presence of an access token. If a valid token is detected, the user is automatically logged in. In the absence of a valid token, the user is prompted to input credentials, which are then verified. Should the credentials fail verification, the credential request process is repeated. Upon successful verification, the login process concludes.

Once logged in, the system requests a prompt from the user. This prompt is utilized to execute a request aimed at generating or editing an image. If the request is unsuccessful, an error message is displayed, offering the user the option to retry. If the user opts to retry, the request is re-executed. Otherwise, the activity concludes.

In the event of a successful request execution, the resulting output is displayed. The user is then invited to rate the output and decide whether to redo the request. If the user chooses not to retry, the activity concludes. However, if a redo is desired, the

user is asked whether to use a new prompt (returning to the prompt request stage) or to repeat the request using the same prompt.

Chapter 11

Mockups

11.1 Welcome Page

Mockup related to the application's home page. This page includes a button for logging in and another for registering if the user doesn't have an account yet.

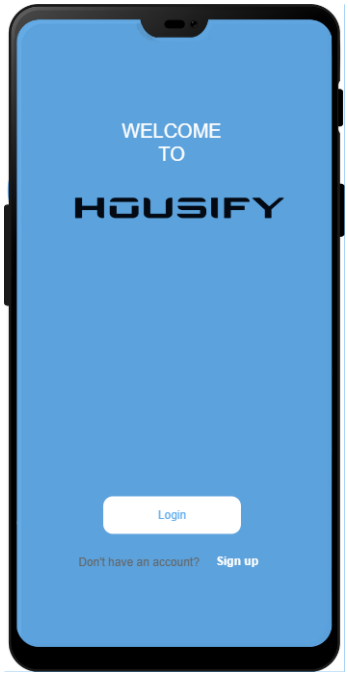

FIGURE 11.1: Mockup related to the application's home page.

11.2 Login Page

Mockup related to the application's login page. This page includes an option to log in, requiring both email and password.

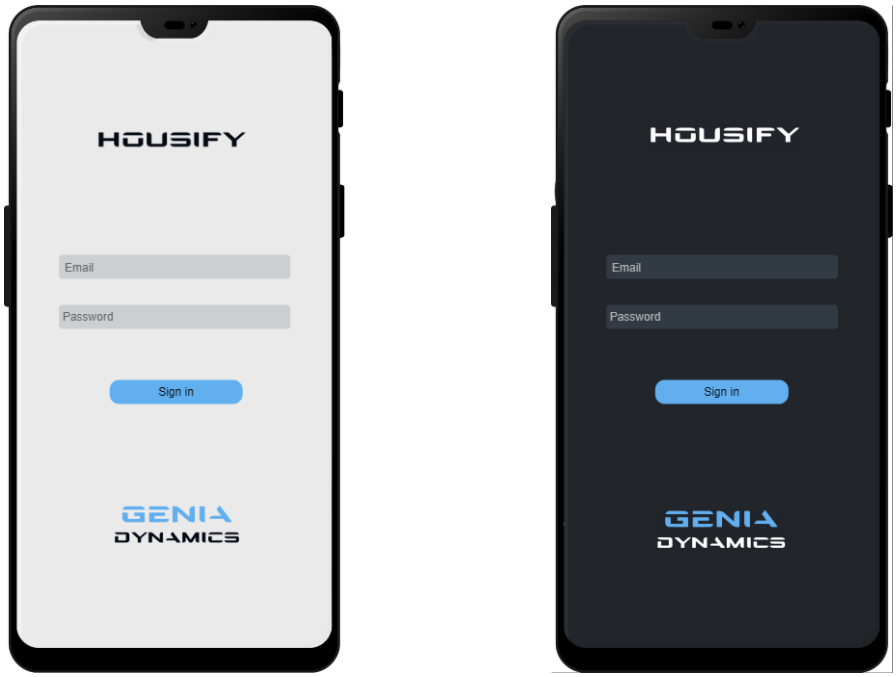

FIGURE 11.2: Mockup related to the application's login page.

11.3 Registration Page

Mockup related to the application's registration page. This page includes an option to register, requiring the following information: first name, last name, phone number, email, password, subscription level, and date of birth.

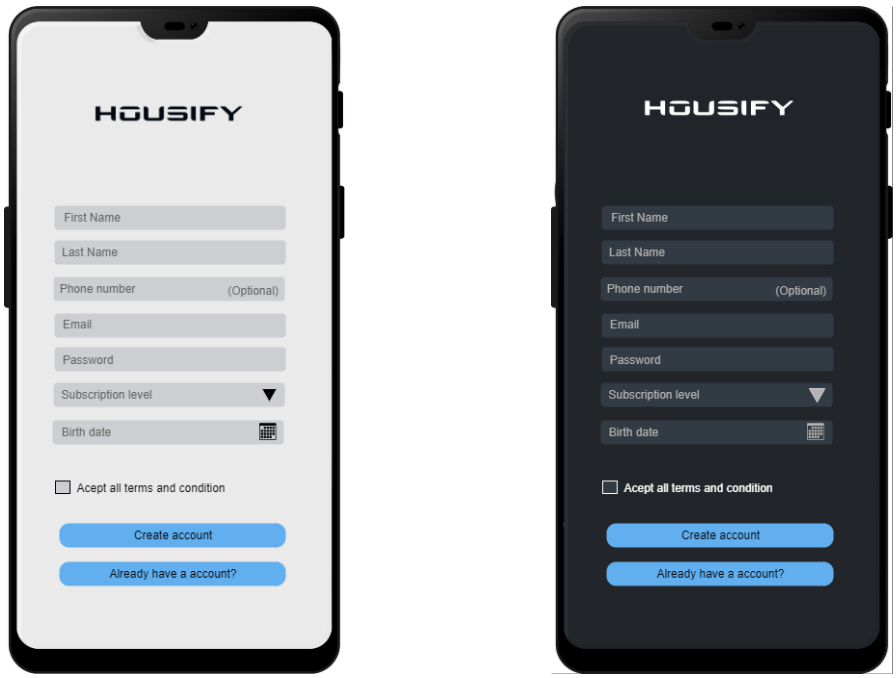

FIGURE 11.3: Mockup related to the application's registration page.

11.4 Billing and Payment Page

Mockup related to the billing page of our application. This page includes options to add a credit card and enter billing information. For credit card details, the required information includes card number, expiration date, and CVV/CVN. Billing information requires address, postal code, city, country, and tax identification number (NIF).

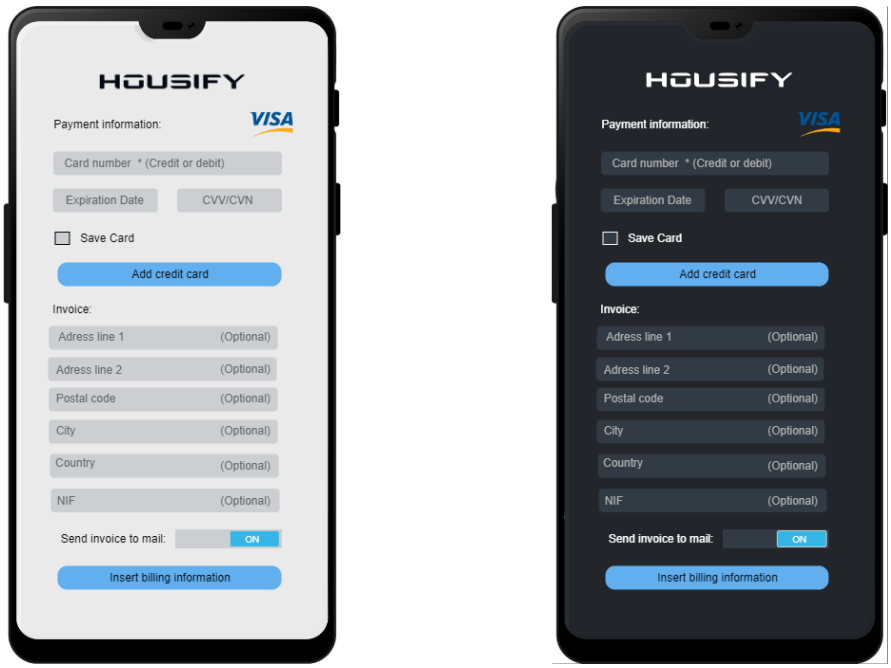

FIGURE 11.4: Mockup related to the billing page of our application.

11.5 Data Change Page – Personal Information

Mockup related to the customer's personal data change page. This page includes options to change different data such as first and last name, phone number, email, password, and subscription level.

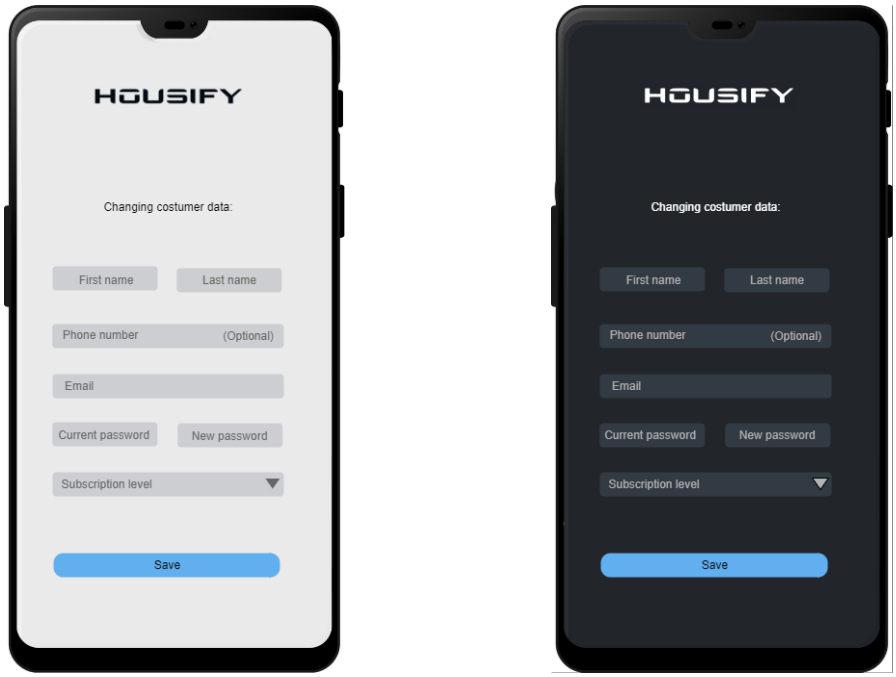

FIGURE 11.5: Mockup related to the customer's personal data change page.

11.6 Data Change Page – Billing and Payment

Mockup related to the customer's billing and payment data change page. This page includes options to change data related to the credit card and billing information.

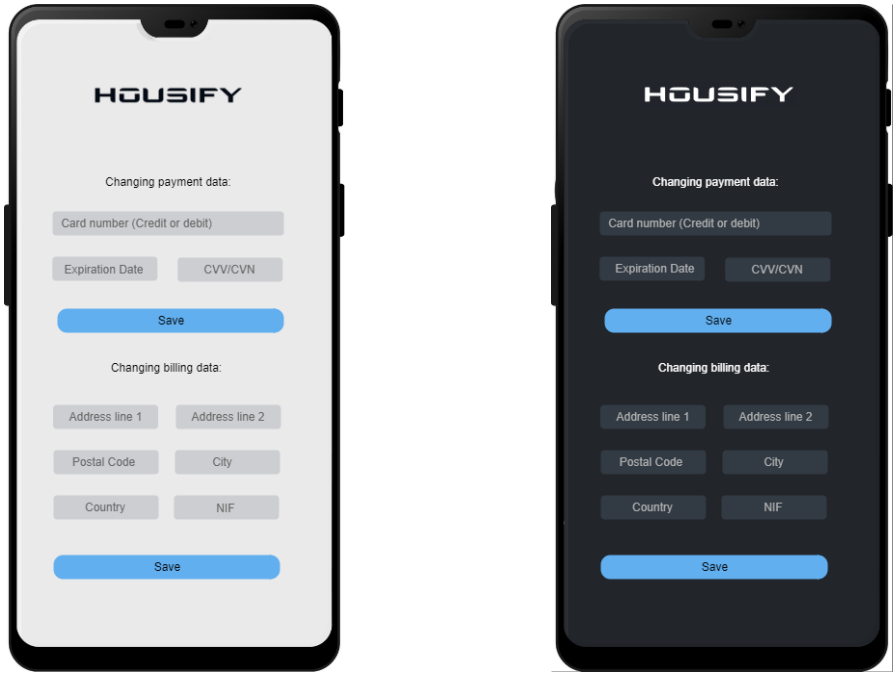

FIGURE 11.6: Mockup related to the customer's billing and payment data change page.

11.7 Image Generation Request Page

Mockup related to the image generation request page. This page includes a text box for the customer to write their request.

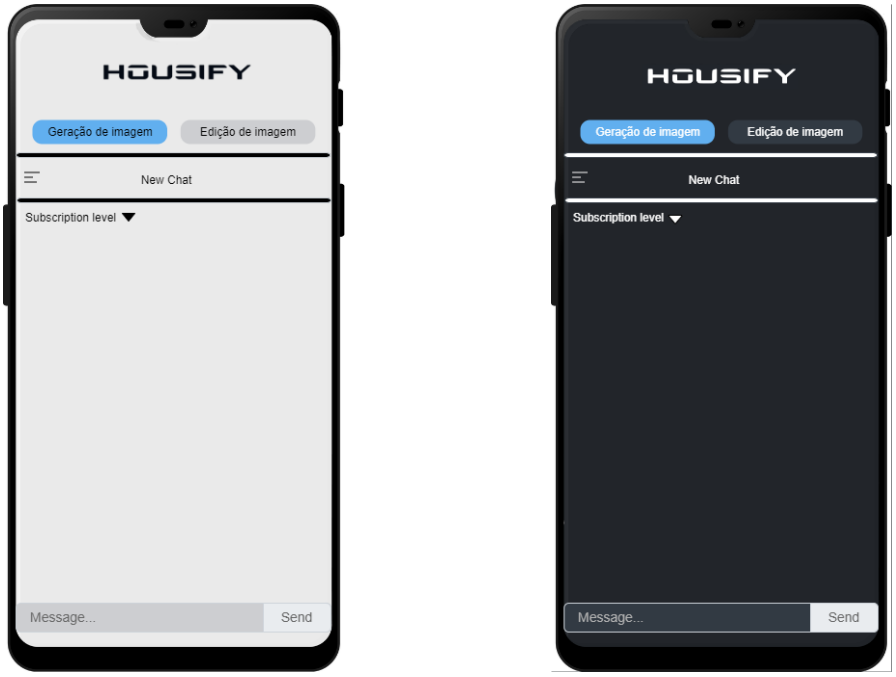

FIGURE 11.7: Mockup related to the image generation request page.

11.8 Image Editing Request Page

Mockup related to the image editing request page. This page includes a button for the customer to upload their image and a text box for writing their request.

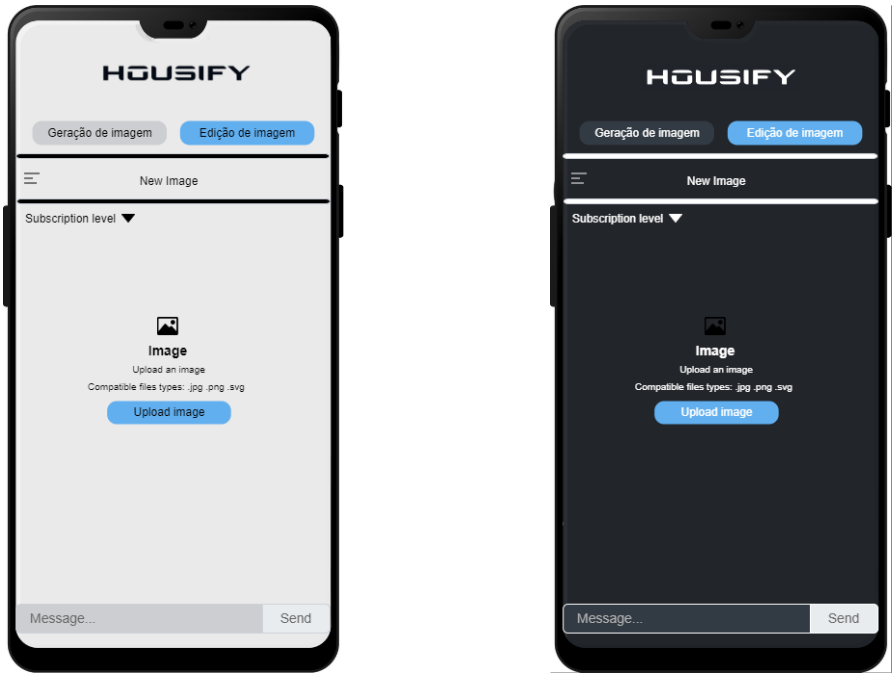

FIGURE 11.8: Mockup related to the image editing request page.

11.9 Image Viewing Page

Mockup related to the image viewing page. This page includes a centralized image with the information provided by the customer underneath.

FIGURE 11.9: Mockup related to the image viewing page.

11.10 History Page

Mockup related to the history page. This page includes previously generated images and the customer's requests for their generation.

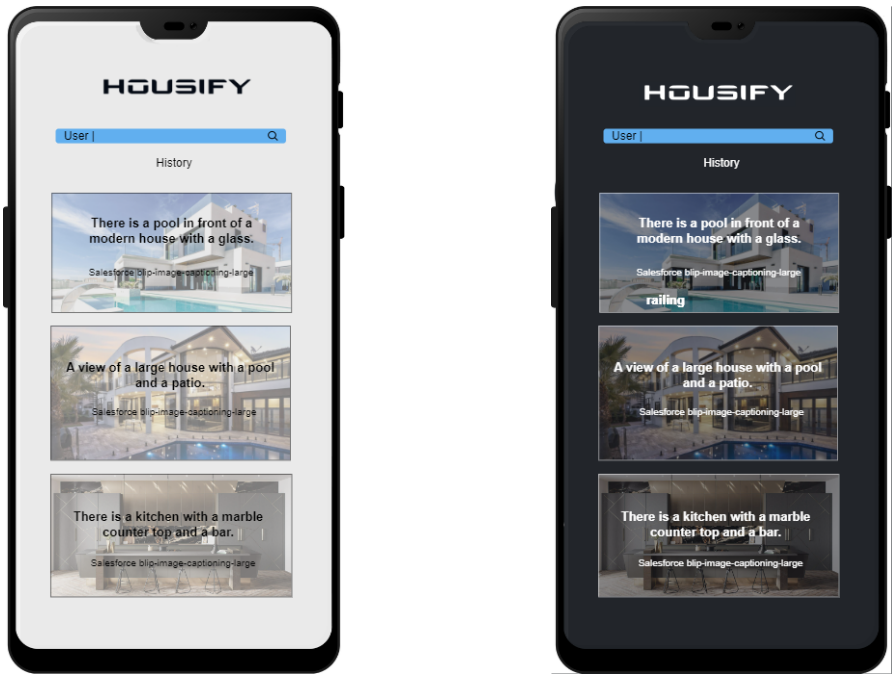

FIGURE 11.10: Mockup related to the history page.

Chapter 12

Legal Compliance and Governance

12.1 Company Policies and Procedures

Preamble

At GeniaDynamics, we are committed to creating a positive and productive work environment that fosters collaboration, innovation, and respect. Our policies and procedures are designed to promote fairness, equity, and inclusion, while also ensuring compliance with applicable laws and regulations. This document outlines our internal regulations and guidelines for employees, contractors, and visitors. It is intended to provide a framework for responsible behavior and decision-making, and to help ensure that everyone associated with our company conducts themselves in a manner that reflects our values and principles.

Section 0. Definitions

- **Company** - refers to GeniaDynamics, a software development company, and its subsidiaries, affiliates, and branches.
- **Employee** - refers to any individual working for the Company, including full-time employees, part-time employees, contractors, interns, and temporary workers.
- **Management** - refers to the Company's management team, including managers, supervisors, and team leads.
- **Workplace** - refers to any location where work is performed, including offices, remote work locations, or client sites.
- **Confidential Information** - refers to any information that is not publicly available and is considered sensitive or proprietary, such as trade secrets, business strategies, customer data, and employee personal information.
- **Intellectual Property** - refers to any intellectual property rights, including patents, copyrights, trademarks, and trade secrets, owned or licensed by the Company.
- **IT Resources** - refers to any computer systems, software applications, networks, and other technology resources provided by the Company for employee use.

- **Work Hours** - refers to the standard hours of work established by Management, which may vary depending on the role and department.
- **Break Periods** - refers to the designated times during the workday when employees are entitled to take breaks.
- **Personal Devices** - refers to any personal electronic devices brought into the workplace, such as smartphones, tablets, or laptops.

Section 1. Employee conduct and ethics

At GeniaDynamics, we believe that maintaining high ethical standards is essential to our success. We expect all employees to adhere to the highest levels of professionalism, honesty, and integrity in their interactions with colleagues, customers, suppliers, and other stakeholders.

The following are some guidelines for employee conduct and ethics:

- **1.1. Honesty and Integrity**
  - Be truthful and transparent in all your dealings, both inside and outside the company.
  - Avoid any behavior that could be perceived as dishonest or unethical.
  - Refrain from engaging in any activity that could compromise your integrity or the integrity of the company.
- **1.2 Respect for Colleagues**
  - Treat all colleagues with respect and dignity, regardless of their position or background.
  - Avoid discrimination, harassment, or bullying of any kind.
  - Foster an inclusive work environment where everyone feels valued and welcome.
- **1.3 Confidentiality**
  - Maintain the confidentiality of company information and data at all times.
  - Do not share sensitive information with unauthorized individuals or entities.
  - Refrain from discussing company business in public areas or on social media platforms.
- **1.4 Compliance with Laws and Regulations**
  - Familiarize yourself with relevant laws, regulations, and industry standards that apply to your role.
  - Ensure that all your actions comply with these requirements.
  - Report any potential violations of law or ethical standards to your supervisor or HR immediately.

- **1.5 Gifts and Entertainment**
  - Avoid accepting gifts or entertainment from suppliers, customers, or other stakeholders if they could be seen as influencing your business decisions.
  - Ensure that any gifts or entertainment you receive are modest in value and not linked to a specific business transaction.
- **1.6 Conflict of Interest**
  - Avoid situations where your personal interests conflict with the interests of the company.
  - Disclose any potential conflicts of interest to your supervisor or HR immediately.
- **1.7 Social Media Conduct**
  - Refrain from posting anything on social media that could damage the reputation of the company or its employees.
  - Avoid sharing confidential information or engaging in discussions that could be perceived as inappropriate or offensive.
- **1.8 Reporting Ethical Violations**
  - If you witness or suspect a violation of ethical standards, report it to your supervisor, HR, or the anonymous ethics hotline immediately.
  - The company will investigate all reports promptly and take appropriate action.
- **1.9 Compliance Training**
  - Attend all mandatory compliance training sessions to ensure you are aware of the latest laws, regulations, and industry standards that apply to your role.

Disciplinary actions:

Our company may have to take disciplinary action against employees who repeatedly or intentionally fail to follow our code of conduct. Disciplinary actions will vary depending on the violation, possible consequences include:

- Demotion.
- Reprimand.
- Suspension or termination for more serious offenses.
- Detraction of benefits for a definite or indefinite time.
- We may take legal action in cases of corruption, theft, embezzlement or other unlawful behavior.

By adhering to these guidelines, we can maintain a workplace culture that is built on trust, respect, and integrity. We expect all employees to embrace these principles and help us uphold the highest ethical standards at all times.

Section 2. Compliance with laws and regulations

The organization is committed to complying with all applicable laws and regulations in the European Union, including but not limited to the General Data Protection Regulation (GDPR), the EU's data protection law. We recognize the importance of protecting personal data and ensuring that it is handled in accordance with relevant laws and regulations.

To ensure compliance, we have implemented a number of measures, including:

2.1 Data Protection Impact Assessment (DPIA)

We conduct regular DPIAs to identify, assess, and mitigate any potential privacy risks associated with our processing of personal data.

2.2 Privacy by Design

We have implemented a 'privacy by design' approach to ensure that data protection is integrated into the development of all our products and services from the outset. This means that we consider data protection when designing new systems, processes, and technologies, and strive to minimize the amount of personal data we collect and process.

2.3 Data Protection Policy

We have developed a comprehensive Data Protection Policy that sets out our approach to protecting personal data. The policy covers topics such as data security, data retention, and data subject rights. All employees are required to read and comply with the policy.

2.4 Training

We provide regular training for all employees on data protection laws and regulations, as well as our own Data Protection Policy. This includes training on GDPR, data classification, data security, and incident response.

2.5 Incident Response Plan

We have developed an Incident Response Plan that sets out the steps we will take in case of a data breach or other security incident. The plan ensures that we are able to respond quickly and effectively to any incidents that may occur.

2.6 Data protection Agreements

We ensure that all our vendors, suppliers, and sub-processors who handle personal data have signed data protection agreements with us. These agreements require them to comply with GDPR and other relevant laws and regulations.

2.7 Cross-Border Data Transfer

We have implemented appropriate safeguards for cross-border data transfers in accordance with the European Commission's Standard Contractual Clauses (SCCs) and Privacy Shield Framework, where applicable.

2.8 Data Subject Rights

We respect the rights of individuals under GDPR, including their right to access, rectify, erase, restrict processing, object to processing, and data portability. Individuals may exercise these rights by contacting our DPO.

2.9 Regular Review

We regularly review and update our policies, procedures, and training programs to ensure they remain compliant with the latest laws and regulations.

2.10 Commitment

By implementing these measures, we demonstrate our commitment to protecting personal data in accordance with applicable laws and regulations in the European Union.

Section 3. Intellectual property protection

GeniaDynamics recognizes the importance of protecting its intellectual property, including patents, trademarks, copyrights, trade secrets, and confidential information. This section outlines our policy and procedures for protecting and enforcing our intellectual property rights.

3.1 Ownership of Intellectual Property

GeniaDynamics retains ownership of all intellectual property rights arising from work performed by employees, contractors, or agents in the course of their employment or engagement with GeniaDynamics. This includes any inventions, discoveries, creations, or other works that are developed using company resources or time.

3.2 Protection of Intellectual Property

GeniaDynamics is committed to protecting its intellectual property from unauthorized use, disclosure, or exploitation. To achieve this, we implement appropriate security measures such as access controls, encryption, and confidentiality agreements. We also monitor our intellectual property rights and take legal action when necessary to enforce them.

3.3 Use of Intellectual Property

Employees, contractors, and agents are prohibited from using GeniaDynamics's intellectual property for personal gain or in any way that may harm the company's interests. Any use of our intellectual property must be authorized by the appropriate manager and in accordance with our policies and procedures.

3.4 Disclosure of Intellectual Property

Employees, contractors, and agents are prohibited from disclosing GeniaDynamics's intellectual property to any third party without prior authorization from the appropriate manager. This includes but is not limited to trade secrets, confidential information, or other proprietary data.

3.5 Enforcement of Intellectual Property Rights

GeniaDynamics will take all necessary steps to enforce its intellectual property rights in case of any violation or infringement. This may include legal action, injunctions, damages, or any other remedy available under law.

3.6 Compliance with Laws and Regulations

GeniaDynamics complies with all applicable laws and regulations related to intellectual property protection. We also expect our employees, contractors, and agents to comply with these laws and regulations when working on behalf of the company.

3.7 Review and Revision

This policy will be reviewed and revised periodically as necessary to ensure that it remains effective and relevant. Any changes will be communicated promptly to all employees, contractors, and agents who have access to GeniaDynamics's intellectual property.

By following this policy, we can protect our intellectual property rights and prevent unauthorized use or disclosure of our proprietary information. It is the responsibility of every employee, contractor, and agent working for GeniaDynamics to adhere to these policies and procedures.

Section 4. Data security and privacy

GeniaDynamics takes the protection of our customers, employees, and partners personal information very seriously. We are committed to ensuring that all data collected, stored, or processed by us is protected from unauthorized access, disclosure, modification, or destruction. This section outlines our policies and procedures for protecting sensitive information.

4.1 Responsibilities

- All employees, contractors, consultants, temporary workers, interns, and other personnel who have access to sensitive data are responsible for following this policy.
- The IT department is responsible for implementing security measures to protect our systems and networks from unauthorized access.
- Data owners are responsible for identifying and classifying the types of data they handle and ensuring that appropriate security controls are in place.

Data category	Definition	Security Controls
public	Information that is intended for public consumption or access. Examples include our website, press releases, and marketing materials.	backed-up regularly, integrity verification.
internal	Information that is intended for internal use only but does not contain sensitive information. Examples include employee contact lists, meeting notes, and company announcements.	Access controls, encryption when transmitted or stored, backed-up regularly, Hashing.
confidential	Information that contains personally identifiable information (PII), financial data, intellectual property, or other highly sensitive information. Examples include customer records, employee personal data, and business strategy documents.	Strong access controls, encryption both in transit and at rest, secure storage, backed-up regularly, Hashing.

Table 12.1: Data security classification

- All personnel who handle sensitive data must use strong passwords, keep them confidential, and follow best practices for password management.

4.2 Data Classification

We classify our data into three categories based on its level of sensitivity: public, internal, and confidential. Table 4.1 defines each category and outlines the appropriate security controls for each one.

4.3 Data Security Measures

We implement the following security measures to protect our systems and networks from unauthorized access:

- Firewalls and intrusion detection/prevention systems (IDPS) to monitor network traffic for suspicious activity.
- Secure authentication, authorization, and accounting (AAA) protocols for all users accessing our systems.
- Encryption of sensitive data both in transit and at rest.
- Access controls, including secure login credentials, two-factor authentication, and role-based access control (RBAC).
- Secure protocols for remote access to our systems, such as virtual private networks (VPNs) and or secure shell (SSH).

- Regular software updates and patches to ensure that all systems are current with the latest security fixes.
- Logging and monitoring of system activity to detect potential security breaches.
- Regular security testing and vulnerability assessments to identify and remediate potential weaknesses.

4.4 Data Breach Response

In the event of a data breach, we will follow our incident response plan to minimize the damage and protect affected individuals' personal information. The plan includes the following steps:

- Containment: Isolate affected systems or networks to prevent further unauthorized access.
- Assessment: Identify the scope of the breach, including what data was accessed and how many individuals were affected.
- Notification: Inform affected individuals and regulatory agencies as required by law.
- Eradication: Remove any malware or unauthorized access points from our systems.
- Recovery: Restore systems to a secure state, including patching vulnerabilities and resetting passwords.
- Lessons Learned: Document the breach and response for future reference and improvement.

4.5 Data Retention and Disposal

We retain personal information only as long as necessary to fulfill the purpose for which it was collected or as required by law. When we no longer need the data, we dispose of it securely using one of the following methods:

- Paper documents are shredded or recycled.
- Electronic files are deleted and overwritten with random characters to prevent recovery.
- Media devices such as hard drives or USB sticks are physically destroyed or degaussed.

4.6 Training and Compliance

All employees must complete annual training on data security and privacy best practices. The training covers topics such as password management, social engineering

attacks, phishing scams, and safe browsing habits. Additionally, all personnel who handle sensitive data must sign a confidentiality agreement acknowledging their responsibility to protect it. We monitor compliance with this policy and take disciplinary action when necessary.

4.7 Third-Party Vendors

We evaluate third-party vendors' security practices before engaging in business relationships or sharing personal information. Vendors must demonstrate that they have implemented appropriate security controls to protect our data. We monitor vendor compliance with their agreed-upon security measures and conduct regular audits to ensure continued adherence.

4.8 Compliance

We comply with all applicable laws and regulations regarding data privacy, including but not limited to the General Data Protection Regulation (GDPR), California Consumer Privacy Act (CCPA), and Payment Card Industry Data Security Standard (PCI DSS). We also adhere to industry standards such as ISO 27001 for information security management.

4.9 Conclusion

Data security and privacy are critical components of our business operations, and we take all necessary measures to protect sensitive information from unauthorized access or disclosure. This policy outlines our procedures for handling personal data and ensures that we comply with legal requirements while maintaining the trust of our customers, employees, and partners.

Section 5. Quality assurance

GeniaDynamics is committed to providing high-quality products and services that meet or exceed our customers' expectations. In order to achieve this goal, we have implemented a comprehensive quality assurance program that includes the following elements:

5.1 Quality Objectives

We have established clear and measurable quality objectives for all of our products and services. These objectives are reviewed and updated regularly to ensure they remain relevant and achievable.

5.2 Quality Management System

We operate a quality management system that is compliant with ISO 9001:2015, the international standard for quality management systems. This system provides a framework for managing our processes, procedures, and resources to ensure we consistently meet customer requirements and regulatory obligations.

5.3 Continuous Improvement

We believe in continuous improvement and strive for excellence in all aspects of our business. We regularly review our processes and procedures to identify opportunities for improvement and implement changes as needed.

5.4 Customer Feedback

We value feedback from our customers and use it as an opportunity to improve our products and services. We have a formal process for collecting, analyzing, and responding to customer feedback, which helps us make informed decisions about product development and quality improvements.

5.5 Document Control

We maintain strict control over all documents related to our products and services, including product specifications, quality manuals, and procedures. We ensure that only the latest versions of these documents are used, and we have a formal process for updating and approving changes.

5.6 Continuity and Business Resilience

We recognize that unexpected events can impact our ability to deliver high-quality products and services. Therefore, we have developed business continuity plans and risk management strategies to ensure our operations continue uninterrupted in the event of an emergency or disaster.

By following these quality assurance procedures, GeniaDynamics is committed to providing its customers with safe, reliable, and high-quality products and services that meet their expectations and comply with all relevant regulations.

Section 6. Project management

The purpose of this policy is to establish guidelines for effective project management within the organization, ensuring that projects are delivered on time, within budget, and to the required quality standards.

6.1 Scope

This policy applies to all projects undertaken by the organization, regardless of their size or complexity. It covers the entire project lifecycle, from planning and execution to monitoring and control, and finally, to closure.

6.2 Roles and Responsibilities

a) Project Manager: The Project Manager is responsible for leading and coordinating the project team, ensuring that projects are delivered within the agreed-upon timeframe, budget, and quality standards. They will also be responsible for managing

stakeholder expectations, identifying and mitigating risks, and communicating project progress to relevant parties.

b) Project Team: The Project Team consists of all individuals involved in the project, including team members, contractors, and consultants. They are responsible for carrying out their assigned tasks and responsibilities as directed by the Project Manager.

c) Stakeholders: Stakeholders include anyone who has an interest in or will be impacted by the project. They may include customers, sponsors, management, and other relevant parties.

6.3 Project Planning

a) Project Charter: The Project Charter is a document that outlines the purpose, objectives, scope, timelines, budget, and stakeholders of the project. It provides authorization for the project to proceed and serves as a reference point throughout the project lifecycle.

b) Work Breakdown Structure (WBS): The WBS is a hierarchical decomposition of the project into smaller, manageable tasks that can be scheduled and budgeted for. It helps to define the scope of work and ensures that all tasks are accounted for.

c) Project Schedule: The project schedule outlines the start and end dates for all tasks and milestones, as well as any dependencies between them. It provides a roadmap for the project team to follow and helps ensure that the project is completed on time.

d) Budgeting: The budgeting process involves estimating costs for resources required for the project, including labor, materials, equipment, and other expenses. The budget should be comprehensive, taking into account contingencies and risks.

e) Risk Management: A risk management plan should be developed to identify potential risks that may impact the project. This includes assessing their likelihood and impact, as well as developing strategies for mitigation or response.

6.4 Project Execution

a) Task Assignment: The Project Manager will assign tasks to team members based on their strengths, expertise, and availability. Team members are expected to carry out their assigned tasks in accordance with the project schedule and quality standards.

b) Quality Control: Quality control measures should be implemented throughout the project lifecycle to ensure that deliverables meet the required standards. This includes inspections, testing, and other quality assurance activities.

c) Communication Plan: A communication plan should be developed to ensure effective communication among all stakeholders. It should outline the types of communication, frequency, channels, and key messages.

d) Change Management: Any changes to the project scope, schedule, budget, or quality must be formally documented and approved by the Project Manager and relevant stakeholders. This includes assessing the impact of the change on the project

and obtaining agreement from all affected parties.

6.5 Monitoring and Control

a) Progress Reporting: Regular progress reports should be submitted to the Project Manager, highlighting accomplishments, issues, and future tasks. These reports help monitor project status and identify any deviations from the plan.

b) Performance Metrics: Key performance metrics (KPIs) should be established to measure project success. These may include schedule performance index, cost performance index, quality metrics, and customer satisfaction surveys.

c) Corrective Actions: If project progress or performance indicates deviations from the plan, corrective actions must be taken promptly to get the project back on track. This may involve revising task assignments, adjusting timelines, or reallocating resources.

6.6 Closure

a) Finalization of Deliverables: All deliverables should be finalized and reviewed by the Project Manager and stakeholders to ensure they meet quality standards.

b) Documentation: The project documentation should be completed and updated, including lessons learned, which can be used for future projects.

c) Evaluation: A post-project evaluation should be conducted to assess project success, identify areas for improvement, and document best practices for future reference.

d) Celebration: The project team should celebrate the successful completion of the project, recognizing individual contributions and achievements.

By following these guidelines, our organization can ensure that projects are delivered efficiently, effectively, and to a high standard, ultimately contributing to our business success.

Section 7. Communication and collaboration

Effective communication and collaboration are critical components of our company's success. In this section, we outline the policies and procedures for internal and external communication, as well as strategies for effective teamwork and collaboration.

7.1 Internal Communication

Our company encourages open and transparent communication among all team members. We believe that clear and timely communication helps to build trust, resolve conflicts, and promote a positive work environment. To ensure effective internal communication, we adopt the following practices:

Regular team meetings: We hold regular team meetings to discuss project updates, share information, and address any concerns or issues.

Open-door policy: Our team members are encouraged to approach their supervisors or HR with questions, concerns, or feedback at any time.

Internal communication channels: We use a private instance of NextCloud Hub for internal communication. All team members are expected to check these channels regularly and respond promptly to messages.

7.2 External Communication

We recognize that effective external communication is essential for building strong relationships with our clients, partners, and stakeholders. Our company adopts the following policies for external communication:

Client communication: We communicate with our clients through email. We ensure that all communications are professional, courteous, and respectful.

Media relations: Our company's media relations policy aims to build and maintain positive relationships with the press and other media outlets. We respond promptly to media inquiries and ensure that our messaging is consistent and aligned with our brand values.

Crisis communication: In the event of a crisis, we have a crisis communication plan in place to manage external communications effectively. The plan includes procedures for issue identification, containment, eradication, recovery, and post-crisis evaluation.

7.3 Collaboration

Collaboration is critical to our company's success. We believe that by working together, we can achieve better results than individually. Our collaboration policies aim to foster a culture of teamwork, respect, and open communication. The following are some strategies we use to promote collaboration:

Cross-functional teams: We create cross-functional teams to encourage collaboration among different departments and functions.

Collaboration tools: We use Nextcloud Hub and gitlab to facilitate collaboration among team members.

Feedback culture: Our company encourages a feedback culture where team members can provide constructive feedback to each other to improve our work processes and outcomes.

7.4 Confidentiality and Data Protection

Our company respects the privacy of our clients' and partners' information. We adopt strict confidentiality and data protection policies to ensure that sensitive information is handled appropriately. All team members are expected to sign a non-disclosure agreement (NDA) before starting work with our company. We also comply with relevant data protection regulations, such as the General Data Protection Regulation (GDPR).

7.5 Language and Communication Style

Our company recognizes that language and communication style can impact how we collaborate and communicate effectively. We adopt the following policies to ensure clarity and inclusivity in our communication:

Language: Our official language is English. However, we recognize that our team members may speak different languages, and we encourage them to communicate in their native language if needed.

Communication style: We promote a respectful and professional communication style. We avoid using jargon or technical terms that may confuse or intimidate others. Our communication should be clear, concise, and appropriate for our audience.

Section 8. Employee training and development

At GeniaDynamics, we recognize the importance of investing in our employees' growth and development. Our goal is to provide opportunities for personal and professional growth, as well as to foster a culture of continuous learning and improvement. To achieve this, we offer various training programs and initiatives that cater to different roles and career paths within the organization.

8.1 Training Programs:

We offer a range of training programs designed to enhance technical, managerial, and soft skills. These include but are not limited to:

- Technical training for software development, testing, and maintenance;
- Leadership and management training for supervisors and managers;
- Communication, teamwork, and collaboration training;
- Time management, prioritization, and productivity training;
- Customer service and sales training;

8.2 Training Methods:

We understand that different individuals have different learning styles, so we offer a variety of training methods to cater to these differences. These include but are not limited to:

- Instructor-led classroom training;
- Online courses and webinars;
- On-the-job training;
- Mentoring programs;

- Self-paced learning modules;

8.3 Career Development:

We believe in promoting from within, and we encourage our employees to pursue their career goals within the company. To support this, we offer career development opportunities such as job rotations, cross-functional projects, and mentorship programs. Our aim is to help employees acquire new skills, gain valuable experience, and advance in their careers.

8.4 Performance Management:

We have a performance management system that includes regular feedback, goal setting, and performance evaluations. This system helps us identify areas where employees need improvement and provide them with the necessary training and support to excel in their roles. Our performance management process also allows us to recognize and reward outstanding performance.

8.5 Employee Engagement:

We believe that engaged employees are more productive, motivated, and committed to achieving our company's goals. To foster engagement, we encourage open communication, provide opportunities for employee feedback, and offer recognition programs to appreciate our employees' hard work and dedication. Our aim is to create a positive work environment where employees feel valued, respected, and empowered to make a difference.

8.6 Continuous Improvement:

We continuously review and update our training programs and policies to ensure they remain relevant and effective. We welcome feedback from employees and management on ways to improve our training initiatives and employee development opportunities. Our goal is to create a culture of continuous learning, improvement, and growth that benefits both the company and our employees.

Section 9. Workplace safety

We are committed to providing a safe and healthy work environment for all employees. The following guidelines have been established to ensure that our workplace is free from hazards and risks associated with physical, psychological, or ergonomic factors. It is the responsibility of every employee to adhere to these guidelines and report any concerns or incidents promptly to their supervisor or HR department.

9.1 Physical Safety

a) All employees must wear appropriate attire, including safety shoes, goggles, gloves, and hard hats when working in areas where potential hazards exist (e.g., construction sites, production floors).

b) Employees are prohibited from engaging in horseplay or other dangerous behavior that could put themselves or others at risk of injury.

c) The company will provide ergonomic furniture and equipment to minimize the risk of musculoskeletal disorders. Employees must report any discomfort or pain associated with their workstation to their supervisor or HR department for assistance.

d) Fire extinguishers, first aid kits, and emergency exit routes will be inspected regularly and maintained in good working condition. Emergency drills will be conducted quarterly to ensure that all employees are familiar with evacuation procedures.

9.2 Psychological Safety

a) The company is committed to maintaining a workplace free from harassment, discrimination, or bullying of any kind. Employees must treat each other with respect and dignity at all times. Any instances of inappropriate behavior will be investigated promptly and addressed according to our disciplinary procedures.

b) The company recognizes that mental health is just as important as physical safety. We encourage employees to take breaks, practice stress-reducing techniques, or seek professional help when needed. Confidential counseling services are available upon request through our employee assistance program (EAP).

9.3 Remote Work Safety

a) Employees working from home or other remote locations must ensure their workspace meets basic safety standards, including proper lighting, ergonomic furniture, and a secure internet connection.

b) Remote employees are expected to maintain regular working hours and take breaks as needed to avoid fatigue and burnout. They should also inform their supervisor or HR department of any changes in their work environment that may impact their productivity or well-being.

9.4 Incident Reporting

a) All incidents, including accidents, injuries, property damage, or security breaches, must be reported to the employee's supervisor or HR department immediately. An incident report form will be provided for this purpose and must include details of what happened, when, where, who was involved, and any recommended actions to prevent future occurrences.

b) The company will investigate all incidents promptly and take appropriate action to address the root cause(s). Employees may also provide feedback or suggestions on how to improve workplace safety through our intranet portal or during regular team meetings.

9.5 Safety Training

a) New employees will receive mandatory safety training as part of their onboarding process, which includes reviewing this policy document and attending a workplace

safety orientation session conducted by HR or the designated safety officer.

b) Regular safety training sessions and workshops will be provided for all employees to refresh their knowledge and skills in areas such as first aid, fire prevention, cybersecurity awareness, and stress management.

9.6 Contractors and Visitors

a) All contractors and visitors must adhere to our workplace safety policies when on company premises or working on company projects. They will be required to sign a copy of this policy document before starting work and attend a safety orientation session if necessary.

b) The company reserves the right to deny access to any individual who fails to comply with our safety policies or poses a risk to themselves or others.

Section 10. Group's Constitution

The group number two of LESI (Licenciatura em Engenharia de Sistemas Informáticos) is made up of the following members:

- Diogo Antunes
- Edgar Baptista
- João Ribeiro
- José Senra

The group's advisor is the esteemed teacher Patrícia Isabel Sousa Trindade Silva Leite, who can participate in the group's meetings to help the conception of the project's objectives.

Section 11. Positions and how often they rotate

The positions on the company are mainly static, changes occur only upon written notice of the executive board

Engineering positions:

Team lead -	Diogo Antunes (effective)
Software Developer/Engineer -	Diogo Antunes (effective) João Ribeiro (effective) Edgar Baptista (effective) José Senra (effective)
Software/Solutions Architect -	Diogo Antunes (effective) Edgar Baptista (effective)
Quality Assurance (QA) Engineer -	Diogo Antunes (effective) Edgar Baptista (effective)
Database Administrator (DBA) -	Diogo Antunes (effective) João Ribeiro (effective)
System Administrator -	Diogo Antunes (effective) João Ribeiro (effective)
UX/UI Designer -	João Ribeiro (effective)
Systems Analyst -	Diogo Antunes (effective) Edgar Baptista (effective)
Scrum Master -	João Ribeiro (effective)
DevOps engineer	Diogo Antunes (effective) Edgar Baptista (effective)
Product Manager -	João Ribeiro (effective)
Project Manager	Diogo Antunes (effective)
Data Scientist	Diogo Antunes (effective)
Data Protection Officer (DPO) -	Diogo Antunes (effective)
Cybersecurity Engineer -	Diogo Antunes (effective)
Technical writer	José Senra (effective)

Executive positions

Chief Executive Officer (CEO) -	Diogo Bernardo
Chief Operating Officer (COO) -	Edgar Baptista
Chief Financial Officer (CFO) -	João Ribeiro
Chief Technology Officer (CTO) -	Diogo Bernardo
Chief Information Officer (CIO) -	José Senra
Chief Human Resources Officer (CHRO) -	João Ribeiro
Chief Legal Officer (CLO) -	Diogo Bernardo

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GeniaDynamics open source.

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If your software can interact with users remotely through a computer network, you should also make sure that it provides a way for users to get its source. For example, if your program is a web application, its interface could display a "Source" link that leads users to an archive of the code. There are many ways you could offer source, and different solutions will be better for different programs; see section 13 for the specific requirements.

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12.3 Privacy Policy and Data protection

Last updated: 6 October 2023

GeniaDynamics respects your privacy and is committed to protecting it. This Privacy Policy explains how we collect, use, disclose, transfer, and store your personal data. By using our services, you consent to the collection and use of your personal data as described in this policy.

Information We Collect

We collect several types of information from and about you, including:

1. Personal data. This category includes personally identifiable information such as Social Security numbers and gender, as well as nonpersonally identifiable information, including your IP address, web browser or mobile application cookies and device IDs (which both your laptop and mobile device have).

2. Engagement data. This type of data details how consumers interact with a business's website, mobile apps, text messages, social media pages, emails, paid ads and customer service routes.

3. Usage data of Housify services.

4. Usage, viewing, technical, and device data when you visit our sites, use our applications on third-party sites or platforms, or open emails we send, or connect with our wireless Internet access services and other similar technologies, including your browser or device type, unique device identifier, and IP address;

We use your personal data for the following purposes

To provide and improve our services: We use your usage data to troubleshoot, debug, and improve our services. We also use your customer invoice data to process payments and provide you with necessary documentation.

To communicate with you: We use your email address to respond to your inquiries, send you updates about our services, and inform you of any changes to this privacy policy.

To comply with legal obligations: We may disclose your personal data if required by law or regulation, or to protect the rights, property, or safety of GeniaDynamics, its customers, or others.

Information Sharing and Disclosure

We do not share your personal data with third parties except in the following circumstances:

With our service providers: We may disclose your personal data to companies that provide services on our behalf, such as payment processors, data analytics providers, or customer support vendors. These service providers are authorized to use your personal data only for the purpose of providing their services to us.

In connection with a merger or acquisition: If GeniaDynamics is involved in a merger, acquisition, or sale of all or a portion of its assets, you will be notified via email and/or prominent notice on our website of any change in ownership or uses of your personal data.

To comply with legal obligations: We may disclose your personal data if required by law or regulation, or to protect the rights, property, or safety of GeniaDynamics, its customers, or others.

Data Retention and Security

We retain your personal data for as long as necessary to provide our services, comply with legal obligations, resolve disputes, and enforce agreements. We take reasonable steps to protect your personal data from unauthorized access, use, or disclosure. Unfortunately, no data transmission over the internet can be guaranteed 100% secure. As a result, we cannot guarantee the security of your personal data transmitted through our services.

Your Rights and Choices

You have certain rights regarding your personal data, including:

Access: You may request access to your personal data that we hold. We will provide you with a copy of your personal data in an electronic format.

Rectification: If your personal data is inaccurate or incomplete, you may request that we correct it.

Erasure: In certain circumstances, you may request that we delete your personal data.

Restriction of processing: You may request that we restrict the use of your personal data.

Data portability: You have the right to receive a copy of your personal data in an electronic format and transfer it to another controller.

To exercise any of these rights, please contact us at datarights@housify.com, We will respond to your request within 30 days.

Changes to This Privacy Policy

We may update this privacy policy from time to time. The updated version will be effective as soon as it is posted on our website. We encourage you to review this privacy policy periodically for any changes. Your continued use of our services constitutes your agreement to any updates to this privacy policy.

Contact Us:

If you have any questions or concerns about this privacy policy, please contact us at contact@geniadynamics.com, we will respond to your inquiry within 30 days.

Bibliography

Brooks, Tim, Aleksander Holynski, and Alexei A Efros (2022). "InstructPix2Pix: Learning to Follow Image Editing Instructions." In: *arXiv preprint arXiv:2211.09800*.

HHousen (2023). *household-rooms*. https://huggingface.co/HHousen/household-rooms. Accessed: 2023-11-13.

Li, Junnan et al. (2022). *BLIP: Bootstrapping Language-Image Pre-training for Unified Vision-Language Understanding and Generation*. DOI: 10.48550/ARXIV.2201.12086. URL: https://arxiv.org/abs/2201.12086.

Nvidia (2023). *Nvidia H100*. Accessed: October 25, 2023. URL: https://www.nvidia.com/en-us/data-center/h100/.

Rombach, Robin et al. (2022). "High-Resolution Image Synthesis With Latent Diffusion Models." In: *Proceedings of the IEEE/CVF Conference on Computer Vision and Pattern Recognition (CVPR)*, pp. 10684–10695.

Stability AI (2023). *stable-diffusion-xl-base-1.0*. https://github.com/Stability-AI/generative-models. Accessed: 2023-11-13.

Wu, Bichen et al. (2020). *Visual Transformers: Token-based Image Representation and Processing for Computer Vision*. arXiv: 2006.03677 [cs.CV].