TED UNIVERSITY

SPRING 2024

CMPE 491

Project Analysis Report

Project Name

3DifyMe

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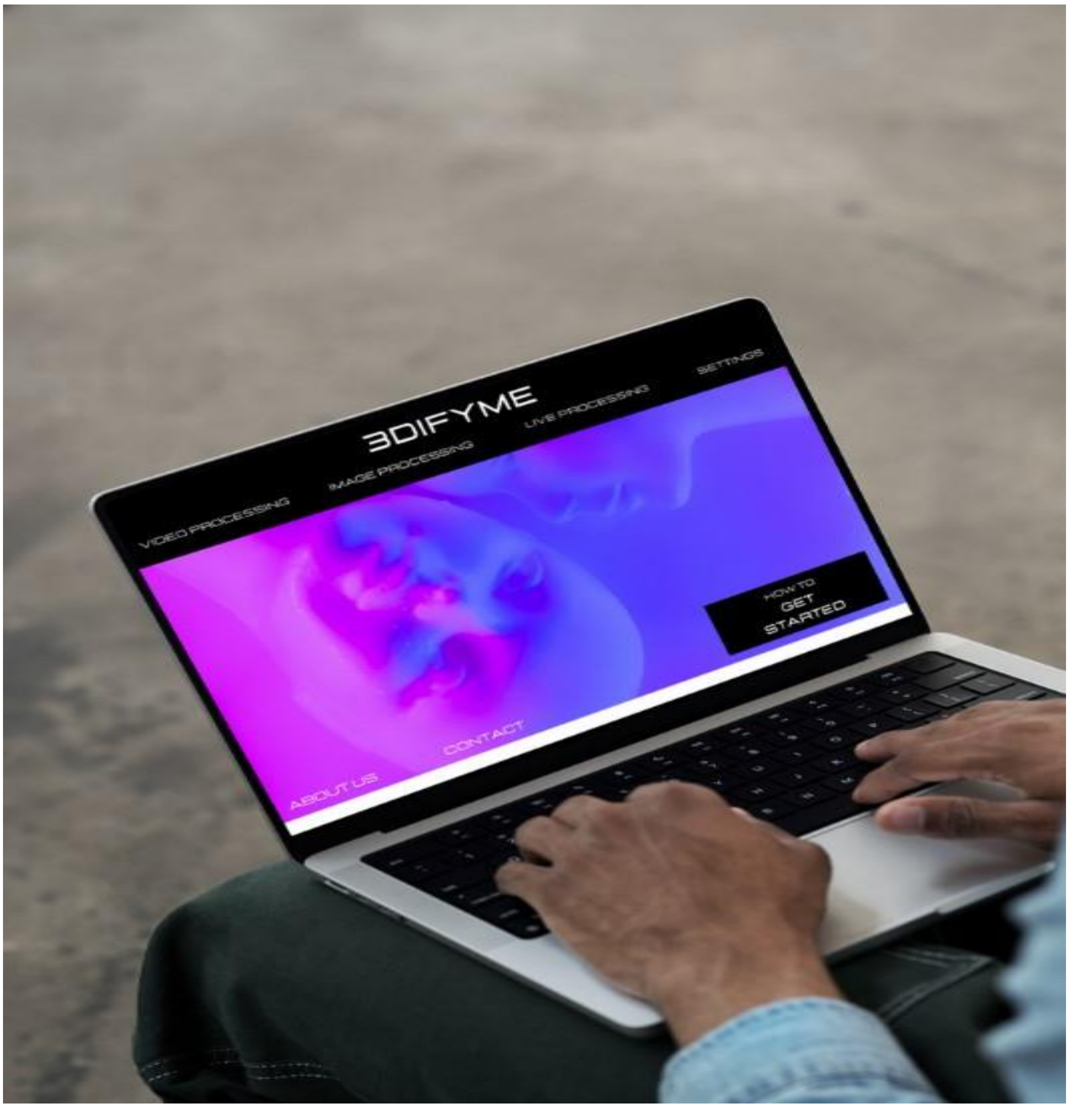
1.Introduction

The analysis document presented here delineates a comprehensive examination of the project's scope and objectives, aimed at converting 2D videos or live camera streams into immersive 3D experiences. By meticulously assessing the requirements, functionalities, system models, and other key aspects outlined in this document, we aim to establish a robust foundation for the development of our desktop application.

Our project aims to improve user experience by adding depth layers to rendered images. This ensures a seamless transition between 2D and 3D video images. Our goal is not just to complete the course, but to make a meaningful impact in our field. We aim to provide a seamless solution to increase user experience.



2.Proposed System

2.1Overview

Our project endeavors to revolutionize the viewing experience of 2D videos and live camera streams by transforming them into immersive 3D experiences. Designed as a desktop application, our primary objective is to bridge the gap between traditional media and cutting-edge technology, offering users a seamless transition into the realm of three-dimensional content.

At the core of our project lies the intricate process of converting existing 2D footage or live camera streams into 3D representations through advanced image processing techniques. Leveraging deep learning methodologies, such as Generative Adversarial Networks (GAN), we aim to infuse depth layers into the processed images, thereby enriching the visual experience with enhanced depth perception and realism.

The centerpiece of our application is its intuitive graphical user interface, which serves as the gateway to a myriad of features and functionalities. Users will have the ability to witness the transformation firsthand as the resulting 3D videos are seamlessly displayed alongside their original 2D counterparts. This dual-view presentation serves as the cornerstone of our application, offering users a side-by-side comparison and immersion into the world of three-dimensional content.

Furthermore, our commitment to innovation extends beyond the core functionality of our application. With ongoing discussions and collaboration with our supervisor, we remain poised to introduce additional features and enhancements to further enrich the user experience. These may include options for camera control, mirror view toggling, 2D to 3D image conversion, video recording capabilities, and the provision of comprehensive user guidance through a dedicated "How to Use" section within the application.

In summary, with the development of our desktop application, we aim to increase depth perception and realism for users by adding depth layers to rendered images. While our primary focus is on creating a user-friendly graphical interface, we are open to exploring additional features through additional development and collaboration with our supervisor.

2.2Functional Requirements

Video Input: A feature allowing users to provide input as either pre-recorded 2D videos or live camera streams.

Processing: The application will utilize image processing techniques and deep learning approaches (such as Generative Adversarial Networks (GAN)) to convert 2D video frames into 3D representations. The specific processing techniques or approaches to be used have not yet been determined.

Depth Layers: Dynamically adding depth layers to processed images to create realistic 3D visuals with depth perception. Users may adjust depth levels based on preferences, enabling customizable viewing experiences.

Real-time 3D Conversion: Implementing real-time 3D conversion capabilities to process live camera streams.

Multi-View Displaying: Presenting processed 3D video alongside the original 2D video in the desktop application with a graphical user interface.

Camera Controls: Providing users with controls such as camera on/off and starting live processing.

Recording: Enabling users to start and stop video recording within the application.

Downloading: Providing an option to download recorded 3D videos to local storage. Recorded videos will be saved for later viewing or sharing.

Customizable Settings: Allowing users to customize application settings such as video resolution, frame rate, and processing quality to match their preferences and device capabilities.

User Instruction: Including a comprehensive user-friendly interface with clear instructions and tooltips on how to effectively use the application. Help documentation and tutorials may be provided to guide users through the process of capturing, processing, and viewing 3D video content.

Adaptive Processing Quality: Attempting to implement adaptive processing quality settings to automatically adjust processing parameters based on device capabilities. This is crucial as accuracy and performance heavily depend on input quality.

Offline Rendering: Users who do not have access to a stable internet connection may be offered offline rendering capabilities, allowing them to convert 2D videos into 3D renderings without requiring an internet connection.

2.3 Nonfunctional Requirements

Performance: The application's processing and conversion processes must be fast and efficient, and ideally, performance metrics should be provided to users.

Usability: The user interface should be simple, clear, and user-friendly. Buttons and controls should be easily accessible for navigation and interaction.

Security: User data must be processed and stored securely, with measures like encryption and authentication to safeguard data transmission and storage against unauthorized access or breaches.

Documentation: Providing a detailed user guide or help document for users, and code documentation and system requirements for developers to facilitate customization, troubleshooting, and integration with other systems.

Testing: Thoroughly testing the application under different scenarios to identify and report possible bugs and errors.

Reliability: Ensuring the application is reliable through reliability testing, identifying and addressing potential points of failure to ensure continuous availability and functionality.

Scalability: The application should be designed to handle increasing user loads and data volumes without sacrificing performance. This ensures that the application can grow seamlessly as user demand increases over time.

Accessibility: The user interface should comply with accessibility standards to ensure that it can be easily used by individuals with disabilities. This includes features such as screen reader compatibility, keyboard navigation, and adjustable font sizes.

2.4 Pseudo requirements

2.4.1 Hardware Limitations: The success of the project hinges on the capabilities of the hardware utilized. Processor speed, RAM capacity, and graphics processing capabilities significantly impact the performance and efficiency of the application. Since our application will show 2d video and 3d processed video side by side, careful consideration must be given to the hardware requirements to ensure optimal functionality. Also, video quality is very important for the proper processing of videos taken or received live from the camera. Low light and low-resolution videos are difficult to convert or any unusual behavior in the input can cause a problem.

2.4.2 Technological Dependencies: The project's success may be contingent upon the availability and reliability of external technologies and dependencies. This includes third-party software libraries, APIs, and hardware components. Effective management of technological dependencies is crucial to minimize disruptions and ensure smooth project execution.

2.4.3 Implementation Constraints: For the project management and for the purpose of working together, we will actively use GitHub. We will use python programming language for most of the project because in the image processing and the other fields, python provides well defined and easy to use libraries. For the graphical interface we are considering using C++ language.

2.4.4 Time Restrictions: The deadline for completing the project is the first months of 2025. This affects the project planning and development process. Certain stages or reporting must be completed by specified dates. It is expected to communicate with supervisors and juries at regular intervals for quality management of the process.

2.4.5 Resource Constraints: Because of the complexity of the main feature in the application, as a team we believe this project is a hard one to complete. For that purpose, we will try to start our implementation early so that we can do research and get feedback from our supervisor. We are thinking, from the start of the implementation, we will try to complete small and solid tasks about the project, so each team member needs to allocate time carefully.

2.4.6 Performance Constraints: The application must be optimized to run efficiently on a variety of hardware configurations, including lower-end devices with limited processing power and memory. Performance optimization techniques such as caching, resource pooling, and parallel processing should be employed to maximize performance across different hardware setups.

2.4.7 Budget Constraints: Our budget may vary depending on the price of the external cameras and 3D glasses.

2.4.8 Offline Rendering and Exporting Constraints: Users may request the option to render and export 3D videos offline, without requiring an internet connection. This can be beneficial for users who need to work in offline environments or have limited internet access.

2.4.9 Augmented Reality (AR) Integration Constraints: Users may express interest in AR integration, allowing them to overlay 3D videos onto real-world environments through their device's camera.

2.5 System Models

2.5.1 Scenarios

Scenario: The user installs the application installer for the first time.

Preconditions:

• The user has internet access.

• The user has downloaded the project correctly / uninterrupted.

Steps:

1. The user opens the website.

2. The user selects the correct version.

3. The user downloads the correct application installer.

4. The user runs the application installer on his device.

Scenario: The user chooses the filter on a live video

Preconditions:

• The user successfully opens the application.

• The user has a device that can run the application.

• The user has a camera or camera device that the application can see.

• The user has 3D glasses.

Steps:

1. The user chooses a live camera input from available live cameras.
2. The user can see live video from the chosen camera input.
3. The user chooses live camera input.
4. The app processes live input consistently.
5. The user put 3D glasses on.
6. The user can see the filtered video.

Scenario: The user chooses the filter on an existing video

Preconditions:

• The user successfully opens the application.

• The user has a device that can run the application.

• The user has a pre-existing video.

• The user has 3D glasses.

Steps:

1. The user chooses a video file as input from the file manager.
2. The user can see the video from the input.
3. The user chooses from menu for video.
4. The application processes the input.
5. The user put 3D glasses on.
6. The user can see the filtered video.

Scenario: The user chooses the filter on an image

Preconditions:

• The user successfully opens the application.

• The user has a device that can run the application.

• The user has a pre-existing image.

Steps:

1. The user chooses an image file as input from the file manager.
2. The user can see the image from the input.
3. The user chooses from menu for the image.
4. The application processes the input.
5. The user can see the filtered image.

Scenario: The user saves the output of the application

Preconditions:

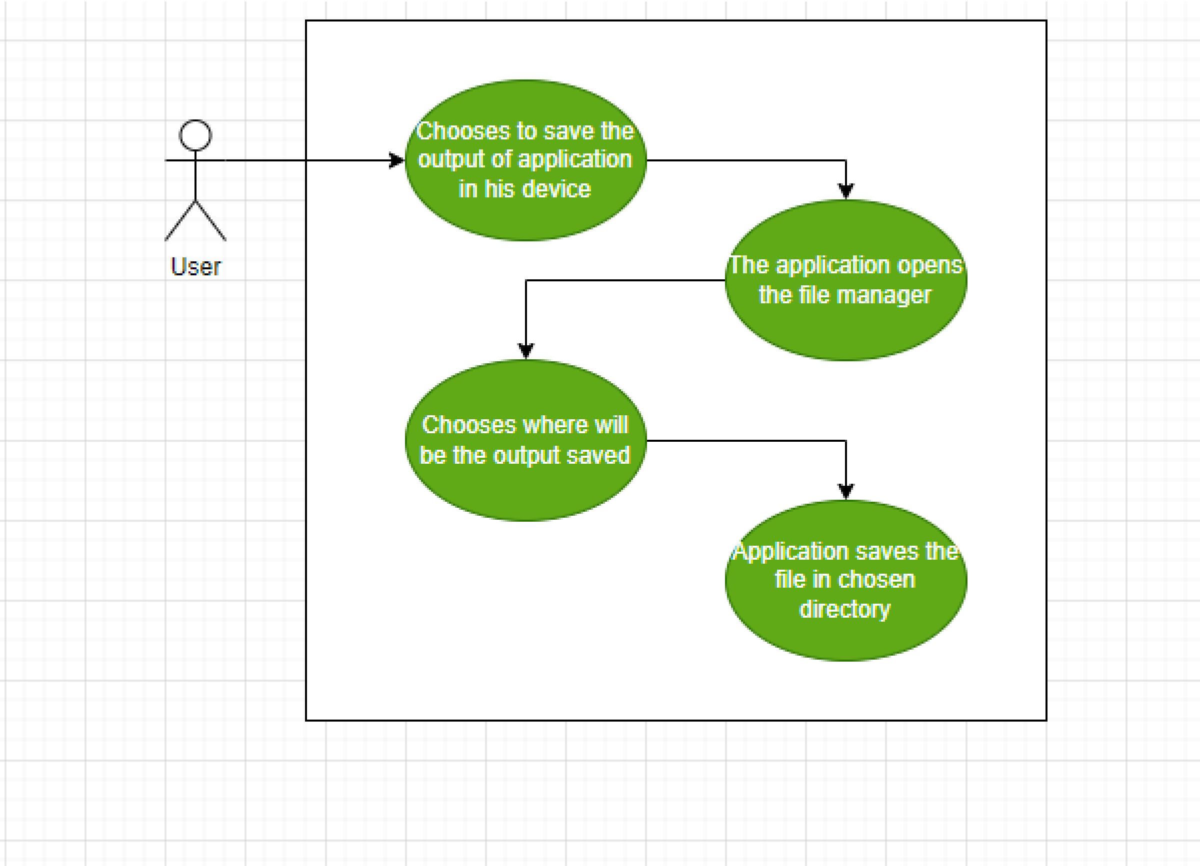
•The application generated an output.

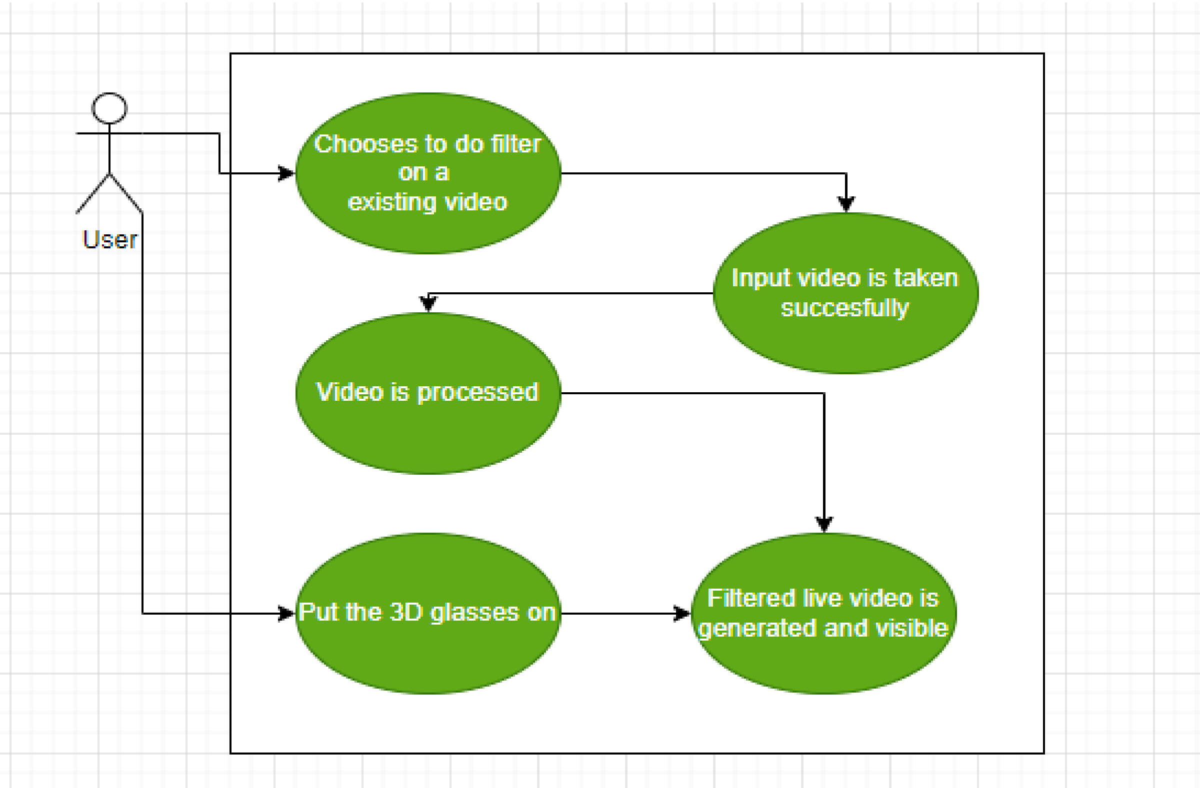
• The user has enough storage.

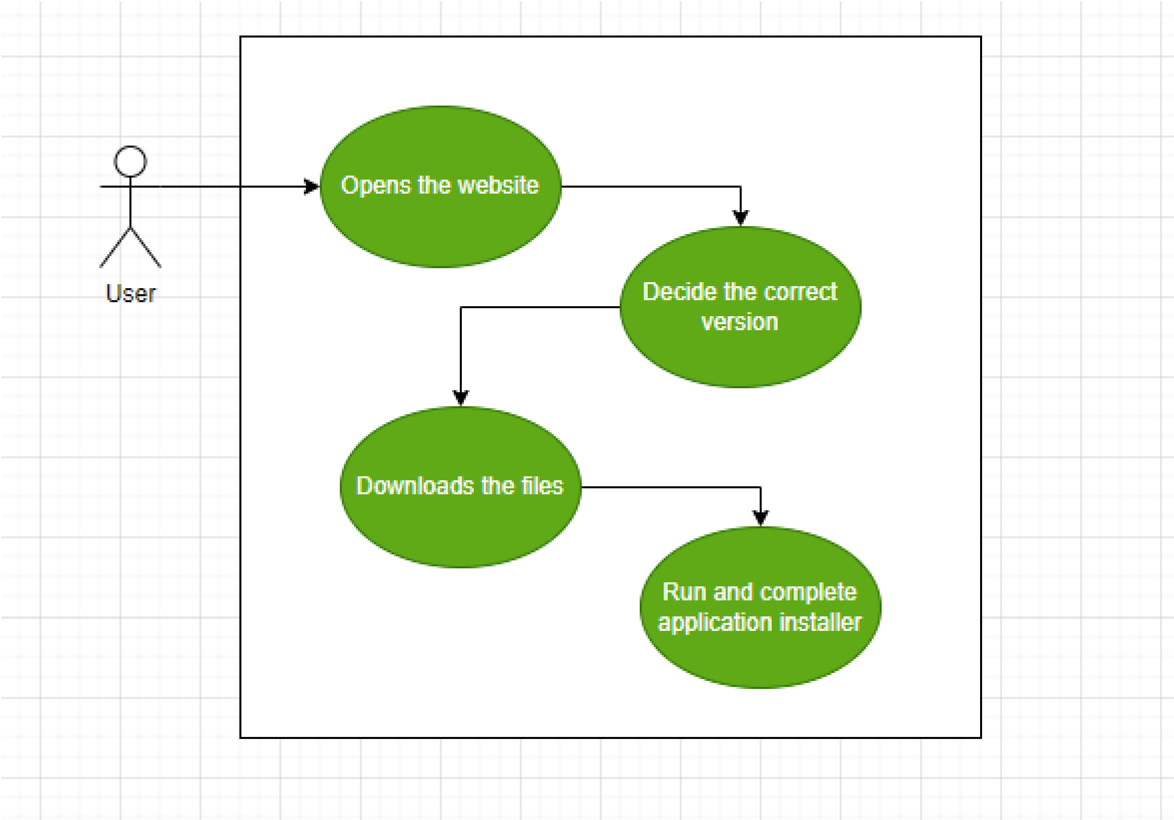
Steps:

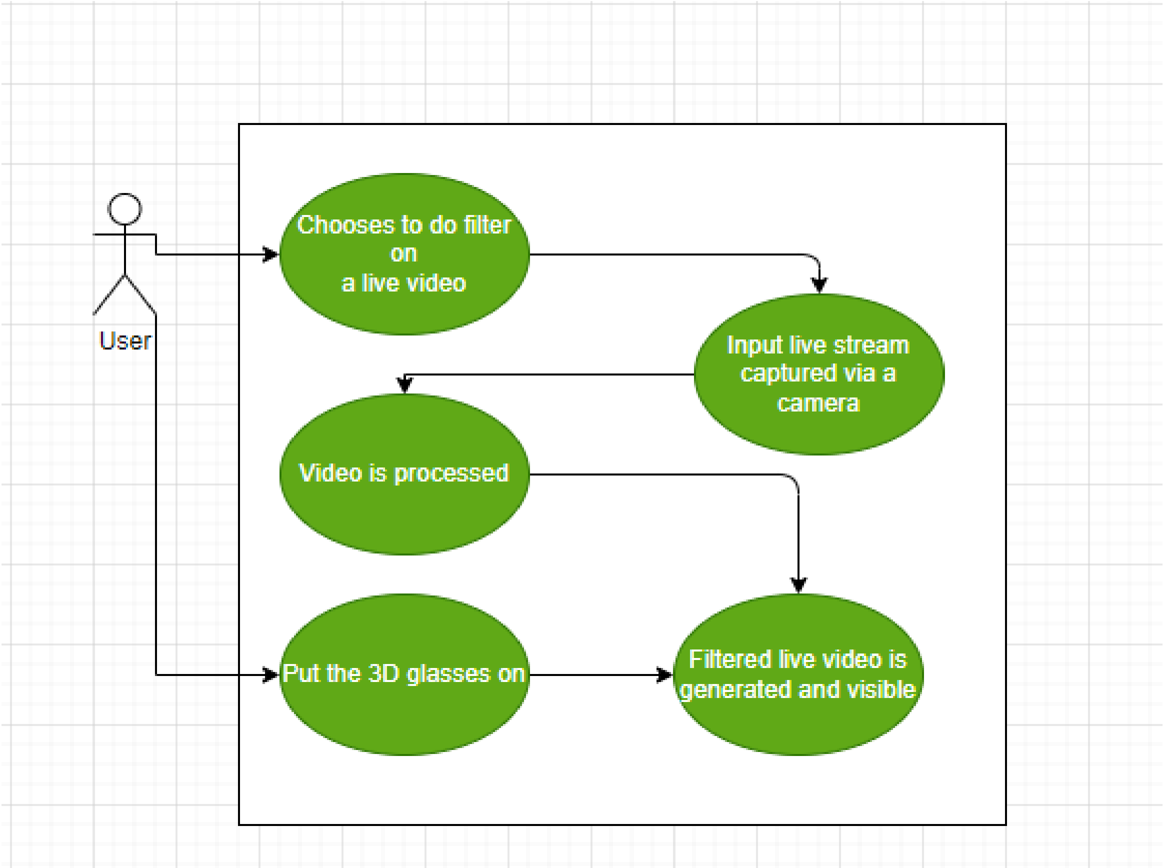
1. The user chooses the file menu from the top bar.
2. The user chooses the save.
3. The application opens the file manager.
4. The user chooses a directory for saving the output.
5. The application saves the file in the chosen directory.

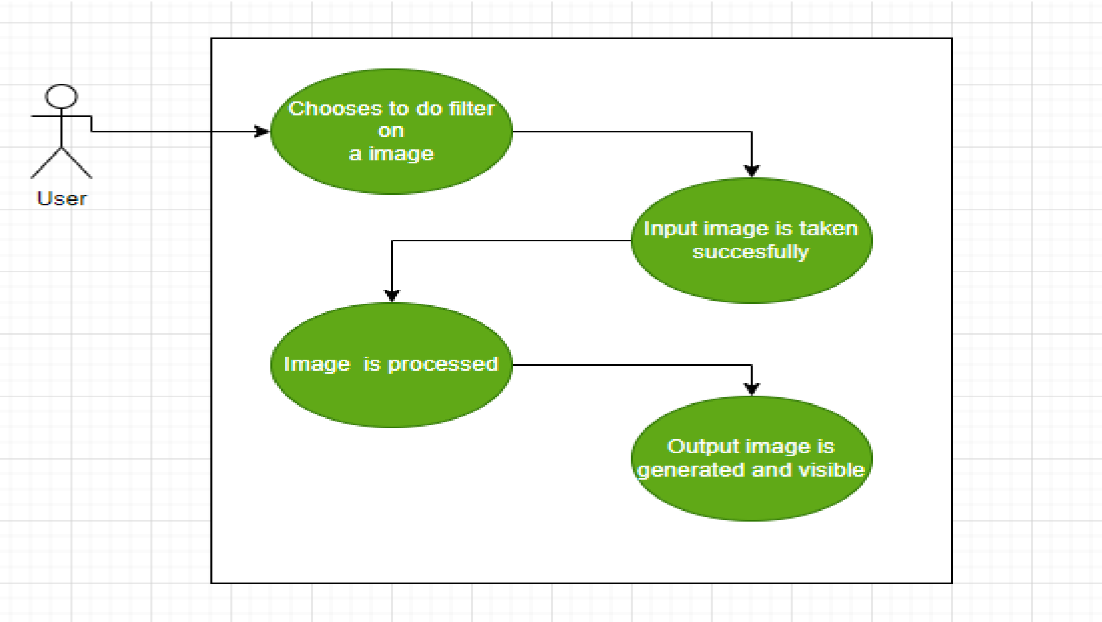
2.5.2 Use case model



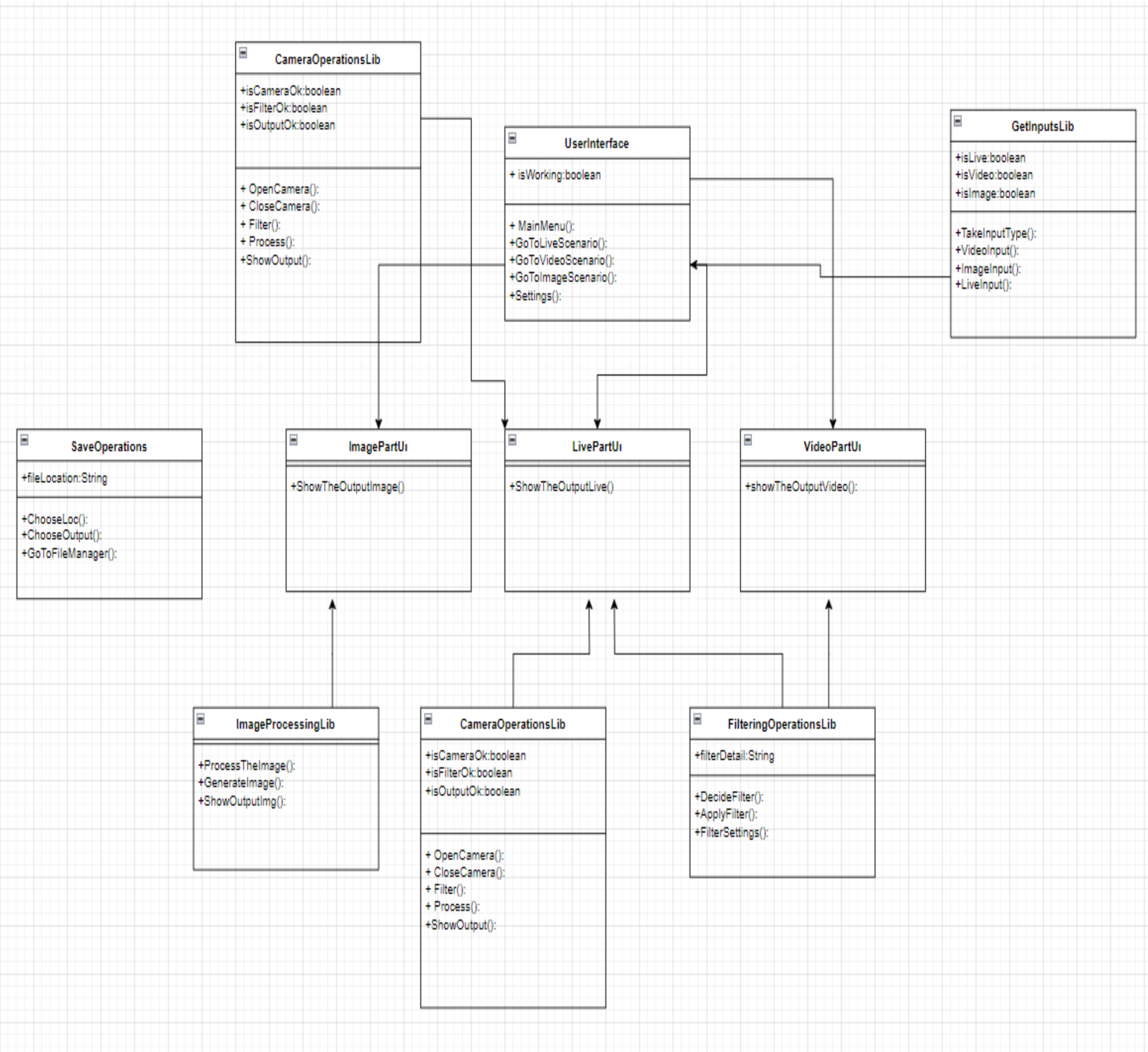



User
Opens the website
Decide the correct version
Downloads the files
Run and complete application installer

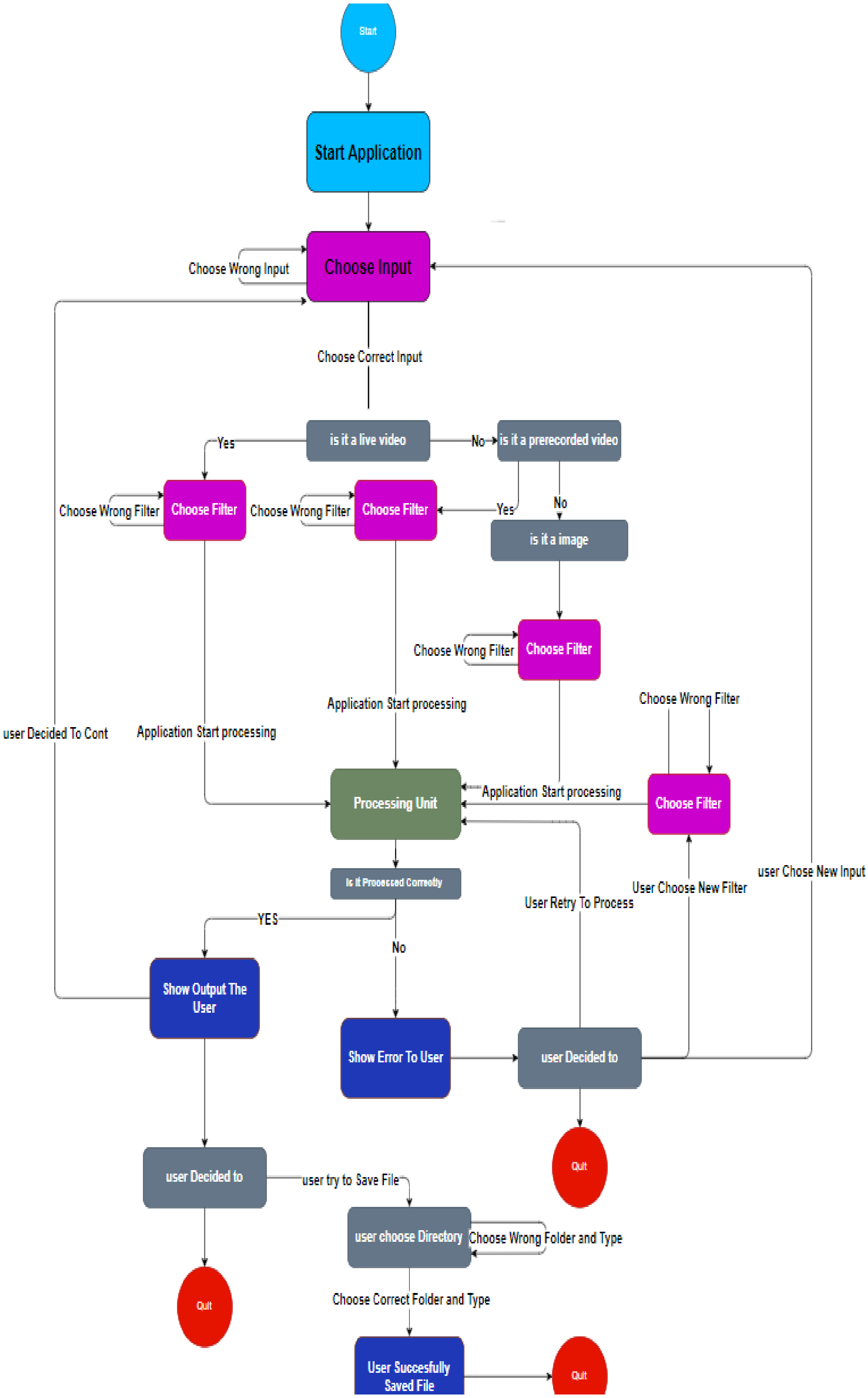

User
Chooses to do filter on a live video
Input live stream captured via a camera
Video is processed
Put the 3D glasses on
Filtered live video is generated and visible



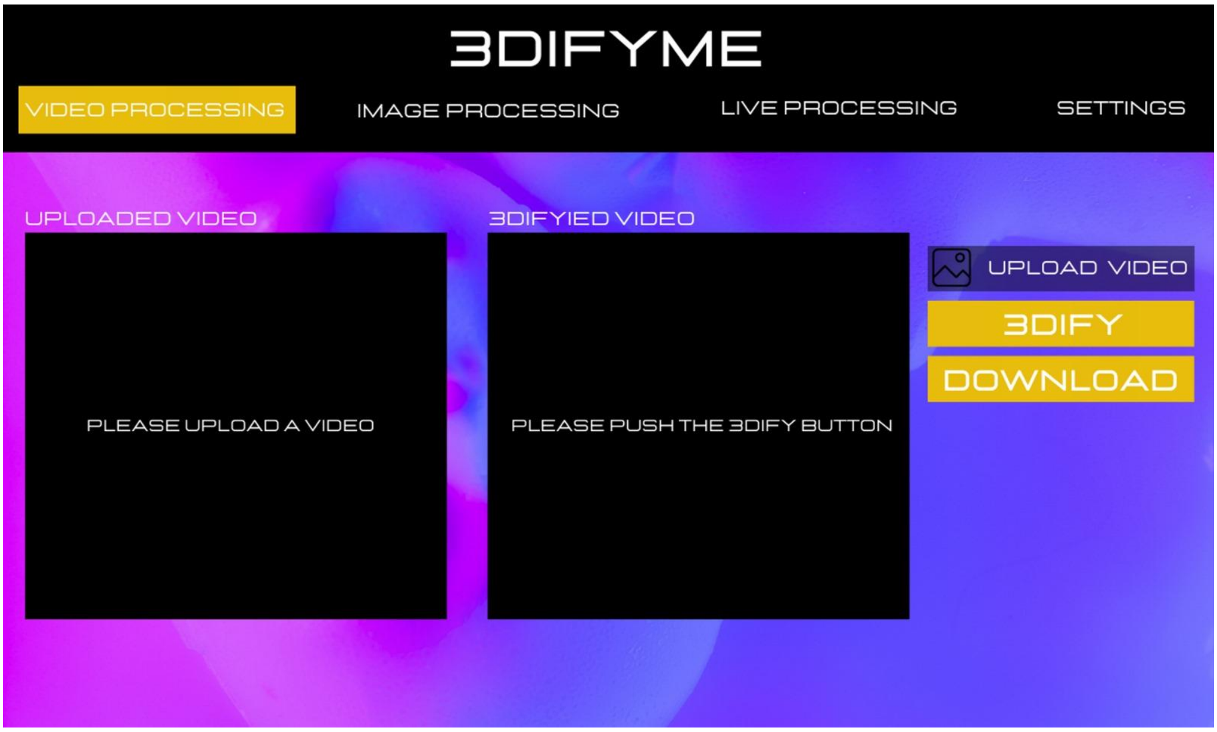
2.5.3 Object and class model

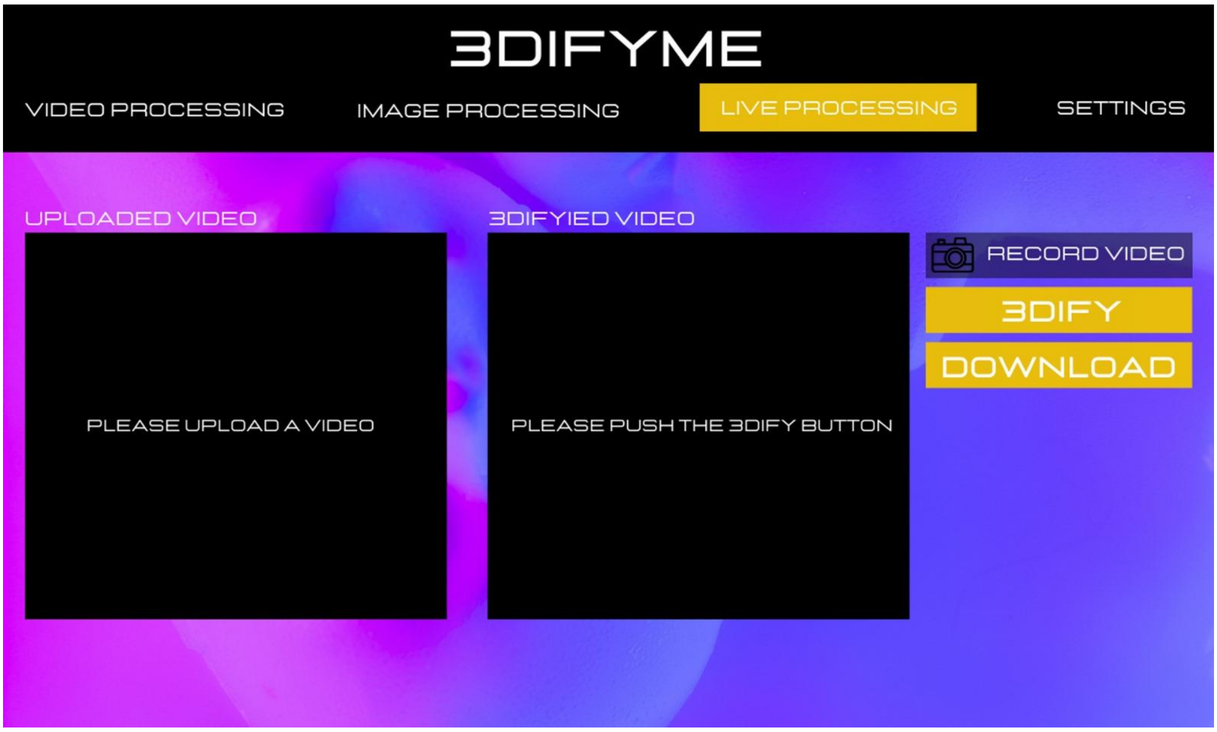


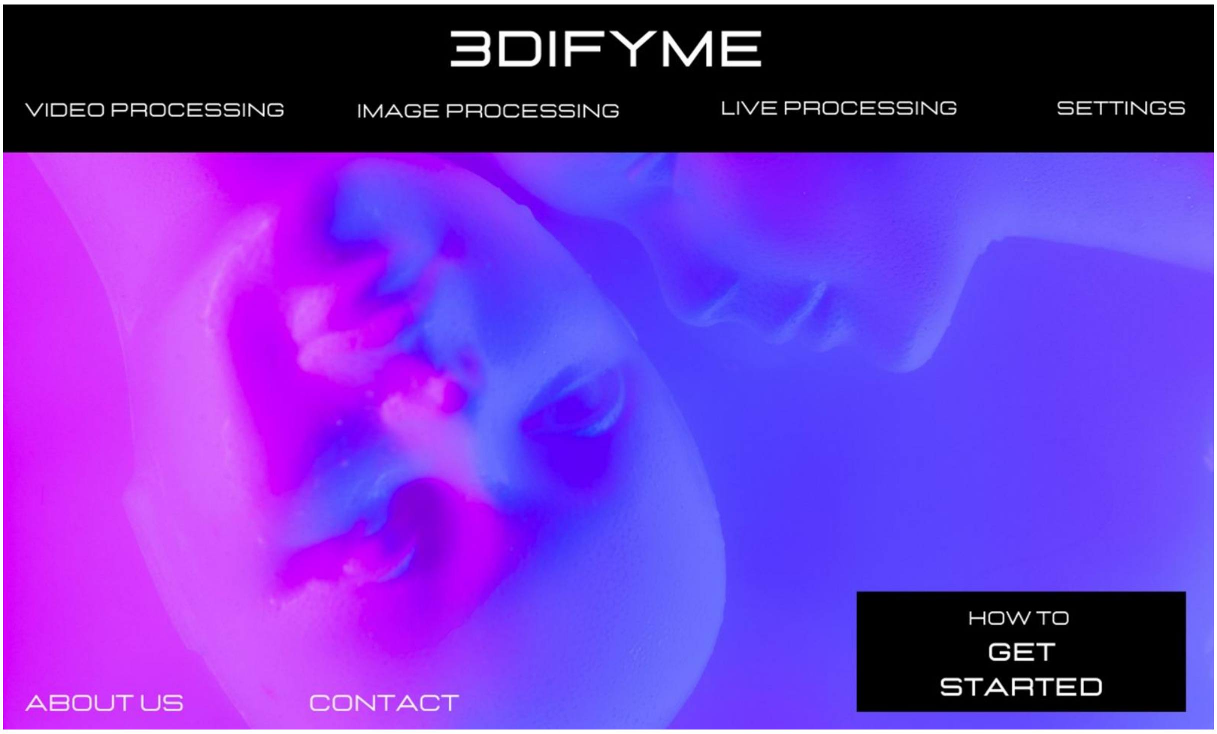
2.5.4 Dynamic models

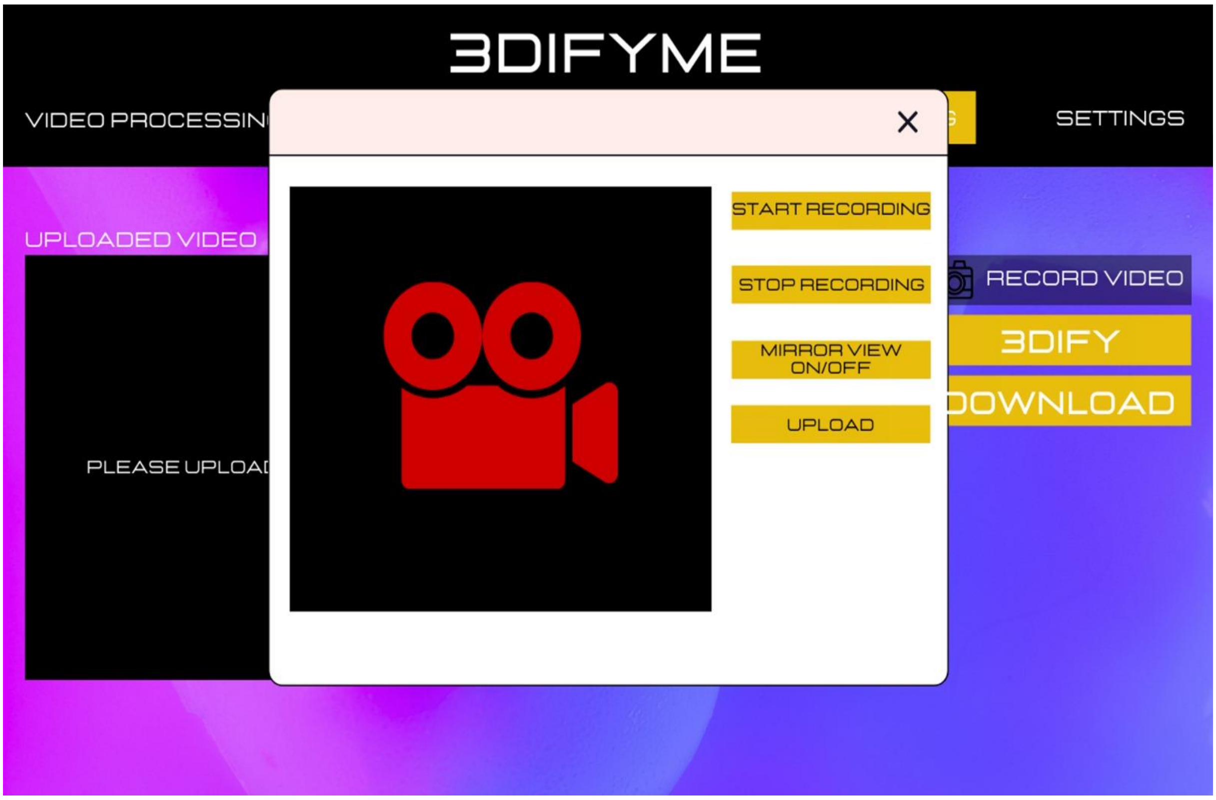


2.5.5 User interface - navigational paths and screen mock-ups






3DIFYME
VIDEO PROCESSING
IMAGE PROCESSING
LIVE PROCESSING
SETTINGS
HOW TO
GET
STARTED
ABOUT US
CONTACT


3DIFYME
SETTINGS
UPLOADED VIDEO
START RECORDING
STOP RECORDING
MIRROR VIEW
ON/OFF
UPLOAD
RECORD VIDEO
3DIFY

3. Glossary

2D Video: A two-dimensional video format that lacks depth perception and appears flat on screen.

3D Video: A three-dimensional video format that incorporates depth layers, providing a more immersive viewing experience.

Desktop Application: A software program designed to run on desktop computers, providing features such as video processing, user interface interactions, and multimedia display.

Graphical User Interface (GUI): The visual interface of the desktop application that allows users to interact with the software through graphical elements like buttons, menus, and icons.

3Dify: converting 2D to 3D.

Video Processing: the section that can be used to convert your previously recorded videos.

Photo Processing: the section that can be used to convert your photo.

Live Processing: the section that can be used to record a video and convert it.

4. References

[1] ACM Code of Ethics and Professional Conduct

[2] The Software Engineering Code of Ethics, IEEE Computer Society

[3] IEEE Code of Ethics

[4] Computer and Information Ethics, Stanford Encyclopedia of Philosophy