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CREAMS

Scaffolding Creativity of Arts Students: Framework, Toolchain, and Educational Material on how to Create their Own Virtual Exhibitions

CREAMS 3D Digit App – User Manual (Version 1.0)

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Executive Summary

This document provides a comprehensive overview of the technical architecture, core functionalities, API specifications, error handling, and maintenance procedures for the Creams 3D Digit Android application. The Target audiences for this document are multidisciplinary users, who would like to have a 3D-digitisation

0 Prerequisites

The prerequisites for the successful use of this workflow are as follows:

- **Android Device:** Android phones and tablets supporting ARCore and running Android 7 (API level 24) or higher
- **Android Version**: Target Android 12, Minimum tested Android 9
- **Internet connectivity**: High bandwidth required for processing photogrammetry and posting to the CREAMS Online Dashboard Artwork due to the potentially high volume of data transferred.
- **RealityScan**: RealityScan is a free-to-download mobile photogrammetry app available from https://www.unrealengine.com/en-US/realityscan. Users are expected to familiarise themselves with the app to capture their objects. A Step-by-step guide is available from the RealityScan website at https://dev.epicgames.com/documentation/en-us/reality-scan/RealityScan-Step-by-Step-Guide and in app. A copy of this is included in Annex 1 of this document.
- **CREAMS 3D Digit**: The android mobile application described in this document

Both the RealityScan and CREAMS 3D Digit applications must be installed on the user's android device before undertaking digitisation.

RealityScan App on GooglePlay

RealityScan Step-by-Step Guide

CREAMS 3D Digit **BETA**

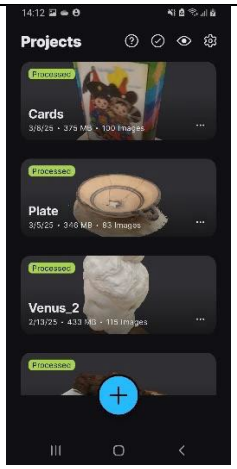
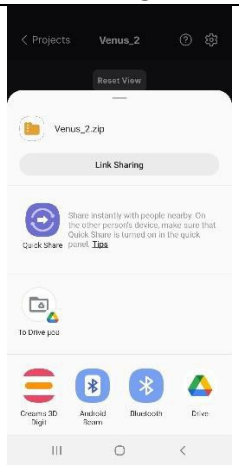
1 CREAMS 3D Digit App Visual Flow

The CREAMS 3D Digit app is activated from the user's device using the application icon shown below (Note this may appear differently depending on the device used).

The following table (*Table* 1) presents a series of screenshots showing the visual flow of the CREAMS 3D Digit app. Each screen is described in the appropriate section 1.1-1.7. A flowchart of the process is included in

Figure 1 at the end of this section.

Table 1 CREAMS 3D Digit App Visual Flow

 1.1 Login	 1.2 Process Data	 1.3 Project View	 1.4 3D Model View
 1.5 Export/Share	 1.6 Selected Files	 1.7 Upload Files	 Upload Success

1.1 Login

The user should have been assigned login credentials for the CREAMS Online Dashboard Artwork system.

- The user is presented with a login screen.
- They enter their credentials (email and password) and tap "Login."

1.2 Process Data

The user launches the external RealityScan app for data processing.

- After successful login, the app displays a screen titled "Process Data."
- A button labelled "Launch External App" is present. The user taps this button.
- The CREAMS 3D Digit app makes a call to the RealityScan app

1.3 Project View

The user selects a specific project/creates a new RealityScan project.

- The app transitions to a "Projects" view, showing a list of projects.
- The user may select an existing project or create a new project
- Projects are shown with a name, thumbnail and timestamp
- The user selects the desired project.

1.4 3D Model View

The user views and interacts with a 3D model. See RealityScan documentation for further details

- The app displays the selected 3D model.
- Interaction with the model is provided on screen though standard user interface finger movements (pinch, swipe, drag)
- The interface toolbar allows for the model to be cropped, renamed, previewed without texture or deleted.
- At the bottom, there are options to:
    - Export the 3D model.
    - Share the model on Sketchfab.

1.5 Export/Share

The user exports or shares the 3D model.

- The user taps "Export 3D Model."
- A system dialog appears for choosing an export location or sharing method.
- Options include saving to local storage or sharing via various apps (Sketchfab, Drive, Messenger, etc.).
- The user selects the **CREAMS 3D Digit** application

1.6 Selected Files

The user names their model ready for upload to the CREAMS online platform.

- The screen transitions to the CREAMS 3D Digit app “Selected Files” screen
- The user can see the files that will be uploaded
- The user can add a logo to identify their model within the CREAMS online platform
- The user can enter a name for their artwork to identify their model within the CREAMS online platform

1.7 Upload Files

The user uploads their model to the CREAMS online platform

- The user taps on the “Upload” button to send the files to the CREAMS Online platform
- Successful upload is indicated by the word “Files Successful Uploaded” on the app screen

The user has now completed the CREAMS 3D Digit app process and can now proceed to the CREAMS Online Dashboard and add relevant details to their model information. The user can return to the main login screen using the Exit icon top right of the screen,

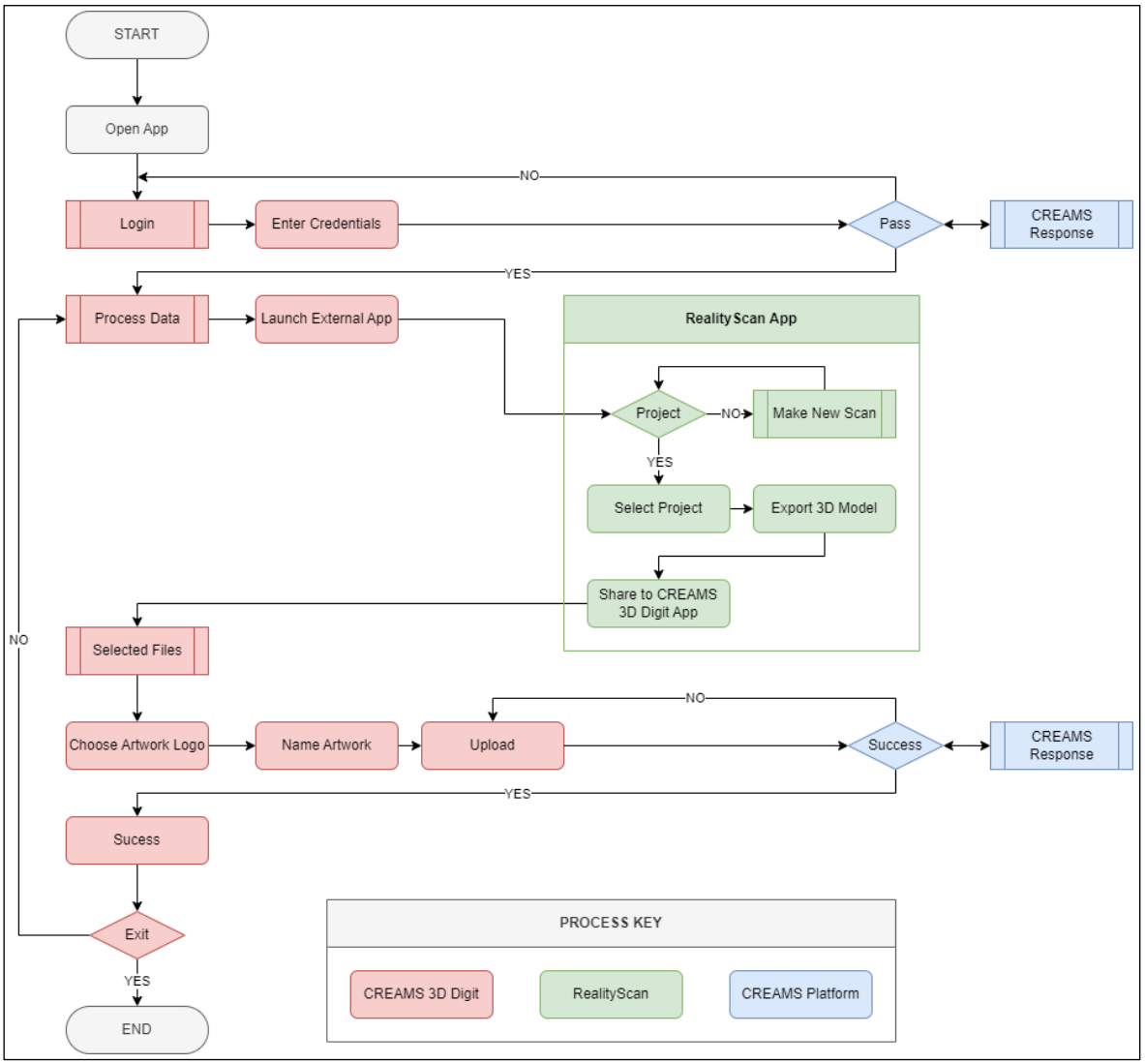


Figure 1 Schematic Flowchart for Operations

2 CREAMS Online Dashboard Artwork Management

The user can view, upload, and manage their 2D and 3D artworks. This is achieved server-side not via the CREAMS 3D Digit app.

- The user navigates to the "Artworks" tab.
- Here, they can view existing artworks in two categories: "Two Dimensional (2D)" and "Three Dimensional (3D)."

2.1 Artwork Selection and Details

- The uploaded artwork is displayed in the “Three Dimensional (3D) Artworks” group.
- Each artwork has a card with its name, a thumbnail image, and "Actions" options.
- The “Edit” option allows the review and editing of information for the uploaded object
- The “3D Viewer” invokes the CREAMS online 3D Viewer to visualise the uploaded model.

2.2 Artwork Edit

The user can edit or check successful uploaded data though the “Edit” screen. This has the following options

- **Artwork List**: Returns to the Artworks page
- **Edit**: Allows the changing of information about the artwork
- **Manage 3D Files**: Allows the review of the uploaded files (typically three files “model.glb”, tex_u0_v0_normal.jpg” and, “tex_u0_v0_diffuse.jpg”). Additional files may also be added or existing files deleted
- **Manage Associated Media**: this allows the user to add, or deleted associated media with this object. By default, this has no items
- **Create QR**: This creates a QRC image for the object
- **Delete**: This deletes the object from the Artwork listings

3 CREAMS 3D Digit App Documentation

Document Scope: Android API 31+ | Kotlin 1.9+

3.1 Core Functionalities

3.1.1 3D Project Upload System

- Input: The system accepts ZIP archives with a MIME type of application/zip.
- Processing: It automatically extracts 3D asset files, specifically those in the GLB format, from the provided ZIP archive.
- Output: The extracted files, which include 3D models and associated assets, are batch-uploaded as a complete project.
- File Operations:
    - Content URI Handling: The application leverages Android Content URIs for efficient file access and processing.
    - Play Store Fallback Installation: The system is designed to support installation from the Google Play Store, providing a fallback option.
    - Cache Directory Management: A cache directory is utilized for the temporary storage of extracted files and intermediate processing results.

3.1.2. Authentication Framework

- Mechanism: JSON Web Tokens (JWT) are employed for secure authentication.
- Token Management:
    - Separate access and refresh tokens are used.
    - Both types of tokens are securely stored.
- Session Persistence: Cookie-based session persistence is implemented to maintain user login status across multiple interactions.
- Token Refresh: An automatic token refresh mechanism is integrated to seamlessly extend session validity.

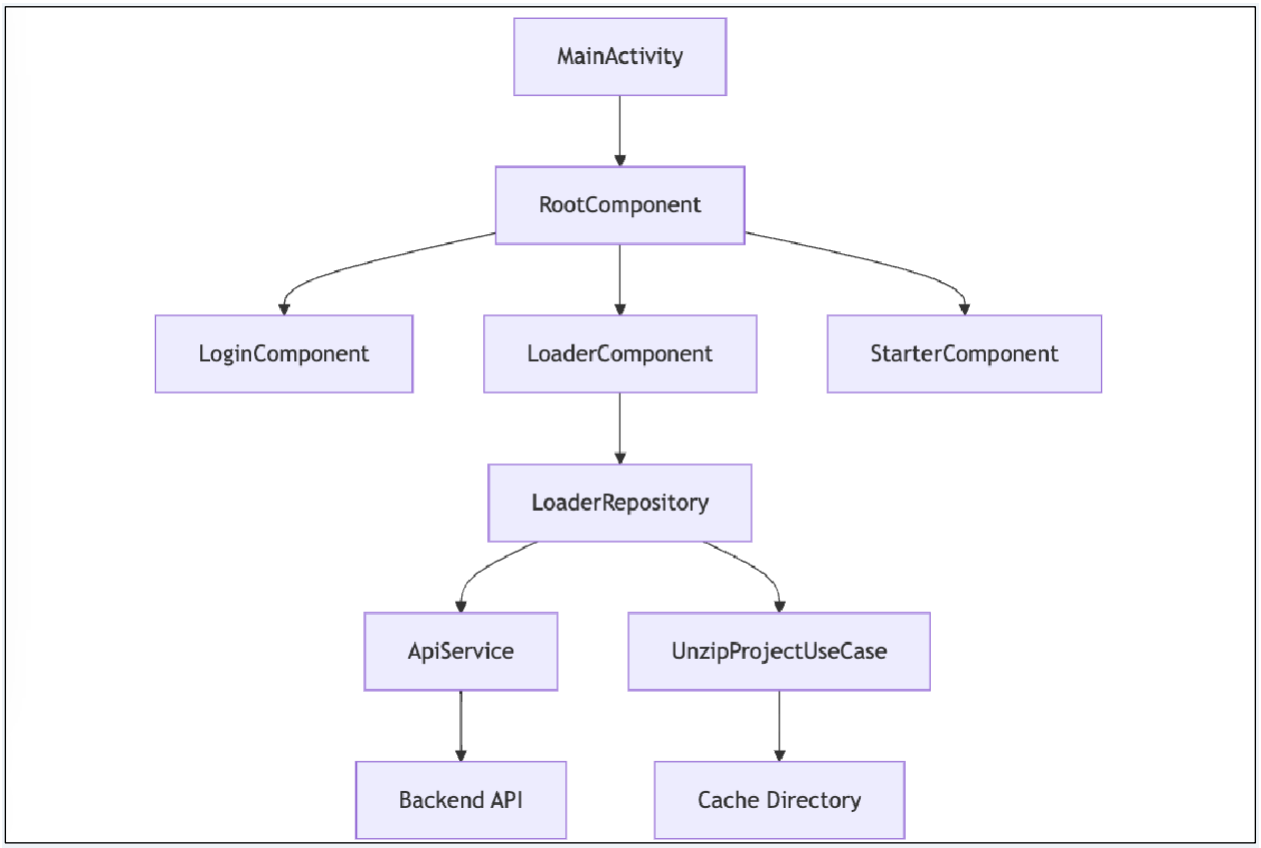
3.1.3. Network Operations

- Multipart File Upload: The application supports uploading multiple files in a single request (batch) or sequentially.
- Artwork Metadata Management: The system enables the creation and storage of descriptive metadata associated with uploaded artwork.
- File Conversion: Automatically converts uploaded images to PNG format.

3.1.4. API Endpoints

- POST /artworks/create/ (Artwork Registration):
    - This endpoint registers new artwork on the server.
    - It accepts artwork metadata and a PNG logo file.
- POST /student/artwork/save_associated_media/:
    - This endpoint uploads a single file associated with an existing artwork ID.
    - It accepts the artwork and other relevant data as parameters.

3.2 Technical Architecture



3.2.1 Main Activity Hub

- File: MainActivity.kt

```
// Core lifecycle handlers
onCreate() {
    DI Initialization
    Edge-to-edge Setup
    Navigation Controller
    Intent Filter Handling
}

// Intent handling
handleIncomingIntent() {
    ACTION_SEND → ZIP processing
    URI validation
    ContentResolver queries
    Metadata extraction
}
```

3.2.2 File Processing Engine

- File: LoaderRepositoryImpl.kt

```
operator fun invoke(uri: Uri): UnzipResult {
    1. Stream initialization
    2. Cache directory setup
    3. Entry-by-entry extraction
    4. URI list generation
    5. Cleanup:
       - Stream closure
       - Error logging
}
```

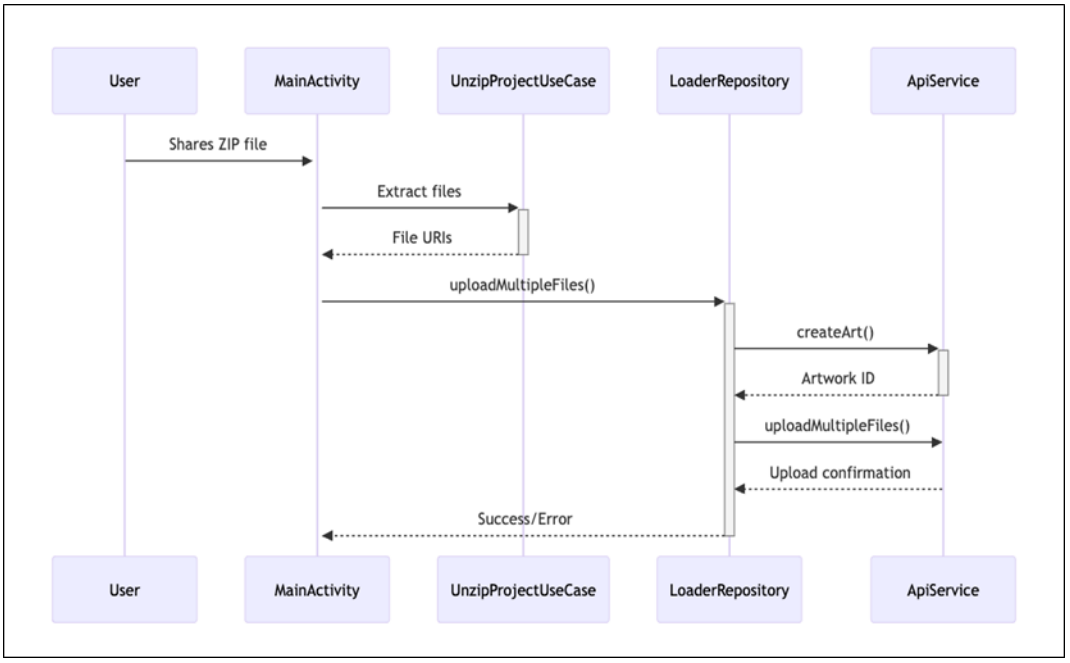
3.2.3 ZIP Extraction Module

- File: UnzipProjectUseCase.kt

```
uploadMultipleFiles(uris: List<Uri>) {
    1. Token validation
    2. Artwork registration (createArt)
    3. Multi-part preparation:
       - PNG logo embedding
       - GLB conversion
       - MIME type handling
    4. Batch upload:
       if (files > 1) → uploadMultipleFiles(
       else → sequential uploadFile()
}
```

3.3 Workflow Diagrams

3.3.1 File Upload Sequence



3.4 API Documentation

3.4.1 createArt Endpoint

```
@POST("create-art")
suspend fun createArt(
    @Header("Authorization") token: String,
    @Header("Cookie") cookie: String,
    @Part src: MultipartBody.Part, // PNG logo
    @Part("name") name: RequestBody, // 3+ chars
    @Part("artType") artType: RequestBody, // "3d"
    @Part("genre") genre: RequestBody // "glb"
): CreateArtResponse
```

3.4.2 File Upload Parameters

- Authorization Header: Bearer {JWT}
- Cookie Header: access_tkn + refresh
- artworkId Part: String
- saveArtType Part: "3d"
- files List: application/octet-stream

3.5 Error Handling Matrix

Error Code	Component	Action
ERR_AUTH	TokenUseCase	Force re-login
ERR_ZIP	UnzipProjectUseCase	Verify ZIP structure
ERR_NAME	LoaderRepository	Validate name ≥3 chars
ERR_API	ApiService	Check network status

Annex 1: Official RealityScan Step-by-Step Guide

Available from: https://dev.epicgames.com/documentation/en-us/reality-scan/RealityScan-Step-by-Step-Guide or via the QR Code shown in the section **0 Prerequisites** of this document

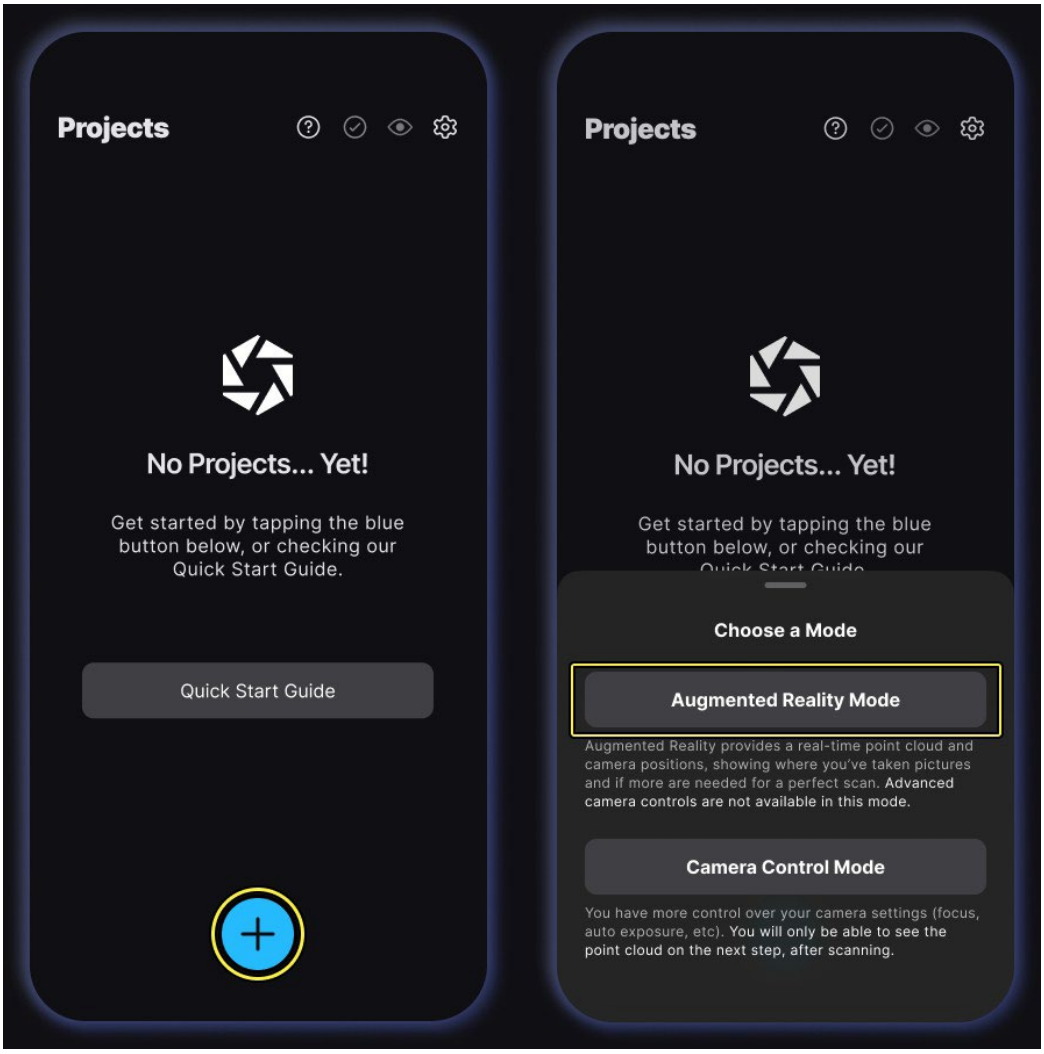
Follow the step-by-step guide to create a model in RealityScan.

This Step-by-Step guide is for new users of RealityScan and aims to show you the basics of getting started.

We will be using the default application settings in this guide and the Augmented Reality mode.

New Project

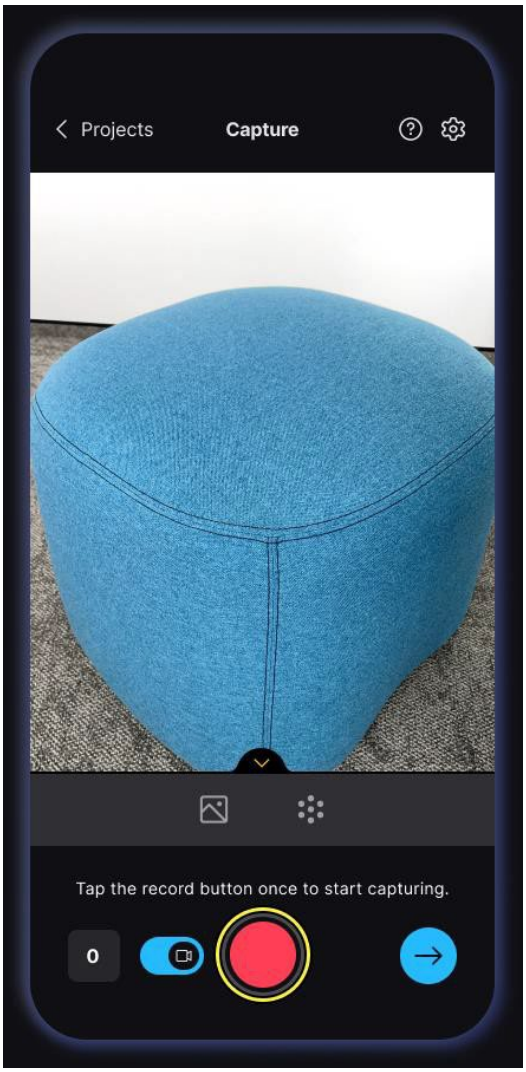
After going through the **Quick Start Tutorial**, first-time users will see an empty project list. To create a new project, use the "New project" button at the bottom of the screen. This will display a drawer menu where you can choose the scanning mode. For the sake of this guide, go with the "Augmented Reality Mode."



Capture Images

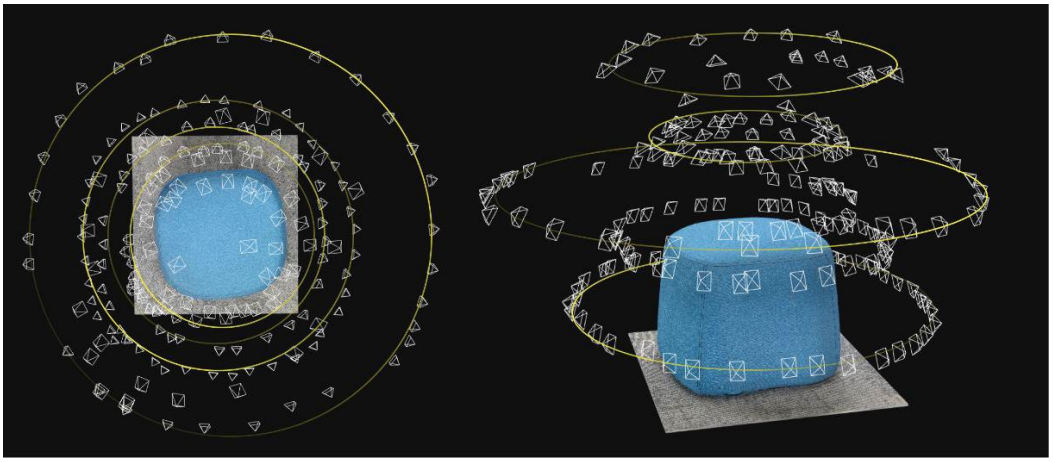
Tap the big red "Capture" button at the bottom of the screen to start capturing. We are using the default settings, meaning the auto-capture is enabled. Start slowly moving your device around the object, and the images will be captured with the detected motion. The image limit is 250.

To pause the auto-capturing, tap the big red button, or use the "Auto-capture toggle" next to the "Capture" button to switch to manual capturing.



When taking images, bear in mind that what is not visible in multiple images won't show up in the resulting model. Make sure to cover every part of the object with a high image overlap. A good rule of thumb is to make circles and arches around the object at multiple heights and at least half of each image to be of the object.

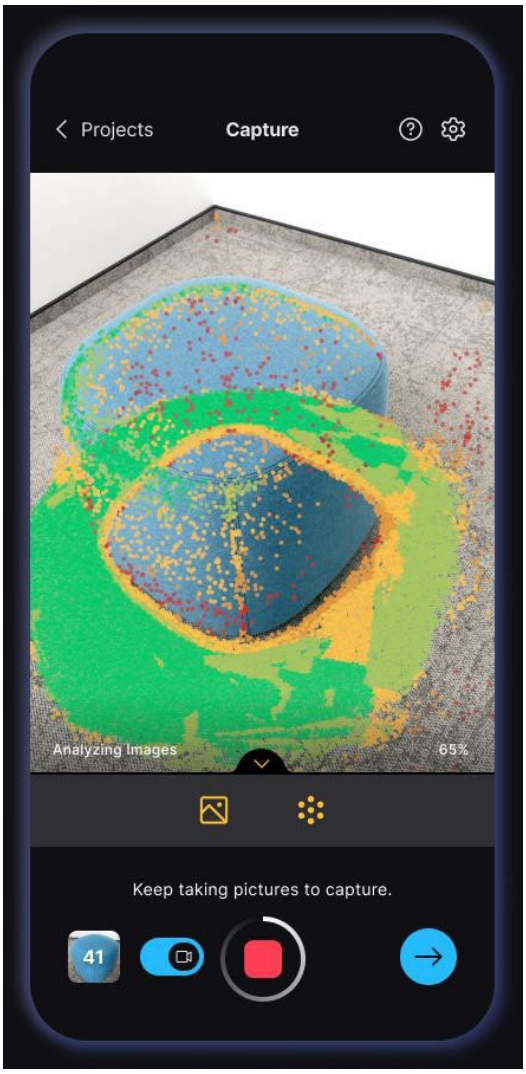
When you are unable to go around the object, follow its shape while ensuring high image coverage and overlap.



Upload and Analyze Images

Images will start uploading the moment you begin capturing them, and they will be analyzed after you take **20 images**. The processes of uploading and analyzing are interleaved, with uploading occurring first, followed by initial analysis, then uploading again, and so on.

Analyzing images calculates camera positions and detects common features from which the point cloud will be created. The point cloud shows up in the camera view after the initial analysis in the quality render mode, helping you to notice parts where the image coverage could be improved.

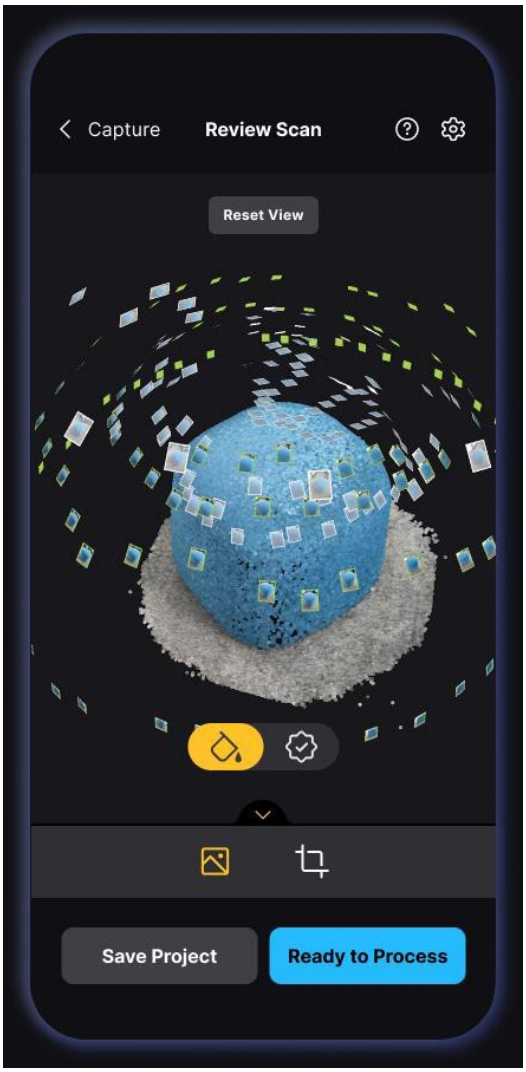


To avoid interruptions and ensure a smooth workflow, please stay within the app without switching to other applications while working on your project.

Review Scan

Use the "Next step" button at the bottom right of the screen to review your scan. You can render the point cloud in color or quality mode and navigate around it without AR.

You can still return to capturing images from this step, so we do not recommend moving far from the object.



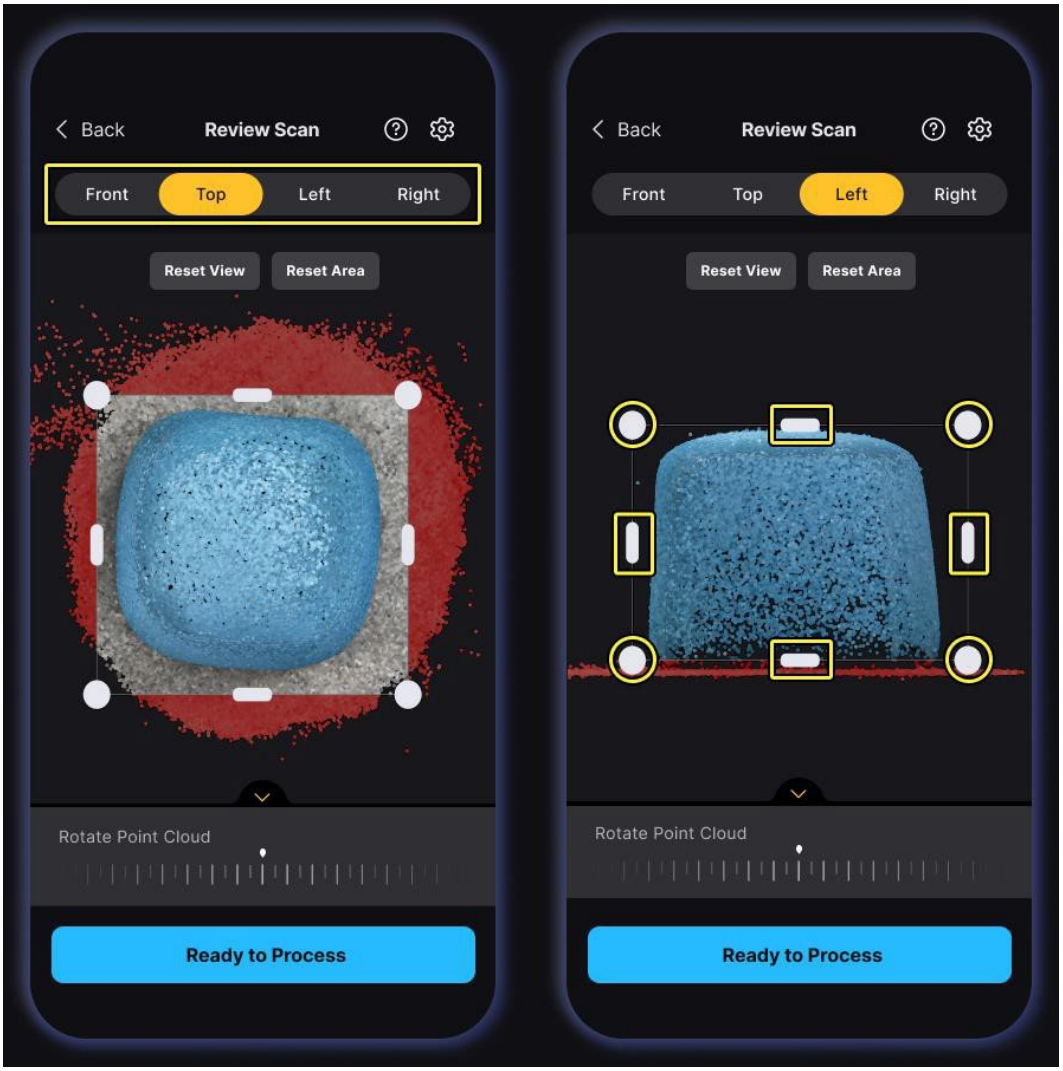
When the images have been analyzed, and you are satisfied with the point cloud, tap the "Ready to Process" button or the "Reconstruction area" button—the right button in the footer.

Reconstruction Area

In the next step, before setting up the processing settings, you can adjust the reconstruction area to filter out unwanted parts of the point cloud. Everything outside the reconstruction area will not be used in the reconstruction and will thus not be in the final model.

Use the upper bar to change the view perspective and the box widgets to change the box size. The circular corner widgets adjust the size in two directions, and the oblong edge widgets adjust only the size parallel to the corresponding edge.

Moving the rotation slider will rotate the point cloud around the axis perpendicular to the device screen.

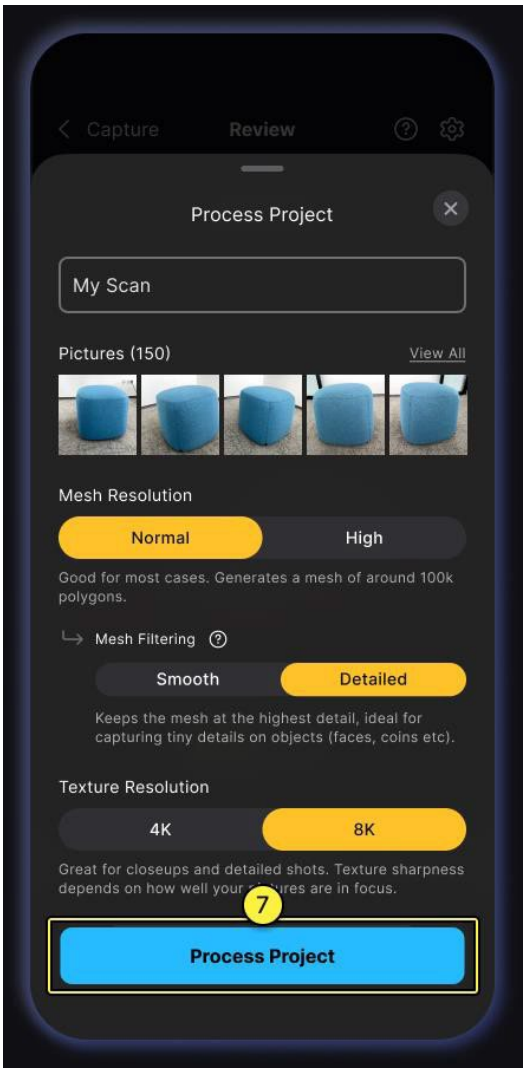


Use the "Ready to Process" button at the bottom of the screen to proceed to the final step: setting up the project information and starting the processing.

Process Project

Before saving your project, the **last step** is to give it a name and set model settings that will affect your resulting model.

Use the "Process Now" button to reconstruct and **download** a textured model to your device. If you want to do it later, use the "Process Later" button. Both options will take you to the project list, but processing now will process your project in the background.



After your project is processed and you can see its status has changed correspondently, your model will automatically be **downloaded** to your device. Learn where to find your model and images in the Project File[1] document.

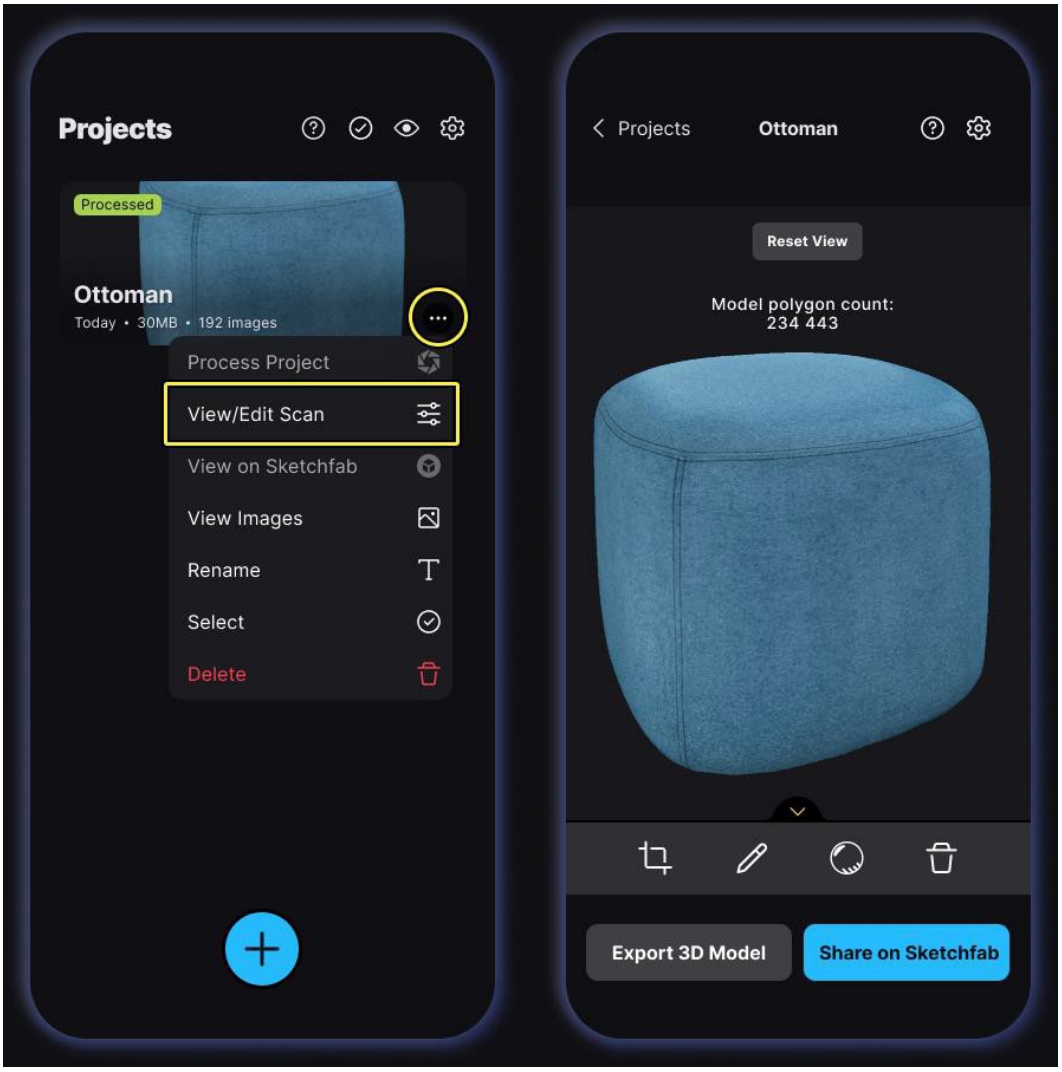
[1] https://dev.epicgames.com/documentation/en-us/reality-scan/RealityScan-Project-Files?revision_hash_id=YdBMv

View and Edit Scan

This step is optional; follow these instructions to share your model on Sketchfab, or export an edited model to your device.

In the project list, you will see your project as a card, and in the upper left corner of that card, you can see the project status. If you decide to process the project, the status will say **Processing**, and selecting to process it later will say **Unprocessed**. Either way, you must process your model and wait for the processing to finish before viewing and editing your scan. The status will say **Processed** once it is ready.

Open the project settings using the three-dot button in the project card, and tap the "View/Edit Scan" option to see, edit, export, or share your 3D model—tapping the project card will do the same. If your project was not processed, or is still processing, you will have to wait for it to finish.



Use the left button in the footer at the bottom to crop your model. **The original model won't be altered**, but you can share the cropped model on Sketchfab or export it to your device.
To rename your project, use the middle button in the footer, and to delete it, use the right button.

After processing, the model is automatically **downloaded** to your device, so viewing and editing are quick and easy.