Design Report

AR App for Museum

GROUP 12

Anurag Ramteke	150101010
Ayush Jain	150101012
Deshmukh Udayraj	150101021

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1.Introduction

1.1 Purpose

The purpose of the design document is to give software development team overall guidance to the architecture of the software project.

1.2 Overview

The design document tells through ERD diagram, decomposition diagram and DFD diagram the entire architecture of the software to be developed.

2. SYSTEM OVERVIEW

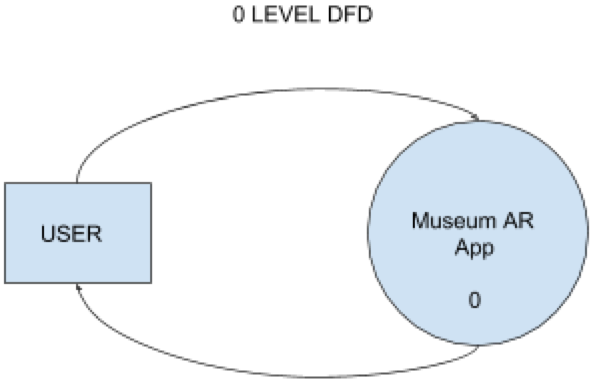
Functionality : The app has to show information about the monuments from a museum when placed in the camera view. For showing the information the app will be using augmented reality. After capturing the image or simply pointing the phone camera towards the monument, the app will detect the monument and then information about that artifact being captured will be shown

Context : Context of the system is visitors of the museum who have access to a smartphone, their camera phones and the monuments in the museum.

Design Approach : The approach followed in this document is function-oriented design approach.

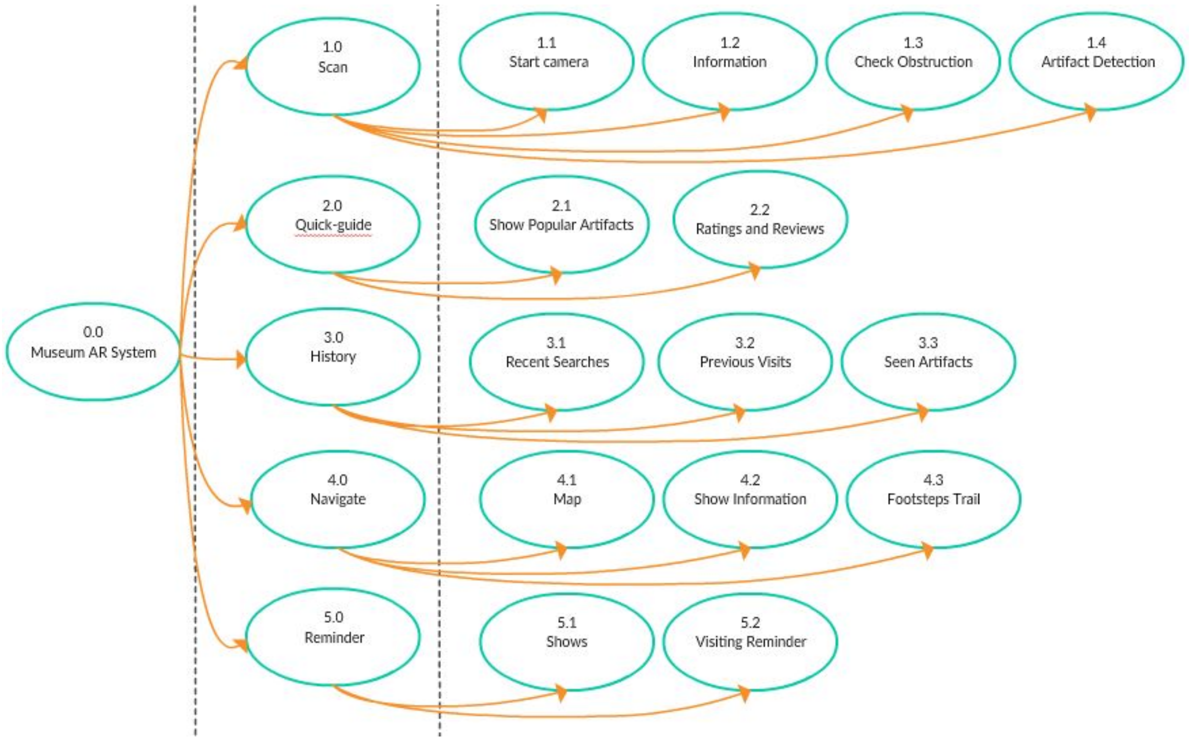
3. SYSTEM ARCHITECTURE

3.1 Contextual Diagram



3.2 Decomposition Description

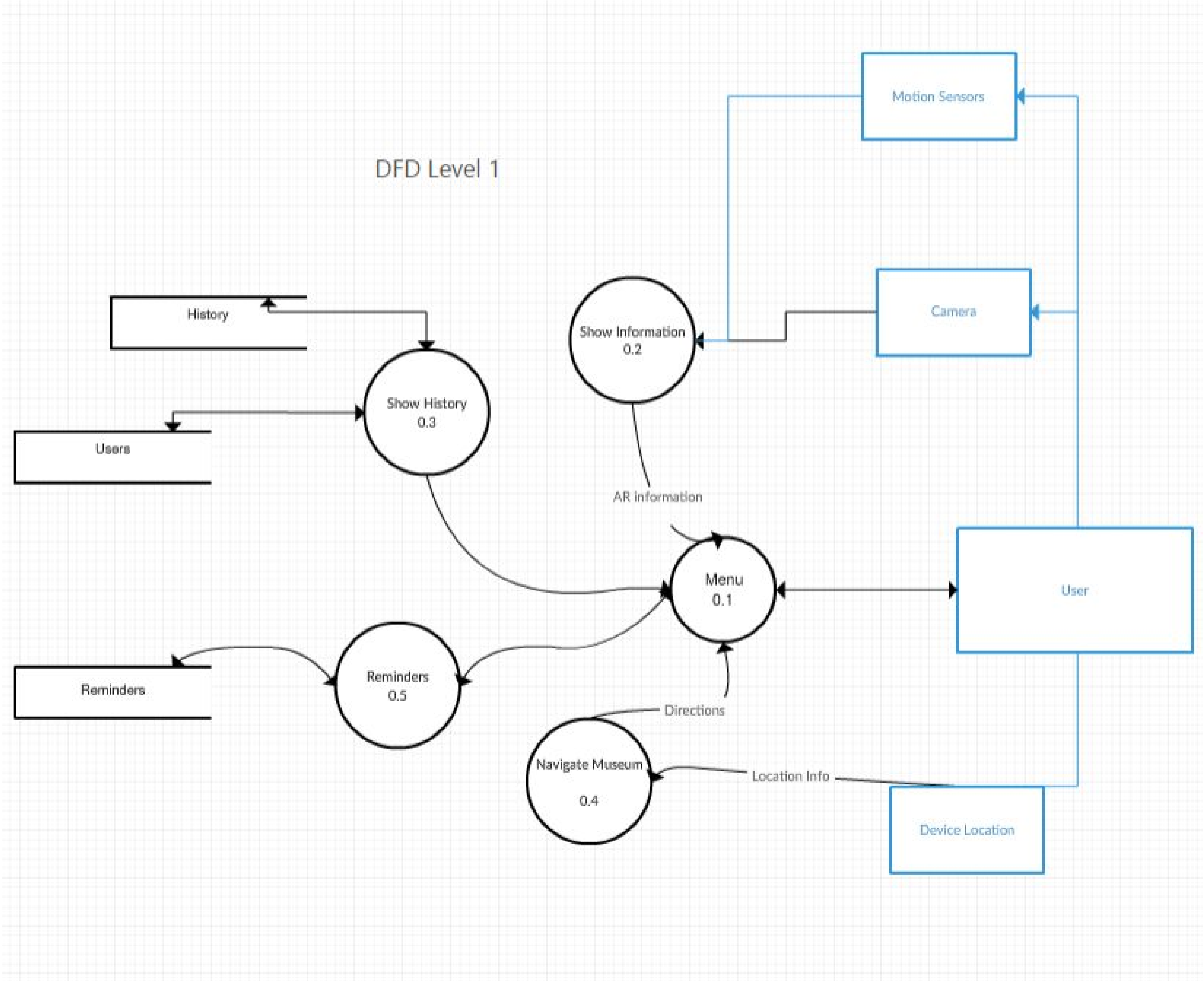
Process Decomposition of the project is as follows -



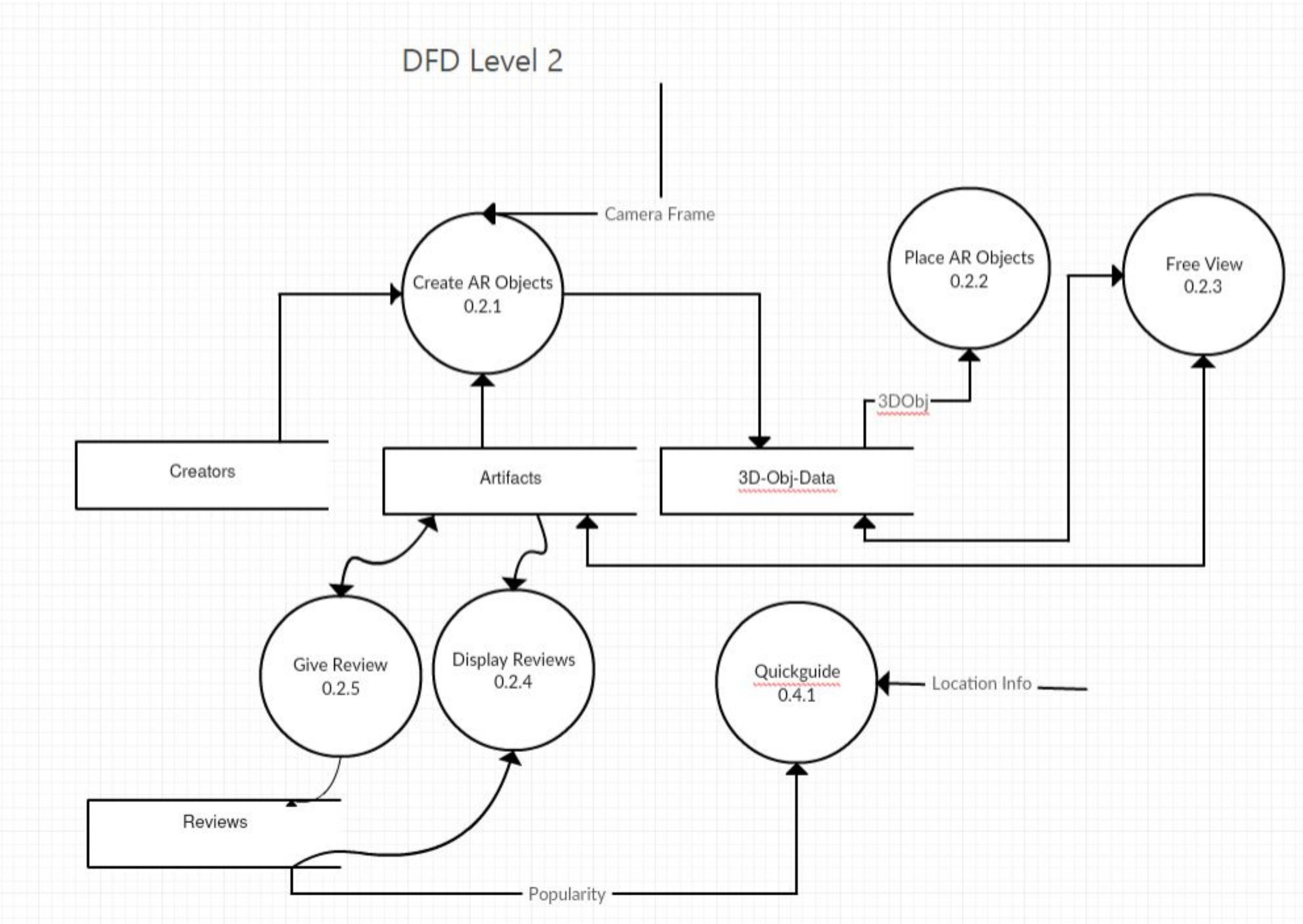
4. Data Description

The Data process of the project.

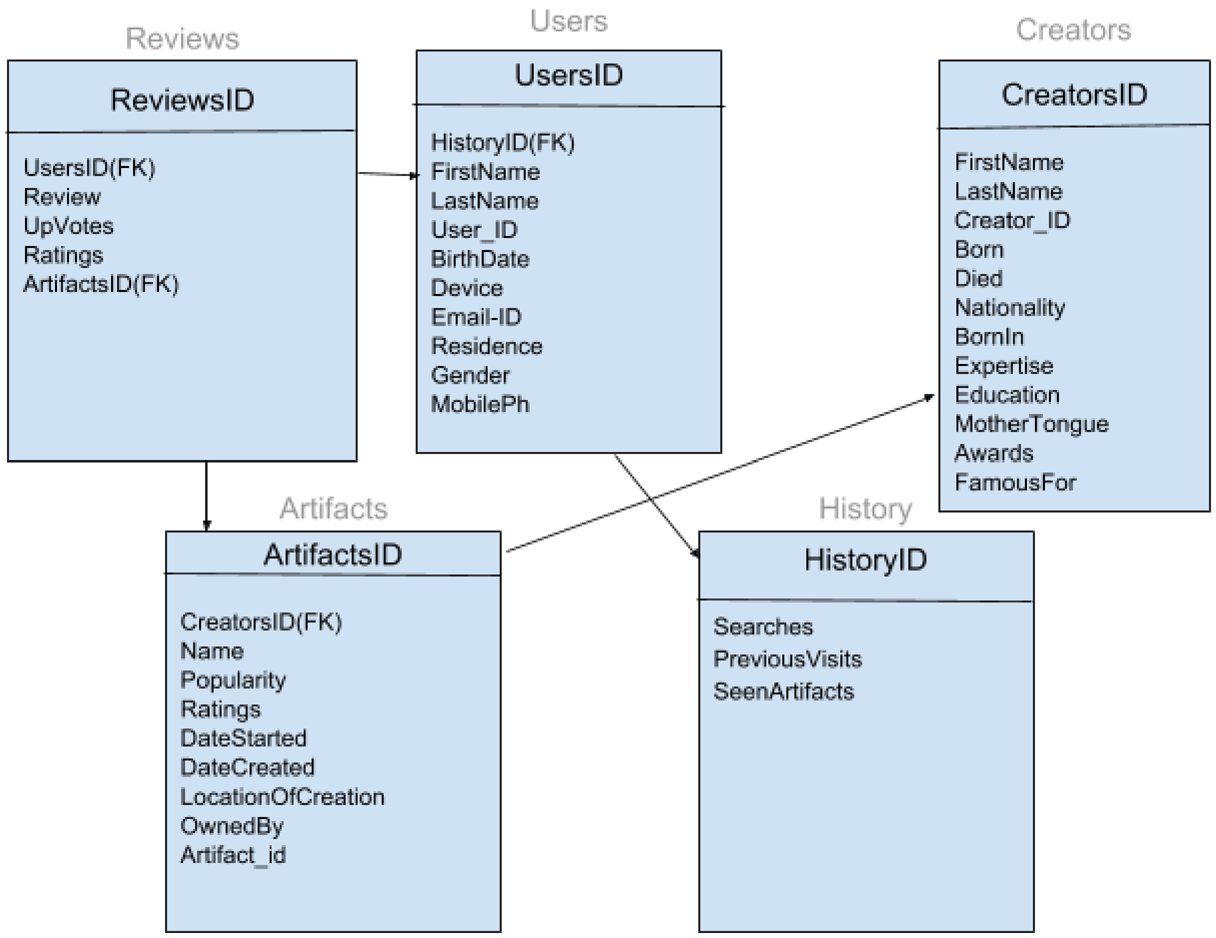
4.1. DFD level 1



4.2. DFD level 2



4.3 ERD


Reviews
ReviewsID
UsersID(FK)
Review
UpVotes
Ratings
ArtifactsID(FK)
Users
UsersID
HistoryID(FK)
FirstName
LastName
User_ID
BirthDate
Device
Email-ID
Residence
Gender
MobilePh
Creators
CreatorsID
FirstName
LastName
Creator_ID
Born
Died
Nationality
BornIn
Expertise
Education
MotherTongue
Awards
FamousFor
Artifacts
ArtifactsID
CreatorsID(FK)
Name
Popularity
Ratings
DateStarted
DateCreated
LocationOfCreation
OwnedBy
Artifact_id
History
HistoryID
Searches
PreviousVisits
SeenArtifacts

4.4 Data dictionary :

Alphabetically ordered list of functions and data-items

Entity Name	**Data Type**	**Description**
ARobject	objBoundary+relative 3Dpoints	Defines the object boundary and relative 3d positions of the boundary of the detected monument
Color	{integer}3	RGB value of a point(pixel)
Creators	Array of Strings	Name of creator(s)
date	integer	-
Date-of-creation	year+month+date	The date, month and year that monument was created
History	Array of Strings	Recent searches, previous visits, list of already covered artifacts
meaning	string	Meaning of the monument explained by the creators and/or philosophers
month	integer	-
name	string	Name of the Monument
objBoundary	{screenPoint}2	two points of the rectangular Boundary
objdata	string	encoded 3D object data points
ObjectInfo	Array of Strings	Name, meaning, historical data and significance and date of creation of the monument
point	posX+posY+posZ+Color	Coordinates of a point and color of that point(pixel)
posX	integer	-
posY	integer	-
posZ	integer	-

relative3Dpoints	{point}*	Points of the rectangular Boundary relative to each other
screenPoint	posX+posY	Coordinates of a point on device screen
year	integer	-
ImageFrame	image	Camera’s original captured frame
AugmentedFrame	image	The image frame with overlay of the AR objects
MotionSensorData	GyroscopeData + AccelerometerData	The total available sensors data
GyroscopeData	{integer}3	gyroscope measures the rate of change of the Axz angle. Its components along the 3 axes.
AccelerometerData	{integer}3	Components of the Force Vector along the 3 axes.

5. Component Design

In this section, we take a closer look at what each component does in a more systematic way.

Detect Object:-The camera will point towards the object and detect it(the user doesn't have to take the picture, the picture will be taken automatically for the history log

Function Name	Detect Object
Data Input	ImageFrame
Data Input Type	ImageFrame
Data Output	Detection status, objCoordinates & Id of a detected object
Steps to Detect Object	
Step 1	Enhance the image frame
Step 2	Scan the image for any object matching with the database (using Viola Jones Algorithm)
Step 3	If multiple objects are matching, scan for presence of the registered QR code, if QR code is not found, return [Detection status as "Require QR code", objCoordinates as detected and Id as NULL]
Step 4	Return Detection status, objCoordinates & Id

Show Information :- After detecting the object, all the related information should be loaded.

Function Name	Show Information
Data Input	Object_Id & objCoordinates & Screen dimensions
Data Output	ImageFrame + ARobject + objCoordinates + MotionSensorData
Steps to Show Information	
Step 1	Retrieve Artifact Info from the database using object Id
Step 2	Create AR object(Artifact Info)
Step 3	Return Place VR objects(ImageFrame + ARobject + objCoordinates + MotionSensorData)

Create AR objects :- Based on the object detected it will create an AR object and will show on the screen.

Function Name	Create AR Object
Data Input	Artifact Info
Data Output	relative3Dpoints
Steps to Create Ar Object	
Step 1	Load the 3D information template from database.
Step 2	Put details of Artifact Info (i.e. name,meaning,history,etc) into respective string fields of the template.
Step 3	Calculate dimensions of the projection of the filled 3D template onto the screen (i.e. X-Y plane). Store them as objBoundary
Step 4	Store the Points' positions relative to the common origin as relative3Dpoints
Step 5	Combine objBoundary and relative3Dpoints together into an ARobject data.
Step 6	Return ARobject

Place AR objects :- According to the collected sensor data, the object is shown besides the object after doing following check accordingly.

Function Name	place AR object
Data Input	ImageFrame + ARobject + objCoordinates + MotionSensorData
Data Output	objBoundary and AugmentedFrame
Steps to place AR object	
Step 1	Calculate projection image of the ARobject using Projection Formula and the relative orientation calculated from MotionSensorData
Step 2	Shade the projection image using vertex Shader by taking objCoordinates
Step 3	Create AugmentedFrame by overlaying the ARobject’s projection onto the imageFrame.
Step 4	Return AugmentedFrame