

# **“GOexp” Landmark Recognition and Retrieval System**

## **Landmark Recognition**

Software Requirements Specification

Project Id - 18-107

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## DECLARATION

I declare that this is my own work and this SRS does not incorporate without acknowledgement any material previously submitted for a degree or diploma in any other university or institute of higher learning and to the best of our knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.



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N.G.K.S Gamage

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# **1. INTRODUCTION**

## **1.1 Purpose**

The purpose of this SRS document is to provide a detail description of the process and all the requirements for the “Landmark recognition” component of the project “GOexp”. This document will explain the brief description of the flow of the project, features, purpose of the system and the constraints which it will operate. The main consideration of this is to the implementation of Landmark Recognition system to detect the various unknown landmarks of the images that are given by the user. This will also contain necessary diagrams, interfaces and functional non-functional requirements of the system for providing a detailed overview of our software product, its parameters, scope, and goals. The document is primarily intended for a Subject coordinator, Supervisor and Co-Supervisor to serve as a reference document while developing this system, as a reference to the development team to develop and as a reference to the testers or evaluators. Since there is no client for this research project, this document act as a contract between the project team and client examiners to obtain the clear understanding and description of the requirements for the system is being developed

## **1.2 Scope**

Primarily the scope of the project Landmark recognition component can be defined as an attempt to provide a mobile-based solution for recognizing the unknown landmarks of the images. It focuses on the people who like to travel across the world. The technologies that will be used to develop the system are image processing and machine learning.

Landmark recognition component use an algorithm to identify the landmark as landmark object. To develop that component, this document clearly specifies the user requirements and developer guides as designs. It will help to understand the scale of the system.

Expected Benefits of this component are,

- Help people who need to identify the unknown landmarks of the images and provide detailed information.
- Help people better understand and organize their photo collections.

## 1.3 Definitions, Acronyms, and Abbreviations

### 1.3.1 Definitions

Terms	Definition
Landmark recognition	Sub-component of the “GOexp” system.
Software requirement specification	A document that completely describes all of the functions of a proposed application and the constraints under which it must operate
Image processing	A computer programming technique used to analyze and manipulate the digitized image for human perception.
Tensor flow	An open source software library for high-performance numerical computation.[1]
Machine learning	A data analytics technique that teaches computers to do what comes naturally to humans and animals: learn from experience.[2]
Component	The subsystem of the main application
GOexp	Main system name

Table 1: Definitions



### 1.3.2 Abbreviations

Abbreviations	Description
SRS	Software Requirements Specification
LR	Landmark Recognition
AI	Artificial Intelligence

Table 2: Abbreviations

## 1.4 Overview

Remaining sections of the SRS document explains landmark recognition component characteristics. General description of this component explains in section 2. It includes system interfaces, users of this component, UML diagrams, assumptions made while designing the component and other constraints. Section 3 gives the functional requirements, data requirements, and constraints. It includes user view interfaces. Also, this section 3 describes external interfaces and their functional requirements. In section 4 describes supporting information .it include the locations of the resources that we used to create this document.

## **2. OVERALL DESCRIPTION**

This section describes the whole overview of the “landmark recognition” component. Here describes how this “landmark recognition” component compared with other existing solutions. Other than that this section describes what type of users use this landmark recognition component and how can they operate this system. Referring to this srs document, developers and users can easily understand the how this component is going on. This section describes available constraints, assumptions and how this component communicates with other components and so on.

### **2.1 Product Perspective**

When we considering the existing system in the marketplace there are only a few mobile solutions available in the world market to recognize the landmarks of images. The most popular existing landmark recognition applications are google goggles. All these applications are not used to recognize only the landmarks.it also used to recognize products, paintings, popular images etc. Our application focus on only to recognize landmarks to helps people to save their time that used to find information. Mainly this product is a focus on tourist field. But it can be used in other sectors also.

To provide a perspective idea on landmark recognition, this section compares with other related and competing products available in the market today.

- Google goggles

Google Goggles is a mobile visual search application currently available for Android mobile phones that lets a user submit a search query by taking a picture.[3].google goggles can identify some visual cues or "landmarks" in an image and generate relevant searches. This technology can also recognize barcodes and even some kinds of text in a photo, such as printed text on a captured page. This program can provide information about a photo taken with a handheld device and has been used in various commercial and educational projects.[4]

- Camfind - visual search engine

Camfind is a search engine that can photograph, identify, and provide information on any object, at any angle. It enables visually impaired people to get the information they want, by

taking a picture and avoiding typing queries into the browser. Some of the application's features are:

- \* Internet search results.
- \* Related/similar images.
- \* price comparisons and online shopping.
- \* Related places and address finder.
- \* Film poster/DVD recognition.
- \* Instant sharing to Facebook, twitter, email, and text.

#### Additional functions

- \* Ability to upload and save images to or from the camera roll.
- \* QR and barcode scanner.
- \* Language translator.
- \* Voice search.
- \* Text search.

User take a picture then the app identifies the picture and not only speaks the result but it proposes on the screen many links related to the picture. The user can also speak anything he-she wants and the app proposes all the related results to the screen.[5]

- Bixby vision

Bixby vision is a new feature on the Samsung galaxy s8 and s8+. You will need to be connected to a Wi-Fi or mobile network, and signed into your Samsung account on your device to use it.

Shopping: Bixby vision can recognize products and search for information such as the product name and its price so you can find and purchase products even when you don't know what it is called.

Nearby places: Bixby vision can recognize landmarks and share information about it and what's nearby.

Text translation: need to know what a sign or menu says? Tap the translate icon to translate it.

Wine information: Bixby vision can tell you a wine's vintage chart, food pairing and world ranking from the bottle's label.

Similar images: search for images similar to the Bixby vision is looking at.

Qr codes: quickly view the information from QR codes.[6]

Features	GOexp	Google goggles	Camfind-Visual Search Engine	Bixby Vision
Recognize landmarks of the images	✓	✓	✓	✓
Recognize various objects of the images. (Such as products, letters)	X	✓	✓	✓
Mainly focused on identification of the landmark of the images.	✓	X	X	X
Use dataset that contains around 30,000 unique landmarks.	✓	X	X	X

Table 3: Comparison of Landmark Recognition applications

### **2.1.1 System interfaces**

From this section of the document covers the individual research area that contributes to the GOexp application. The individual research area covered up by this document is the identification of the landmarks of the given images and retrieve the details of that landmarks. Once the system recognizes the landmark, it will provide various kind of facilities to the user in this system in order to provide business value for the users. That facilities are implemented by other components of the system. The recognition of the landmark will be done by creating a model and train that model using the datasets. In order to implement this system, Android API is used to design the interface.

### **2.1.2 User interfaces**

This section provides the basic sketches of the main interface of the Landmark Recognition Component that include the Android application GOexp. This interface gives the user to access to all functionalities of Landmark Recognition.

This section provides the basic sketch of the main interface of the landmark recognition component. This is the major component of the GOexp system. In this interface what I expect to do is get the images from the gallery or by taking an image from the camera in order to proceed the landmark details. Likewise, after the analysis of the image, if the system recognizes the landmark this interface provides navigation to another page in order to show the landmark details. In order to provide some idea of this LR component, the sketched interface is shown in below. The sketched Interfaces may change when the developing is in progress.



Figure 1: Main user interface sketch of landmark recognition

### 2.1.3 Hardware interfaces

This component does not require any specific hardware components to function. Yet the system will be developed as a mobile application where an Android enabled mobile phone would be required for the hosting purposes.

### 2.1.4 Software interfaces

The user will require an Android device to have GOexp android application, therefore a mobile application should be installed on the user's Android device. The application GOexp will be developed using the android studio.

### 2.1.5 Communicational interfaces

As the landmark recognition & retrieval system is a mobile-based application, the connection to the internet should be established before the execution of the landmark recognition process, therefore, Android enabled mobile phone with 3g/hspda/Wi-Fi connection needed for high-speed connectivity of the internet.

### **2.1.6 Memory constraints**

Landmark recognition component should have at least 1 GB ram and 100 MB free space to gain better performance.

### **2.1.7 Operations**

This LR component is mainly focused on people who need to find places by using images. Also after this LR part done. That means system identify the landmark of the given image, this system functioning user reservations around the area that landmark located. This reservation part is done by a different component of this “GOexp” system. So this LR component is the main component of this GOexp application. This landmark recognition technology will be very supportive of the people who love to travel over the world without knowing the places.

The main operation- identify the landmark.

User operation- upload an image with the unknown landmark.

Machine operation-

- i. Recognize the landmark (AI part)
- ii. Retrieve the landmark details and showing it to the user.
- iii. Upload the image to the database and add that image to the user history.

### **2.1.8 Site adaption requirements**

As LA component is the part of GOexp application it required android enabled mobile device

The whole System will display the information using in the English Language.

Interfaces of the LA component developed in a user-friendly manner in order to give the best product satisfaction to the users.

## 2.2 Product Function

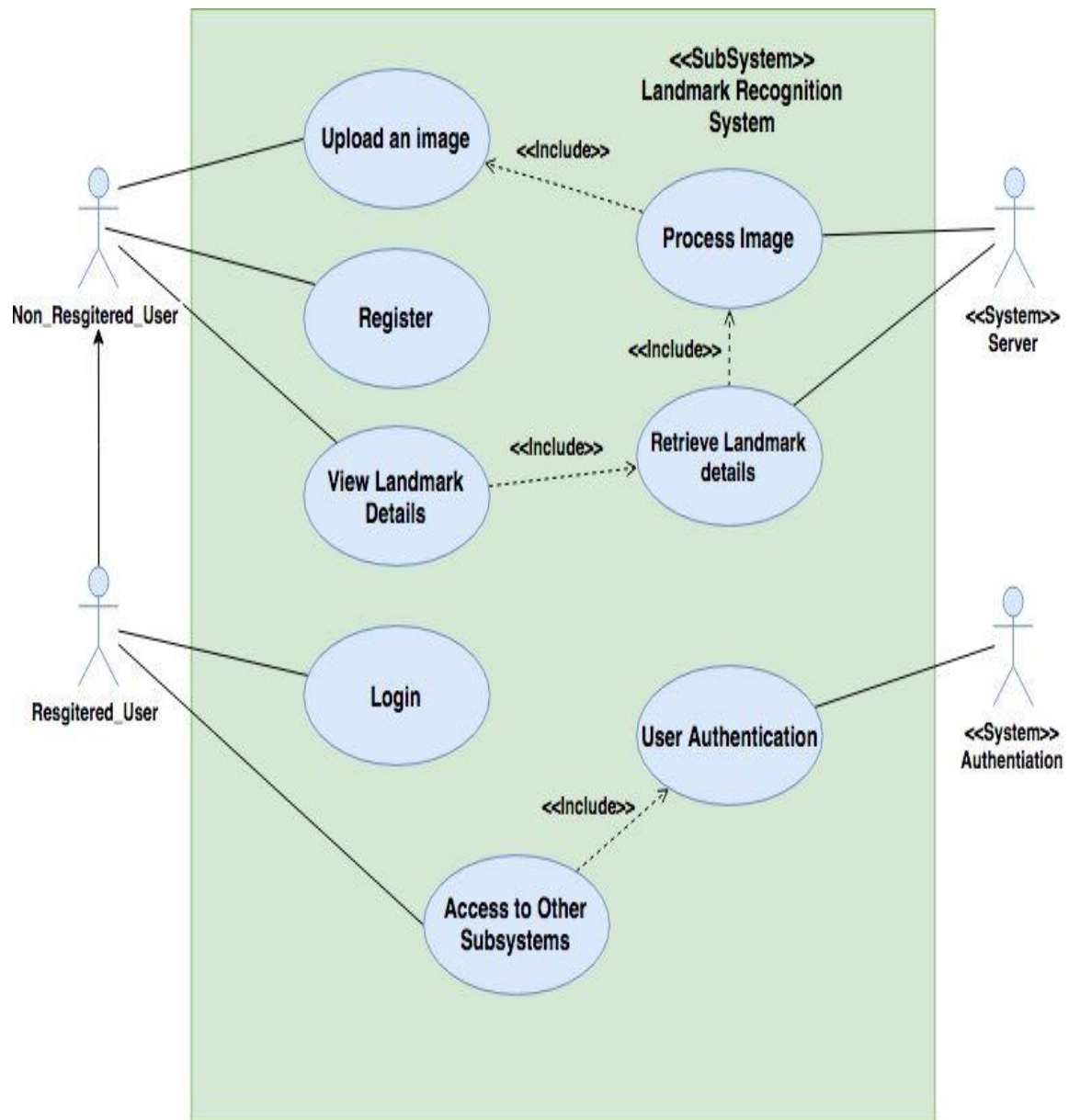


Figure 2: Overall use case for landmark recognition



Use case	Register
Preconditions	The user should have an email address
Actors	Registered user, non registered user
Flow of events	<ol style="list-style-type: none"> <li>1. Use case starts when the user launches the app.</li> <li>2. The system display user mode selection interface.</li> <li>3. User select registered user mode</li> <li>4. The system displays sign-up interface.</li> <li>5. The system prompts the user to sign-up with the GOexp app</li> <li>6. The user is navigated back to the login page</li> <li>7. The use case ends.</li> </ol>
Extensions	<ol style="list-style-type: none"> <li>3. A. User select registered user mode <ol style="list-style-type: none"> <li>3. A.1. The user enters email and password.</li> <li>3. A.2. User clicks on sign-up.</li> <li>3. A.3. User's email address is validated.</li> <li>3. A.4. The system sends email verification to the email.</li> <li>3. A.5. The user is redirected to the login page.</li> </ol> </li> </ol>

Table 4: Use case scenario - Register

Use case	Login
Preconditions	User must be registered in the system.
Actors	Registered User
Flow of events	<ol style="list-style-type: none"> <li>1. Use case starts when the user launches the app</li> <li>2. The system displays login interface.</li> <li>3. The user enters username and password.</li> <li>4. User clicks on 'login' button.</li> <li>5. The user is validated.</li> </ol>

	6. The system displays the message “hello <user name>” 7. The use case ends.
--	---

Table 5: Use case scenario – Login

Use case	Upload an image
Preconditions	The database should be connected to the backend.
Actors	Non-Registered User, Registered User
Flow of Events	<ol style="list-style-type: none"> <li>1. Use case starts when the user launches the app.</li> <li>2. The system display user mode selection interface.</li> <li>3. The user selects User mode</li> <li>4. User redirect to the LR interface</li> <li>5. User select image upload option</li> <li>6. Upload image to the system.</li> <li>7. The system displays the message “Image upload successfully”</li> <li>8. The use case ends.</li> </ol>
Extensions	5.A. User select option upload image from gallery

	5.B. User select option take an image from the camera
--	---

Table 6: Use case scenario – Upload an image

Use case	View landmark details
Preconditions	The database should be connected to the backend.  Image needed to be uploaded.
Actors	Non registered user, registered user, system
Flow of events	<ol style="list-style-type: none"> <li>1. Uses case started when a user uploads an image to the system.</li> <li>2. System process the image.</li> <li>3. The system retrieves the details of the image.</li> <li>4. User clicks the button to view Details.</li> <li>5. The system displays the landmark details.</li> <li>6. The use case ends.</li> </ol>

Table 7: Use case scenario – View Landmark details

Use case	Access to other subsystems
Goal	Show the options of another subsystem to the registered users.
Preconditions	The user should be logged into the system.
Actors	Registered user
Flow of events	<ol style="list-style-type: none"> <li>1. Use case starts when the user login to the system.</li> <li>2. User redirect to the lr interface.</li> <li>3. User uploads an image.</li> <li>4. System process and retrieve landmark details.</li> <li>5. The system checks the user is registered or not.</li> <li>6. The system shows advanced options of the application.</li> <li>7. The user selects the other options.</li> <li>8. Use case ends</li> </ol>

Table 8: Use case scenario – Access to other subsystems

## 2.3 User Characteristics

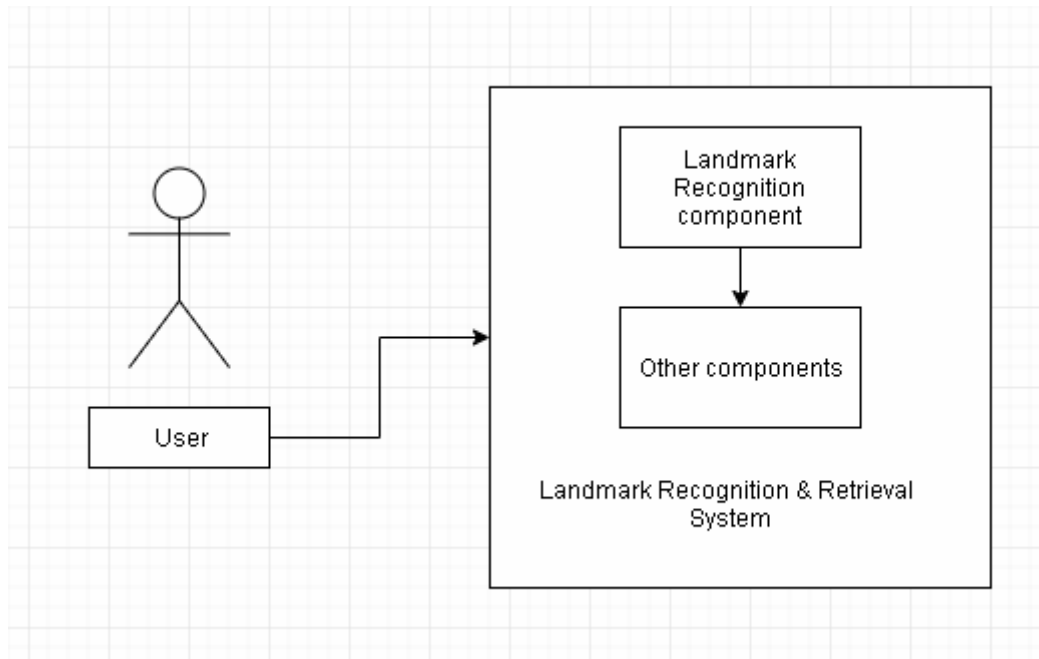


Figure 3: Connection of components

This application is mainly focused on people who familiar with the use of the android application and people who would like to travel and find new places.

When considering to the “GOexp” system there are 2 types of users that will be using the “landmark recognition” system,

- Registered user

In our “GOexp” application there 4 main component. In order to use this 4 components, the user needs to register first. These users can use the entire system including “landmark recognition” component. These individuals can be software professionals. Therefore this proposed system is created for the individual with the good knowledge of computer literacy. These are the type of people who would like to use 1 application to get everything.

- Non registered user

These users can't use entire system .what they can use is only the "landmark recognition" component. In that component what users can do is identify the unknown landmark details only. In order to use full features of the application, the user has to register first.

## 2.4 Constraints

This system consists of the mobile application. Therefore mobile application constraints should consider. In order to work with a better level of quality, bellow mentioned memory limits are needed by the application.

### Mobile application

- Mobile phone should have an Android operating system to run the application.
- The Android version should be 5.0 or above. And must have a most recent version of the application.
- Mobile phone CPU should be 1 GHz or above for optimal performance. So that all the processing tasks would be done faster and the user would gain the output results very faster.
- Mobile phone ram should be 1gb or above for better performance
- Mobile phone should have a camera with a resolution of 7 megapixels or above for optimal performance.
- Internet connection is required for the software to function properly. High bandwidth is encouraged for smooth operation.

### Implementation constraints

- Android would be needed for mobile application development.
- Firebase would be used for data storing purposes of mobile application.
- Android studio ide should be used as the development environment for android implementation.

## **2.5 Assumptions and Dependencies**

### **2.5.1 Assumptions**

- There should be a network connection
- The entire hardware and software requirement should meet the client and server.
- The database should be secured with passwords and username from unauthorized access.
- The system is developed with the understanding of both the language grammar.

### **2.5.2 Dependencies**

- GOexp system is depended on the network connection of the mobile device.
- The user should provide correct details in order to get good suggestions

## **2.6 Apportioning of requirements**

The SRS document section 1.5 provides the overview of the supposed subsystem requirements and section 2 provides the detailed overall description of the subsystem. Section 3 contains detailed requirements that should be followed while design and implementations. The subsystem “landmark recognition” is supposed to be implemented with the preliminary and functional specifications in section 3. There may be few changes in the final product due to time constraint but will be fulfilled in a future release

### 3. SPECIFIC REQUIREMENTS

#### 3.1 External interface requirements

##### 3.1.1 User interfaces

Below user interface sketches show how the LR component of the GOexp application identifies the landmark of the images.



Figure 4: Interface for user sign in





Figure 5: Interface for user sign up



Figure 6: Interface for image upload

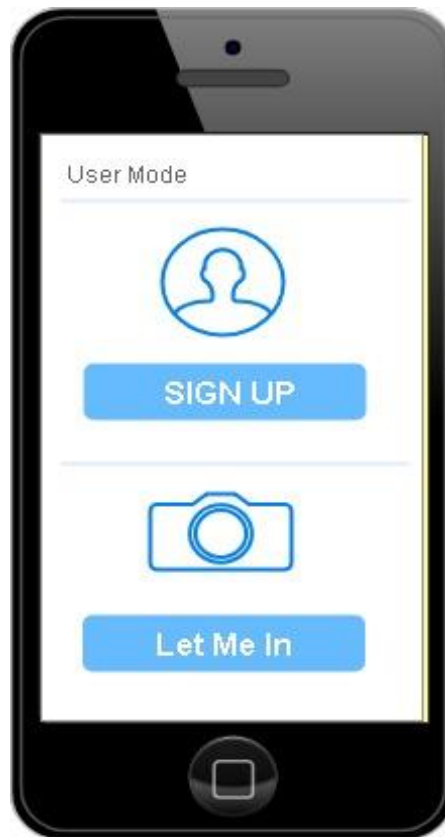


Figure 7: Interface for user mode



Figure 8: Interface for landmark result

### 3.1.2 Hardware interfaces

Since the mobile application doesn't have any designated hardware, it does not have any direct hardware interfaces.

### 3.1.3 Software interfaces

The required software interfaces are shown below,

Android studio	Development purposes
Firebase	NoSQL database management
Tenser flow	Machine learning purposes

Table 9: Software interfaces

### 3.1.4 Communication interfaces

As the "Landmark Recognition" component is a part of the "GOexp" mobile-based application, it's heavily depended on the network. The client applications must need to connect to the database through the internet.

### 3.2 Classes diagram

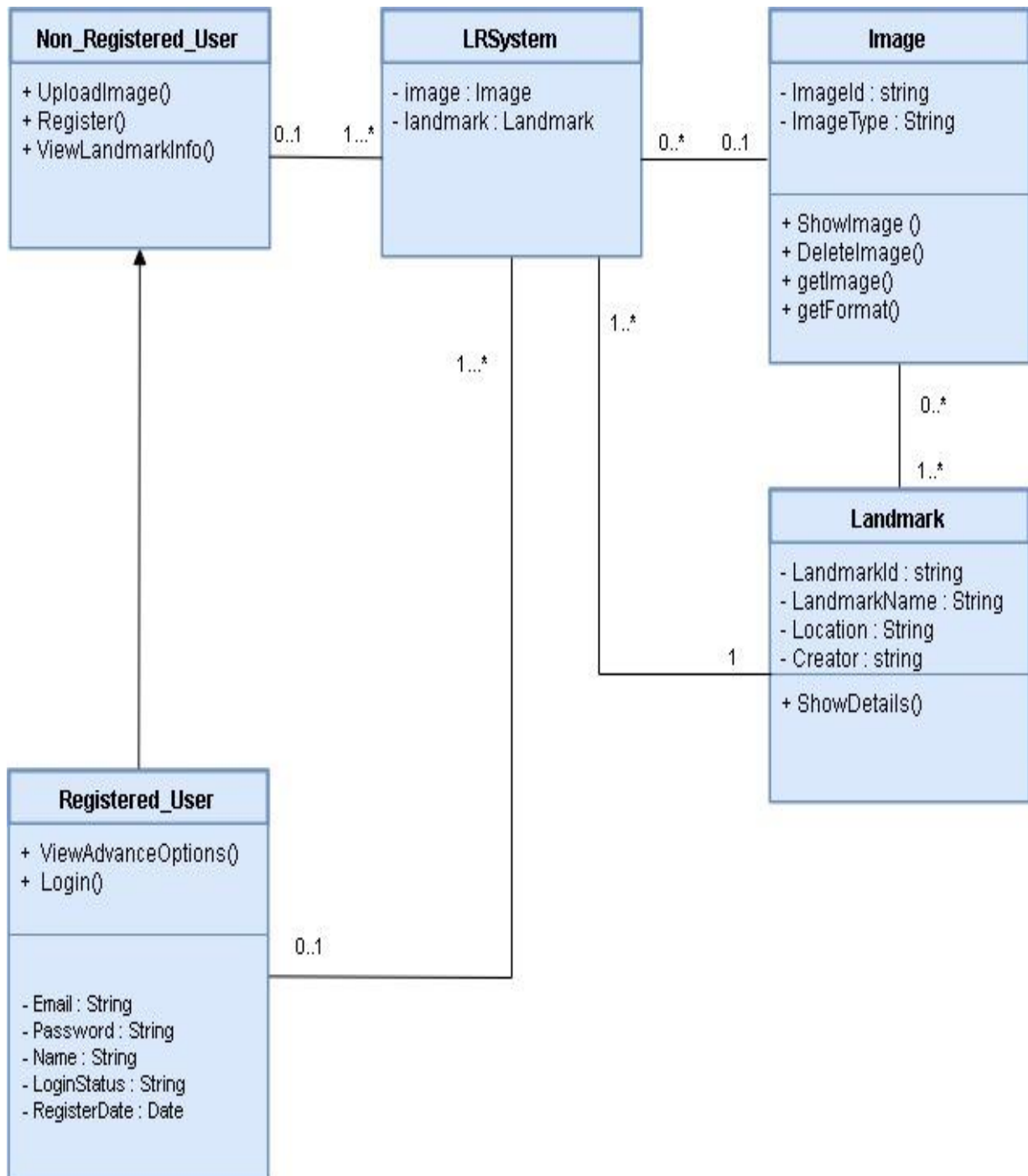


Figure 9: Class diagram

### **3.3 Performance requirements**

The successful output is the ultimate desire of the GOexp system. If the system is performing properly without delaying replies then the performance of the system is more than the moderate level.

The ultimate desire of this “Landmark recognition” component is to produce a successful product, If the performance, of this “Landmark recognition” component is high then it’s massively affected the whole application performance.

This component totally depends on the quality of the image that is given by the user. That means if a user uploads an image with bad quality, then the system can’t identify the landmark that is in the image. If there are high-quality images, this component accuracy will increase. In addition to that performance of the network is the next thing that affects the application performance. That means client device needed to have good internet connection in order to have a consistent connection between client and server. Other than that if the mobile device has low features such as low memory, low android version then application takes a lot of time to execute the output so the performance of the application degrades. Even though the user has a high-performance mobile device but low-speed internet or not proper communication then the GOexp system will not show the maximum performance

Other than that this application supported to access simultaneous users and only one application instance can run at a time.

### **3.4 Design constraints**

GOexp is a mobile application. Therefore while developing the mobile application main constraint is the display real state. The designer should follow a very consistency design throughout the application and should choose a very promotional and a state of art design. Navigation should be user-friendly and should be able to find wanted information in few clicks

### **3.5 Software system attributes**

#### **3.5.1 Availability**

If the system can identify the landmark of the image at a given time then the availability of the “landmark recognition” component is a success. In order provide this service user device needed to have internet connectivity.

The interfaces should be simple and easily understandable to users and it should be real time.

#### **3.5.2 Maintainability**

The requirements are changing rapidly day by day and the technology is getting advanced, so the existing system getting expired. The new requirements have to be identified gathered and new features should be added to the system to achieve the performance and the productivity. Considering it the GOexp is been designed to assists for the updates of the software in future. The code is commented wherever it is necessary, especially in critical and complex code segments. This will help the developers or the maintaining team for further modifications in future.

#### **3.5.3 Security**

Security is a major software requirement of any software application. Therefore the system should provide complete security mode to maintain the security of the system.

When user mainly uploads an image to the system it will upload to the database. These images can be protected and give access to view the images only to the user.

#### **3.5.4 Reliability**

The algorithm training, landmark recognizing and landmark details retrieve should be done accurately.

The algorithm is trained using a large dataset that contains 30,000 unique landmarks To make sure it's probability of identifying landmark failure is very low value.

At a time of a failure in a system function, there should be a proper mechanism to notify the relevant users about the failure.

If the system can't identify the landmark of the image, at that time there should be a proper mechanism to notify the user about the failure.(ex-( 1)if the image quality is the issue, show the details about the issue.(2), if the dataset doesn't contain the landmark that equals to the given image. Then provide the details about the error.)

### **3.6 Other requirements**

- The system should not crash
- It should not make the user frustrated, angry or terrified while using the system
- Functionality should be suitable for all end users
- Extensibility & Modifiability
- Adaptability

## 4. SUPPORTING INFORMATION

### 4.1 Appendix

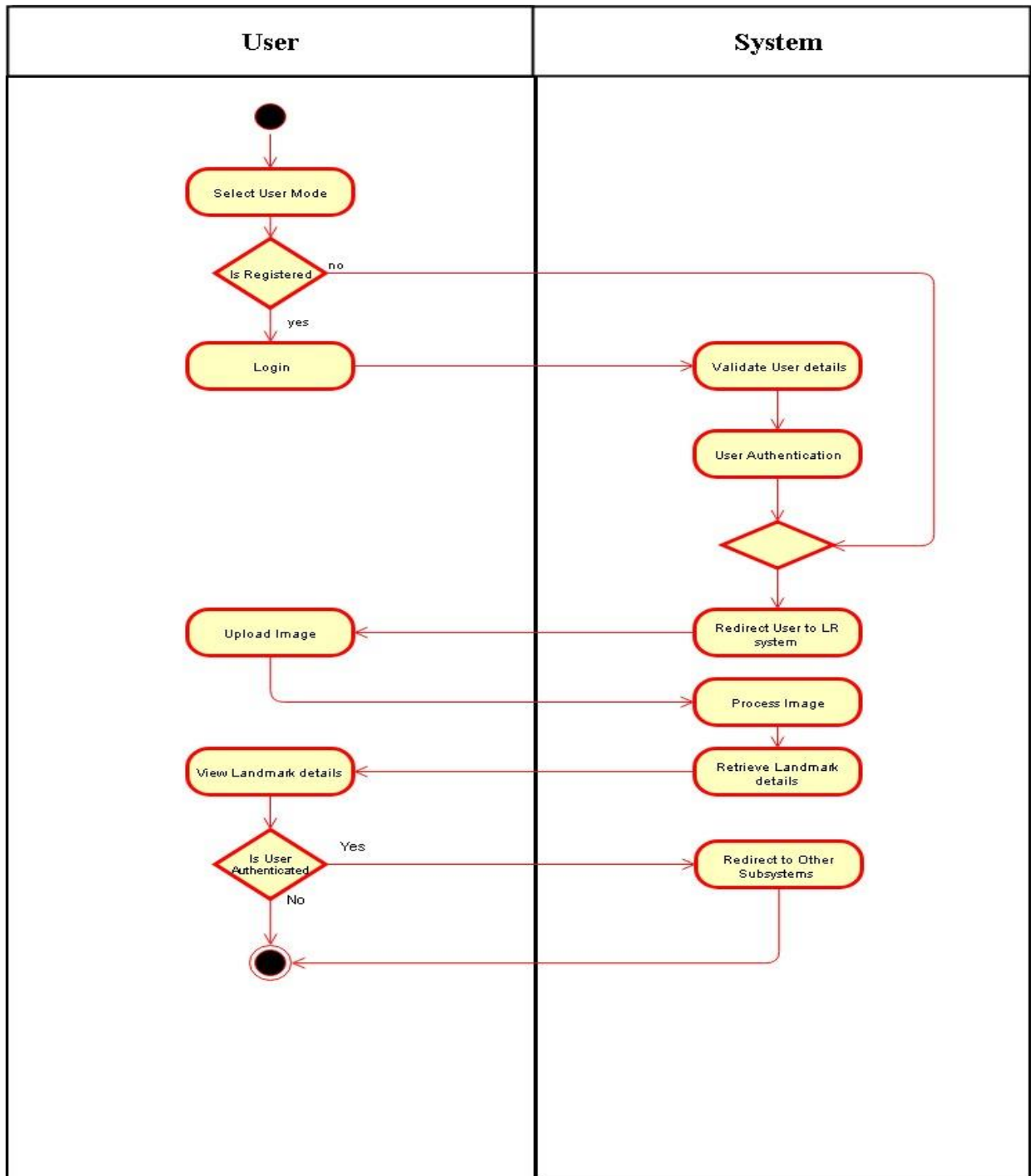


Figure 10: Activity diagram for LR system



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