3A04 Group 3: FIA
High Level Architectural Design

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March 21, 2018
Version 1.0

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Table 1: **Revision History**

Version	Date	Notes
1.0	28/02/2018	Created and updated document
1.0	08/03/2018	Finalized document for revision 1

1 Introduction

1.1 Purpose

The purpose of this document is to provide a detailed description of the high level architectural design used to construct the Flag Identifier Application (FIA). The following sections in this document decompose the system into subsystems and discuss the relationships among the subsystems. This document serves as a reference for stakeholders of the application, mainly developers, to refer to when implementing the system.

1.2 System Description

The system's primary function is flag identification. The system will allow the user to upload an image of a flag through their Android Smartphone. The system will also access of the GPS location of the Android Smartphone. This information will be handled by three system experts; colour expert, graph expert and GPS expert. With the help of these three experts, the system will be able to present the user with six flags, and their corresponding information, that best match the flag uploaded. The user will be able to select whether any of the returned flags match their uploaded image. The application will allow the user to view their previously searched flags. Additionally, the application will allow users to see the most searched for flags across all users.

1.3 Overview

The sections to follow contain in-depth descriptions of the subsystems of the system to be. This includes a Use Case Diagram (section 2), an Analysis Case Diagram (section 3), a detailed description of the Architectural Design (section 4), and Class Responsibility Collaboration cards (section 5). Appendix A details how each member of the development team contributed to the document.
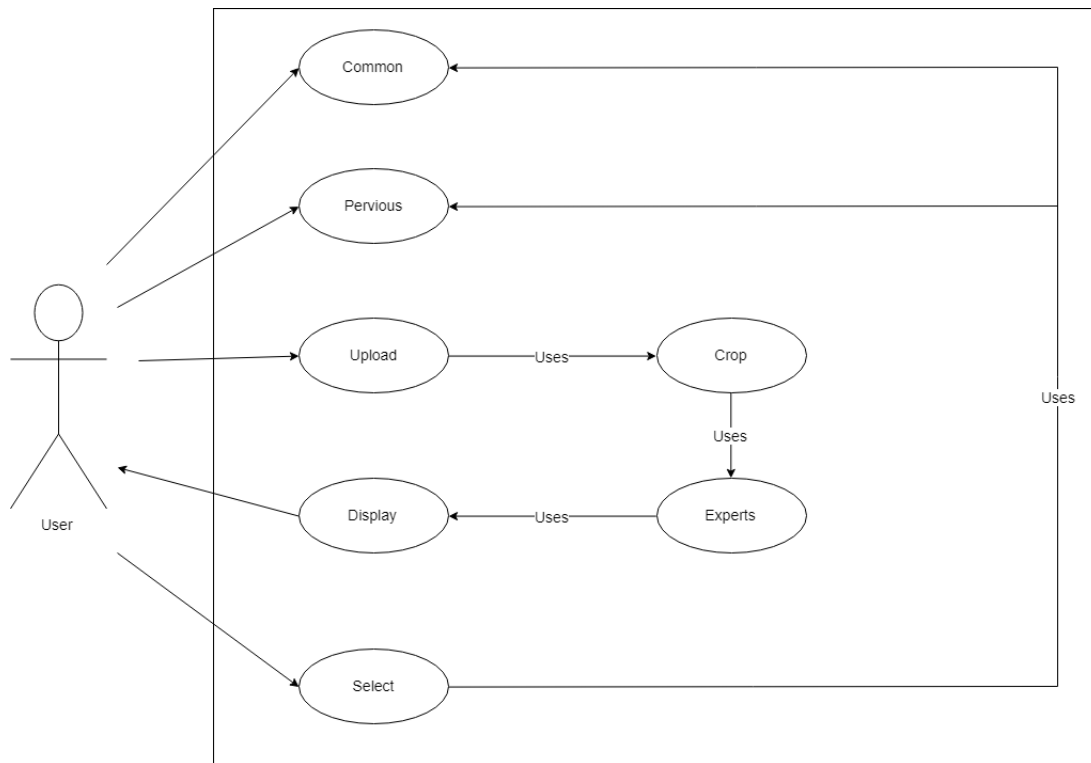
2   Use Case Diagram

Figure 1: Use Case Diagram of FIA

- Upload: This Use Case involves the User uploading a photo from their photo library on the Smartphone.

- Crop: This Use Case involves cropping the photo uploaded in the Upload Use Case. (Crop $< Uses >$ Upload)

- Experts: This Use Case involves the system Experts analyzing the Cropped photo and the GPS information. (Experts $< Uses >$ Crop)

- Display: This Use Case involves Displaying the results produced by the Experts to the User. (Display $< Uses >$ Experts)

- Select: This Use Case involves the User Selecting either the 'Correct' Flag or 'None Of The Above'. The results of this Selection are then Saved in Previous and Common. (Select 'Uses' Previous, Select $< Uses >$ Common)

- Previous: This Use Case involves the User selecting Previous searched Flag results. The Previous results that are displayed for the User come from the saved Select Use Case. (Select $< Uses >$ Previous)

- Common: This Use Case involves the User selecting Common searched Flag results. The most Common results that are displayed for the User come from the saved Select Use Case. (Select $< Uses >$ Common)

3 Analysis Class Diagram

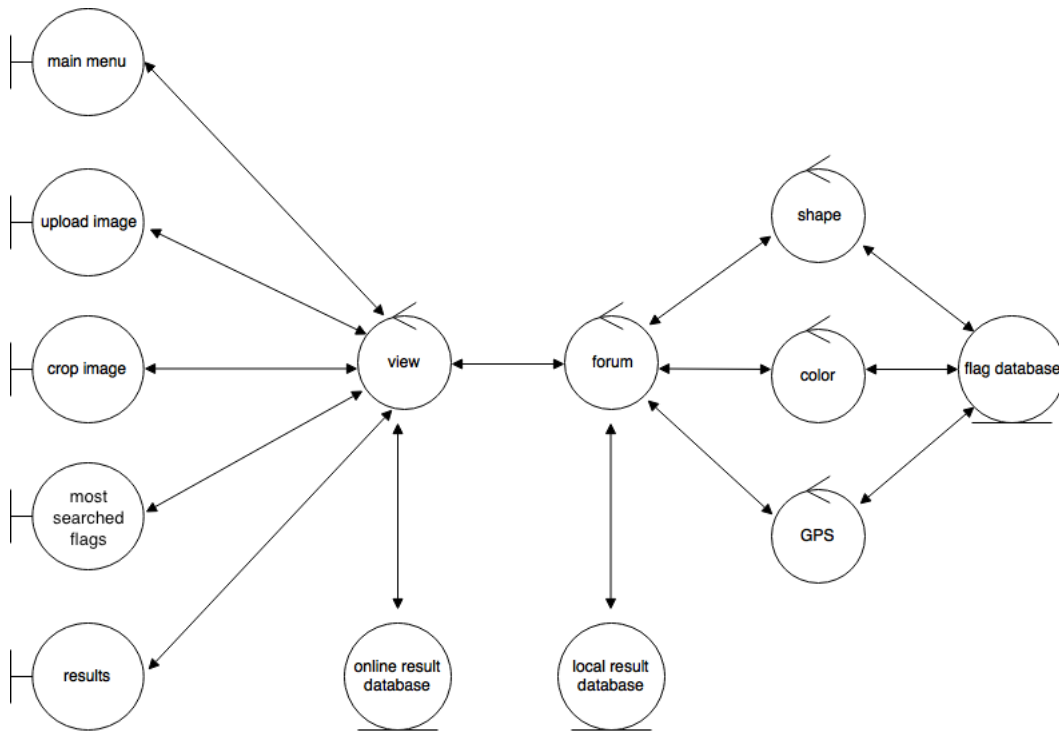Below is the analysis class diagram for the FIA application:

Figure 2: Analysis Class Diagram

4 Architectural Design

4.1 System Architecture

The FIA system is following a modified blackboard architectural design. Blackboard architecture is a data centered architecture made up primarily of two different components; the blackboard and the agents (knowledge sources). Each agent can work in parallel and independently to contribute knowledge to the blackboard in order to solve a problem.

Within the FIA system each expert (colour, shape, GPS) acts as an agent. The forum controller combined with the local result database acts as the blackboard. Each of the experts in the system can work in parallel and have their own independent domain. Each expert works on solving a specific aspect of the flag (colour, shape, GPS) and all of their partial solutions together solve the complex problem of properly identifying the uploaded flag. Additionally, the experts do not need to interact with one another, as they only need to communicate with the forum controller (blackboard).

The User Interface portion does not perform a large amount of processing and therefore can be condensed into a small UI subsystem that does not participate in the blackboard architecture design. The structural architectural diagram below shows the FIA application divided into the aforementioned subsystems.
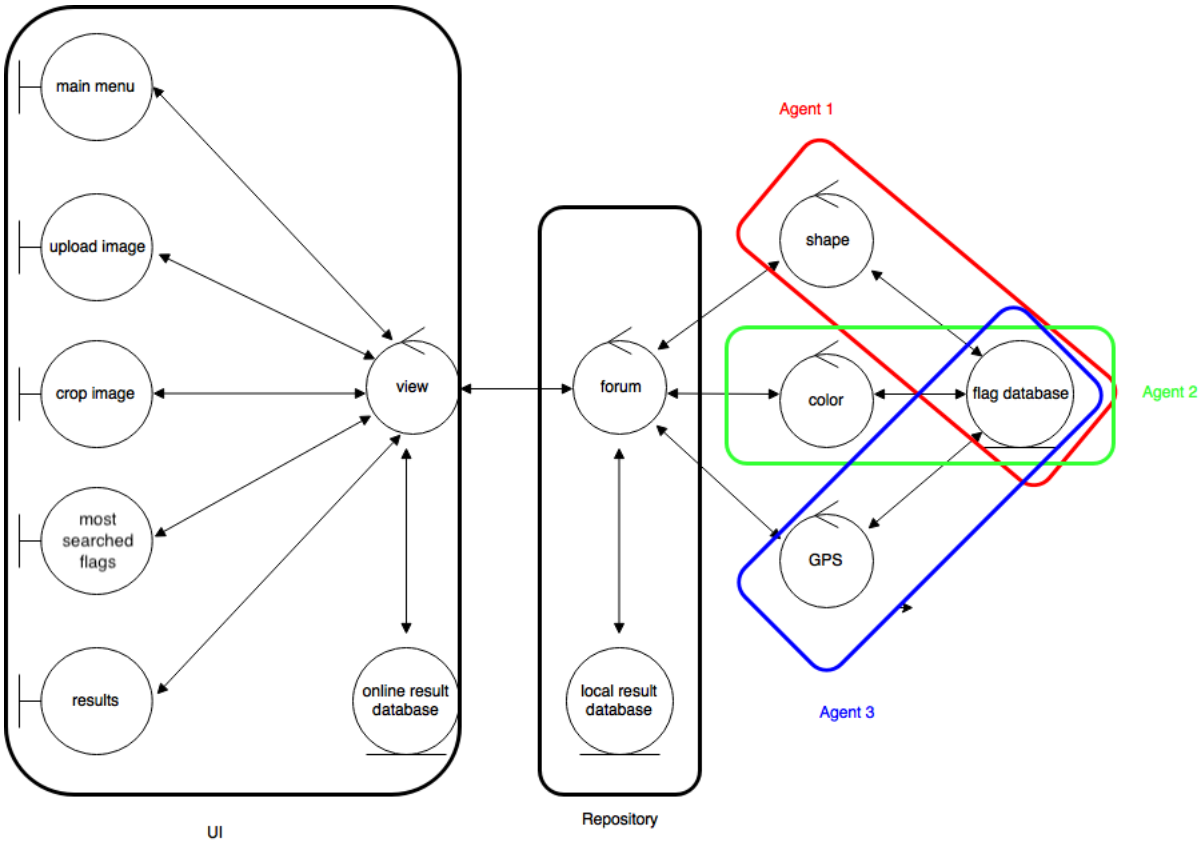
Figure 3: Structural Architectural Diagram of Subsystems

4.2　Subsystems

The FIA system utilizes the following five subsystems:

- UI: The UI consists of the the Main Menu, Upload Image, Crop Image, Most Searched Flags, Results, View, and Online Results Database as seen in Figure 3. This subsystem provides the display and all the functionality for the user. The UI provides the user with the option to upload and crop an image, view recently searched flags, or view the most commonly searched for flags. The UI is responsible for sending the cropped image to the Repository. The UI must then receive and display the top six best results to the user, and allow them to pick if any of the returned results are correct.

- Repository: Repository consists of the Forum and the Local Results Database as seen in Figure 3. This subsystem holds the initial image information as well as the information returned by the three Agents. The Forum first receives the cropped image from the UI, passes it to the three Agents, then receives back the best matches found by the Agents. The Repository then compares the best matches, and returns the six best results to the UI. The Repository also receives and stores the user selected result from the UI for future reference.

- Agent 1: Agent 1 consists of the Shape and the Flag Database as seen in Figure 3. This subsystem analyses the image based on the recognizable shapes found within. Agent

1 is sent a cropped image from the Repository. Agent 1 then analyses the image. The flags are given priority ratings relating to their best match, which is then returned to the Repository.

- Agent 2: Agent 2 consists of the Color and the Flag Database as seen in Figure 3. This subsystem analyses the image based on the recognizable colors found within. Agent 2 is sent a cropped image from the Repository. Agent 2 then analyses the image. The flags are given priority ratings relating to their best match, which is then returned to the Repository.

- Agent 3: Agent 3 consists of the GPS and the Flag Database as seen in Figure 3. Agent 3 is sent the Smartphone's GPS location from the Repository. Agent 3 then analyses the GPS location against flag locations from the Flag Database. The flags are given priority ratings relating to their best match, which is then returned to the Repository.

5   Class Responsibility (CRC) Cards

The following are the CRC cards for each class in the system.

Main Menu

Responsibility	Collaborators
Select upload image	View
Display menu, accept a choice from touchscreen	
Select most searched flags	View
Select results	View
Select tutorial/FAQ	

Upload Image

Responsibility	Collaborators
Access camera roll and select image	
Prompt message for confirming image selection	
Send image to Crop controller for cropping	View
Respond to cancel button selected	View

Crop Image

Responsibility	Collaborators
Allow cropping of image down to flag size	
Send image to view for final upload	View
Respond to cancel button selected	View

Most Searched Flags

Responsibility	Collaborators
Prompt a window for top 10 most searched for flags	View
Select a result and display corresponding information about flag	View
Respond to exit button selected	View

Results

Responsibility	Collaborators
Display best six results of current search	View
Respond to user confirming correct flag selection of current search	
Respond to user selecting none of the above of current search	View
Display corresponding information about current flag search	View
Display last 50 locally searched for flags	View
Select a past result and display corresponding information about flag	View
Respond to exit button selected	View

View

Responsibility	Collaborators
Accepts request to upload flag image	Main Menu
Accepts uploaded flag image and sends to Crop Image	Upload Image, Crop Image
Accepts cropped image and sends to Forum	Crop Image, Forum
Accepts results from Forum and sends to Results	Forum, Results
Accepts user selected result of search and sends to Forum and Online Results Database	Forum, Results, Online Results Database
Accepts request to view most searched for flags	Main Menu
Retrieve information from Online Results Database and send to Most Searched Flags	Online Results Database, Most Searched Flags
Accepts request to exit Upload Image page and redirects to Main Menu	Upload Image, Main Menu
Accepts request to exit Crop Image page and redirects to Main Menu	Crop Image, Main Menu
Accepts request to exit Most Searched Flags and redirects to Main Menu	Most Searched Flags, Main Menu
Accepts request to exit Results page and redirects to Main Menu	Results, Main Menu

Online Results Database

Responsibility	Collaborators
Accepts data from view and update database	View
Store data for how many times a flag was searched for	
Send data to View	View

Forum

Responsibility	Collaborators
Accepts cropped image from View	View
Sends image to Local Results Database	Local Results Database
Sends image to Colour	Colour
Sends image to Shape	Shape
Sends image to GPS	GPS
Receives results from Colour	Colour
Receives results from Shape	Shape
Receives results from GPS	GPS
analyses combined results from Colour, Shape and GPS to determine up to the best 6 results	
Sends top 6 results to View	View
Sends top 6 results to Local Results Database	Local Results Database
Receives user selected result from View and sends to Local Results Database	View, Local Result Database

Local Results Database

Responsibility	Collaborators
Receives and stores cropped flag image	Forum
Sends cropped flag image	Forum
Receives and stores suggested results	Forum
Sends suggested results to Forum	Forum
Receives and stores user confirmed result	Forum
Accept request for recently searched flags	Forum
Sends data for recently searched flags	Forum
Stores local recently searched flags	
Accesses user's phone GPS location and sends to Forum	Forum

Shape

Responsibility	Collaborators
Accepts cropped image from Forum	Forum
analyses shape of cropped image against Flag Database	Flag Database
Sends all possible matching flags to Forum with priority ratings	Forum

Colour

Responsibility	Collaborators
Accepts cropped image from Forum	Forum
analyses colours of cropped image against Flag Database	Flag Database
Sends all possible matching flags to Forum with priority ratings	Forum

GPS

Responsibility	Collaborators
Accepts GPS data from Forum	Forum
analyses GPS data against Flag Database	Flag Database
Sends all possible matching flags to Forum with priority ratings	Forum

Flag Database

Responsibility	Collaborators
Stores all possible flags and corresponding information	
Responds to request from Colour	Colour
Responds to request from Shape	Shape
Responds to request from GPS	GPS

A   Division of Labour

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