

Deliverable #2

SE 3A04: Software Design II – Large System Design

Tutorial Number: T03

Group Number: G6

Group Members:

- Cass Braun
- Nehad Shikh Trab
- Savvy Liu
- Tvesha Shah
- Victor Yu

IMPORTANT NOTES

- Please document any non-standard notations that you may have used
 - *Rule of Thumb*: if you feel there is any doubt surrounding the meaning of your notations, document them
- Some diagrams may be difficult to fit into one page
 - Ensure that the text is readable when printed, or when viewed at 100% on a regular laptop-sized screen.
 - If you need to break a diagram onto multiple pages, please adopt a system of doing so and thoroughly explain how it can be reconnected from one page to the next; if you are unsure about this, please ask about it
- Please submit the latest version of Deliverable 1 with Deliverable 2
 - Indicate any changes you made.
- If you do NOT have a Division of Labour sheet, your deliverable will NOT be marked

1 Introduction

1.1 Purpose

This document provides a high-level overview of the Gaim wildlife identification system architecture, including design considerations for the system and its subsystems. The document details architectural choices, subsystem interactions, and class-level responsibilities within the system.

The intended audience for this document includes internal stakeholders such as software developers, system architects, project managers, domain experts in wildlife identification, and potential investors interested in the technological aspects of Gaim. It is recommended that Deliverable 1 be reviewed prior to reading this document for a foundational understanding of the system requirements.

1.2 System Description

The system utilizes a Model-View-Controller (MVC) architecture combined with Repository and Blackboard architectural styles to efficiently process data from various knowledge sources and provide accurate species identification.

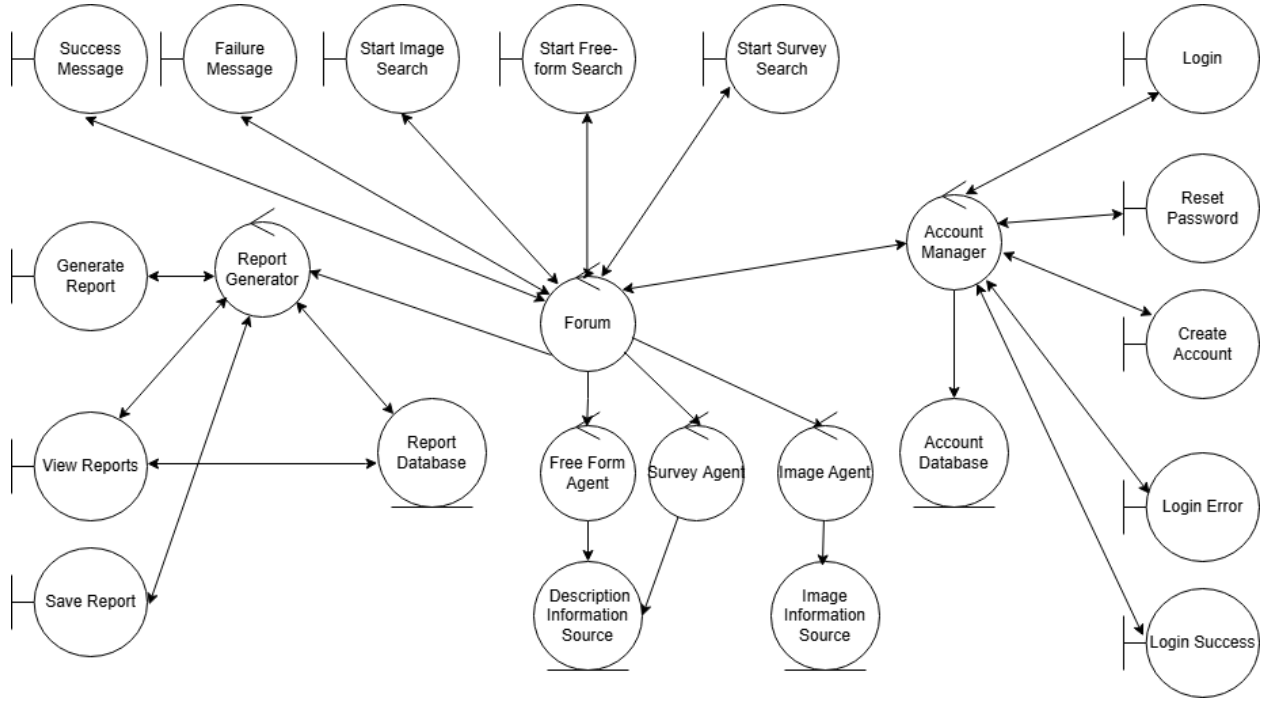
The system is designed to facilitate interactions between different subsystems with some subsystems incorporating blackboard architecture, while others incorporate repository architectural style.

1.3 Overview

The remainder of this document is structured as follows:

- **Section 2:** Provides the Analysis Class Diagram for Gaim, illustrating the relationships between key system components.
- **Section 3:** Discusses the overall architectural design of the system, including the rationale behind the chosen architectural styles, the division of the system into subsystems, and their respective functionalities.
- **Section 4:** Presents Class Responsibility Collaboration (CRC) cards, detailing the responsibilities of major classes and their interactions.

2 Analysis Class Diagram



3 Architectural Design

3.1 System Architecture

The Gaim app utilizes an Interaction-Oriented Software Architecture, specifically Model View Controller, to house all the subsystems. The view represents the interface for user interaction and the controller and model represent the three major subsystems and their respective database. The subsystems follow Data-Centric Architecture styles with classification subsystems using Blackboard. The agents are the independent experts (knowledge sources) with whom the user can interact. Synchronously, the blackboard, the active data store component, will take this information in, dividing the solution space, providing a non-deterministic answer and controlling the logic of the application.

Within our system, the components are defined as the following:

Subsystem	Purpose	Architectural Style
Classification Management	Start a search, submit an image, submit text, fill a survey	Blackboard
Generate a Report	View result, generate report, view score, save	Repository
Account Management	Create an account and log in to an account	Repository

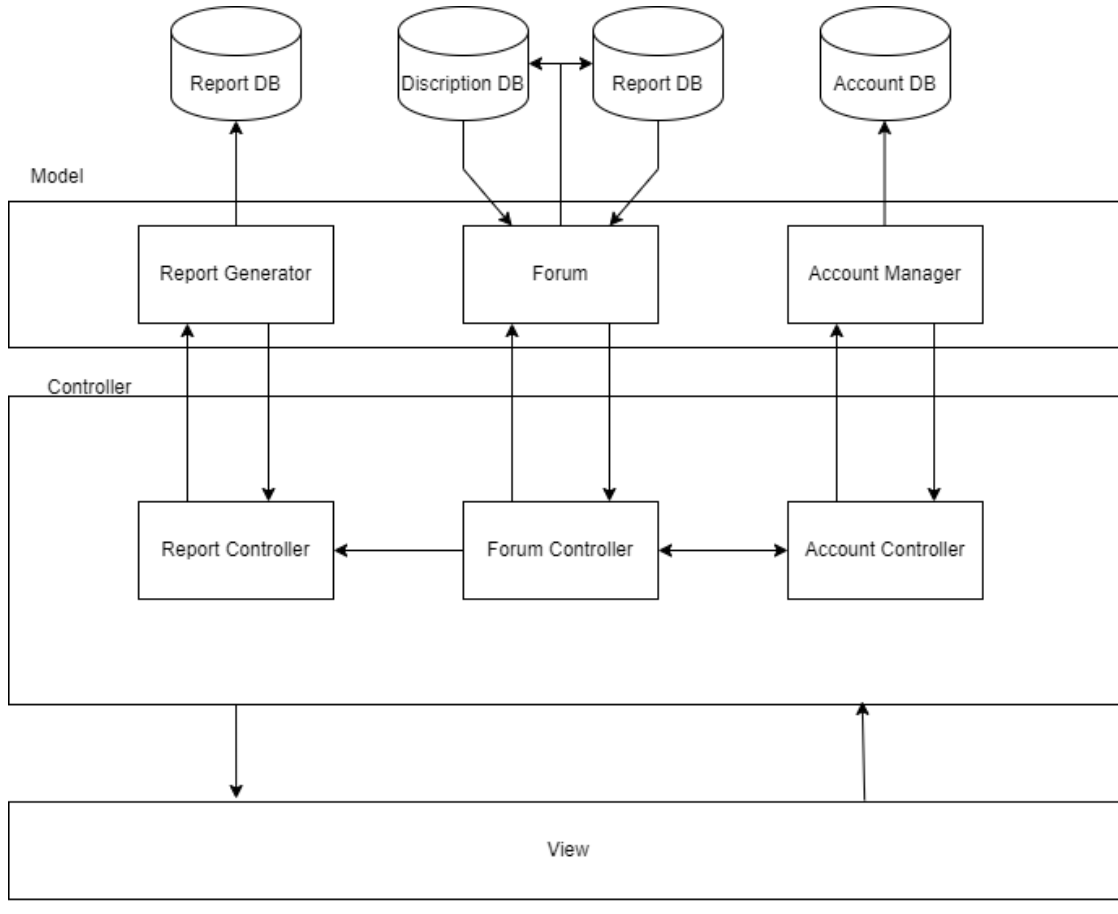
System relationships are defined in section 3.2 of this document.

Three databases are present on the model level of this architecture. An account database for account details, a classification database with background information regarding species identification (encompassing both description and image sources), and a report generation database to track user-saved searches.

Our system architecture incorporates the Repository and Blackboard architecture styles. The blackboard style is chosen because it supports multiple independent knowledge sources that can be independently called and allows for a logical data store to present a final output. This is beneficial as our app involves multiple experts/sources of input that the user can utilize, either exclusively or in tandem, to classify a species. Due to this functionality, Blackboard architecture is ideal for classification management as we can narrow down the solution space based on agents and manage them based on the status of the data store. Additionally, in terms of further expansion, it will become very easy to incorporate additional experts/knowledge sources, giving the user more potential use cases for the application.

Another one of the architectures we chose is the Repository Architecture Style as it supports the direct fetching of deterministic outputs from agent requests. This architectural style supports large complex information systems where different components need to access various areas of information. This is the type of access the account management subsystem and report generation system will require, as many users should be able to use the application at the same time and access their specific reports and data. Additionally, this style allows the account management system to easily access stored user information, making it easy for agents to create new accounts and pull credentials for verification. This style also supports data integrity, for backups and restores, which is ideal for account security. Furthermore, for the generated report subsystem, the repository style allows direct access to information from our report generation database and enables the subsystem to display the requested report based on user (agent) input. This architectural style is ideal for expanding new applications, making it easy for us to manage user data, ensure data integrity, and potentially expand the user base.

The overall architecture style chosen for the interaction between these subsystems is the Model View Controller. This architecture style is used because it supports the connection between the user view (presentation) and the data model (backend component) through a controller component that manages input situations and communicates with the appropriate subsystem/database functionality. We can also support frequent data changes, which is essential in the hunting sector which has a changing landscape based on seasonality and new regulations. Further, it is easy to update current functionalities and logic in one component without changing the entire system. This can be beneficial for a newer product because of frequent updates in the user interface or changes to classification logic.



We considered the Pipe and Filter Architecture Style, but it does not support the dynamic interactions required for the Gaim app. Our system needs to process real-time user interactions, such as searching for species, submitting images, and generating reports. A filtering method would be difficult for our classification and reporting functionalities.

The Batch Sequential Architecture Style was also considered, but we do not have batch data inputs, it is not suitable for handling report generation or for the interactive part of the input. Batch processing also introduces delays and low throughput, which would be frustrating for our user's experience, especially in a system where real-time access to classification results and reports is essential.

We ruled out the Process-Control Architecture Style because the function of continuous monitoring and automated control loops is non-existent in our app. The Gaim app requires data from a data-centered structure because of our databases, and our user interaction rather than algorithm-controlled interaction, this architecture style is not a suitable fit.

3.2 Subsystems

3.2.1 Classification Management

The purpose of the Classification Management subsystem is to manage interactions with the user, allowing them to start a search for an animal, and offering various optional input types such as image submission, text submission, and survey submission. It will then interface with both the Report Generation and Account Management submissions to first pass its results and save them to the account history respectively. Overall, it manages the main animal search function of the app, and coordinates these details with the other subsystems.

3.2.2 Generate Report

The Generate Report subsystem manages all aspects of the report on the animal guessed. Its primary functions include Allowing the user to view the result of their given input, generating a unique report with details about the result of their search and related information (such as animal age, lifespan, habitat, etc.), viewing the accuracy score of each search, and saving the result which allows the user to store the output of their search. It interfaces with the Forum subsystem to request search results in order to generate its reports.

3.2.3 Account Management

This subsystem manages all aspects of account creation and account interaction including creating an account, logging in to the account, and managing account details such as password resets and interacting with the greater account database. It interfaces with the Classification Management subsystem in order to associate search result details to a specific account as well as allowing access to the Classification Management subsystem itself through logging in.

4 Class Responsibility Collaboration (CRC) Cards

Class Name: Success Message (Forum - Boundary)	
Responsibility:	Collaborators:
Knows Forum Displays success message to user upon successful operation Provides feedback on completed processes	Forum

Class Name: Failure Message (Forum - Boundary)	
Responsibility:	Collaborators:
Knows Forum Displays error message when a process fails Provides guidance on next steps for users	Forum

Class Name: Login Error (Account - Boundary)	
Responsibility:	Collaborators:
Knows Account Manager Displays login failure message Provides options to reset password or re-enter credentials	Account Manager

Class Name: Login Success (Account - Boundary)	
Responsibility:	Collaborators:
Knows Account Manager Confirms successful login and redirects user to dashboard Provides session authentication for continued use	Account Manager

Class Name: Forum (Controller)	
Responsibility:	Collaborators:
Knows Free Form Search	Start Free Form Search
Knows Survey Search	Start Image Search
Knows Image Search	Start Survey Search
Knows Success Message	Success Message
Knows Failure Message	Failure Message
Knows Free Form Agent	Free Form Agent
Knows Survey Agent	Survey Agent
Knows Image Agent	Image Agent

Class Name: Start Image Search (Boundary)	
Responsibility:	Collaborators:
Knows Forum	Forum
Handles image submission events	

Class Name: Start Freeform Search (Boundary)	
Responsibility:	Collaborators:
Knows Forum	Forum
Handles freeform test submission events	

Class Name: Start Survey Search (Boundary)	
Responsibility:	Collaborators:
Knows Forum	Forum
Handles survey submission events	

Class Name: Generate Report (Boundary)	
Responsibility:	Collaborators:
Knows Report Generator	Forum
Knows Report Database	Report Generator
	Report Database

Class Name: Report Generator (Controller)	
Responsibility:	Collaborators:
Knows Forum	Forum
Knows Report Database	Report Database
	View Reports

Class Name: Report Database (Entity)	
Responsibility:	Collaborators:
Knows Report Generator	Report Generator
Knows View Reports	View Reports

Class Name: View Reports (Boundary)	
Responsibility:	Collaborators:
Knows Report Database	Report Database
Knows Report Generator	Report Generator

Class Name: Save Report (Boundary)	
Responsibility:	Collaborators:
Knows Report Generator	Report Generator Report Database

Class Name: Account Manager (Controller)	
Responsibility:	Collaborators:
Knows Login Knows Reset Password Knows Create Account Knows Login Error Knows Login Success Knows Forum Coordinates account interactions from user	Login Reset Password Create Account Login Error Login Success Forum

Class Name: Account Database (Entity)	
Responsibility:	Collaborators:
Knows Account Manager Keeps record of all accounts	Account Manager

Class Name: Login (Boundary)	
Responsibility:	Collaborators:
Knows Account Manager Displays Login Form	Account Manager

Class Name: Reset Password (Boundary)	
Responsibility:	Collaborators:
Knows Account Manager Displays reset password form Relays new password information to Account Manager	Account Manager

Class Name: Create Account (Boundary)	
Responsibility:	Collaborators:
Knows Account Manager Displays create account screen Runs process to create new account Relays new account information to Account Manager	Account Manager

Class Name: Survey Agent (Controller)	
Responsibility:	Collaborators:
Knows Image Information Source Provides logic for determining animal based on survey input	Forum Description Information Source

Class Name: Free Form Agent (Controller)	
Responsibility:	Collaborators:
Knows Image Information Source Provides logic for determining animal based on free form input	Forum Description Information Source

Class Name: Image Agent (Controller)	
Responsibility:	Collaborators:
Knows Description Information Source Provides logic for determining animal based on image input	Forum Image Information Source

Class Name: Description Information Source (Entity)	
Responsibility:	Collaborators:
Knows Free Form Agent Knows Survey Agent Provides rules for determining animal based on survey and text input	Free Form Agent Survey Agent

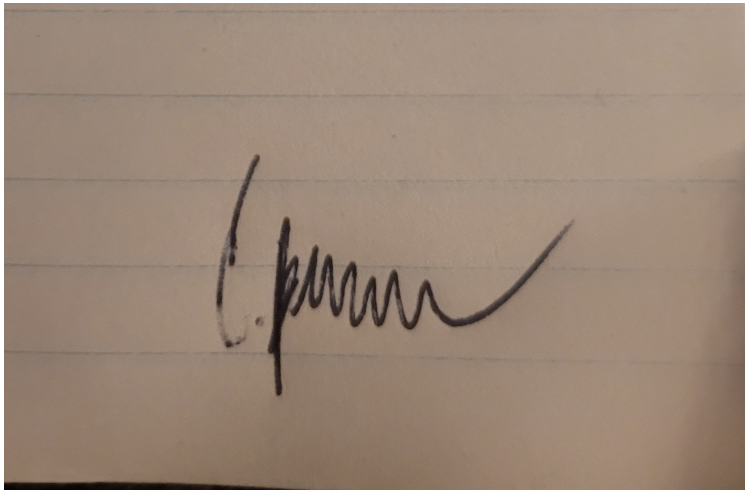
Class Name: Image Information Source (Entity)	
Responsibility:	Collaborators:
Knows Image Agent Provides rules for determining animal based on image input	Image Agent

A Division of Labour

Include a Division of Labour sheet which indicates the contributions of each team member. This sheet must be signed by all team members.

Cass Braun

- Section 3.2
- Section 4 - CRC card Account Manager (Controller)
- Section 4 - CRC card Account Database (Entity)
- Section 4 - CRC card Login (Boundary)
- Section 4 - CRC card Reset Password (Boundary)
- Section 4 - CRC card Create Account (Boundary)

A photograph of a handwritten signature in dark ink on a piece of lined paper. The signature is cursive and appears to read 'C. Braun'. The paper has horizontal lines and is slightly aged.

Nehad Shikh Trab

- Added purpose
- Added system description
- Added overview
- Added Success Message CRC card
- Added Failure Message CRC card
- Added Login Error CRC Card
- Added Login Success CRC Card



Savvy Liu

- Section 2 - Create and refine analysis class diagram
- Section 4 - CRC card Free Form Agent
- Section 4 - CRC card Image Agent
- Section 4 - CRC card Search Agent



Tvesha Shah

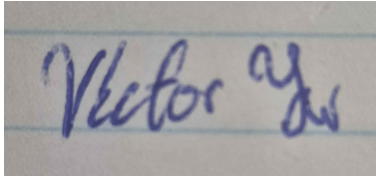
- Section 3 - Identify and explain the overall architecture of your system
- Section 3 - Provide the reasoning and justification of the choice of architecture
- Section 4 - CRC card Forum
- Section 4 - CRC card Start Image Search (Boundary)
- Section 4 - CRC card Start Freeform Search (Boundary)
- Section 4 - CRC card Start Survey Search (Boundary)
- Section 4 - CRC card Description Information Source (Entity)
- Section 4 - CRC card Image Information Source (Entity)
- Managed github set up and assisted with formatting



Victor Yu

- Section 3 - Provide the reasoning and justification of the alternative architectures and why we didn't choose them
- Section 3 - architectural diagram in 3.1
- Section 4 - CRC card Generate Report
- Section 4 - CRC card Report Generator (Controller)

- Section 4 - CRC card Report Database (Entity)
- Section 4 - CRC card View Reports (Boundary)
- Section 4 - CRC card Save Report (Boundary)

A photograph of a handwritten signature in blue ink on lined paper. The signature appears to be "Victor Y" with a stylized flourish at the end.