Collaborative Surveillance of Large Geographical Area by Fleet of Drones

Team: sdmay23-50

Client: Professor Goce Trajcevski

https://sdmay23-50.sd.ece.iastate.edu/

Team

- Marcus Jakubowsky - *Team Lead*, Software Engineering
- Jacob Houts - *Testing*, Software Engineering
- Joseph Edeker - *UI/UX Design*, Software Engineering
- Rowan Collins - *Testing*, Software Engineering
- Thomas Glass - *Standards & Security*, Cyber Security
- Jaden Forde - *Client Interaction*, Software Engineering

Problem & Project Vision

Problem:

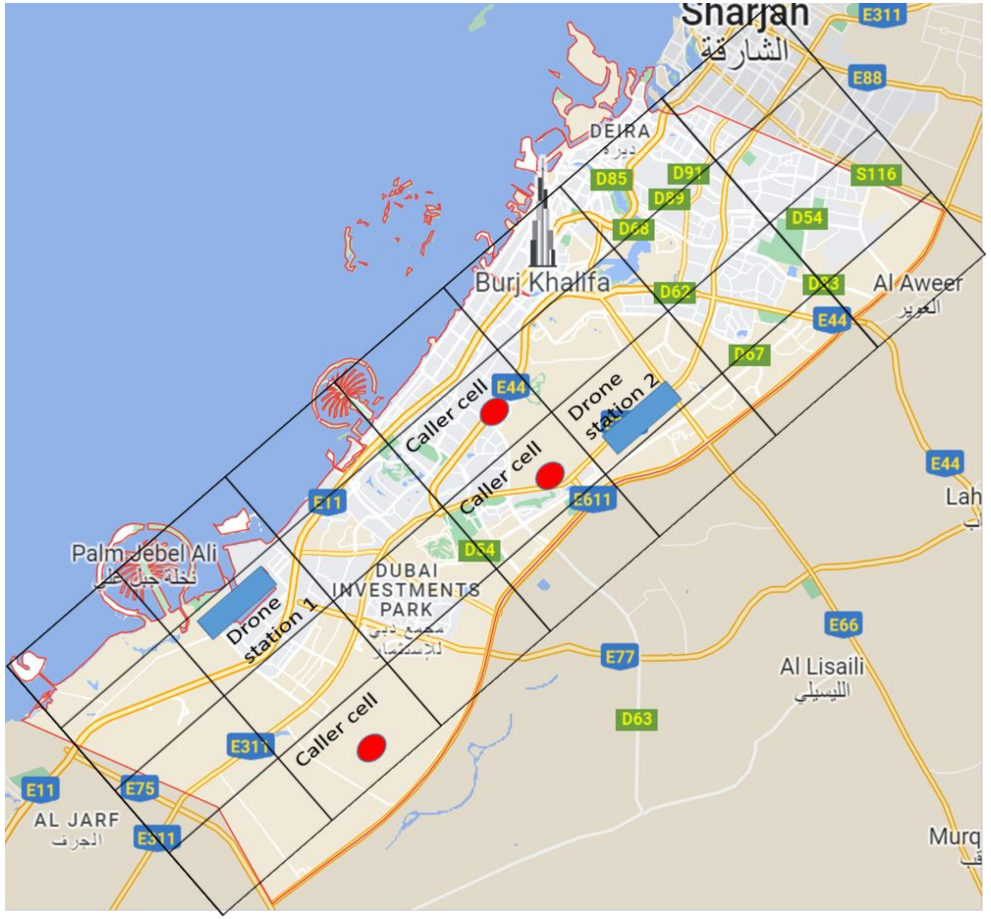
- Live drone testing = Expensive
- Drone fleets algorithms development
- No current system for comparing Targeted Features across different:
  - Algorithms
  - Data settings

Solution:

- Web application
- Custom algorithm simulation
- Compare algorithms & situations

Target Users

- Drone Manufacturers
- Researchers
- First Responders
- Government Agencies
- Agricultural Use

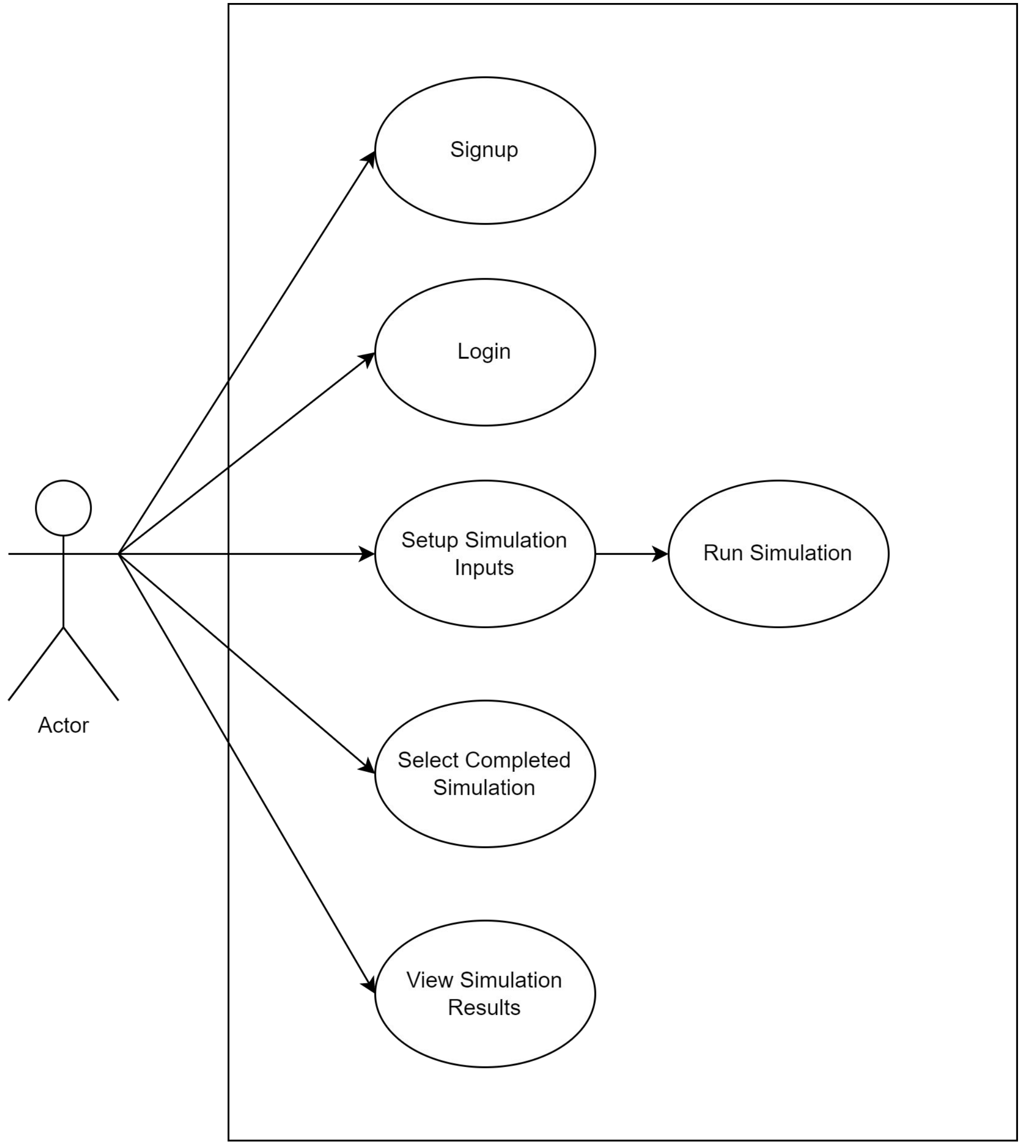


https://www.newscientist.com/article/2284387-dubai-police-will-use-citywide-network-of-drones-to-respond-to-crime/

Visual Sketch

Use Case Diagram

- Use cases are shared across target users
- Unique input parameters for each user



Requirements

Functional Requirements

- 2D drone visualization
- User selected algorithms
- Datasets with ground phenomena
- Saved previous simulations
- Utilize a queue to simulate requests in order
- Email notification system to notify user their simulation has run

The full list of functional requirements can be found in our design document inside section 2.3 (p. 10)

Non-Functional Requirements and Constraints

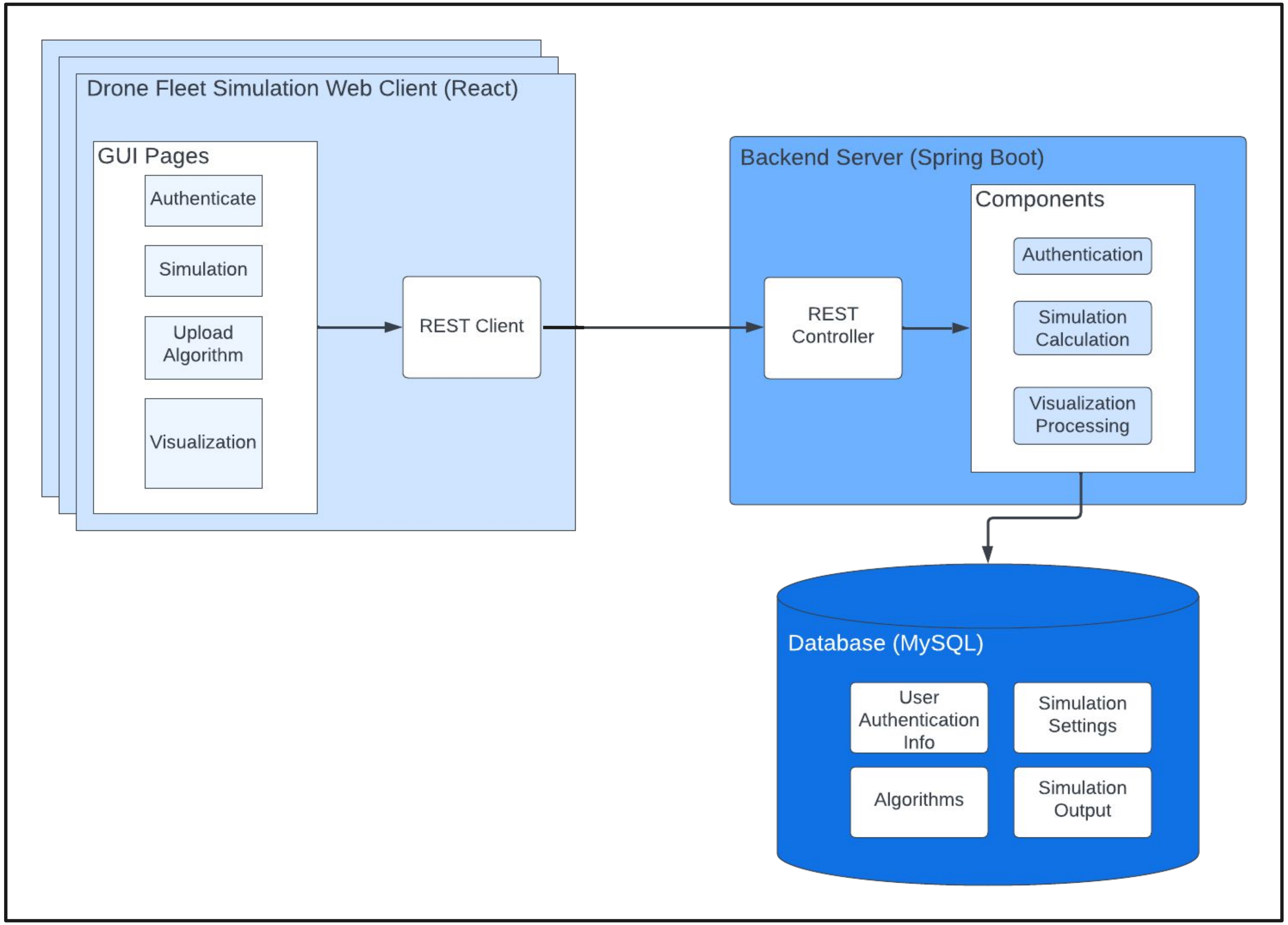
- Software will be easy to use
- Application will be web based
- Maintainable codebase
- Handle errors in input
- Concurrent access to the web application

The full list of non-functional requirements can be found in our design document inside section 2.3 (p. 11)

Conceptual Design Diagram

High-Level Design

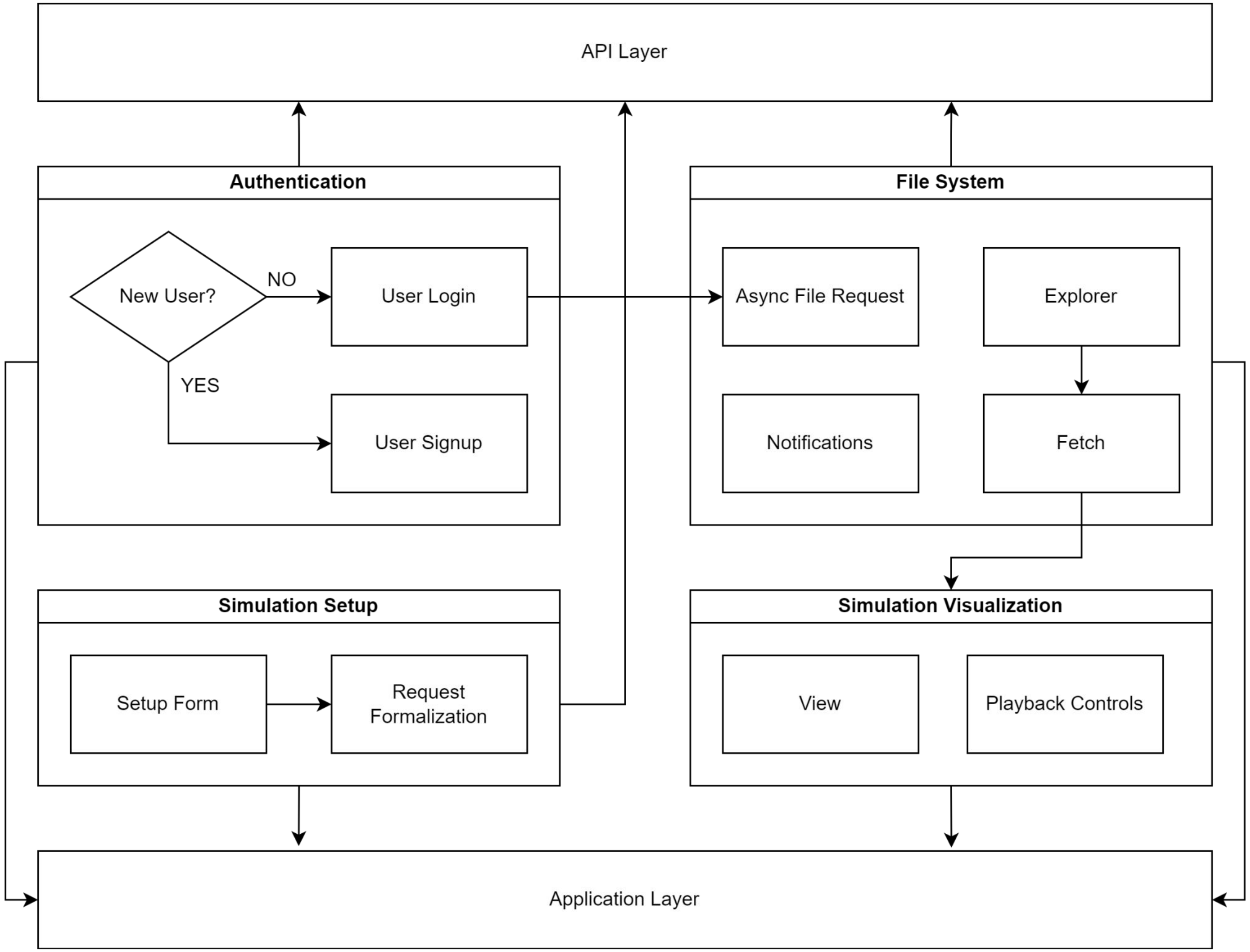
- Shaped by requirements
- Broken down into UI, processing, and storage
- See section 4.4 of Design Doc for framework selection

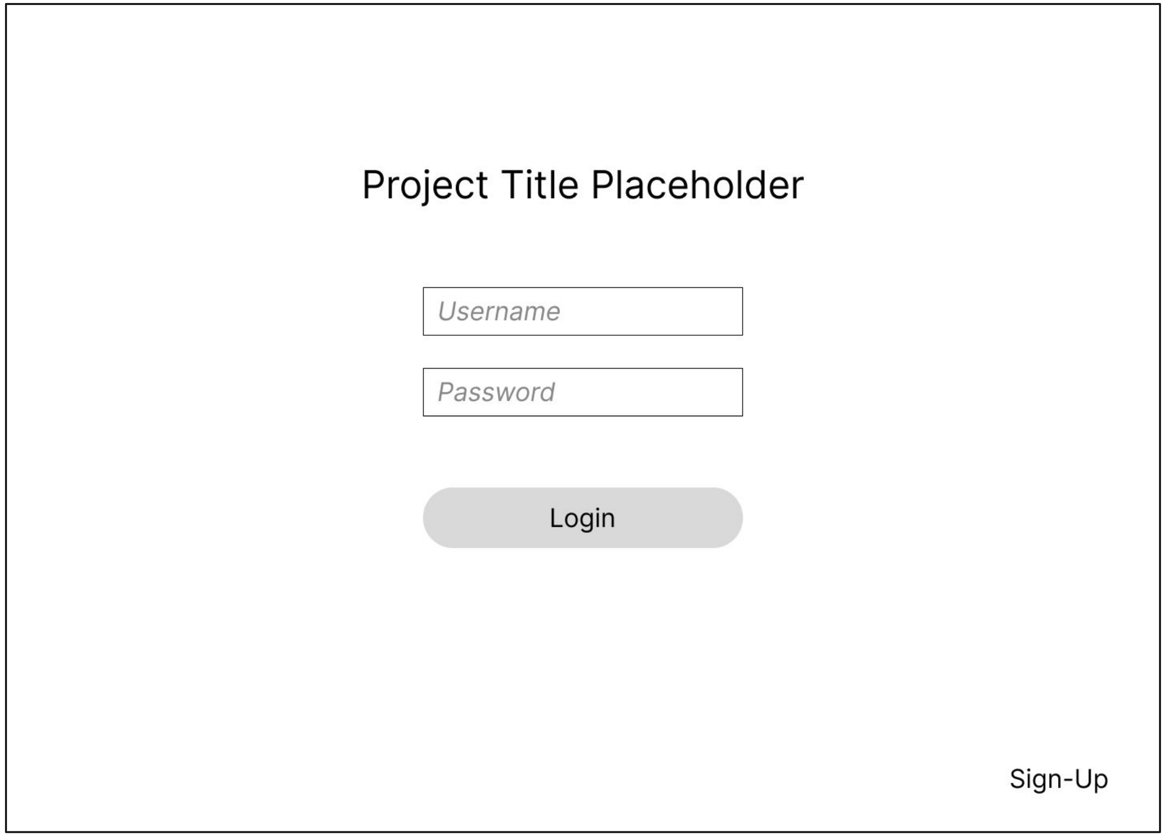


System Design - Frontend

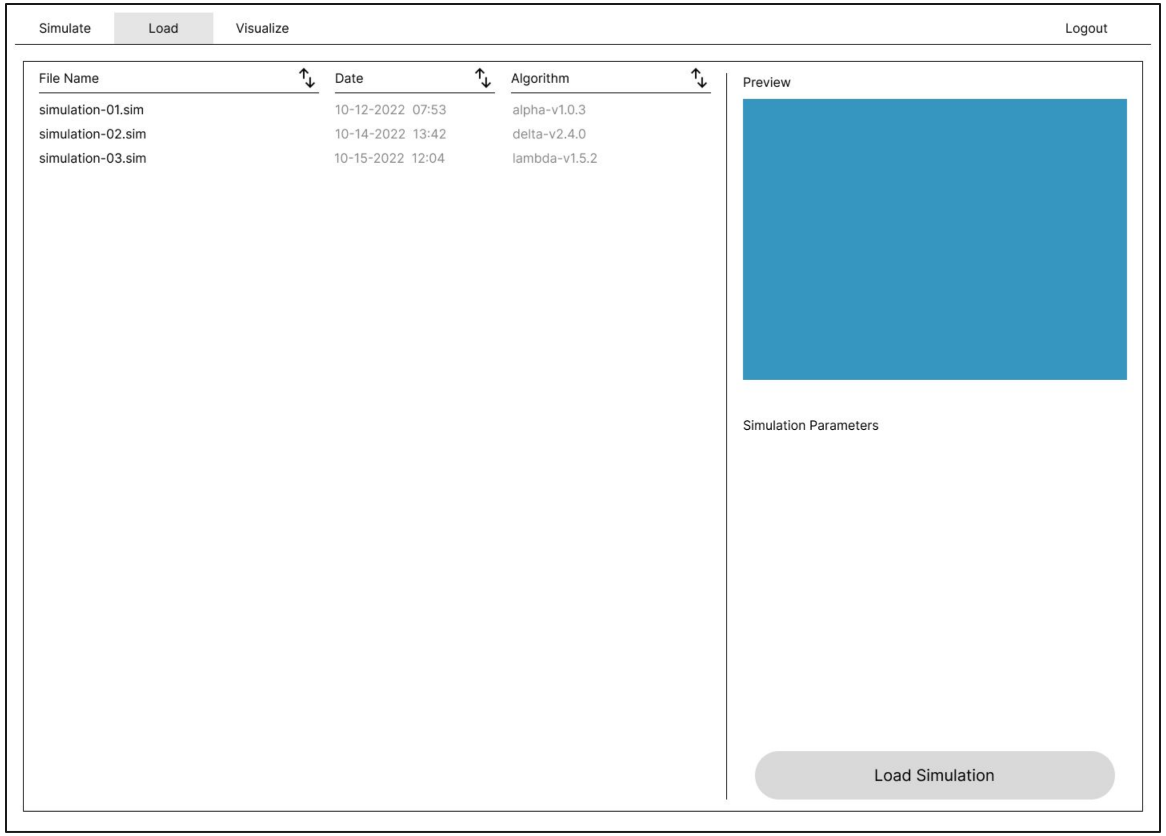
Frontend Architecture

- Based on User Needs
- Four main modules



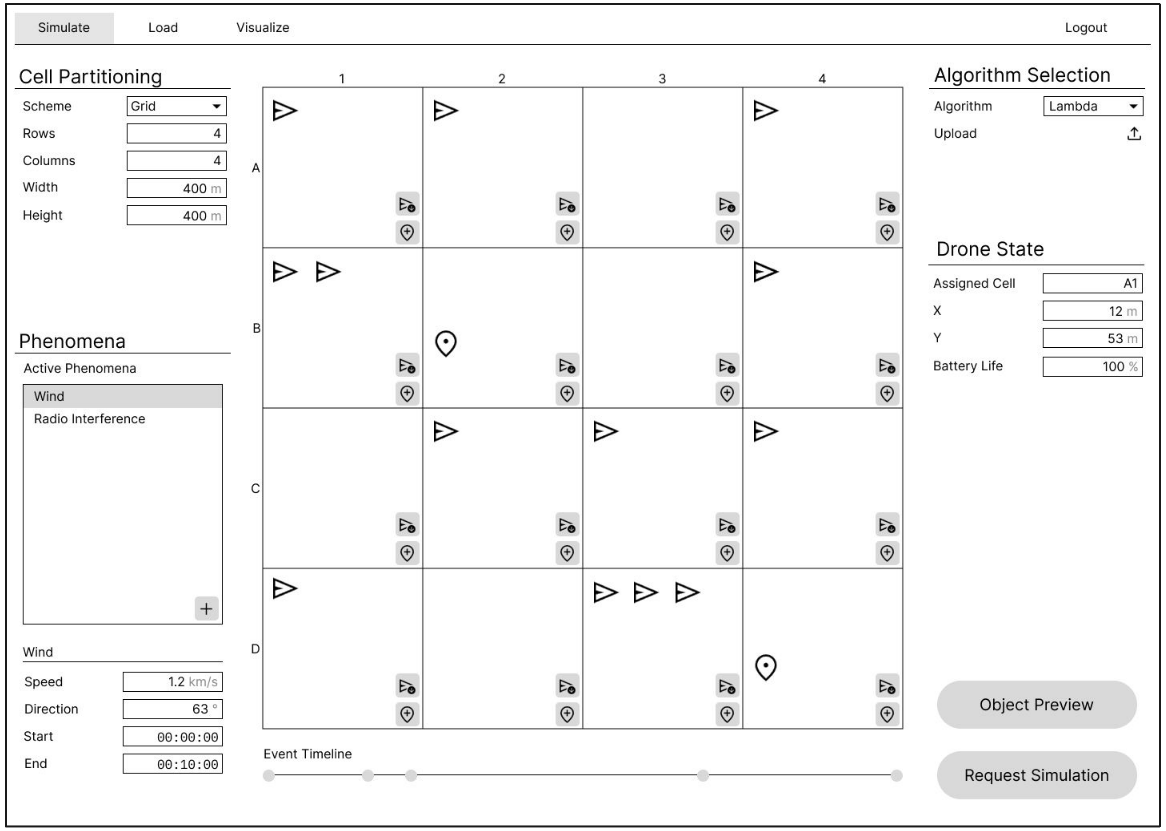


Login Page



File Name	Date	Algorithm
simulation-01.sim	10-12-2022 07:53	alpha-v1.0.3
simulation-02.sim	10-14-2022 13:42	delta-v2.4.0
simulation-03.sim	10-15-2022 12:04	lambda-v1.5.2

File Selection



Cell Partitioning

Scheme	Grid
Rows	4
Columns	4
Width	400 m
Height	400 m

Phenomena

Active Phenomena

Wind
Radio Interference

Wind

Speed	1.2 km/s
Direction	63 °
Start	00:00:00
End	00:10:00

Event Timeline

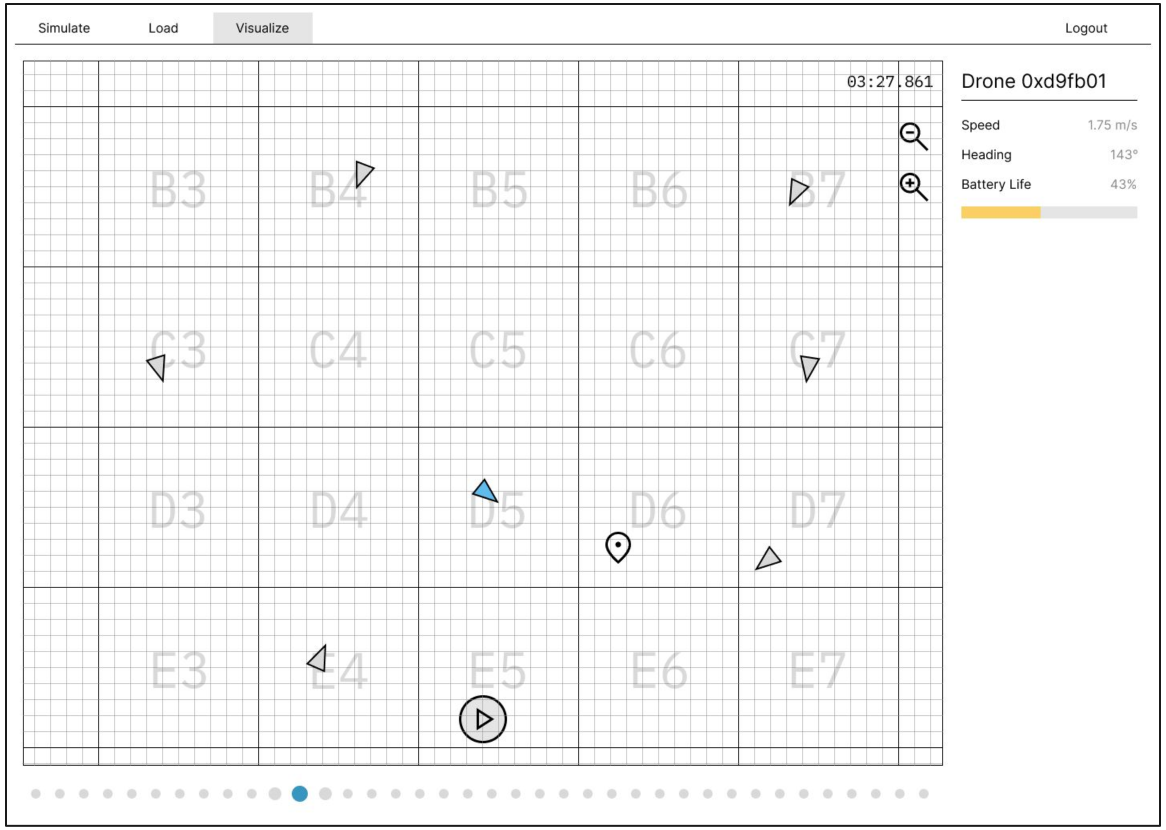
Algorithm Selection

Algorithm	Lambda
Upload	

Drone State

Assigned Cell	A1
X	12 m
Y	53 m
Battery Life	100 %

Simulation Setup



03:27.861

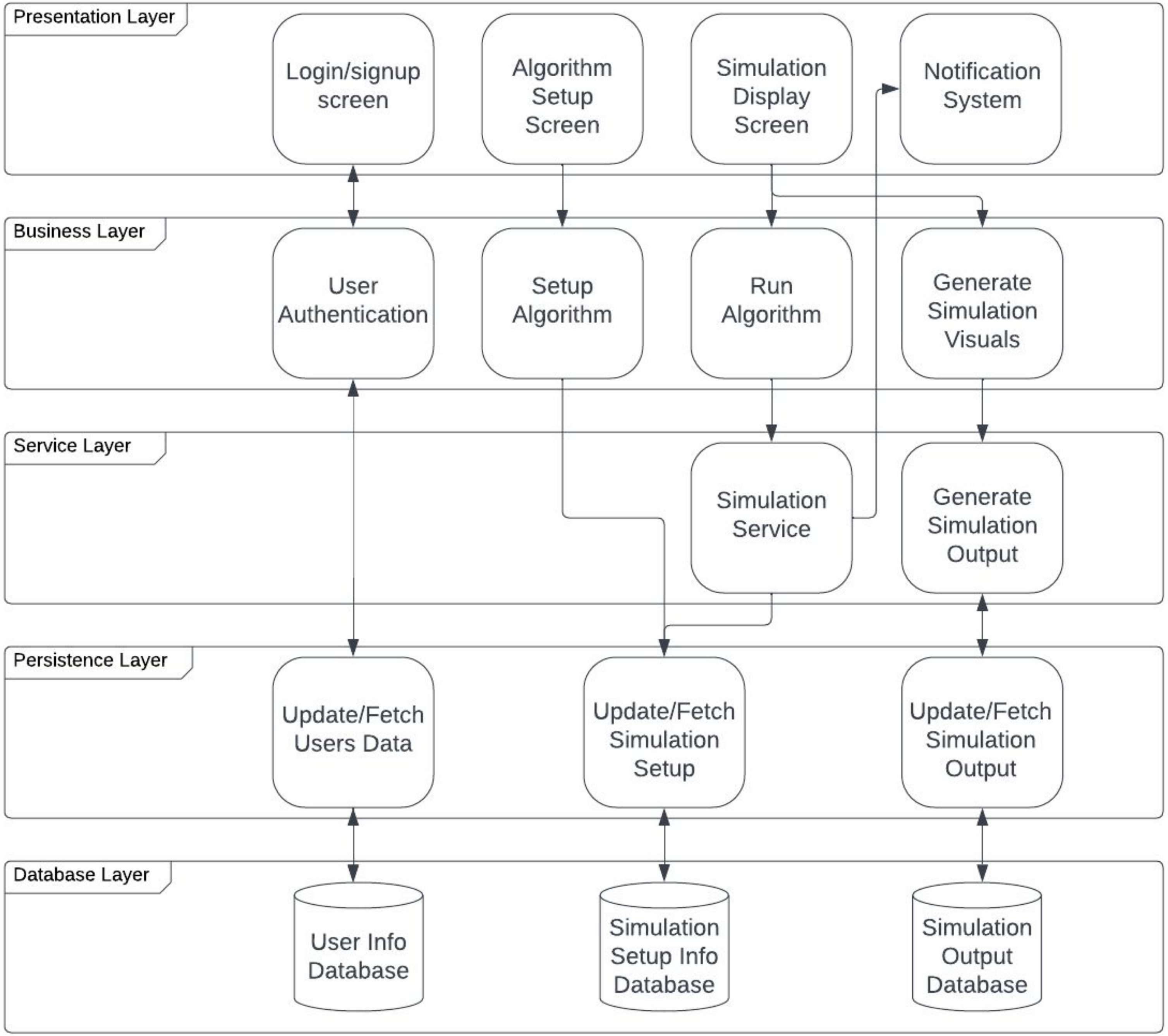
Drone 0xd9fb01

Speed	1.75 m/s
Heading	143°
Battery Life	43%

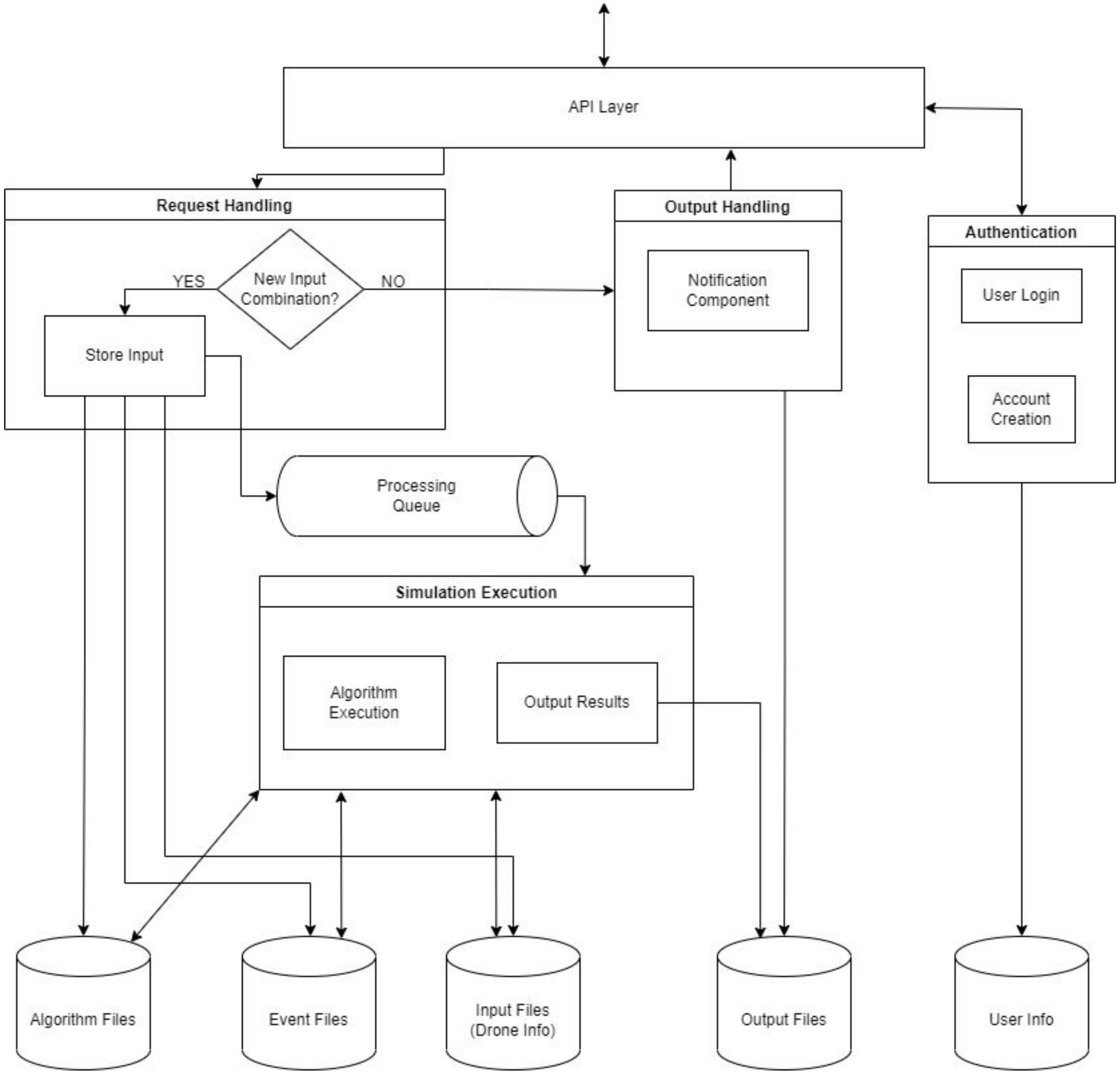
Simulation Visualization

System Design - Backend

Layered Architecture



Backend Data Flow



Project Plan

Project Plan - Tasks

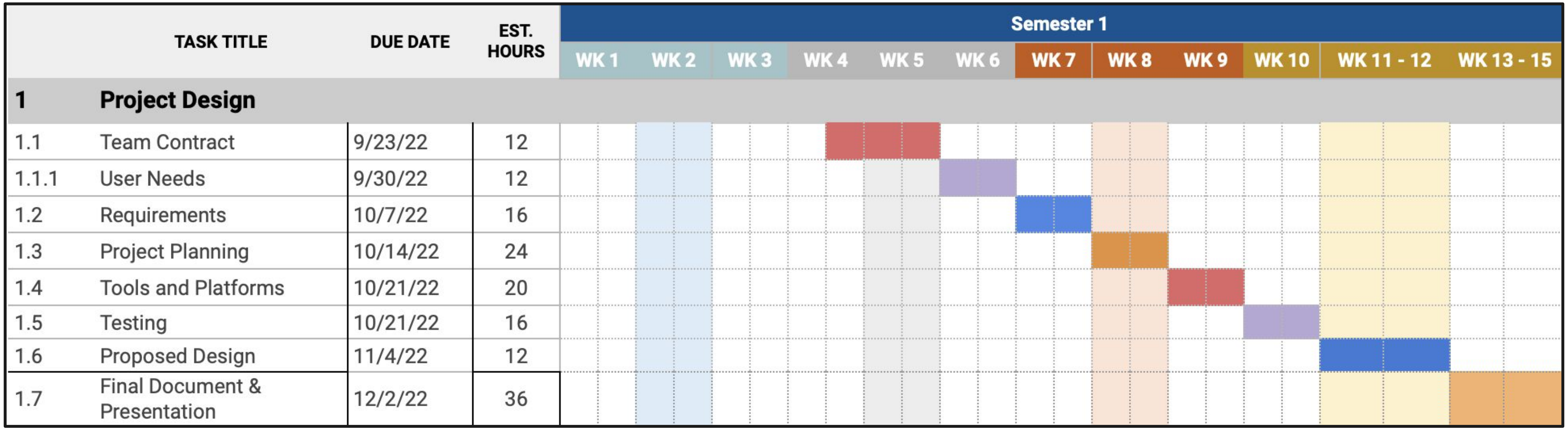
- User authentication system
- Phenomena file selection
- Algorithm/Protocol selection
- Algorithm execution
- Ability to visualize simulations
- Ability to save previous simulation results

Project Plan - Risks & Mitigation

- Client Usability
  - Research, feedback, queue
- User Data Security
  - Pen testing, secure software development
- Testing All Use Cases
  - Testing tools

Project Plan - Fall 2022

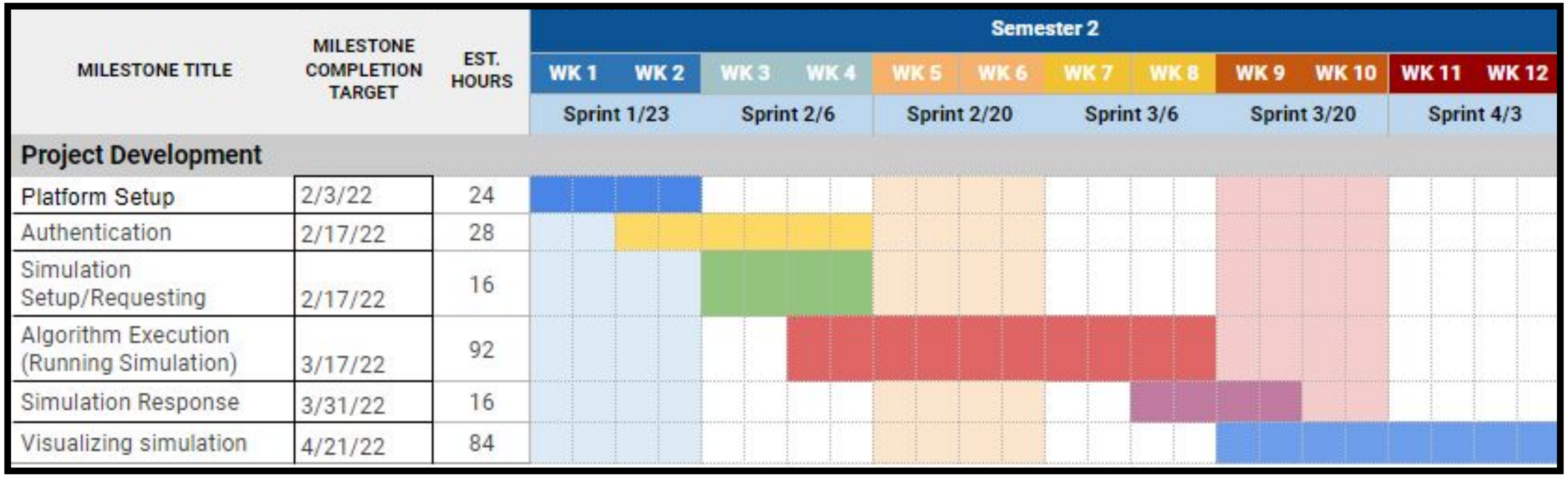
- Design document - measured on received feedback
  - Project planning
  - Requirements
  - Tools/Framework considerations
  - Testing
  - Proposed design



	TASK TITLE	DUE DATE	EST. HOURS	Semester 1											
				WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11 - 12	WK 13 - 15
1	**Project Design**														
1.1	Team Contract	9/23/22	12				🟥	🟥							
1.1.1	User Needs	9/30/22	12						🟪						
1.2	Requirements	10/7/22	16							🟦					
1.3	Project Planning	10/14/22	24								🟧				
1.4	Tools and Platforms	10/21/22	20									🟥			
1.5	Testing	10/21/22	16										🟪		
1.6	Proposed Design	11/4/22	12											🟦	
1.7	Final Document & Presentation	12/2/22	36												🟧

Project Plan - Spring 2023

- Platform Setup
  - Measured by functionality
  - February 3rd
- Authentication
  - Measured by unit testing
  - February 17th
- Algorithm Execution
  - Measured by unit testing
  - March 17th
- Visualizing the Simulation
  - Measured by individuals and unit testing
  - April 21st



MILESTONE TITLE	MILESTONE COMPLETION TARGET	EST. HOURS	Semester 2											
			WK 1	WK 2	WK 3	WK 4	WK 5	WK 6	WK 7	WK 8	WK 9	WK 10	WK 11	WK 12
			Sprint 1/23		Sprint 2/6		Sprint 2/20		Sprint 3/6		Sprint 3/20		Sprint 4/3	
Project Development														
Platform Setup	2/3/22	24	🟦	🟦										
Authentication	2/17/22	28		🟨	🟨	🟨								
Simulation Setup/Requesting	2/17/22	16			🟩	🟩								
Algorithm Execution (Running Simulation)	3/17/22	92				🟥	🟥	🟥	🟥	🟥				
Simulation Response	3/31/22	16								🟪	🟪			
Visualizing simulation	4/21/22	84									🟦	🟦	🟦	🟦

Test Plan

Testing Plan

- Unit Tests
  - Test specific aspects to quickly identify problems
  - Tests conducted in parallel
  - Used to test basic functionalities - User Auth
- Interface Testing
  - Test communication between different parts of the application.
  - Use Mockito and Postman to test our API calls.

Testing Plan (cont.)

- System Testing
  - Test functionalities that require the entire system to be operational
  - Use project requirements as tests.
  - Example - log in to user profile
- Acceptance Testing
  - Test to show that all our requirements have been met.
  - Demo the project for client/teammate/faculty to meet acceptance criteria
  - Examples in section 5.6 of design doc.

Testing Plan (cont.)

- Regression Testing
  - Make tests for components as you build them - Agile Development
  - Before deploying a new feature, gather previously created tests to re-test functionality.
  - Check impact of adding (instances of) modules
    - Algorithms
    - Datasets
- Security Testing
  - User Authentication

Conclusion

Final Thoughts

- Serious code implementation to begin next semester
- Agile methodology, Gantt chart outlined in section 3.4 of Design Document

Task	**Leading Member(s)**
Platform Setup	All Members
Authentication	Thomas, Jaden
Simulation Setup/Requesting	Marcus, Rowan
Algorithm Execution	Jacob, Marcus, Jaden
Simulation	Joe, Thomas
Visualizing Simulation	Joe, Rowan

Questions?