Implementing a Web Portal System for Drone Simulation and Control

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Problem and Need Statement

The goal is to make a web simulator for a drone which can visually depict a simulation environment and control the drone.

Requirements

Functional

- Drone Simulation
- Drone Control
- Computer Vision Generated Environments

Non-Functional

- Safety
- Scalability
- Compatibility

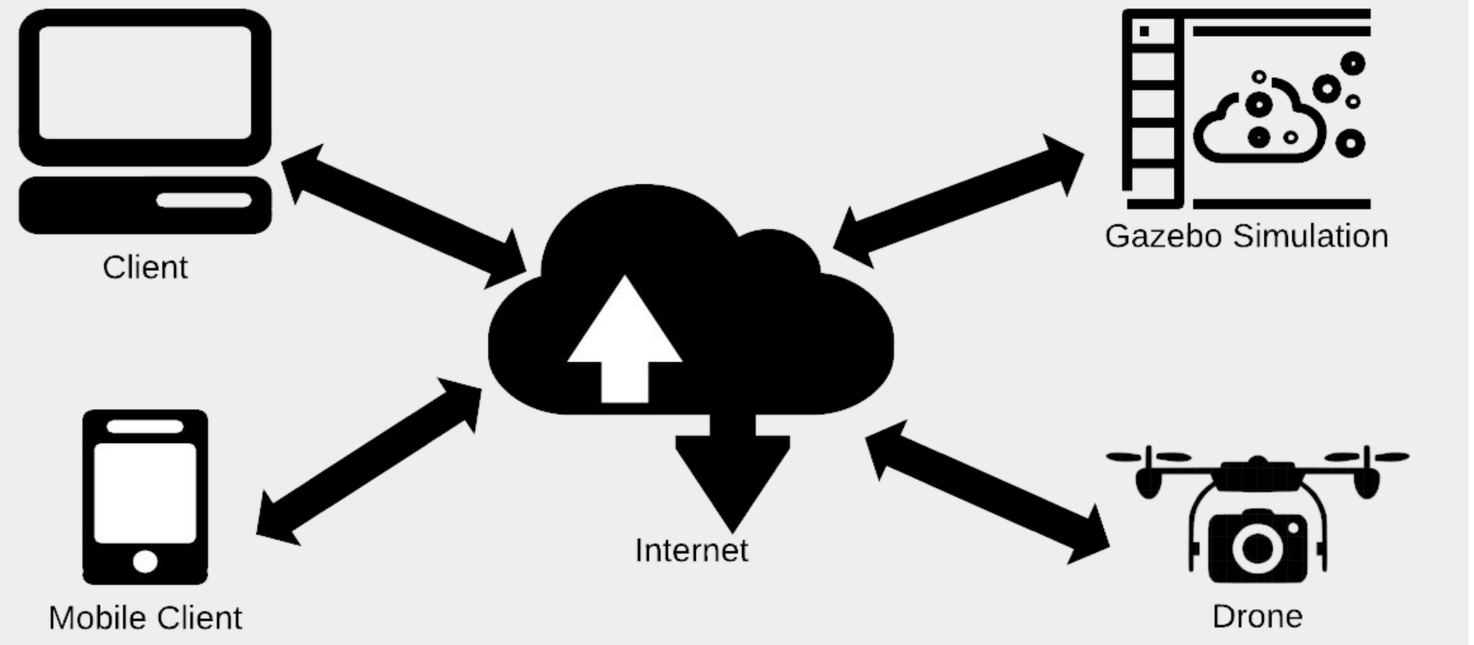
Intended Users and Uses

- Researchers interested in sensor collected data
- Recreational users
- Developers developing autonomous flight technologies

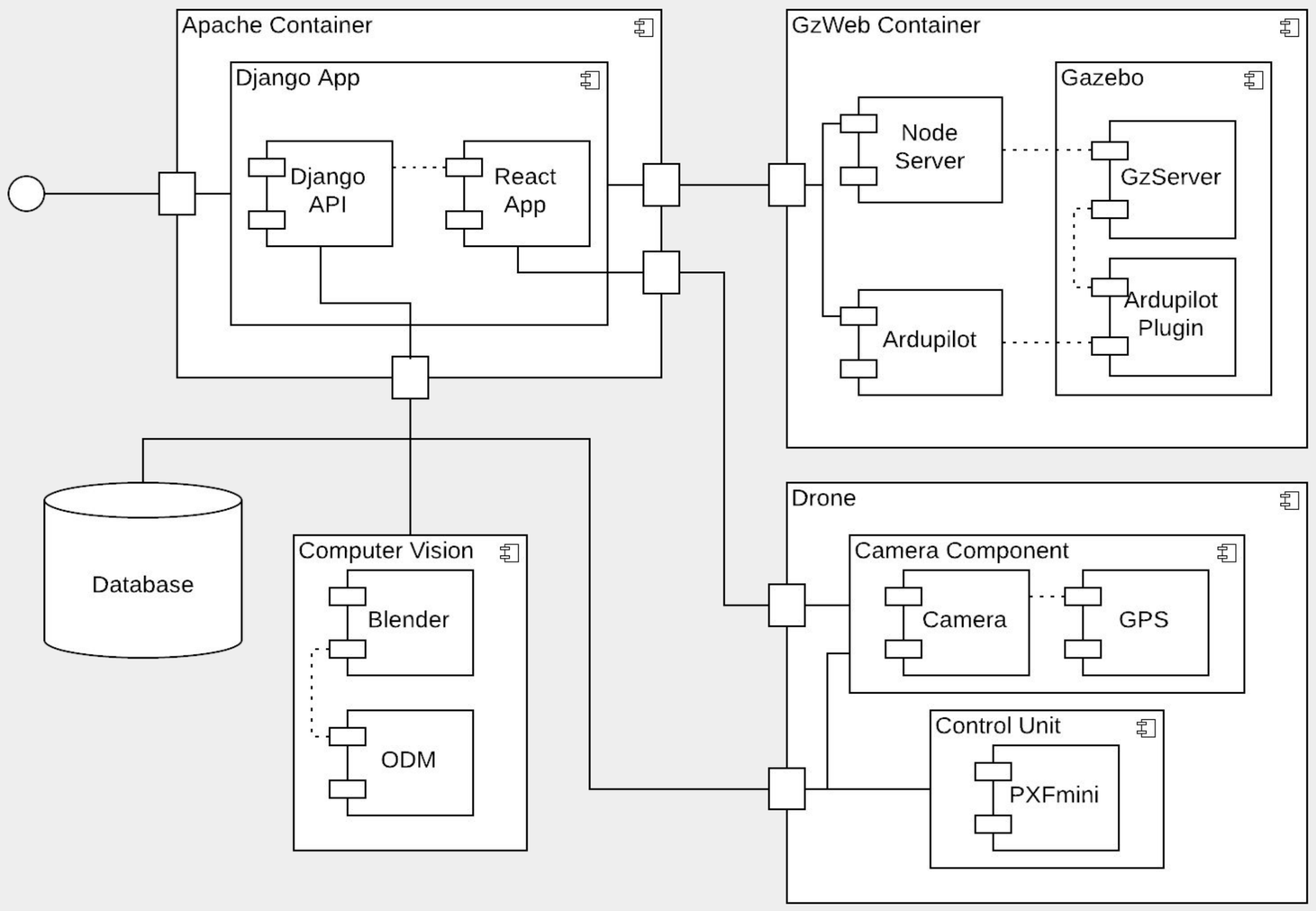
Testing

- Test-driven development with unit tests using Jest and Postman
- Manual system tests for the web portal, backend server, and drone

Concept Sketch



Block Diagram



Technical Details

- Django app (Python, JavaScript)
  - Serves web frontend (React), handles user requests, and starts simulations
  - Communicates with the computer vision app
- GzWeb container (primarily C++)
  - Gazebo runs the simulation itself, with the loaded simulation environment and flight physics
  - GzServer and Node server relay the simulation to the web client
  - ArduPilot handles piloting the drone and plotting flight paths
- Computer vision app (Python)
  - Open Drone Mapping (ODM) service creates environment model
  - Blender, Gazebo Simulation Depiction Format (SDF)
- Raspberry Pi used for drone control (C++)
  - Communicates with APM planner and Flight Control Unit (PXFmini)
  - Runs Robot Operating System (ROS)
- Raspberry Pi used for image processing (Python)
  - Livestreams video from the drone
  - Geo-tags the images taken by it for image stitching purposes