Project Structure Documentation

This document outlines the structure and organization of the Wildlife Detection System project.

Directory Structure

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```
WildlifeDetectionSystem/
├── api/                   # Flask backend
│   ├── app/               # Application source
│   │   ├── models/        # Database models
│   │   ├── routes/        # API endpoints
│   │   ├── services/      # Business logic
│   │   ├── static/        # Static files (annotation UIs)
│   │   ├── templates/     # HTML templates
│   │   └── utils/         # Helper utilities
│   ├── config.py          # Configuration
│   ├── debug/             # Debugging tools
│   ├── instance/          # Instance data (contains SQLite DB)
│   └── run.py             # Application entry point
├── data/                  # Data storage
│   ├── raw_images/        # Original camera trap images
│   ├── processed_images/  # Standardized images
│   ├── annotations/       # Annotation data directory
│   └── export/            # Export directory for ML data
├── docs/                  # Documentation
├── scripts/               # Utility scripts
└── requirements.txt       # Python dependencies
```

Key Files

Database Models (`api/app/models/models.py`)

Contains SQLAlchemy models for:

- `Image`: Camera trap image metadata

- `Species`: Wildlife species definitions

- `Annotation`: Bounding box annotations

- `EnvironmentalData`: Environmental context data

- `BehavioralNote`: Animal behavior documentation

- `SequenceEvent`: Chronological tracking data

API Routes

- `api/app/routes/image_routes.py`: Image management endpoints
- `api/app/routes/species_routes.py`: Species management endpoints
- `api/app/routes/annotation_routes.py`: Annotation management endpoints

Services

- `api/app/services/image_service.py`: Image processing logic
- `api/app/services/annotation_service.py`: Annotation business logic
- `api/app/services/habitat_analysis.py`: Microhabitat analysis functionality
- `api/app/services/behavior_analysis.py`: Behavioral analysis functionality

Static Files

- `api/app/static/js/annotator.js`: Advanced annotation interface
- `api/app/static/css/annotator.css`: Styling for annotation interfaces

Templates

- `api/app/templates/advanced-annotator.html`: Advanced annotation interface
- `api/app/templates/ground-truth-annotator.html`: Ground truth interface
- `api/app/templates/simple-annotator.html`: Simple annotation interface

Database Schema

Image Table

Column	Type	Description
id	INTEGER	Primary key
filename	VARCHAR(255)	Relative path to image
original_path	VARCHAR(512)	Absolute path to original image
processed_path	VARCHAR(512)	Path to processed version (if any)
width	INTEGER	Image width in pixels
height	INTEGER	Image height in pixels
upload_date	DATETIME	When image was added to system
location	VARCHAR(255)	Geographic location data
timestamp	DATETIME	When image was captured
camera_id	VARCHAR(100)	ID of the camera trap

Species Table

Column	Type	Description
id	INTEGER	Primary key
name	VARCHAR(100)	Common name (e.g., "Red Deer")
scientific_name	VARCHAR(255)	Latin name
description	TEXT	Additional information

Annotation Table

Column	Type	Description
id	INTEGER	Primary key
image_id	INTEGER	Foreign key to Image
species_id	INTEGER	Foreign key to Species
x_min	FLOAT	Left boundary (0-1 normalized)
y_min	FLOAT	Top boundary (0-1 normalized)
x_max	FLOAT	Right boundary (0-1 normalized)
y_max	FLOAT	Bottom boundary (0-1 normalized)
confidence	FLOAT	Prediction confidence (for ML)
is_verified	BOOLEAN	Human verification flag
created_at	DATETIME	Creation timestamp
updated_at	DATETIME	Last update timestamp

EnvironmentalData Table

Column	Type	Description
id	INTEGER	Primary key
image_id	INTEGER	Foreign key to Image
temperature	FLOAT	Temperature when image was captured
moon_phase	VARCHAR(50)	Moon phase when image was captured
snow_cover	BOOLEAN	Whether snow is present
light_condition	VARCHAR(50)	Light conditions (e.g., "Full darkness")
vegetation_type	VARCHAR(100)	Type of vegetation in the image

Feature Development Status

Feature	Status	Target Completion
Image indexing and management	Complete	N/A
Species management	Complete	N/A
Basic annotation interface	Complete	N/A
Box manipulation tools	Complete	N/A
COCO/YOLO export	Complete	N/A
Microhabitat analysis	In Progress	May 2025
Behavioral tracking	In Progress	June 2025
Diurnal activity analysis	Planned	July 2025
ML model integration	Planned	August 2025