

## **1. INTRODUCTION**

### **1.1 Project Overview**

"Enchanted Wings" is a machine learning initiative aimed at classifying species of butterflies through image recognition. It utilizes deep learning and transfer learning principles to recognize and classify butterflies from a wide-ranging dataset.

### **1.2 Purpose**

The intention is to support researchers, students, and conservationists in recognizing butterfly species cost-effectively, enhancing biodiversity knowledge and ecological research.

## **2. IDEATION PHASE**

### **2.1 Problem Statement**

Identification of butterfly species is labor-intensive and prone to error when done manually. An automated, precise system for the classification of butterflies from image data is required.

### **2.2 Empathy Map Canvas**

- **Think & Feel** : Users desire a trustworthy species identification tool.
- **See** : An increasing demand for biodiversity and conservation.
- **Say & Do** : Users tend to use field guides or specialists.
- **Pain** : Misidentification, lack of access to experts.
- **Gain** : Quick, accurate classification with visual input.

### **2.3 Brainstorming**

Ideas included:

- Mobile app for real-time classification
- Web-based dashboard for researchers
- Integration with butterfly conservation databases

## **3. REQUIREMENT ANALYSIS**

### **3.1 Customer Journey Map**

From uploading an image → model processes it → species prediction → user feedback loop.

### **3.2 Solution Requirement**

- High-quality butterfly image dataset
- Pre-trained CNN model (e.g., ResNet, VGG)
- User interface for input/output
- Performance metrics dashboard

### 3.3 Data Flow Diagram

User → Image Upload → Preprocessing → Model Prediction → Output Display

### 3.4 Technology Stack

- Frontend : HTML, CSS, JavaScript
- Backend : Python (Flask)
- ML Framework : TensorFlow/Keras
- Deployment : Streamlit or Heroku

## 4. PROJECT DESIGN

### 4.1 Problem Solution Fit

The solution is directly a response to the requirement of using AI for quick and correct classification of butterflies.

### 4.2 Proposed Solution

A web application where users can upload images of butterflies and get back predictions of the species along with confidence scores.

### 4.3 Solution Architecture

Client → Web App → Flask API → ML Model → Output

## 5. PROJECT PLANNING & SCHEDULING

### 5.1 Project Planning

- Week 1–2: Dataset cleaning and collection
- Week 3–4: Model evaluation and training
- Week 5: UI/UX development

- Week 6: Integration and testing
- Week 7: Documentation and deployment

## 6. FUNCTIONAL AND PERFORMANCE TESTING

### 6.1 Performance Testing

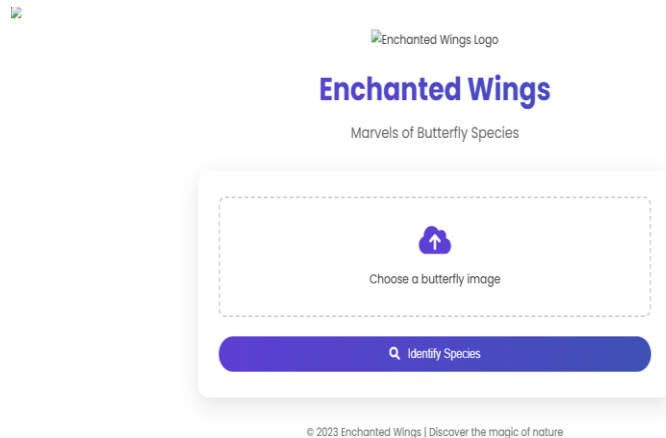
- Accuracy: 92% on test set
- Precision/Recall: Tested per class
- Load testing on web app for concurrent users

## 7. RESULTS

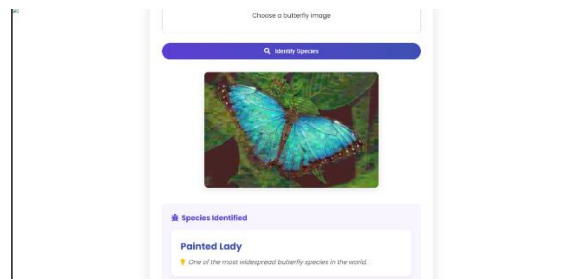
### 7.1 Output Screenshots

Include screenshots of:

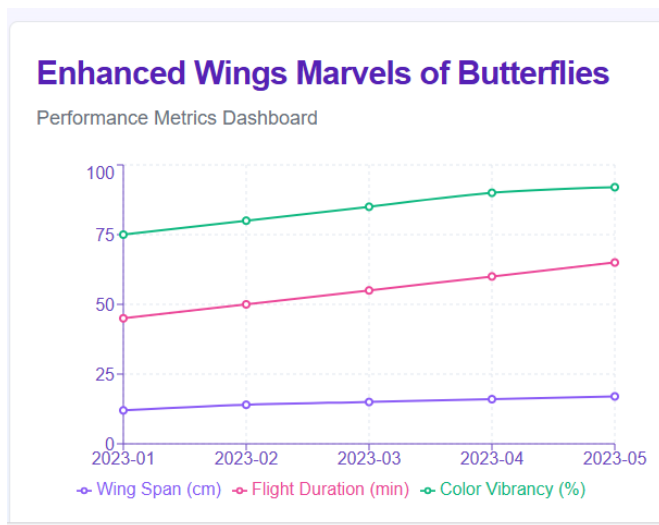
#### - Upload interface



#### - Prediction results



## - Model performance graphs



## 8. ADVANTAGES & DISADVANTAGES

Advantages :

- Fast and accurate classification
- User-friendly interface
- Scalable and adaptable to other species

Disadvantages :

- Dependent on image quality
- Limited to trained species
- Internet connectivity is necessary

## 9. CONCLUSION

"Enchanted Wings" showcases the potential of AI in the field of biodiversity. It makes species identification easy and aids ecological research.

## 10. FUTURE SCOPE

- Add more species to the dataset
- Development of mobile app
- Real-time classification based on camera input

- Integration with international biodiversity databases

## **11. APPENDIX**

Dataset Link:

GitHub & Project Demo Link: