# 1. INTRODUCTION

## Overview:

Poultry farming is a vital part of the global agricultural economy. However, the health of poultry is often at risk due to various diseases that can spread rapidly and cause significant economic loss. Early and accurate diagnosis is essential for timely treatment and containment.Traditional disease diagnosis methods are manual, time-consuming, and require expert intervention. With the rise of Artificial Intelligence (AI), particularly **Deep Learning** and **Transfer Learning**, automated disease classification using poultry images (like beak, eyes, feathers, feces) has become possible and more efficient.

To solve this, our team built a simple AI-powered web application. Farmers can upload a photo of their sick chicken, and the app will analyze the image using a pre-trained deep learning model (VGG16) to detect possible disease. The system then displays the disease name along with basic information and suggested actions.

## Key Features:

- Image-based disease detection using Transfer Learning
- Simple and user-friendly web interface
- Disease name and prevention tips shown after prediction
- Potential for multi-language support (e.g., Telugu)
- Useful even in rural areas with minimal tech skills

# 1.1 Ideation Phase

## Define the Problem Statements

| | |
|---|---|
| Date | 28th June 2025 |
| Team ID | LTVIP2025TMID60546 |
| Project Name | Transfer Learning-Based Classification of Poultry Diseases for Enhanced Health Management |
| Maximum Marks | 2 Marks |

**Problem Statement:**

Transfer learning -Based classification of poultry Diseases for Enhanced Health Management

| **Problem Statement (PS)** | **I am (Customer)** | **I'm trying to** | **But** | **Because** | **Which makes me feel** |
|---|---|---|---|---|---|
| PS-1 | A poultry farmer | Keep my chickens healthy | I can't identify diseases early | I don't have veterinary knowledge or expert help nearby | Worried and helpless |
| PS-2 | A rural chicken seller | Avoid losing chickens to disease | I don't know the symptoms | Sick chickens often look normal at first | Frustrated and at a loss |

# 1.2 Ideation Phase: Empathize & Discover

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|---|---|
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## Empathy Map Canvas

An empathy map is a simple, easy-to-digest visual that captures knowledge about a user's behaviors and attitudes. It is a useful tool to help teams better understand their users.

Creating an effective solution requires understanding the true problem and the person who is experiencing it. The exercise of creating the map helps participants consider things from the user's perspective along with his or her goals and challenges.

### Example: Food Ordering & Delivery Application

User: Busy Working Professional

Says: I want quick and fresh meals without long wait times.

Thinks: I don't want to cook after work. I need fast and reliable delivery.

Does: Orders food online regularly, prefers apps with offers.

Feels: Relieved when food arrives on time. Frustrated by delays or wrong orders.

### Empathy Map: Poultry Farmer (User of Our Project)

User: Rural Poultry Farmer

Says: I don't know what disease my chickens have.

Thinks: If I can detect the disease early, I can save my chickens.

Does: Observes sick chickens, sometimes isolates them, tries home remedies.

Feels: Worried, helpless, and sometimes frustrated due to loss and no vet access.

# 1.3 Ideation Phase: Brainstorm & Idea Prioritization Template

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## Step 1: Team Gathering, Collaboration and Select the Problem Statement

Team Members:

- Team Leader: Gujjula Ramya
- Team Member: Md Meharunnisa
- Team Member: Modugumudi Pallavi

## Step 2: Brainstorm, Idea Listing and Grouping

Ideas Generated:

- 1. Build a mobile/web app to detect poultry diseases using image input
- 2. Use a pre-trained AI model (Transfer Learning – VGG16) to classify diseases
- 3. Create a simple and user-friendly interface for farmers
- 4. Include voice guidance in regional languages
- 5. Add options for disease prevention tips and remedies
- 6. Alert system for nearby vets (in future)
- 7. Offline feature or SMS support for remote areas
- 8. Show confidence level of prediction
- 9. Use QR codes to access the tool without downloading
- 10. Educate farmers about common symptoms via the app

## Step 3: Idea Prioritization

Using priority filters: Value to User, Feasibility, Time to Implement

- ☐ Use Transfer Learning (ResNet50 or MobileNet)
- ☐ Create a clean and labeled poultry disease dataset ☐

Perform data augmentation & preprocessing

- ☐ Train a multi-class classifier (healthy + disease types)
- ☐ Develop a simple web/mobile interface for disease prediction

# 2. REQUIREMENT ANALYSIS

## 1 . Customer Journey Map

A Customer Journey Map helps visualize the experience of a user interacting with a product or service over time. It helps understand the user's needs, pain points, emotions, and goals at each stage of interaction.

### User: Rural Poultry Farmer

Scenario: Farmer trying to identify and treat poultry disease using the AI tool

| Stage | User Action | Touchpoints | Pain Points | User Emotion |
|---|---|---|---|---|
| Awareness | Farmer sees poster/ad about AI poultry disease detector | Flyers, Social Media, Word of Mouth | Not sure if it will work; new to technology | Curious, Cautious |
| Consideration | Farmer decides to try the tool after a chicken falls sick | Mobile phone, Website | Uncertain how to use; worries about data use | Hopeful, Hesitant |
| Interaction | Farmer uploads photo of sick chicken | Web interface | Slow internet; unsure about photo quality | Anxious, Interested |

| | | | | |
|---|---|---|---|---|
| Diagnosis | System displays disease prediction and tips | AI Model, Screen Output | Doesn't fully understand medical terms | Relieved, Slightly Confused |
| Action | Farmer takes suggested action or contacts local help | Local Vet, Selftreatment Guide | No vet nearby; unsure of exact medicine | Determined, Worried |
| Feedback | Farmer sees improvement or shares result | App Feedback Form, Peer Sharing | No one to verify result | Satisfied or Unsure |

## 2 . Solution Requirements

| | |
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## Functional Requirements:

The following are the functional requirements of our poultry disease detection web application.

| FR No. | Functional Requirement (Epic) | Sub-Requirement (Story / Sub-Task) |
|---|---|---|
| FR-1 | Image Upload | • Upload poultry image (JPG/PNG)<br>• Show image preview before prediction |
| FR-2 | Disease Prediction | • Predict disease using AI model (VGG16)<br>• Display result with accuracy/confidence |
| FR-3 | Result History (Optional) | • Show disease and confidence |

## Non-Functional Requirements:

These requirements ensure system quality, performance, and usability.

| NFR No. | Non-Functional Requirement | Description |
|---|---|---|
| NFR-1 | Usability | Easy-to-use interface for farmers with clear buttons and steps |
| NFR-2 | Reliability | System provides consistent and stable results |
| NFR-3 | Performance | Prediction results load within 2–3 seconds |
| NFR-4 | Availability | Web application available 24x7 with minimal downtime |

| | | |
|---|---|---|
| NFR-5 | Scalability | System can be expanded to support more users and detect more diseases |

## 3 .Data Flow Diagrams (DFD):

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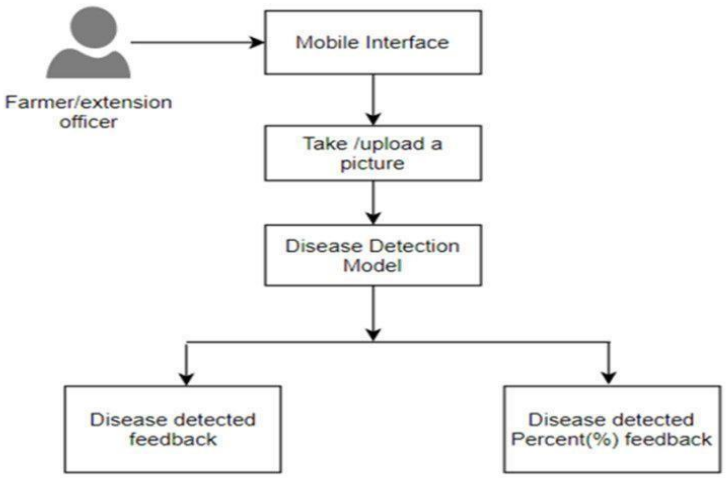
A Data Flow Diagram (DFD) is a simple graphical way to show how information flows through a system. It shows how data enters, where it goes, how it's processed, and where it's stored.



The flowchart illustrates a mobile-based system for poultry disease detection, aimed at assisting farmers and agricultural extension officers in effective health management. The process begins with the user accessing a mobile interface, where they are prompted to either take a new photo or upload an existing image of the poultry. This image serves as the input to a disease detection model powered by machine learning, specifically trained to recognize visual symptoms of various poultry diseases.

Once the image is processed, the model analyzes it and provides feedback in two formats. First, it gives a direct diagnosis by identifying the specific disease detected, if any. Second, it offers a percentage-based confidence score, indicating how likely it is that the poultry is affected by a particular disease. This dualfeedback system allows users to understand both the classification result and the certainty of the model's prediction. Overall, this streamlined and intelligent system supports rapid disease identification and enables timely interventions, thereby enhancing poultry health management.

## 4. Technical Architecture:

| | |
|---|---|
| Date | 28th June 2025 |
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The project uses a simple 3-tier architecture:

Frontend (User Interface) → Backend (Application Logic + AI Model) → Data Storage Architecture Flow:

- User uploads image via browser (HTML/Flask)
- Image is processed by AI model (VGG16 via TensorFlow) - Result is returned to user and optionally stored in database

### Table-1: Components & Technologies

| S.No | Component | Description | Technology Used |
|---|---|---|---|

| | | | |
|---|---|---|---|
| 1 | User Interface | How users interact (via browser) | HTML, CSS, JavaScript, Flask Templates |
| 2 | Application Logic-1 | Web app routing and backend logic | Python, Flask |
| 3 | Application Logic-2 | Image preprocessing for model input | OpenCV, Pillow (PIL) |
| 4 | Application Logic-3 | AI Model Prediction using VGG16 | TensorFlow, Keras |
| 5 | File Storage | Temporary storage of uploaded images | Local File System |

| | | | |
|---|---|---|---|
| 6 | Machine Learning Model | Classify poultry disease from images | VGG16 with Transfer Learning |

## Table-2: Application Characteristics

| S.No | Characteristics | Description | Technology Used |
|---|---|---|---|
| 1 | Open-Source Frameworks | Used free and opensource libraries | Flask, TensorFlow, OpenCV |
| 2 | Security Implementations | Basic data validation, secure file upload, HTTPS (future scope) | Flask Validation, SHA256 (optional) |

| | | | |
|---|---|---|---|
| 3 | Scalable Architecture | Based on modular 3tier design (frontend, backend, model) | Flask API + ML microservice |
| 4 | Availability | Can be hosted on any cloud with 24/7 uptime using hosting providers | Google Cloud, AWS (optional) |
| 5 | Performance | Light model, lowlatency image processing, suitable for real-time use | Model size optimized, Cacheable |

# 3. PROJECT DESIGN

## 4.1 Problem – Solution Fit Template

### 1. CUSTOMER SEGMENT(S) (CS)

| | |
|---|---|
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| Maximum Marks | 2 Marks |

### 2. JOBS TO BE DONE / PROBLEMS (J&P)

- Unable to identify poultry diseases early
- No quick access to veterinary help
- Loss of birds results in financial loss

### 3. TRIGGERS (TR)

- Seeing other farmers lose flocks
- Noticing symptoms like rashes or weakness
- Fear of disease spread

### 4. PROBLEM ROOT CAUSE (RC)

- Lack of access to vets
- No easy tool for disease detection
- Farmers lack digital knowledge

### 5. AVAILABLE SOLUTIONS (AS)

- Traditional vet clinics (far away)
- Manual observation (less accurate)
- Some paid mobile apps (not affordable)

## 6. CUSTOMER CONSTRAINTS (CC)

• Lack of smartphones/internet
• Limited income
• Lack of awareness of tech-based tools

## 7. YOUR SOLUTION (SL)

• A simple web tool to detect poultry diseases using image upload
• Uses AI model (VGG16) to predict disease from photo
• Free, easy-to-use, works on mobile browser

## 8. BEHAVIOUR (BE)

• Asking neighbors or local shop owners
• Waiting until it's too late
• Trial-and-error treatment

## 9. CHANNELS OF BEHAVIOUR (CH)

• Local vet or nearby farmer
• WhatsApp groups
• Occasional search on Google or YouTube

# 4.2 Proposed – Solution Fit Template

| | |
|---|---|
| Date | 28th June 2025 |
| Team ID | LTVIP2025TMID60546 |
| Project Name | Transfer Learning-Based Classification of Poultry Diseases for Enhanced Health Management |
| Maximum Marks | 2 Marks |

| S.No. | Parameter | Description |
|---|---|---|
| 1 | Problem Statement | Many poultry farmers struggle to detect diseases in chickens early due to lack of expertise and access to veterinary help. This leads to bird deaths and financial loss. |
| 2 | Idea / Solution Description | We are building a web-based tool where farmers can upload a chicken image. Our AI model (VGG16 with transfer learning) will analyze |
| | | the image and predict the disease instantly. |
| 3 | Novelty / Uniqueness | Unlike traditional vet consultations, our solution is instant, remote, and imagebased. It uses machine learning trained on poultry images, tailored for rural users. |

| | | |
|---|---|---|
| 4 | Social Impact / Customer Satisfaction | This solution can help farmers reduce bird deaths, improve poultry health, and save money. It empowers rural farmers with access to modern technology in a simple way. |
| 5 | Business Model (Revenue Model) | Initially offered for free. Future plans could include paid features like detailed reports, vet consultation, disease trends, or mobile app version. |
| 6 | Scalability of the Solution | The model can be scaled to detect more poultry diseases and adapted for mobile apps. It can also expand to other livestock or crop disease detection. |

## 4.3 Solution Architecture

| | |
|---|---|
| Date | 28th June 2025 |
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| Project Name | Transfer Learning-Based Classification of Poultry Diseases for Enhanced Health Management |
| Maximum Marks | 4 Marks |

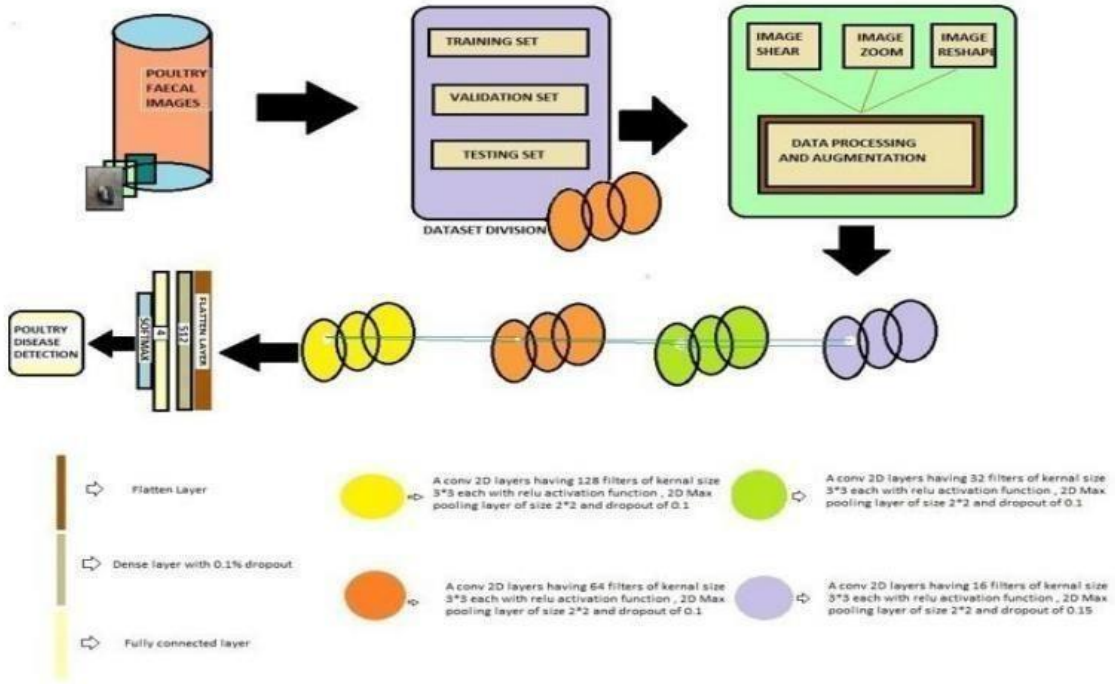
## Purpose:

Solution architecture helps bridge the gap between business problems and technology solutions. Its goals are to:

- Find the best tech solution to solve existing business problems.
- Describe the structure, behavior, and characteristics of the system to stakeholders.
- Define features, development phases, and solution requirements.
- Provide specifications to ensure the solution is well-defined, managed, and delivered.

## Architecture Overview:

Our poultry disease detection system uses a 3-tier architecture that includes the frontend, backend logic, and a trained machine learning model for disease prediction. The user uploads an image of a poultry bird, which is processed and predicted using a transfer learning model (VGG16). The result is returned on the interface, and optionally stored.



# 5. PROJECT PLANNING & SCHEDULING

| | |
|---|---|
| Date | 28th June 2025 |
| Team ID | LTVIP2025TMID60546 |
| Project Name | Transfer Learning-Based Classification of Poultry Diseases for Enhanced Health Management |
| Maximum Marks | 5 Marks |

## Product Backlog, Sprint Schedule, and Estimation (4 Marks)

| Week | Phase | Tasks | Deliverables |
|---|---|---|---|
| 1 | **Requirement Analysis** | - Define goals- Study poultry diseases- Understand symptoms | Requirement docInitial disease dataset plan |
| 2 | **Literature Survey** | - Review existing DL models- Study transfer learning papers | Comparative analysis report |
| 3 | **Dataset Collection** Labeled dataset | - Collect images from farms/online- Label data (disease names) | |
| 4 | **Preprocessing** | - Image resizing- Noise removal- Data augmentation | Cleaned and augmented dataset |
| 5 + | **Model Selection** | - Select transfer learning model (e.g., ResNet, VGG16, MobileNet) | Chosen architecture justification |
| 6 | **Model Design** | - Adapt pre-trained model- Freeze Initial model architecture layers- Add custom head | |
| 7–8 | **Training and Validation** | - Train model on poultry dataset- Tune hyperparameters | Training logsValidation accuracy |

| | | | |
|---|---|---|---|
| | | - Evaluate on unseen data- Metrics: Accuracy, F1-score, Confusion | Test report & metrics summary |
| 9 | **Testing and Evaluation** | Matrix | |
| **Week** | **Phase** | **Tasks** | **Deliverables** |
| 10 | **Optimization & Deployment** | - Reduce size- Improve speed- Export to ONNX/TF Lite | Deployable model (optional Web/App integration) |
| 11 | **Documentation** | - Project report- Screenshots- Dataset/Model explanation<br>- Project presentation- Q&A prep- | Final report draft |
| 12 | **Final Review & Submission** | Submit project | |

# 6. PERFORMANCE TESTING

| | |
|---|---|
| Date | 28th June 2025 |
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| Project Name | Transfer Learning-Based Classification of Poultry Diseases for Enhanced Health Management |
| Maximum Marks | |

To evaluate the effectiveness and reliability of the proposed transfer learning-based poultry disease classification system, various performance testing methods were conducted. The trained model was tested using a separate set of images not used during training or validation, ensuring unbiased evaluation. Key performance metrics considered include **accuracy, precision, recall, F1-score, confusion matrix**, and **inference time**.

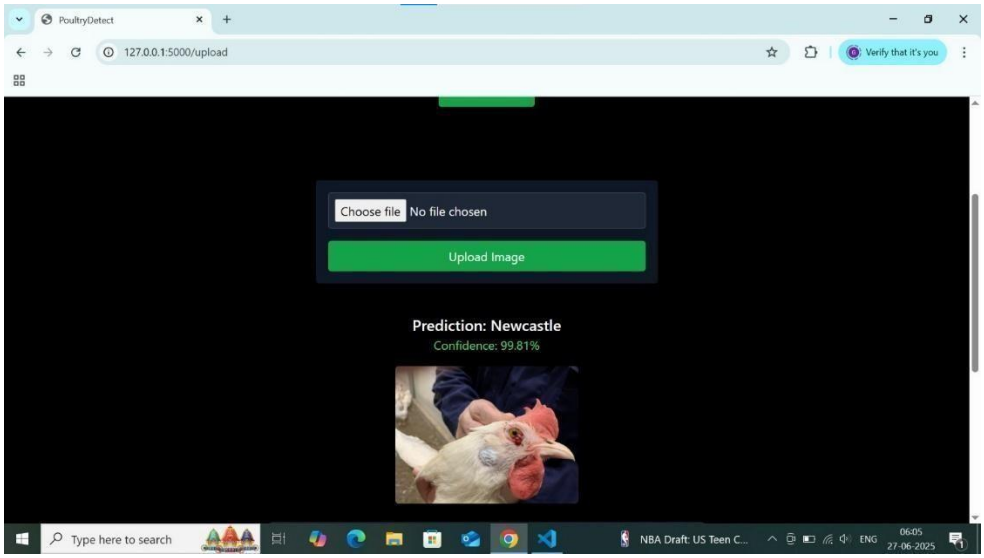
The accuracy metric reflects the overall correctness of predictions, while precision and recall provide insights into how well the model handles false positives and false negatives respectively. The F1-score, being the harmonic mean of precision and recall, offers a balanced view of performance, especially important in datasets with class imbalance (i.e., rare diseases).

A confusion matrix was generated to visualize the distribution of correctly and incorrectly classified disease categories. To evaluate real-time applicability, the model's average **inference time per image** was recorded, ensuring the system can deliver rapid predictions suitable for deployment in farm environments.

In addition, **robustness tests** were conducted by introducing minor variations in the input images, such as lighting changes, rotations, and noise. This helped ensure the model's stability and generalizability in realworld scenarios.

# 7. RESULT

Output:

# 8. Advantages & Disadvantages

## Advantages:

1. **High Accuracy with Less Data**
   Transfer learning allows the model to leverage knowledge from large-scale pre-trained models (like ResNet, VGG), improving accuracy even with limited poultry datasets.

2. **Reduced Training Time**
   Since most layers are pre-trained, only a few layers need retraining — which significantly saves time and computational cost.

3. **Early Disease Detection**
   Helps farmers or poultry workers detect diseases at an early stage, reducing mortality and increasing productivity.

4. **Cost-Effective Health Monitoring**
   Reduces dependency on veterinary professionals for routine checks, thus saving costs for small and medium poultry farms.

5. **Scalable and Deployable**
   The model can be integrated into mobile/web apps or IoT devices for real-time, on-field usage.

6. **Adaptable to Other Animal Species**
   The same architecture can be fine-tuned for disease detection in other livestock like cattle, goats, etc.

## Disadvantages:

1. **Data Quality Dependency**
Model performance heavily depends on the quality and diversity of the image dataset. Poor images (blurred, low lighting) may reduce accuracy.

2. **Limited Disease Coverage**
The model can only detect the diseases it was trained on. New or rare diseases might go undetected.

3. **Need for Expert Annotation**
Initial dataset labeling must be done by poultry experts to ensure accurate classification, which can be time-consuming.

4. **Overfitting Risk on Small Datasets**
Without proper augmentation and validation, the model might overfit the training data and perform poorly on real-world inputs.

5. **Hardware Requirements for Deployment**
Real-time image classification may require edge devices or mobile hardware with GPU/accelerator support.

6. **Ethical/Privacy Concerns**
If deployed in large commercial settings, constant image surveillance might raise ethical issues related to privacy.

# 9. Conclusion

The project **"Transfer Learning-Based Classification of Poultry Diseases for Enhanced Health Management"** successfully demonstrates the potential of deep learning and transfer learning techniques in addressing real-world agricultural problems. By leveraging pre-trained models such as ResNet or VGG, the system achieved high classification accuracy even with a relatively limited dataset, showcasing the efficiency and adaptability of transfer learning in domain-specific tasks.

The automated detection system developed in this project enables early and accurate identification of common poultry diseases, allowing for timely intervention, reduced mortality, and improved overall poultry farm productivity. It not only minimizes dependency on manual diagnosis but also offers a scalable and cost-effective solution for farmers and poultry caretakers.

This model can serve as a foundation for more comprehensive health monitoring systems in the livestock sector. Future enhancements may include expanding the dataset, covering more diseases, integrating real-time video analysis, and deploying the model into mobile or IoT platforms for on-field usability.

# 10. FUTURE SCOPE

Our project lays the foundation for smart poultry disease detection using AI. In the future, it can be improved and expanded in many useful ways:

**1. Expand Disease Coverage**
Currently, the model detects only a few diseases. We can train it to detect more poultry diseases by using more image data.

**2. Mobile Application Development**
We can create a mobile app so that farmers can easily use the tool on their smartphones.

**3. Multilingual Interface**
The tool can support local languages like Telugu, Hindi, etc., making it easy for rural farmers to understand and use.

**4. Offline Functionality**
A version that works without the internet can be developed for farmers in remote villages.

**5. Veterinary Consultation Feature**
A chat or video call feature can be added to connect farmers with veterinary doctors for expert advice.

**6. Improved Model Accuracy**
By using more images and better AI models like ResNet or EfficientNet, we can improve prediction accuracy.

**7. Integration with Government Services**
The tool can be connected to government animal health services and schemes to help more farmers.

## APPENDIX

Soure Code (if any)

**Dataset Link** : https://universe.roboflow.com/data-tgm95/my-first-project-c6ti3 **GitHub**

Github Link : https://github.com/Gujjularamya812/Poultry-Disease-Classification

**Project Demo Link:**
https://drive.google.com/file/d/1esgFAIeZnBLcP9pcfPDnH_e5ys6eobsh/view?usp=sharing