ARTIFICIAL INTELLIGENCE

AgriVision: An AI-Powered Multilingual Platform for Plant Disease Detection and Crop Recommendation

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Abstract

Crop health and crop choice both depend on conditions that differ from one farm to the next, including weather, soil, season, and water supply, yet farmers in many regions have little access to timely, locally relevant advice. This paper presents AgriVision, a web-based platform that brings plant disease detection, crop recommendation, and farmer guidance together in one application. A user uploads or captures a photograph of a leaf, and a deep-learning classifier returns the most likely disease with a confidence score, followed by symptoms, preventive practices, and management steps. A separate module suggests crops from the farmer's soil type, season, water availability, and location, and the interface is available in Telugu, Hindi, and English with a saved scan history. The prototype is built for farmers in Telangana and is intended as preliminary decision support, not as a replacement for expert diagnosis. We describe the system design, implementation, and limitations, and outline the field validation required before wider use.

Keywords: plant disease detection; smart agriculture; crop recommendation; computer vision; deep learning; multilingual interface; precision agriculture; farmer decision support

1 Introduction

Agriculture is shaped by plant health, weather, soil, the season, and the availability of water, and disease is among the most damaging pressures on yield. In the field, diagnosis still relies largely on a farmer's own eye or on a visit from an extension expert, which is slow and often out of reach for smallholders. Advances in deep learning now make it possible to recognize many leaf diseases directly from photographs [1], and a smartphone camera is enough to collect the input. Recognition alone, however, does not tell a farmer what to plant next season or how to act on a result in a language they read comfortably. AgriVision was developed to meet this wider need. A user uploads or captures a photograph of a leaf, and the system returns the predicted disease with a confidence score, then explains the symptoms, likely causes, prevention, and treatment options in plain language. A second module recommends crops using the farmer's soil type, season, water availability, and location. The platform also offers weather information and disease-risk alerts, presents its content in Telugu, Hindi, and English, and keeps a record of past scans; voice-based assistance is planned as future work. The aim is a single practical assistant for everyday farm decisions rather than a stand-alone disease classifier.

2 Related work

Early work on automated leaf-disease recognition combined hand-crafted image features with conventional classifiers. Jadhav et al. [2], for example, applied multiclass SVM and KNN classifiers to soybean leaves and also measured disease severity, and Harakannanavar et al. [3] paired image-processing steps with machine-learning algorithms for leaf disease detection. More recently, convolutional neural networks have become the dominant approach. Ferentinos [1] evaluated several deep CNN architectures for diagnosing plant diseases from leaf images, and the reviews and surveys in [4]-[7] describe how deep learning and machine learning methods are now used for plant disease classification and detection, together with the challenges that remain.

Much of the literature cited above concentrates on the recognition task itself and is evaluated on image datasets rather than delivered as a complete service. A farmer who has to act on a diagnosis also needs treatment guidance, advice on crops suited to local conditions, and an interface in a familiar language. AgriVision addresses this gap by embedding a disease classifier in a web platform that adds localized guidance, crop recommendation, and Telugu, Hindi, and English support.

3 Problem statement and objectives

Smallholder farmers often struggle to recognize a plant disease early, to choose a suitable treatment, and to decide which crops fit their land and season. Diagnosis usually depends on personal experience or on an expert who may be far away, so action can come late. General agricultural advisories add to the problem because they seldom reflect the weather, soil, season, or water supply of a particular farm. This work therefore sets out to (i) identify plant diseases from a single leaf photograph, (ii) give treatment and prevention guidance in simple language, (iii) recommend crops that suit local soil, season, and water conditions, and (iv) deliver all of this in Telugu, Hindi, and English through a mobile-friendly web interface.

4 Proposed system

AgriVision is a web platform that links a plant-disease classifier with a set of localized advisory services. A farmer photographs a leaf, and computer-vision analysis identifies the most probable disease. The system then reports the typical symptoms, probable causes, preventive practices, and management measures for that disease. Alongside diagnosis, it suggests crops according to soil type, water availability, season, and region. Because the intended users are farmers in Telangana, the interface is offered in Telugu, Hindi, and English and keeps a history of earlier scans, so that a farmer can follow a plant's condition over time. By giving a first assessment without waiting for an expert visit, the platform aims to shorten the time between noticing a problem and acting on it.

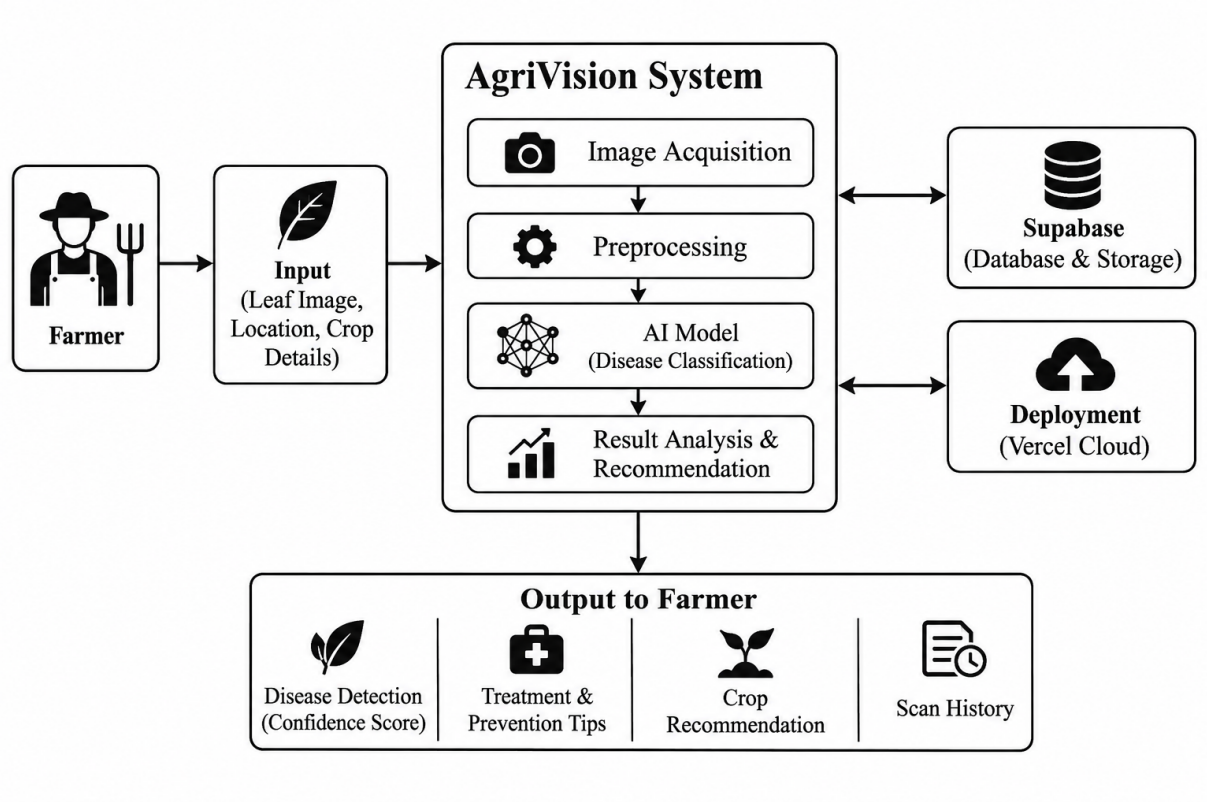


Figure 1. Overall architecture of the AgriVision system.

5 Methodology

5.1 Processing workflow

The AgriVision pipeline starts with a leaf image, which is validated and preprocessed, passed through feature extraction, and classified. The predicted disease and confidence score are then paired with treatment and prevention guidance and with a crop recommendation, and the combined result is shown in the user's chosen language (Figure 2). The image can be captured with the device camera or uploaded from storage.

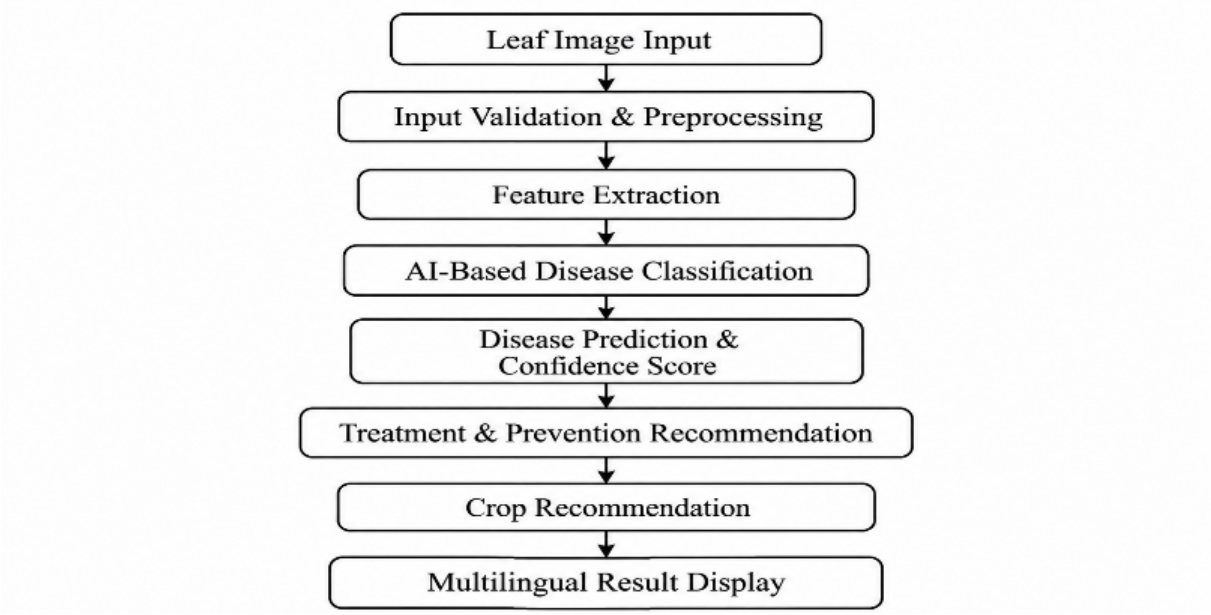


Figure 2. Processing workflow followed by the proposed AgriVision system.

5.2 Data preparation

The classifier is intended to be trained on leaf images covering different crops and disease conditions. Publicly available plant-disease image collections form the basis of the training data, and field-captured images are included to bring the model closer to real use. Images are arranged by crop and disease category before training. The dataset size, class distribution, and train-test split follow the configuration chosen during implementation.

5.3 Image preprocessing

Before classification, each submitted image is resized and normalized to the input format that the trained model expects. This keeps photographs taken by users, who may use different cameras and resolutions, consistent with the images the model saw during training.

5.4 Feature extraction

Features are learned by a deep convolutional network rather than designed by hand. During training, the network picks up the visual cues that separate diseased from healthy leaves, such as changes in colour, texture, and shape, and the presence of spots or lesions. A lightweight architecture such as EfficientNet or MobileNet is a suitable choice because it balances classification quality against the computing cost of serving requests from a web application.

5.5 Disease classification

The learned features feed a classification layer that selects the most probable disease class and attaches a confidence score showing how strongly the model favours that class. The system is designed to cover crops commonly grown in Telangana: rice, cotton, maize, chilli, tomato, groundnut, brinjal, okra, pigeon pea, and mango.

5.6 Recommendation generation

Once a disease has been identified, the system retrieves guidance for that condition: typical symptoms, likely causes, preventive practices, and next steps. Crop recommendations are generated

separately from the farmer's profile, using crop type, soil type, water availability, season, and region. These outputs are meant to support a farmer's decision and are not a substitute for professional diagnosis.

5.7 Multilingual result presentation

Results appear in a mobile-friendly interface in the farmer's chosen language: Telugu, Hindi, or English. The result screen presents the predicted disease, confidence score, symptoms, prevention information, and recommendations in plain language, and every analysis is saved to a scan history so that earlier results can be reopened.

6 Implementation and interface

6.1 Technology stack

AgriVision is built as a responsive web application. The front end uses Next.js with TypeScript and Tailwind CSS, with Lucide icons for visual cues. Cloud services handle user authentication, the database, and storage of user data and scan records, and the AI component is connected to the application to analyse images and return predictions.

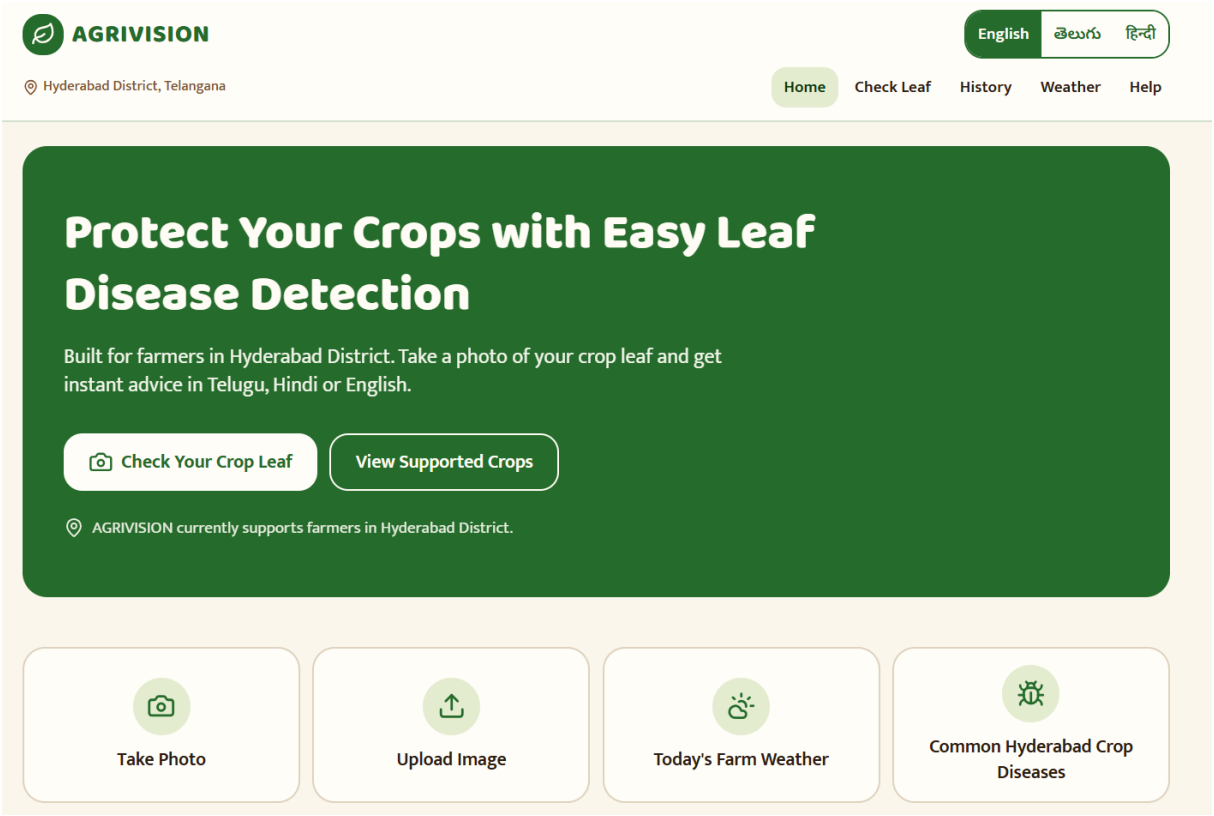


Figure 3. Home page of the AgriVision web application.

6.2 User authentication

Users register and log in before they can reach the services. Scan history and uploaded images are tied to the user's account, which keeps each person's records separate and limits access to stored data.

6.3 Farmer onboarding

After registration, an onboarding screen collects details about the farmer's context: location, district, village or mandal, crop selection, soil type, season, and water availability. These inputs allow the platform to tailor crop-related information and recommendations to the farm.

6.4 Plant disease detection interface

The detection screen lets the farmer upload or capture a leaf photograph and choose the crop concerned. The input is validated and sent through the detection pipeline. The interface is designed to keep the number of steps between taking a photograph and receiving a first assessment as small as possible.

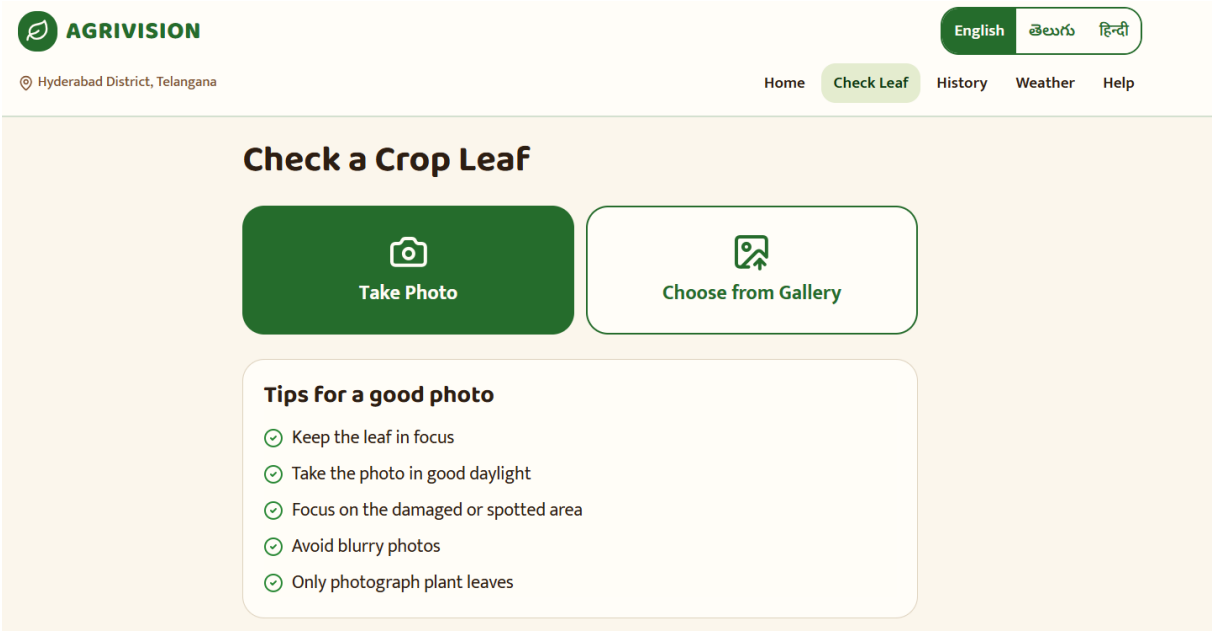


Figure 4. Plant disease detection interface of AgriVision.

6.5 AI-based disease detection

Submitted images are preprocessed, and features are extracted before classification. The model examines the visual characteristics of the leaf and returns the most probable disease with a confidence score, which the application then displays to the user.

6.6 Disease result and recommendation interface

The result screen names the detected disease and shows the confidence score alongside visible symptoms, probable causes, preventive measures, and recommended next steps. It is intended as preliminary decision support and does not replace a professional diagnosis.

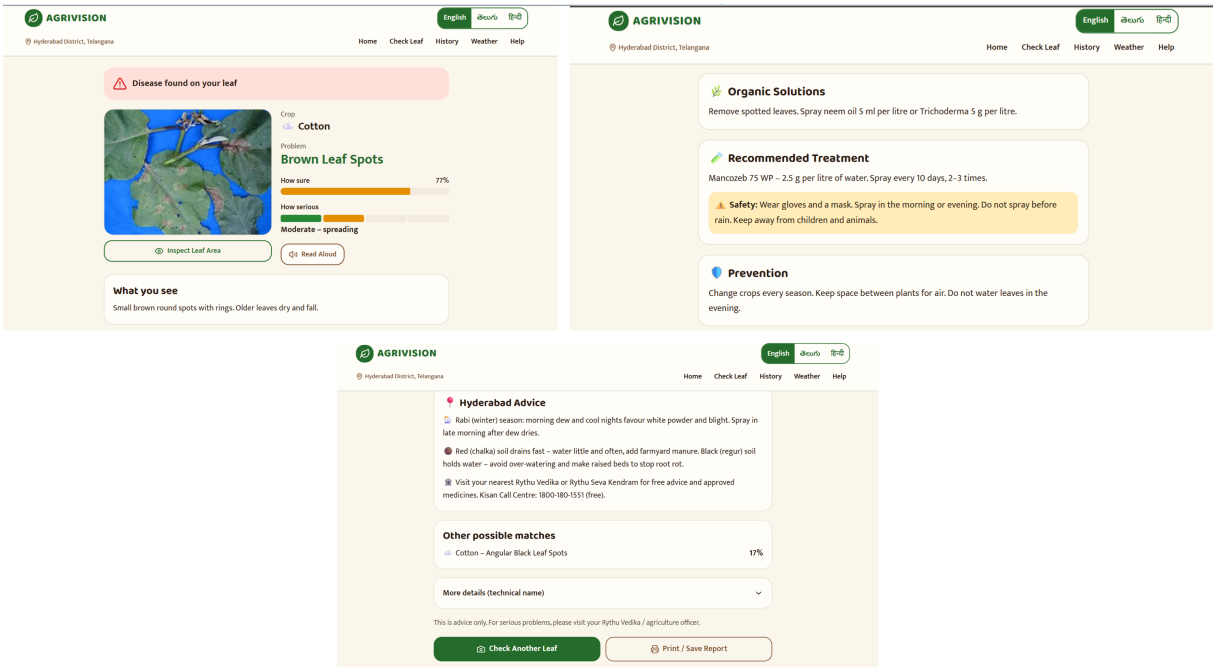


Figure 5. Disease detection result and recommendation interface.

6.7 Crop recommendation module

The crop recommendation module helps farmers select crops that suit their situation. It takes into account soil type, water availability, season, crop requirements, and regional conditions, and it lists the results under familiar local crop names so that they are easy to read.

6.8 Multilingual interface

Telugu, Hindi, and English are supported, and the selected language applies to the main interface elements, disease information, and recommendations. This lowers the language barrier for farmers in Telangana who may be less comfortable with English-only tools.multilingual capability helps reduce language barriers and improves the usability of the system in Telangana.

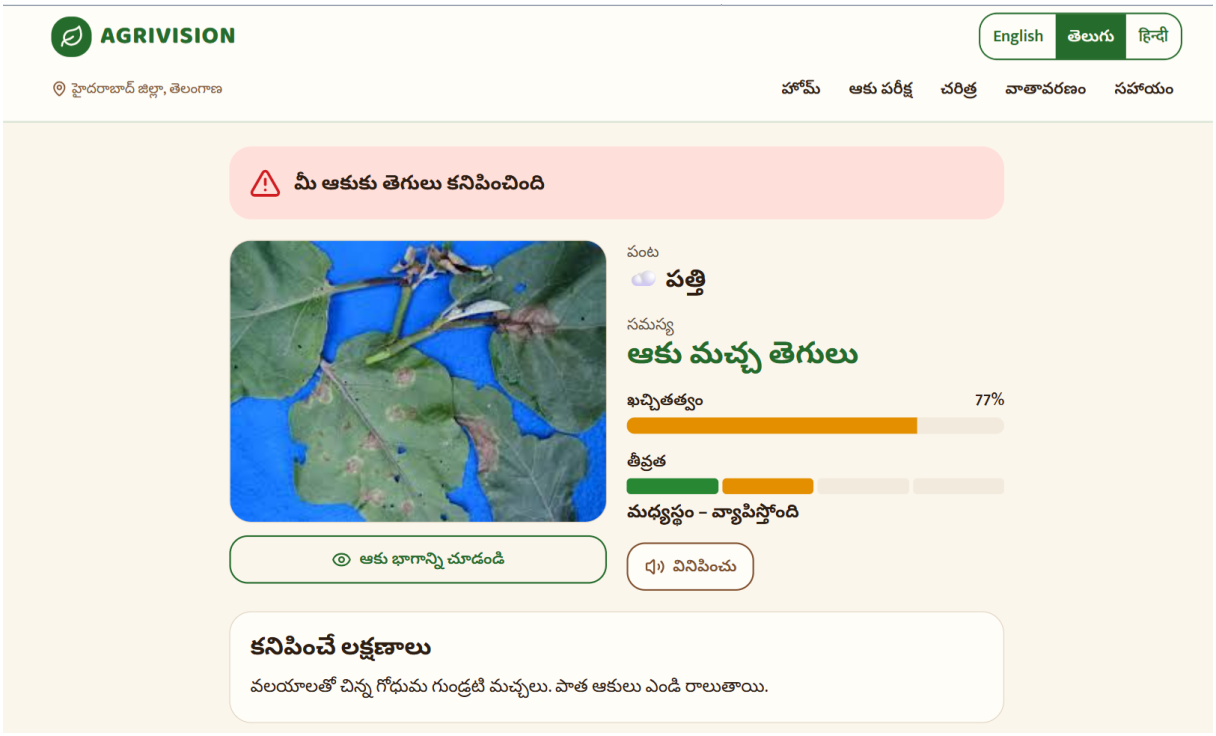


Figure 6. Multilingual interface of the AgriVision system.

6.9 Scan history

Every completed analysis is saved to the user's account. Farmers can reopen earlier scans and their results, which makes it easier to follow how a plant's condition changes over time.

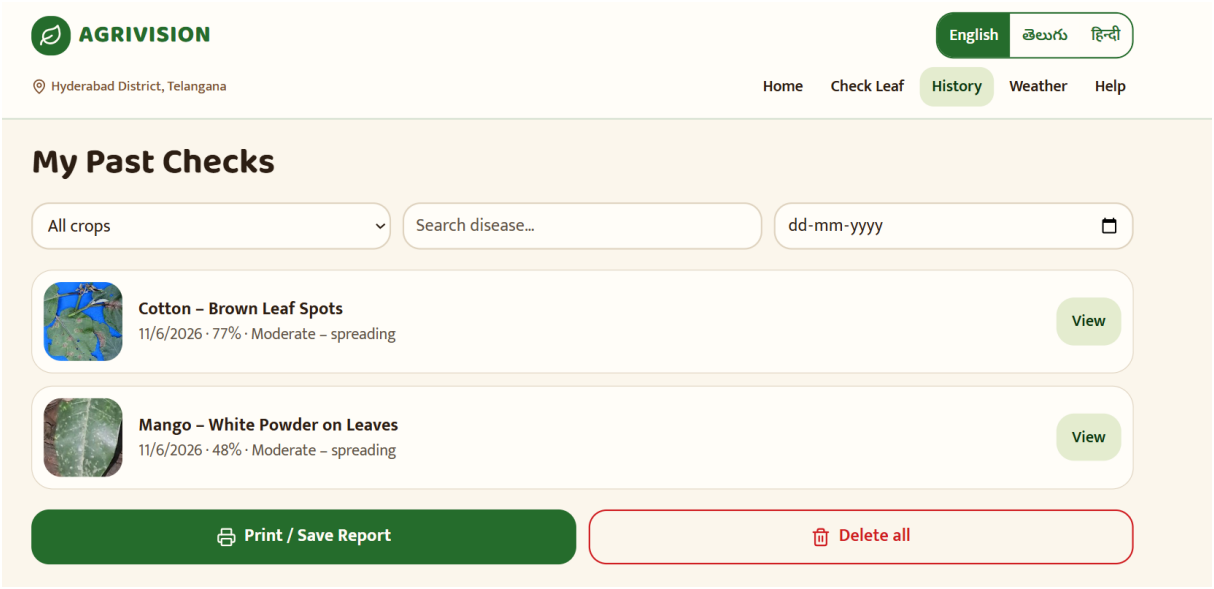


Figure 7. Scan history interface showing previously analyzed plant disease records.

6.10 Mobile-friendly design

Because most farmers reach digital services through smartphones, the interface follows a mobile-first approach with large buttons, readable text, simple icons, and clear navigation. The layout adapts to different screen sizes and avoids unnecessary complexity for users with limited technical experience.

6.11 Database and storage

Cloud database and storage services hold authentication data, crop-related data, scan records, and uploaded images, and are accessed through the application's backend. Access-control rules keep one user's data separate from another's.

6.12 Deployment

The application is deployed on a cloud hosting platform and opened through a web browser, so farmers do not need to install anything. Hosting in the cloud also allows updates to be applied centrally.

6.13 User interface workflow

A typical session follows the sequence below.

Login/Register → Farmer Onboarding → Select Crop → Upload/Capture Leaf Image → AI Disease Detection → View Prediction → View Treatment & Prevention Guidance → Crop Recommendation → Save/View Scan History

In this way, the main functions are reachable within a few clearly defined steps.

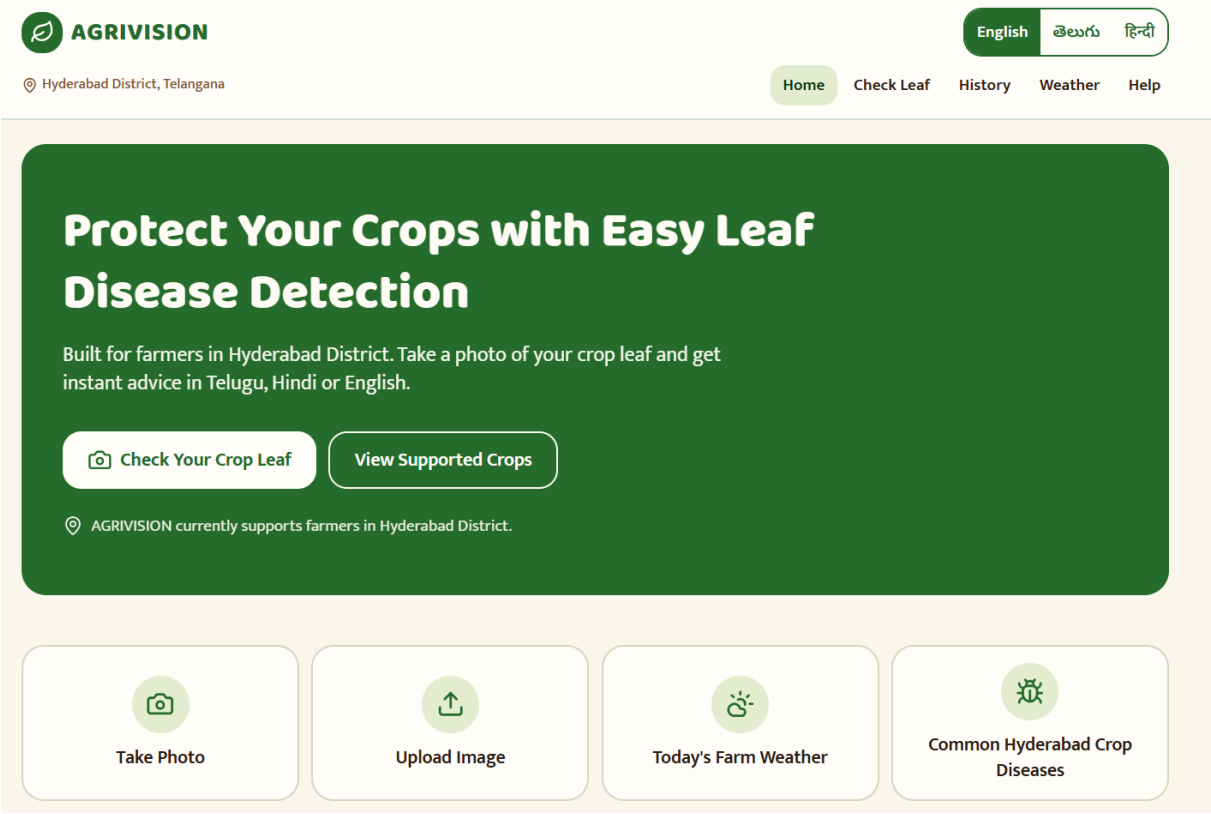


Figure 8. Dashboard page of the web application showing the overview metric cards.

7 Results and discussion

7.1 Prototype outcome

The AgriVision prototype combines plant disease detection, crop information, crop recommendation, multilingual support, and scan history in a single application for farmers. A user can select a crop,

upload or capture a leaf photograph, and receive a preliminary AI-based assessment through an interface that keeps the use of AI simple.

7.2 Disease detection output

For each submitted image, the detection module returns a predicted disease and a confidence score, and the result screen adds symptoms, probable causes, preventive measures, and next steps. A farmer therefore obtains useful first guidance from one photograph instead of relying only on manual inspection.

The module is meant to support early recognition of visible symptoms, and its output should be treated as a preliminary assessment, not a professional diagnosis. Reliability can change with image quality, lighting, leaf orientation, the crop concerned, and how closely a submitted image resembles the training data.

7.3 Crop recommendation

The crop recommendation module produces suggestions from the available agricultural and environmental information: soil type, water availability, season, crop requirements, and regional conditions. Because the inputs describe the farmer's own situation, the suggestions are more specific than general advisories that ignore local conditions.

7.4 Language support and usability

Support for Telugu, Hindi, and English lets farmers use the system and read agricultural information in the language they prefer. The interface is mobile-first, with large buttons, simple icons, readable text, and direct navigation, so that disease scanning, crop recommendation, and scan history are each reachable from clearly labelled components, including for users with limited technical experience.

7.5 Scan history and data management

Saved scans give users a record of earlier plant-health assessments and let them compare results over time. Cloud database and storage services hold user information, uploaded images, and scan records.

7.6 Discussion

The prototype shows that AI-based disease detection can be combined with localized guidance in a single platform. Where many systems stop at classifying the disease, AgriVision adds disease information, crop recommendation, multilingual interaction, and scan history, giving farmers broader decision support.

These benefits come with limits, which are set out under Limitations. In particular, the prototype has not yet been validated on large and varied field datasets, so its output should not be used for high-stakes decisions without further testing.

Overall, the prototype demonstrates that AI, computer vision, and localized digital services can make agricultural assistance more accessible. Evaluation on real Telangana field images, larger datasets, and review by domain experts would strengthen its reliability and practical value.

8 Limitations

AgriVision has several limitations. Disease detection accuracy depends on the quality and variety of the training images, and poor lighting, blur, unclear leaves, or cluttered backgrounds can degrade predictions. Diseases with similar symptoms may be hard to tell apart. Crop recommendations are only as reliable as the soil, season, water, and location information supplied. The system is web-based and needs an internet connection to upload images and view results. It also needs more testing on real field images from different crops, locations, seasons, and disease stages. Its predictions are preliminary and should not replace professional agricultural advice.

9 Conclusion and future work

AgriVision is an AI-powered web platform that helps farmers identify plant diseases from leaf photographs and make better crop-related decisions. For each image it returns a preliminary prediction with a confidence score, symptoms, prevention measures, and next steps, and it recommends crops using soil type, season, water availability, and local conditions. Support for Telugu, Hindi, and English makes the platform easier to use for farmers in Telangana. The work shows a practical way to bring AI and computer vision to farm-level decisions.

Future work will focus on training the classifier with larger and more varied real-world field datasets and extending coverage to more crops, diseases, and pest detection. Real-time weather and soil data could make crop recommendations more accurate and local. Other planned improvements include offline operation for areas with poor connectivity, voice interaction in regional languages, and expert validation of predictions. Field trials with farmers across Telangana would show how well the system works in practice.

Acknowledgment

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