AgriScan: AI-Powered Mobile App for Real-Time potato/maize(corn) Disease Detection.

CHAPTER 1

* 1. **Background of the Study**

Agriculture continues to be the backbone of many economics worldwide, particularly in developing countries in developing countries where it serves as the primary source of food and income for millions of households. Among the wide range of crops cultivated, potato(Solanum tuberosum) and maize (corn, Zea mays) stand out as two of the most important staple crops globally.

Both maize and potato production are heavily threatened by plant diseases. For instance: Potato is prone to diseases such as late blight (Phytophthora infestans), early blight (Alternaria solani), and bacterial wilt. While Maize is affected by northern leaf blight (Exserohilum turcicum), maize streak virus, and gray ledaf spot(Cercospora zeae-maydis).

These diseases can cause 30-70% yield diseases, depending on the severity of the outbreak, environmental conditions, and farmers access to early intervention strategies, in worst case scenarios, epidemics like the Irish Potato Famine in the 19th century demonstrate the devastating socio-economic consequences of unchecked plant diseases.

Traditionally, farmers rely on visual inspectations or advice from agricultural extension officers to diagnose crop diseases. However, these methods are time-consuming, subjective, and often inaccessible to smallholder farmers living in remote areas. Laboratory-based diagnostics, while accurate, are expensive and not practical for on-field decision making.

With the advancement of Artificial Intelligence(AI), Computer Vision, and Mobile Technologies, there is now an opportunity to democratize plant disease diagnosis. AI-powered mobile applications can enable farmers to simply capture an image of a diseased crop leaf with their smartphone, process the image using Convolutional Neural Networks(CNNs), and receive instant feedback about the disease type and possible control measures.

This project proposes AgriScan, an AI-powered mobile application designed specifically for real-time disease detection in potato and maize crops. By providing early, accurate, and accessible disease identification, AgriScan AI aims to improve crop productivity, reduce yield losses, and enchance food security.

* 1. **Statement Of The Problem**

Crop diseases are a major barrier to sustainable farming. Smallholder farmers, who make up most of the potato and maize producers in developing countries, face several challenges.

Many farmers lack access to expert knowledge. This makes it hard for them to get accurate diagnoses from extension officers or plant pathologists. Diagnoses often come too late. By the time symptoms appear, diseases may have spread widely, making treatment ineffective. Misdiagnosis is common too, as farmers frequently confuse nutrient deficiencies or environmental stress with diseases. This leads to wrong treatments. Additionally, potatoes are especially affected by storage diseases, which result in large post-harvest losses. There is also a digital divide, as most agricultural apps focus on major crops like wheat or rice. This leaves regionally important crops like maize and potato in Africa without enough support.

These issues show the urgent need for an easy-to-use, low-cost disease detection system. Such a system would help farmers identify diseases accurately and take timely preventive or corrective actions.

* 1. **Aim and Objectives**

Aim:

The aim is to design and develop a mobile-based application (AgriScan) for real-time detection of diseases in potato and maize crops.

The objective of this project are:

1. The application is an intuitive mobile interface that allows farmers to capture and upload crop leaf images.
2. To train and integrate a Convolutional Neural Network (CNN) to be a able to identifying common potato and maize leaf diseases.
3. The application provides a real-time diagnostics feedback and basic treatment recommendations.
   1. **Scope Of The Study**

The scope of this project will cover the development of a mobile app (Android-based initially) for potato and maize disease detection. The focus on leaf based diseases due to their visibility and diagnosability through image processing, using machine learning (CNN models) for classification. It provides actionable feedback in user-friendly formats (e.g., text and icons).

However, there are some limitations affecting the development of the app like the fact that only leaf diseases are considered (root and stalk diseases excluded). the availability may limit the number of diseases covered and suggested treatments will be informational, not prescriptive or region-specific.

* 1. **Project Risks**

Table 1.1: Risks Assessment

|  |  |  |  |
| --- | --- | --- | --- |
| Risk | Description | Impact | Mitigation Strategy |
| Poor image quality | Blurry or poorly lit photos may reduce | Incorrect diagnosis | Provide image-taking guidelines in app |
| Dataset limitations | Lack of region-specific images of potato/maize diseases | Limited disease coverage | Partner with research institutes for dataset expansion |
| Model bias | CNN may classify some diseases more | Misdiagnosis risk | Regular retraining with diverse datasets |
| Adoption barriers | Farmers may be reluctant to trust AI | Low usuage | Provide simple UI and farmer training workshop |

* 1. **Swot Analysis**

Table 1.2: Swot Analysis

|  |  |  |  |
| --- | --- | --- | --- |
| Strengths | Weaknesses | Opportunities | Threats |
| Real-time diagnosis with AI | Dependent on quality of images | Expansion to other crops beyond maize/potato | Competition from global agricultural app |
| User-friendly mobile app | Limited disease scope initially | Partnerships with agricultural bodies | Cybersecurity/data privacy risks |
| Supports smallholder farmers | No control over treatment implementation | Contribution to digital agriculture policies | Farmers mistrust of digital tools |

* 1. **Significance Of The Study**

The development of AgriScan is significant in several ways like, the mobile application provides an immediate, expert-level disease diagnosis without requiring expensive consultations for farmers, for researchers, it contributes datasets and diagnostic tools for under-researched crops (potato and maize in Africa). It also aligns with digital agriculture goals enhancing good security and poverty reduction efforts. It also reduces crop losses, increases yield, and ensures better nutrition for communities reliant on potatoes and maizes.

* 1. **Definition of Terms**

1. **AgriScan:** The proposed mobile apllication developed in this study, designed to detect potato and maize diseases using AI.
2. **Machine Learning:** A subset of AI that enables systems to learn from data and improve performance without being explicity programmed.
3. **Image Preprocessing:** A set of techniques applied to raw images to prepare for input into a machine learning model.
4. **Real-Time Detection:** The ability of the system to analyze and deliver results immediately after a farmer uploads or captures an image.
   1. **Organization Of The Project**

* Chapter One: Introduction (background, problem statement, aims, objectives, scope, SWOT, and significance).
* Chapter Two: Literature Review (plant disease detection, AI in agriculture, mobile apps, image processing, research gaps).
* Chapter Three: System Design and Architecture (model design, dataset, system workflow, and app structure).
* Chapter Four: Implementation and testing (development, model integration, results, evaluation).
* Chapter Five: Summary, Conclusion, and Recommendations.