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Darpan App Utilization in Agricultural Crops

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Abstract:-

Crop Darpan aims to provide an intuitive, expert-like interaction for farmers diagnosing crop diseases using smartphones. The system is built on two primary research focuses: developing a protocol to collect disease symptom knowledge from experts and creating a question-popping algorithm to identify crop diseases based on visual symptoms. This chapter outlines the incremental development of Crop Darpan, which resulted in five frameworks, culminating in the final HHM framework.

1. Introduction:

Crop Darpan, translating to "Crop Mirror" from Sanskrit, is a pioneering system designed to assist farmers in diagnosing crop diseases using their smartphones while in the field. The development of Crop Darpan addresses two main research issues: firstly, creating a protocol for collecting knowledge of disease symptoms from agricultural experts, and secondly, developing a question-popping algorithm to help farmers identify crop problems based on visual symptoms. This chapter details the development and components of Crop Darpan, which evolved incrementally through five frameworks.

Crop Darpan is a human-computer interactive tool that mimics the diagnostic conversations between farmers and agricultural experts. The system leverages a knowledge base of visual symptoms for various crop diseases and engages the farmer through a series of questions, much like the 20

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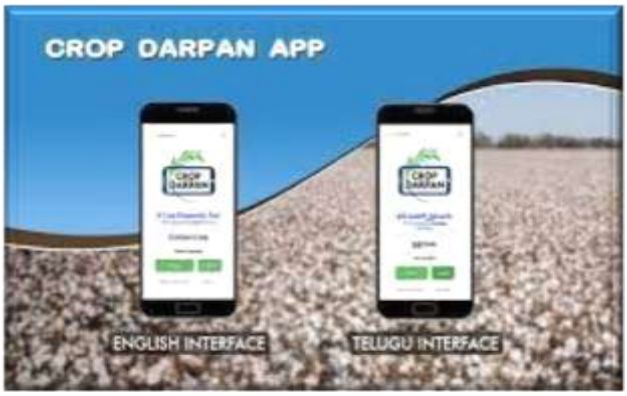
Questions game, to identify the disease. This approach assumes the farmer's ability to accurately recognize symptoms in their crops.

Despite advancements in agricultural extension methods, many Indian farmers still struggle to access actionable information due to knowledge and communication gaps. With the increasing adoption of smartphones in India, which have capabilities comparable to computers, there is a significant opportunity to leverage mobile technology for agricultural advisories.

This research focuses on developing a smartphone-based crop disease diagnosis guide, Crop Darpan, by utilizing advancements in data science and mobile technology. The system is designed to emulate the diagnostic process of agricultural experts, embedding their knowledge of disease symptoms into the system. The components of Crop Darpan include the Knowledge Acquisition Protocol, Knowledgebase, Question Popping Model, and User Interface. The development process followed engineering research methodology, resulting in the final Hierarchy-based protocol for knowledge acquisition and Hierarchy model for question popping with multi-questions per screen (HHM) framework.

The evaluation of Crop Darpan with domain experts and farmers demonstrated its effectiveness. The system can be adapted for any crop and extended to various languages and regions, providing a scalable solution for crop disease diagnosis.



2. Background and Motivation

2.1 Agricultural Knowledge Dissemination Challenges

Despite various agricultural extension approaches, many Indian farmers lack access to practical agricultural information. Knowledge and communication gaps are significant barriers to effective information dissemination.

2.2 Smartphone Adoption and Literacy Growth

India's smartphone revolution and increasing literacy rates present an opportunity to use mobile technology for agricultural advisories. Smartphones offer capabilities comparable to computers and are becoming more accessible to farmers.

3. Crop Darpan System Design

3.1 Concept and Objective

Crop Darpan is designed to resemble the diagnostic process of agricultural experts, embedding their knowledge about visual

symptoms of crop diseases. The system engages farmers through a series of questions, akin to the 20 Questions game, to identify the disease.

3.2 Components of Crop Darpan

- **Knowledge Acquisition Protocol:** Collects disease symptom knowledge from experts.
- **Knowledgebase:** Stores the collected information.
- **Question Popping Model:** Engages farmers with questions based on visual symptoms.
- **User Interface:** Ensures ease of use and accessibility for farmers.

4. Framework Design

1. **Human-Computer Interaction**: The system should make the farmer feel they are interacting with an expert. The expert's knowledge of visual symptoms for all diseases is embedded in the system, enabling it to pose relevant questions.
2. **Incremental Development**: Crop Darpan has been developed through five frameworks, each building on the previous one to enhance the system's diagnostic capabilities.
3. **Symptom-Based Questions**: The system asks questions based on visual symptoms observed in the crops, helping the farmer identify the disease through a process of elimination and deductive reasoning.

5. Development Process

5.1 Engineering Research Methodology

The development of Crop Darpan followed an iterative engineering research methodology, incorporating feedback from previous designs to refine the system.

5.2 Framework Evolution

Five design frameworks were developed incrementally, leading to the final HHM framework.

6. Evaluation and Results

6.1 Field Implementation

Crop Darpan was implemented in the field and evaluated with domain experts and farmers.

6.2 Effectiveness

The evaluation showed that the system's diagnostic methodology aligns with expert practices and enables farmers to diagnose most crop diseases accurately.

7. Conclusions and Advantages

Based on the development and evaluation of Crop Darpan, the following conclusions and advantages were identified:

- The system's diagnostic methodology is in agreement with domain experts, and farmers can diagnose most crop diseases.
- Crop Darpan provides a generic framework applicable to any crop.

- The system mimics agricultural experts' behavior, helping farmers identify crop diseases based on visual symptoms.
- It acts as an auditing tool, ensuring that if no disease is detected, the crop is likely healthy.
- Crop Darpan is extendable to all languages and regions, requiring only translation efforts.
- The system is scalable to all crops and regions in India and abroad.