Web based Soybean Disease Expert System

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In different parts of the country more than 100 diseases have been reported to inflict soybean crop, thirty-five of them are important in India. The insect-pests and diseases together cause yield losses to the extent of 32% in soybean crop. Annual yield losses due to these diseases in the country are nearly 12 percent of the total production. World wide annual yield losses from diseases alone in soybean are approximately 10-30 percent of the total production. Therefore, one has to be proactive to diagnose so as to protect and manage soybean crop. This will prevent the soybean crop from the devastating diseases that leads to high yield losses.

The experts for disease management are limited in numbers throughout the country and also they are not easily available at times of need. So, to facilitate the extension workers, farmer advisors and the growers to diagnose and take appropriate course of management, a fuzzy-logic based on-line disease expert system for soybean is developed at Directorate of Soybean Research, Indore, India (Fig. 1). This system helps in identification of twenty five soybean diseases. The system is developed using ASP .NET technology of Microsoft Visual Studio .NET. The knowledge on twenty five soybean diseases is stored in the form of knowledge base developed using SQL Server. The main user interface of the system consists of –i) Disease Knowledge Acquisition System ii) Intelligent Disease Tutor System iii) Expert Disease Diagnosis System.

Fig. 1 Home page of Expert System for Soybean Disease Diagnosis

Disease Knowledge Acquisition System

The Expert System for Soybean diseases has a Knowledge Acquisition System (Fig. 2) for efficient handling of the soybean disease knowledge during the entire process of knowledge engineering. Knowledge engineering is the process of building the knowledge base for an Expert system. The knowledge engineering includes steps for knowledge acquisition, classification, representation, processing and final storage. This system provides a strong and reliable knowledgebase support for the Expert System of Soybean diseases.

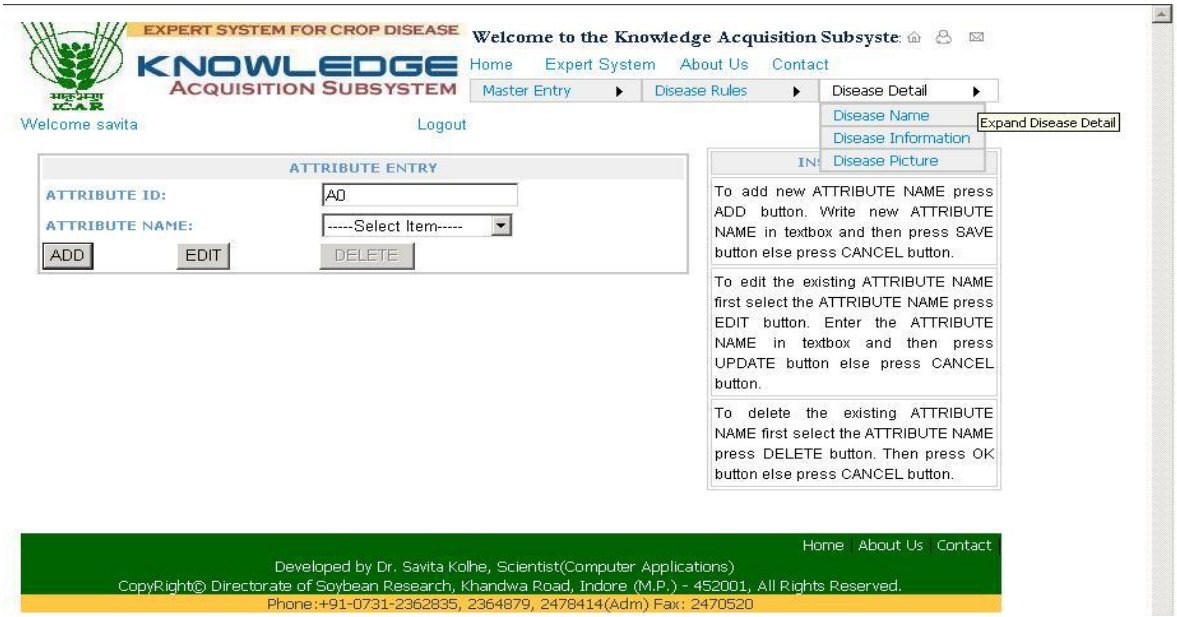

Fig. 2 The Knowledge Acquisition Subsystem of the soybean disease expert system.

Intelligent Disease Tutor System

Intelligent Soybean Disease Tutor System (Fig. 3) is a subsystem of Expert System of Soybean diseases. It serves as an audio-visual soybean disease training tool. It provides the soybean disease information on useful disease related aspects like pathogen, geographic distribution, economic impact, favorable climatic conditions, detection methods and effective integrated management of practices. It is a very useful and interactive audio-visual training tool for providing pathological trainings with the help of multimedia effects, color pictures, videos, texts, and graphics with capability of text-to-voice interface.

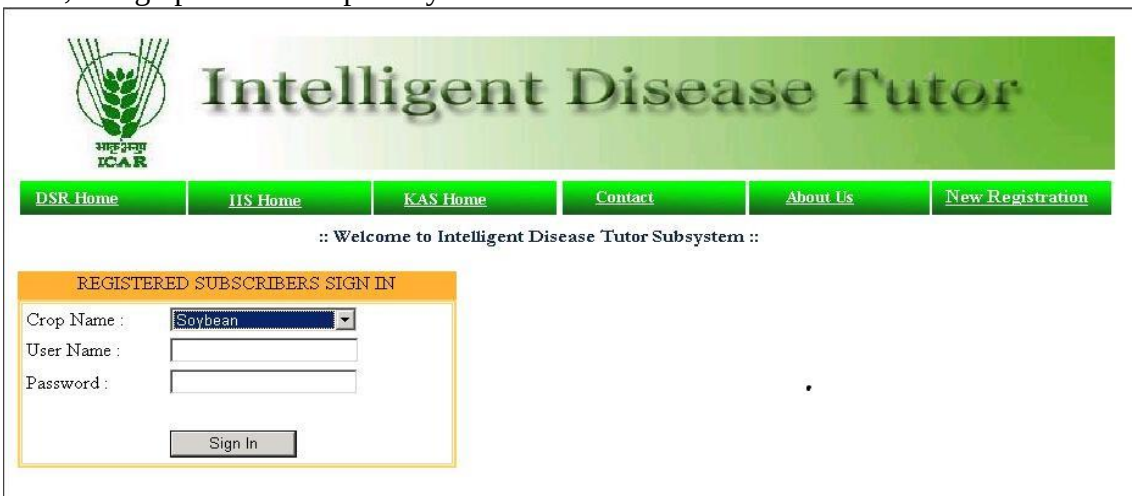

Fig. 3 Main web page of Intelligent Disease Tutor.

Expert Disease Diagnosis System

This is the main system which provides a user interface for diagnosing soybean diseases using the intelligence of soybean disease experts. It uses the knowledge base developed with the help of knowledge acquisition system to get the knowledge of diseases to give proper diagnostic decisions. It uses the inference engine containing – i) computerized inference technique based on the heuristic knowledge of disease experts, ii) fuzzy logic for efficiently handling uncertainty iii) disease case studies iv) statistical methods. The expert system identifies the disease based on the disease symptom inputs given by the user as shown in Fig. 4.

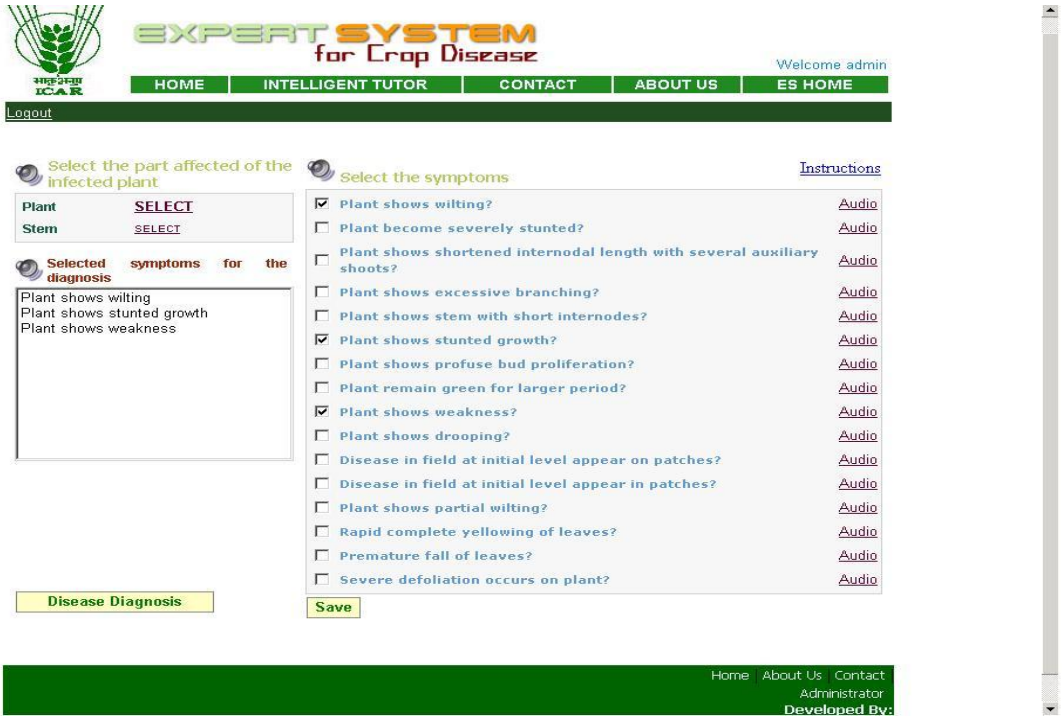

Fig. 4 Web page showing disease symptom inputs by the user.

The disease symptoms are provided based on the infected part of the plant like Plant, leaves, stem, root etc. With this input system finally identifies the disease and provide a suitable control measure to manage it using the Inference Engine that stores the complete inference drawing expert logic. The user has the facility to get the detail information of the diagnosed disease to gain more knowledge. The user can also see the inference technique used by the system to reach to the diagnostic decision.

The system is available at our institute website http://www.dsrindore.org. This real-time on-line disease diagnosis system for soybean can help soybean growers in disease diagnosis, in taking appropriate quick decision /judgment in real time field conditions by harnessing the analytical and decision-making capabilities of disease experts. The real-time application of the system can minimize yield losses due to massive disease attacks to a great extent by providing awareness of pre-disposing climatic factors, making the exact diagnosis and management expertise available on WWW at right time at right place in the right form at minimum cost. It can also be used as a consultation tool and a good source of knowledge for farmers/cultivars, agriculture advisors/extension workers, researchers, managers and farmers' advisory agencies like Kisan Call Centres, Agricultural Technology Information Centres, E-Choupaals etc.

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