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Web Based Expert System to Detect and Diagnose the Leaf Diseases of Cereals in Punjabi Language

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***Abstract*— The current era is witnessing a vast development in all fields of agriculture. In order to remain competitive, the modern farmer depends upon agricultural specialists and advisors to provide information for decision making. But the number of experts is lesser than their demand in certain domains. So the agricultural specialist assistance is not always available when the farmer needs it. Therefore there is need for an unconventional method to transfer the knowledge of experts in certain domain to general public of farmers. This knowledge transfer must be in a language that must be understood by the farmers because unless we support user understandable languages on the technology environments, it is impossible to use IT or internet for the benefits of rural and uneducated population. So the proposed expert system is developed so that it is capable of providing the expert advice to the farmers of Punjab in their regional language Punjabi.**

***Keywords*— Expert system, Punjabi, Farmers, J2EE, MySQL, Pixel Comparison.**

I. INTRODUCTION

An expert system is a computer program which imitates behavior of an expert in a specific area of knowledge. The web technologies allowed the knowledge engineers and domain experts to build the expert systems that are having dynamic knowledgebase capabilities. The domain experts could update the knowledge at the central servers and users have an access to the recent knowledge through the web interface. Once the expert system is developed the domain experts require minimal intervention of programmer.

Such an expert system is very essential for the farmers as experts are not always available with the farmers and the diseases are one of the important factors for under productivity. The integration of knowledge and experience of different specialists are facilitated on the expert system. Some expert systems rely on farmer's understandability about abnormal observations to find a diagnosis for a crop disease. If, however, the farmer is unable to understand the written symptoms, he will lead to a wrong conclusion. So in the web based expert system this drawback is overcome by use of images as input. This is achieved by collaborating image processing technique with this diagnostic problem solver. The expert system will compare images uploaded by farmers with the images present in their database and will give the farmers accurate results. The expert system will overcome the language barriers for farmers of Punjab because it will communicate with farmers in Punjabi language. The expert system uses Gurmukhi script to represent the Punjabi language. Gurmukhi derives its letter shapes from Landa, but considerable influence from Nagari is evident from the top horizontal bar present in most letters. Direction of writing is left to right in horizontal lines. In unicode, Gurmukhi sub range is from U+0A00 to U+0A7F. These are total 128 code points, but only 77 are used for Gurmukhi script.

II. LITERATURE REVIEW

Duan et al (2004) concluded that rapid development of Internet technology has changed the way that expert systems can be developed and distributed. The essence of an expert system is to mimic expertise and distribute expert knowledge into non-experts' hands. This can be enhanced significantly by using the Internet. [1]

Prasad et al (2006) analyzed various expert systems in agriculture. They concluded that expert systems unite the accumulated expertise of individual disciplines, e.g., plant pathology, entomology, horticulture and agricultural meteorology, into a framework that best addresses the specific, on-site needs of farmers. [2]

Khan et al (2008) presented expert systems in the agriculture domain in Pakistan. Their experience and lessons learned from the development of expert system suggested that the system was still useless for many farmers in its present form. Many farmers in the country are illiterate and knowledge of computers in rural areas is still a problem. The system needs to be developed in many regional languages. [3]

Kumar et al (2008) studied the image based rapeseed-mustard disease expert system which is developed by integrating image and textual data. The system can be used by extension personnel, researchers and farmers to identify rapeseed-mustard diseases and enable their management. [4]

Thind (2008) defined unicode as the accepted international standard that includes support for all major scripts of the World and is adopted by all current major computer operating systems. This is a 16- bit standard that allows use of more than 65,000 characters in one font. It has support for major Indic (Indian) scripts that include Devanagari (Hindi, Marathi, Sanskrit), Bengali (Bengali, Assamese), Gurmukhi (Punjabi), Gujarati, Oriya, Tamil, Telugu, Kannada and Malayalam. Microsoft Windows has full support for Indic scripts, including Gurmukhi. [5]

Lai et al (2010) studied an image based expert system for corn diseases. Accurate identification and treatment depends on the method which is used in disease

and insect pest diagnosis. The old adage “a picture is worth a thousand words” is crucially relevant. Considering the user's capability to deal and interact with the expert system easily and clearly, a web-based diagnostic expert-system and frames with a color image database was developed and applied to corn disease diagnosis as a case study. [6]

Devraj et al (2011) studied the design and development of an expert system for the diagnosis and control of diseases in pulse crops (PulsExpert). PulsExpert is an operational automatic diagnostic tool that helps farmers/extension workers to identify diseases of major pulse crops viz., Chickpea, Pigeon pea, Mungbean and Urdbean (highly consumed pulse crops) and suggests the appropriate control measures. [7]

Chaki et al (2012) proposed an automated system for recognizing plant species based on leaf images. Plant leaf images corresponding to three plant types, are analyzed using three different shape modeling techniques, the first two based on the Moments-Invariant (M-I) model and the Centroid-Radii (C-R) model and the third based on a proposed technique of Binary-Superposition (B-S). For the M-I model the first four central normalized moments have been considered. [8]

Yelapure et al (2012) concluded that expert system is most powerful approach that simulates human knowledge from an expert in certain domain for assist human to make decision at a level of or greater than human expert. Expert system helps to Growers in making economically viable and environmentally strong decision related to crop management. After considering success of expert system various expert systems were developed in agriculture. [9]

Tijare et al (2014) studied image recognition based crop disease identification system they concluded that now a day’s crop faces many diseases. The naked eye observation of experts was the main approach adopted in practice for detection and identification of cotton plant diseases. But, this needed continuous monitoring of experts which might be prohibitively expensive in large farms. So automatic detection of cotton plant diseases were an important research topic as it may prove benefits in monitoring large field of crops, and thus automatically detect diseases from symptoms that appear on plant leaves. [10]

III. Material and Methodology

For the development of web based expert system J2EE and MySQL platforms are used. Model View Controller (MVC) design pattern is used. Business logic is separated from the presentation. Servlets are used for business logic and JSPs are used for presentation. For implementing the system in Punjabi language, Punjabi Unicode has been used. Unicode is the international standard whose goal is to specify a code matching every character needed by every written human language to a single code point (integer). Unicode was developed to specify a code for every single character needed by every human language. Instead of 8 bit scheme which only allowed for (28 - 1) 255 characters, Unicode allows for 1114112 (216 + 220) code points. 65,535 of the code points are reserved for characters and 1,048,576 code points are reserved for Unicode Transformation Format (UTF). The proposed system uses UTF-8 character encoding for storing data in database and in programming as well.

The proposed system is intended for two types of users: Administrator and Farmer. In our case administrator will be a domain expert and user will be a farmer. Data flow diagrams were prepared both for administrator module (Fig. 1) and user module (Fig. 2).

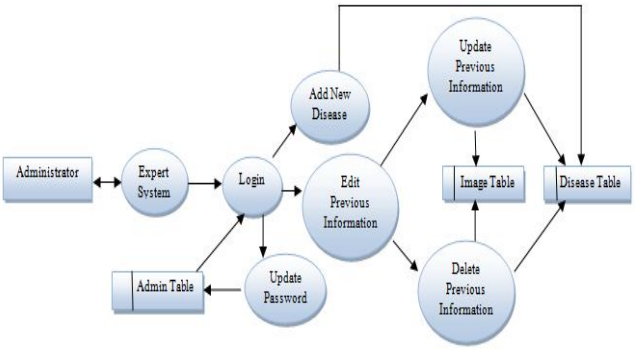

Fig. 1 Data Flow Diagram for Administrator Module

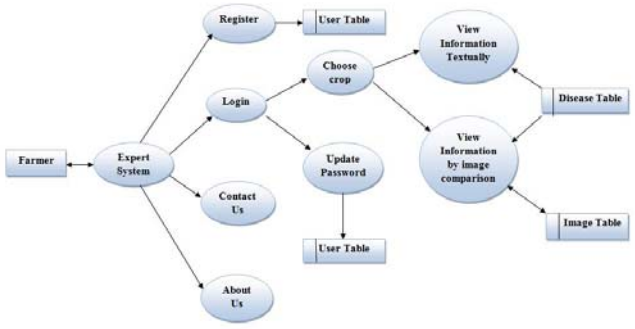

Fig. 2 Data flow Diagram for User module

The administrator can add and update the information in Punjabi language by using a Punjabi keyboard. The registered users can view the diagnosis information for the leaf disease of a cereal. They can also upload the image of infected leaf and system will compare the uploaded image with images in database to detect the disease.

Fig. 3 Home page of web based expert system

Fig. 3 shows the home page of the expert system. From here administrator and farmer can login into the system. Farmers can also register themselves.

Fig. 4 Home page for administrator

Fig. 4 shows the home page for administrator.

Fig. 5 Web page showing symptoms, precautions and images of various leaf disease of wheat

When a farmer login into the system and select his required crop then symptoms, precautions and images of all the leaf disease of that crop are displayed as shown in fig. 5. If the farmer however is unable to understand the displayed information he can upload the image of his infected leaf. The system will compare the uploaded image with the images in database and will give the farmer appropriate results.

IV. Conclusion

The proposed expert system has been developed in an efficient and effective way. System analysis of the expert system involves comparing shortcomings of the existing physical expert advisory system and its practical usage to the advantages of the online expert advisory system in regional language which does not require a physical meeting. Information requirements of the farmers were collected and attempt has been made to meet them completely. Most important feature of the project is that it is implemented in regional language of Punjab, thereby, overcoming the limitation of language barrier. So, it is web based application that could be accessed by anyone, anywhere and will provide an online expert advice to the farmers.

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