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Design and Development of a Crop Information System for Technology Transfer

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ABSTRACT

Kerala Forest Research Institute have documented over 5000 plants from the state of Kerala of which around 1300 are crop plants. A comprehensive information system comprising the plant identification details, photos of various parts of the plant, botany for plant identification, and agro techniques was found necessary. The crop information system was designed and developed with this objective in mind. There are over 3,12,000 permutations and combinations through which the selection of plants can be made. The Agile software development approach was used for the development of the software. The interactivity and easiness of the use were specially taken care in the development phase. The developed software was tested with a group of research scientists, extension officials and progressive farmers for final validation. It was made available in the website www.farmextensionmanager.com. The application can act as a ready to use guide for the farming community in the area of plant identification and cultivation.

Key Words: Crop, Directory, Extension, Farm Manager, Information systems.

INTRODUCTION

Plants form a fundamental part of life on earth, providing us with breathable oxygen, food, fuel, medicine and more besides. Estimates of numbers of species of flowering plants vary from about 220,000 (Scotland and Wortley, 2003) to 4,20,000 (Govaerts, 2003). A better understanding of plants is important to improve agricultural productivity and sustainability, to discover new pharmaceuticals, to plan for and mitigate the worst effects of climate change, and to come to a better understanding of life as a whole (Cope *et al,* 2012).

Plant identification is important for various reasons. It is currently important because of concerns about climatic change and the resultant changes in geographic distribution and abundance of species. Plant identification can be challenging for the inexperienced. The growing cities and biodiversity loss has made plant identification an important problem for number of professionals such as foresters, environmental protectors, land managers, unprofessional gardeners and agronomists (Mzoughi *et al,* 2013). The traditional approach to identify the species and their relationships is to train taxonomists who can examine specimens and assign taxonomic labels to them. However, there is a shortage of such skilled subject matter experts which leads to create a taxonomic impediment as well as a limit on financial support from the funding agencies (Carvalho, 2007). The use of computers has brought tremendous changes in the field of plant taxonomy and its allied disciplines. Automated

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identification of plant species is a worthwhile goal because of the current combination of rapidly dwindling biodiversity and the dearth of suitably qualified taxonomists, particularly in the parts of the world which currently have the greater numbers of species and those with largest number of endemics (Ramasubbu *et al*, 2015).

Information Retrieval (IR) is the science of searching for documents for information within documents and for metadata about documents, as well as that of searching relational databases and the World Wide Web (Singhal, 2001). Nowadays, the e-technology has developed in a wide range of application and occupies almost in all the fields of science, even in the plant taxonomy too. Development and installation of web-based identification tool for regionally useful and common plants found in the country is very vital. Hence, an effort in this direction to develop a crop information system for technology transfer was attempted.

MATERIALS AND METHODS

The information system for crop plants was designed to serve as an online resource material for plant identification and imparting knowledge on agro techniques.The design was planned to include 1300 plants relevant to Kerala. The need identification process was carried to identify the user need and requirements for the crop information system. Data from 100 respondents were collected through a questionnaire. The respondents include agricultural students, research scientists, extension workers and progressive farmers.

Agile software development approach was used for design and development of the information system for plant identification (Sunil, 2019). The

Table 1. List of crop information system relevant to Kerala.

Sr. No	Name of the information system	Institution responsible for development
1	Flowering plants of Kerala	KFRI, Peechi
2	Medicinal and aromatic plants	AMPRS, Odakkali, KAU
3	Fruitipedia	Dr Chiranjith Parmar
4	Garden plants of humid tropics	KVK Thrissur, KAU
5	Karshika Vivara sanketham oru viral thumbil	Department of Agriculture, Kerala
6	KAU Agri-infotech Portal	KAU, Vellanikkara
7	Farm Extension Manager	KVK Malappuram, KAU
8	Kissan Kerala Information System	Kissan Kerala project

Table 2. Required design specifications for the system.

Sr. No	Parameter	Per cent of respondents
1	Specific photos on various plant parts and cultivation aspects is needed	95
2	The system should have information on as many plants as possible	92
3	The plant nomenclature should be in all possible Indian languages	88
4	The users should able to navigate within the system with minimum hardship	81
5	The plant botany should be in common man language	79
6	The users should able to arrive at their choice in a number of ways	76
7	The importance and cultivation details of the plant should be there	73
8	The software should be in the form of free entry and use to all	68

agile development approach enables requirements and solutions to evolve through the combined effort of the development team and the customer (Collier, 2011). It promotes adaptive planning, evolutionary development, early delivery and continuous improvements. Content materials and photoswith regard to nomenclature, plant botany and agro-techniques were collected and validated with expert to serve as a database. The validation of database for the system was done in three stages. First, the content materials were prepared and corrected by the research team. Then the materials are given to two experts and their suggestions were incorporated. At a third level technological workshops were arranged with research scientists, agricultural students, extension personal and progressive farmers and the materials were validated.

Hereafter, the software was developed and tested for its working. The final software was uploaded in the online website www.farmextensionmanager.com and was observed continuously for user feedback and comments.

RESULTS AND DISCUSSION

Discovering the user requirements

There are a number of comprehensive information system developed for crop plants that are relevant to Kerala(Table 1).

An in depth analysis of these information systems was done to find out to what extent they satisfy the user needs and requirements. Accordingly, the user needs and design specifications were worked out and presented in Table 2.

Based on the results, it can be inferred that users need specific photos on various plant parts like branches, flowers, fruits, cut opened fruits and complete plant as a whole (95 %). This was followed by the need to have more number of plants in one information system (92 %).

Arriving at the prototype design

The functional model for the prototype design for the crop information system was developed (Fig.1.). The model was arrived after taking input from the need analysis part and detailed discussion with expert in the field.

Fig.1. Functional diagram for the prototype design

The model has a crop part, name part, classification part and description part. The crop part has information on all the crop plant included in the system. The user will select the crop group which can be fruit plants, vegetable plants, spice plants, medicinal plants or garden plants during the first stage.The second layer was the name part. Here, the Scientific name, Malayalam name, English name and Regional name of the selected crop plants were displayed. The user has to make a selection in this layer to go further.

The third layer contain twelve classification criteria under each crop group. The specific criteria used in this layer will help the users to narrow their selection. The fourth layer was the descriptive layer. The crop information starting from photos on different aspects, detailed nomenclature, plant botany and agro techniques will be displayed on selection of individual plants.

Preparation of the database

The database of the software was designed with help of primary and secondary data sources. First, a list of all cultivated plants in Kerala was enlisted. The various literature and CD pertaining to this was used. A total of around 1500 plants were identified taking scientific name as base. Hereafter, with

Table 3.Specific classification criteria for the plants.

Sr. No	Fruit plant	Vegetable plant	Spice plant	Medicinal plant	Garden plant
1	Summer fruits	Leafy vegetables	Cool season	Ayurveda medicine	Foliage
2	Winter fruits	Toots and tubers	Root/tubers	Folk medicine	Water
3	Dry fruits	Warm season	Leaf/Bark	Homeo medicine	Indoor/bonsai
4	Fleshy fruits	Cold season	Vegetative grown	Sidha medicine	Butterfly
5	Exotic plants	Seed propagated	Seed grown	Unnani medicine	Religious
6	Annual plants	Vegetative propagated	Annual plants	Modern medicine	Fragrant
7	Perennial plants	Annual plants	Perennial plants	Poisonous plants	Cactus plants
8	Climbing plants	Perennial plants	Climbing plants	Climbing plants	Climbing plants
9	Herb plants	Climbers/trailers	Herb plants	Herb plants	Herb plants
10	Shrub plants	Herbs/Shrubs	Shrub plants	Shrub plants	Shrub plants
11	Tree plants	Tree vegetables	Tree plants	Tree plants	Tree plants
12	All fruit plants	All vegetable plants	All spice plants	All medicinal plants	All garden plants

expert support the plants were further studied to avoid repetitions. There were plants included with old and new scientific name in the list. Hence, plant ID was given to all plant to keep its individuality. A total of 1300 plants were finally identified through the process.

The identified plants were further classified into broad categories like fruit plants, vegetable plants, spice plants, medicinal plants and garden plants. Specific criteria for classification was also identified under each category (Table 3). With expert support the 1300 plants were classified into each of the above criteria. A total of 3,12,000 combinations were identified. It was further wetted in technological workshop.

The scientific name, english name, regional name and malayalam name was collected and included for all the plants. Later, the photos of the crop plants were collected from various available sources. The thump rule kept was to have one photo each of whole plant, branches, flowers, fruit and cut open fruit. The plant botany and agro techniques were also prepared simultaneously. The layman style of writing botany was adopted. In agro-techniques, the emphasis was on basic technology for cultivation. The content materials thus prepared was wetted with experts in that field to ensure its authenticity.

Development of the software

Converting the theoretical design to computer design is meant by the term software development. The development of software was done in such a way so as to work both in offline and online mode. And based on the analysis of data structure, it found necessary to develop the software in three basic layers. The three basic layers include the user side interface layer, the business logic layer and the database layer at the bottom.

The user side interface layer represents the layer of the programme that appears in front of us. The user interface was designed using Hyper Text Markup Language. The business logic layer acts as the connecting link between the database layer and client side interface layer. The request from the users are processed and replied through this layer. The business logic application layer for the programme was developed through Java script. Database layer represent the area where the basic data to be used by

Table 4. Observation of respondents about the crop information system.

Sr. No	Parameter	Per cent of respondents
1	The photos used in the system help a lot in identification of the plant	82
2	The plant botany is really in common man language and help a lot in plant identification	80
3	The system have basic information on almost all cultivated plants of Kerala	75
4	The users are able to navigate within the system with minimum hardship	65
5	It is possible to identify the plant based on different nomenclature	63
6	The broad classification parameters identified are relevant	60
7	The importance and cultivation details of the plant should be covered much more	53
8	The facility to enlarge photos is very much useful to have a larger perspective	45

the system was stored. The data base layer for the system was developed in java script language.

The software thus developed was tested in three stages. During the first stage the working of the programme were tested. In the second stage, the language parts of the software were checked for spelling and grammatical errors. In the third stage, the programmes were used in different computers with different operating systems to see its working. The problems noticed were rectified every now and then. And the final software was made available in the domain www.farmextensionmanager.com

Testing and validation of the tool

The final testing of the crop information system was done with 100 numbers of respondents comprising agricultural officers, research scientists, agricultural students and progressive farmers. The respondents were first demonstrated and later asked to use the crop information system for half an hour. Then they were asked list out their observations about the system. The responses of the participants were content analyzed and classified to arrive at the final result of testing (Table 4).

The respondents found the photos used in the system as highly useful (82 %). This was followed by 80 per cent of the respondents find the style of writing of the botanical details most useful. Based on the results, it can be inferred that the overall design of the interactive tool has a very high acceptance among the respondents.

CONCLUSION

A comprehensive crop information system for crop plant identification was developed as part of the project. A total of around 1300 plants were included in the crop information system. There are over 3,12,000 permutations and combinations taken care in the system development that makes the retrieval of required information easy. The Agile software development approach was used for the development of the software. The interactivity and easiness of the use are specially taken care in the development phase. The developed software was tested with a group of research scientists, extension officials and progressive farmers for final validation. It was made available in the website www.farmextensionmanager.com. The application can act as a ready to use guide for the farming community in the area of plant identification and cultivation.

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REFERENCES

Carvalho M R, Bockmann F A, Amorim D S, Brando C R F, Vivo M and Figueiredo J L (2007). Taxonomic impediment or impediment to taxonomy? A commentary on systematics and the Cybertaxonomic-Automation paradigm. *Evol Biol* **34:** 140– 143.

Collier K W (2011).*Agile Analytics: A Value-Driven Approach to Business Intelligence and Data Warehousing*. Addison-Wesley Professional. pp.121.

Cope J S, Corney D, Clark J Y, Remagnino P and Wilkin P (2012). Plant species identification using digital morphometrics: A review. *Expert Systems with Applications* **39**(8):7562–7573.

Govaerts R (2003). How many species of seed plants are there? *Taxon* **52**(3):583-584.

Mzoughi O,Yahiaoui I, Boujemaa N and Zagrouba E (2013). Advanced tree species identification using multiple leaf parts image queries, *IEEE International Conference on Image Processing*, Melbourne, VIC, 2013, pp. 3967-3971.

Ramasubbu R, Sathya S and Manikandan G (2015).*Computer aided alternative tool for the identification of angiosperm families (dicots) of south India.*Recent Advances in Computer Science and Applications. International Conference on Evolution in Engineering & Management (ICEEM-2015): 359-362.

Scotland R W and Wortley A H (2003). How many species of seed plants are there? *Taxon* **52**(1): 101–104.

Singhal A (2001).Modern information retrieval: a brief overview. Bull. *IEEE Comp. soc. tech. Comm. Data Eng*. **24**(4), 35-43.

Sunil V G, Berin Pathrose and Prasanth K (2019). Design and development of an expert support system for fertilizer calculation. *J Krishi Vigyan* **8**(1): 38-42

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