

Iconic Interface for Farmers to Retrieve Information

Aniket Kulkarni
Computer Dept.,
V.E.S. Institute of
Technology,
Mumbai-74,
India.

Ajit Naik
Computer Dept.,
V.E.S. Institute of
Technology,
Mumbai-74,
India.

Sagar Gurnani
Computer Dept.,
V.E.S. Institute of
Technology,
Mumbai-74,
India.

Indu Dokare
Computer Dept.,
V.E.S. Institute of
Technology,
Mumbai-74,
India.

Abstract

In this paper, we explore the possibilities in the domain of Human-Computer Interaction for effective information retrieval, especially in the case where the primary beneficiaries will be the illiterate/semi-literate segments of the population. We have concentrated on utilizing an icon-based, keyboard free approach for gaining access to a plethora of information related to agriculture, as it is the prime occupation of the people living in the rural areas of India. This is a step in the right direction for these areas where modernization is still a few years away from realization. The prime motivation for choosing to study this topic was to provide the farmers and associated laborers with an extensive repository of information on various aspects of agriculture. For achieving this, we built upon studies and research on the efficacy and intuitiveness of icon-based interfaces and similar applications built in the past. Using certain techniques that greatly improved the cognitive factor of the resulting application; we were able to create an application as mentioned above.

Keywords: Illiteracy, Human Computer Interaction (HCI), Iconic Interface, Agriculture, Information Retrieval

1. Introduction

India's illiterate population equals the population of USA. According to UNESCO, there are a total of 775 million illiterate adults in the world and India, alone, consists of 287 million of them, i.e. 37% of the total number. Majority of the illiterate population in India consist of farmers. Even though new, efficient agriculture technologies have been developed, these farmers, due to their illiteracy, are unaware of such emerging technologies. As a result they are often held back by inefficient, unproductive methods. If farmers pick up more innovative methods to improve

production and quality; it would help in a great way to satiate the hunger of densely populated India.

A farmer generally should have the knowledge of the following:

Climate: Which climate is favorable for which crop and what is the optimum time for planting.

Biology: The quality of soil in the area and crops suitable for that soil.

Chemistry: Does the soil require fertilizers, and how much?

Finance: To deal with banks for availing loans and subsidies.

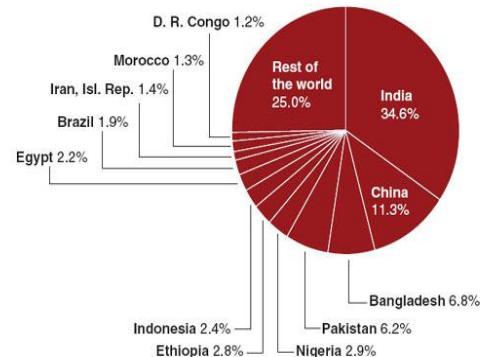


Fig. 1 Distribution of illiterate population

With the advent of the Internet, one can now gain access to a huge repository of data. It is possible to gain knowledge in any subject with the help of the Internet. But the factor which impedes its use is the literacy of English language. Even though websites are available in native languages, devices like keyboard or touchpad consists of English alphabets. Due to this, a person illiterate in English is unable to operate a computer and thus, cannot gain access to a plethora of information.

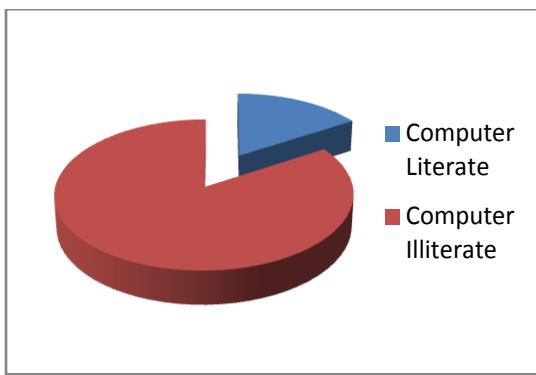


Fig. 2 Computer Literacy in India

HCI has great potential to make such modern technology accessible to them.

1.1 Human Computer Interaction (HCI)

HCI is an amalgamation of different fields, such as computer science, electronics, behavioral science, psychology, biology, organizational science, etc.

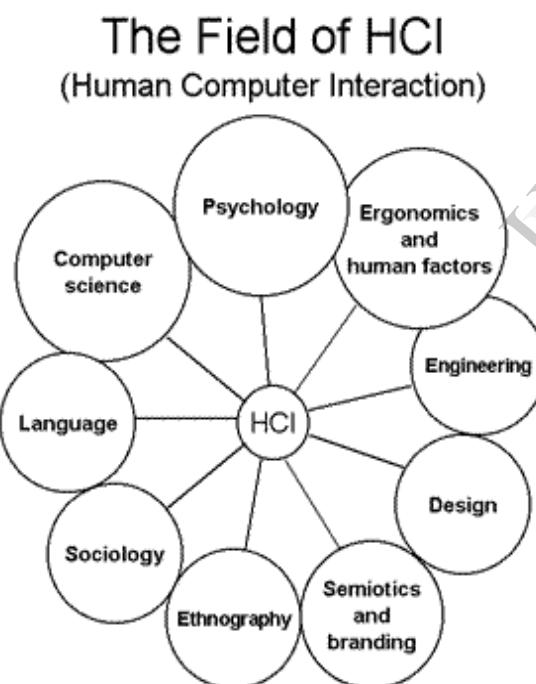


Fig. 3 Overview of HCI

Human-computer interaction is a discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them ^[1]. The form of HCI which we are focusing on is *Iconic Representation for Information Retrieval*.

2. Icon

Icon is defined by the Oxford dictionary (2010) as “*a devotional painting of Christ or another holy figure, typically on wood, venerated in the Byzantine and other Eastern Churches*”. Icons are images with meanings. ‘*Icons have replaced textual commands as an abstract representation of the software commands*’ ^[2]. Icons are pictures, often small and associated with an action.

An icon consists of following factors:

Cultural Specific: These are icons which are perceived differently by different cultures. Interpretation of icons by different cultures is described in the study “*Cultural influences on the comprehensibility of icons in mobile-computer interaction*” ^[3]. Participants in the study were given a set of icons and were asked to answer what they thought the icon represented. By carrying out the study first in Germany and later in India, the researchers came to a conclusion that perception of icons varies with culture.

Table 1 Cultural difference in transparency of icons standardized in western cultures

Targets	Indians		Germans			
	Pictorial Transparency (%)	Semantic Transparency (%)	Pictorial Transparency (%)		Semantic Transparency (%)	
			Young	Older	Young	Older
☒	58	17	100	86	100	86
☒	75	50	100	85	100	77

Cultural Unspecific: These are icons which are perceived in the same way irrespective of the culture. Such icons are depicted below:



Fig. 4 Commonly used icons

Few advantages of icons are listed out by Horton (Cited in SIAU, 2005) ^[4]:

- Icons enhance productivity and reliability.
- Icons are better than words for visual and spatial concepts
- Well-designed icons save space
- Icons speed up search
- Icons facilitate immediate recognition
- Icons lead to better recall
- Icons reduce the necessity of reading
- Icons are more internationally recognizable

3. Existing Technologies

3.1 An icon based application for illiterate/semi-literate Indian construction labourers

Rupesh Kumar had developed a prototype of an icon based application for illiterate and semi-literate Indian construction labourers to keep track of their day to day activities, monitor the construction progress as well as emphasizing the use of safety equipment related to work ^[5]. The prototype had an iconic interface. The application received a positive feedback from workers and research suggests that such a system may help in project management and make the overall construction process more productive and profitable



Fig. 5 Interface of the application

3.2 Iconic interface to retrieve information from the internet

A prototype was developed to retrieve information, based in the tourism domain ^[6]. A limited number of travel queries can be fired using this interface. Among the icons displayed in the interface, the user has to select icons related to the desired query. A query will be generated automatically and then fed to the search engine. The search engine returns results

in text form. The limitation of this application is that prediction is used to form queries as a result of which undesirable results can be achieved. Also, the user has to decide which website to visit from the displayed results, thus increasing the cognitive overload.



Fig. 6 Interface of the application

3.3 Avaaj Otalo

Avaaj Otalo (meaning “voice stoop”) ^[7] is an interactive mobile application developed for small-scale farmers in Gujarat. It was designed in 2008 as a joint project of Development support center (DSC), an NGO in Ahmedabad, Gujarat, India and IBM India Research Laboratory, based in New Delhi, India.

It has the following features:

Question and Answer Forum: The user can record a question, answer a question or browse through existing list of question and answers. After recording the question, the user can call back later to check for responses. The limitation was that users were allowed only 30 seconds for each question or answer they recorded.

Announcement Board: It was used to broadcast messages about agriculture, animal husbandry, government policies, market prices, weather, etc.

Radio Archive: Episodes of radio program of DSC were recorded in the archive. User could listen to any episode he missed.

Avaaj Otalo allowed users to choose between voice commands or press-key inputs for navigating menus. The application asked the users to say the given keyword or press the key corresponding to the option they wanted. It was observed that most users preferred press-key navigation, as they found voice input more error prone.

3.3.1 Limitations of Avaaj Otalo

Avaaj Otalo did not provide a feature to search for specified content in the forum. Users had to listen to questions sequentially starting from the most recent question. Each question was followed by their answers. Users did not have the option to skip ahead to the next question.

As the questions were answered by other users, the answer was not guaranteed to be accurate. Initially, a staff was employed to answer the questions along with the users. To check the farmer involvement, the staff stopped answering questions for some time. The effect was that both question and answer traffic dropped dramatically. Users took less interest in answering the questions and as a result many questions were left unanswered, due to which the number of people accessing the application went down.

4. Our Contribution

We have designed an application having an iconic interface which can be used by illiterate and semi-literate farmers to acquire information related to:

Crops: Cultivation methods, Fertilizers & Diseases.

Soil: Types of soils.

Weather: Average values of meteorological parameters arranged month-wise.

Government Policies:

This application makes void the use of keyboard and can be operated with the use of mouse only. All information is available at a click of a mouse and as it does not require keyboard, the requirement of knowing English is eliminated. Also, audio is provided for given information so that illiterates who do not know to read can also benefit. The application supports two languages: English and Hindi (Hindi is the most widely spoken language in India).

4.1 Features

- No need of keyboard
- Multi-lingual support – English and Hindi
- Audio playback of information for illiterates.
- Iconic Interface
- Red-Green Signaling System to indicate current active state

4.2 Software's used

- Computer specification: Windows XP/Windows 7, RAM: 512 MB
- Intuitive development environment of Visual Studio 2010

- Google Translate, for Text and Audio (with Windows Sound Recorder)
- India's first open source and Unicode compatible font for Devanagri script – MANGAL
- Microsoft SQL Server Management Studio 2008

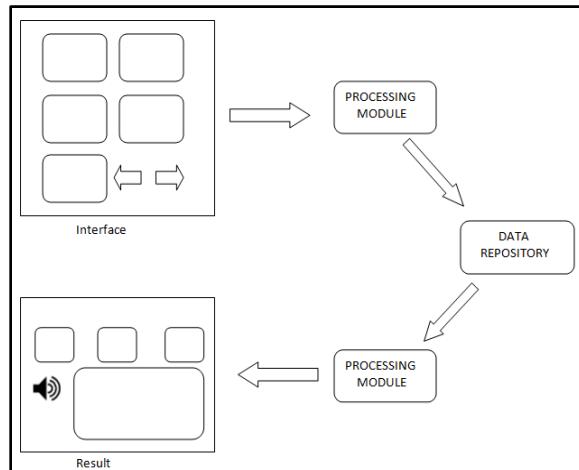


Fig. 7 Block diagram representing the process of information retrieval

The required data was taken from Maharashtra Organic Farming Federation. All the text information was stored in the database of Microsoft SQL Server Management Studio 2008. The audio files were created using Google Translator and stored at a different location. Front-end was developed using Visual Studio 2008. The GUI was developed in such a way that on hovering the cursor on a particular button, an audio describing its functionality would be played. A Connection String was maintained to open database connection. Based on the icons selected by the user, a dynamic query was generated.

The generated query was executed by SQL Server Engine. The results were then displayed in the GUI. Based on the query results, corresponding images were displayed. If the user doesn't know how to read, then the audio button can be used to read out the contents. The application works as follows:

- The user will select a language of his choice.
- Relevant icons will be displayed
- On selecting an icon, its sub-icons will be displayed.
- On selecting any sub-icon, the relevant text will be displayed in the language selected.
- An audio button is provided which when pressed will read the displayed text. A red-green signaling system is used to indicate the current active state.

- Each icon represents the information that it contains. Easily perceivable icons were selected for the application so that the user can become familiar with the interface as early as possible.

Efficiency \propto Usability

For example, the icon which contains information related to a crop is represented by an image of that crop.



Fig. 8 Icon for cotton crop

4.3 Interface Pages

The following layouts are the final design which was produced; shown pages are only static



Fig. 9 Interface to select the desired language



Fig. 10 Menu depicted in the English language



Fig. 11 Menu depicted in Hindi

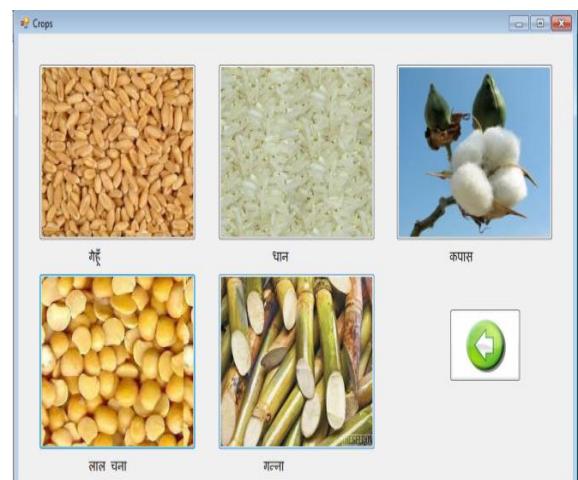


Fig. 12 Sub-menu of crops in Hindi

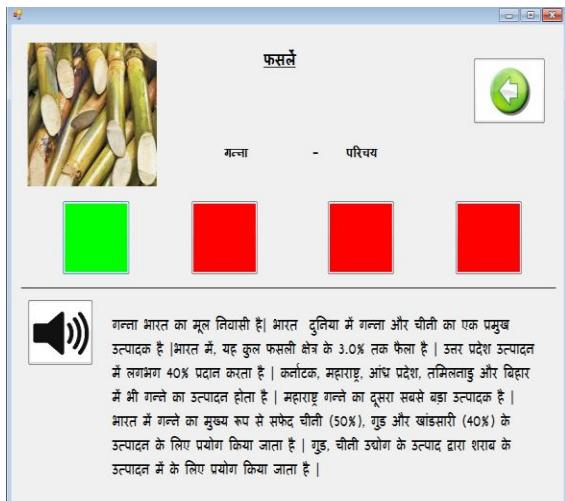


Fig. 13 Text and audio playback

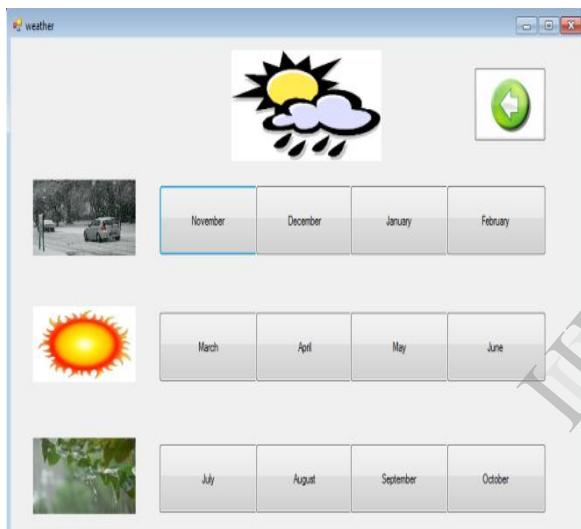


Fig. 14 Weather menu



Fig. 15 Weather details in English

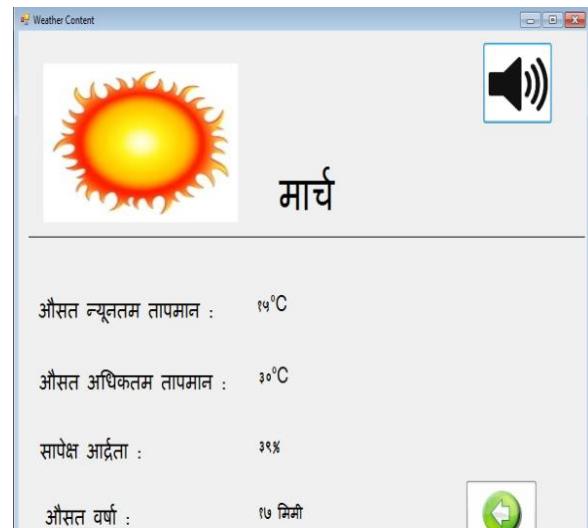


Fig. 16 Weather details in Hindi

4.4 Limitations

- Weather data is static and contains average recorded values of temperature, humidity etc.
- Information needs to be updated to reflect current situation of Government Policies.
- Needs a computer center installation in the village
- Requires Internet connectivity if weather data is to be current. Most of the rural areas in India don't have internet connectivity.

5. Conclusion

- An application using iconic interface was developed for farmers. We hope that a practical modification of this application goes a long way in helping out semi-literate and illiterate farmers in the rural areas someday. We hope that this application is easy to learn and use, and results in great benefits to them.
- There are several challenges to give this idea a complete shape. Some of them are icon design, arrangement, image database handling, proper query generation etc. The positive side of an icon is that a single icon is sufficient to represent a query but again misrepresentation leads to failure of query generation.
- So looking at both the positive and negative aspects of icons it is clear that it is a big challenge to design interface properly but efficient implementation is very much effective and useful for target user.

6. Future Scope

- Real time weather information for systems having Internet access.
- A query resolution technique where the support staff contacts the farmer, as the phone number of the user will be taken when the application initializes.
- Tie-up with Government bodies for up to date policy details.
- Dynamic translation of text-to-speech.
- Wider range of crops & soils. Addition of new fields like Poultry & Farm Animals.
- Mobile supported version of the application.

Study of an Interactive Voice Forum for Small Farmers in Rural India.

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