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Design Of Intelligent Adaptive Interaction Framework For Indian Farmer

[1] Anuradha M. Bhatt Oza, Dr. M.V.Sarode
[1] Lecturer, Computer Science,Mumbai.
[2] Head of Department, Computer Eng, Yavatmal.
[1] anuradha2jb@gmail.com, [2]mvsarode2013@gmail.com

Abstract: ***Speech and hand gesture are promising tool to convey information to illiterate or semiliterate users through non-text user interfaces. This paper describes the challenges that marginal farmers in India face for interaction with machine. The modularity seems to be trustworthy for farmers to adapt their practices by means of speech and hand gesture interaction at economic cost. Intelligent and adaptive interface build the bridge between farmer and machine for taking decision regarding strategies, harvesting and economical fluctuations. The objective of the paper is to enhance the control and productivity of small acreage cultivation through the development and dissemination of prototype interface module.***

Keywords: ***Human computer Interaction, Multimodality, Framework, Human Interface.***

I. INTRODUCTION

A man machine interface is a way for computer to be acquainted with human communicating with it, thus building a richer bridge between machines and human than primitive text user interface or graphic user interface, limiting the majority of input to keyboard and mouse that is for communication between humans, speech and hand gestures are usually exploited tools, traditionally communication between human and computer is bounded to keyboard, mouse, touch sensing devices. Thus Human-Computer Interaction is the discipline concerned with the design, evaluation and implementation of interactive computing systems for human use and with the study of major phenomena surrounding them. It encompasses not only ease of use but also new interaction techniques for supporting user tasks, providing better access to information, and creating more powerful forms of communication.

Adaptation and problem solving are important topics addressed by research on artificial intelligence (AI) and therefore many Intelligent User Interfaces draw heavily on the techniques developed in AI research. However, not all intelligent user interfaces have learning or problem solving capabilities. Many interface that so call intelligent focus on the communication channels between the user and machine. These interfaces often apply new interaction techniques such as speech processing, gaze tracking or facial recognition. Some examples are: psychology, ergonomics, human factors, cognitive science and social sciences. In Figure 1 we have depicted several Interaction User

Interface research topics and their relationship to the other research fields.

Human hand gestures are a means of non-verbal interaction among people. They range from simple actions of using our

hand to point at and move objects around to more complex ones that express our feelings and allow us to communicate with others. The gesture in interaction is required to provide the means by which they can be interpreted by computers. The interpretation of gestures and speech requires a dynamic and/or static configurations of the human hand, arm, and even other parts of human body, be measurable by the machine. This has spawned active research toward more "natural" HCI techniques.

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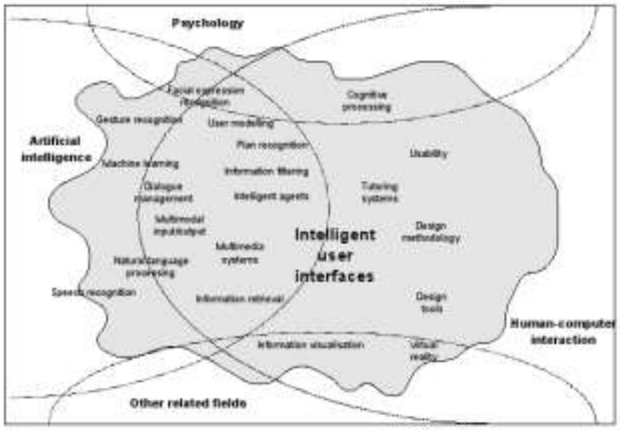

Figure 1 : Intelligent user interface and its related field

Rapid development in the field of communication technology ensures growth in sectors like-agriculture, education, healthcare etc. However a users located in rural area are unable to take the advantages of the communication revolution on account of lack of technical information. According to the UNESCO report, population of such people in the globe is 64% who are unable to use the technology due to language and technology barrier.

II. LITERATURE SURVEY

Pradipta Biswas and Pat Langdon [1] summarizes the user interface and interaction design strategy for developing applications in the context of India-UK Advanced Technology Centre (IU-ATC) of excellence in next generation networks systems and services for developing adaptive user interfaces it make use of new modalities of interaction like eye-gaze trackers or head trackers for everyday computing like online banking, shopping, travelling and so on.

Andrew English, Patrick Ross, David Ball [2] describes a novel vision based texture tracking method to guide autonomous vehicles in agricultural fields where the crop rows are challenging to detect. It requires sufficient visual difference between the crop and soil for segmentation, or explicit knowledge of the structure of the crop rows. This method works by extracting and tracking the direction and lateral offset of the dominant parallel texture in a simulated overhead view of the scene and hence abstracts away crop-specific details such as colour, spacing and periodicity.

Zhengyoung Huyan, Likui Xu, Shuai Fang, Zhe Liu, Xiaodong Zhang and Lin Li [3] use speech recognition technology of interpersonal interaction, It has HMM model that is used to build a wild information acquisition system which is based on the theory offline continuous speech recognition through open source tools such as HTK and Sphinx.

Javeria Farooq and Muhaddisa Barat Ali [4] uses hand gesture recognition technique to interact with the computer, since interactions with the computer can be increased through multidimensional use of hand gestures as compare to other input methods. It explore three different techniques for HGR (hand gesture recognition) using finger tips detection. They present a system that uses only a webcam and algorithms which are developed using computer vision, image and the video processing toolboxes of Matlab.

Pratap Rajkumar Tokekar[5] make use of robotic sensing systems hold the potential to revolutionize a diverse collection of applications such as agriculture, environmental monitoring, climate studies, security and surveillance. He develop new sensor planning algorithms and present prototype robotic sensing systems which plan the motion of a team of aerial robots tasked with tracking targets that are moving on the ground. For this it make use of robotic boats to monitor radio-tagged invasive fish in lakes, and using ground and aerial robots for data collection in precision agriculture.

Delphian Desktop [6] predicts the destination of the cursor based on initial movement and rapidly ‘flies’ the cursor towards its target. Although these techniques were designed for single monitor conditions, they can be easily tailored for multi-monitor setups. Head and eye tracking techniques were proposed to position the cursor on the monitor of interest [7,8].

Multimodal interfaces try to integrate speech, written text, body language, gestures, eye or lip movements and other forms of communication in order to better understand the user and to communicate more effectively. Of course, the choice of the used modalities in multimodal interfaces depends very much on the application of the system [9].When users can choose from multiple modalities to interact with a system, the system has the potential to be accessible to a broader range of users, for example people with disabilities. Also, multimodal user interfaces are much more robust than normal interfaces, at least in theory. Processing input from one modality can be simplified by using information from another and the user can choose the modality that is the least error prone given the circumstances [11].

Ninja cursor [12] proposes a technique to improve the performance of target acquisition, particularly on large screens. This technique uses multiple distributed cursors to reduce the average distance to targets. Each cursor moves synchronously following mouse movement. explore the possibilities for augmenting the standard computer mouse with multitouch capabilities so that it can sense the position of the user's fingers and thereby complement traditional pointer-based desktop interactions with touch and gestures. They present five different multi-touch mouse implementations, each of which explores a different touch sensing strategy, which leads to differing form-factors and hence interaction possibilities.

According to Rasmussen's SRK model [10], in a task, people's cognitive mode could be skill-based, rule-based or knowledge-based. At the lowest level, the skill-based mode, human performance is governed by patterns of preprogrammed behaviors represented as analogue structures in a time-space domain in human memory. When a familiar situation is recognized, a certain feedback is made. Neither any conscious analysis of the situation nor any sort of deliberation of alternative solutions is required.

III. ADAPTIVE MODULARITY

In this paper, the design of adaptive interface modularity is controls operation at the field via speech and gestures based on inputs provided by user. The proposed modularity requires low cost camera that provides a single view supporting peripheral vision and targeted execution. The interaction styles include virtual, mixed and augmented reality, tangible interaction, ubiquitous and pervasive interaction, context aware computing, handheld or mobile interaction which can be used to analyse specific interaction designs as represented by flow:

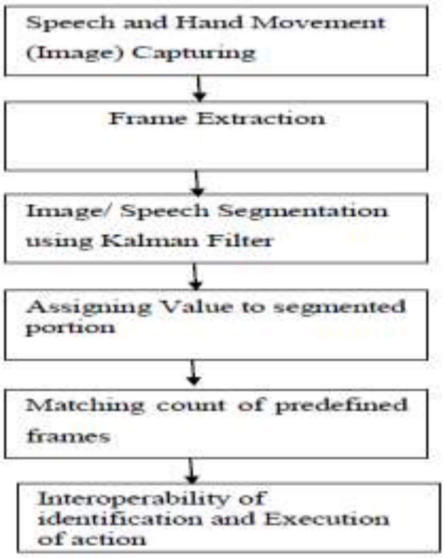

Figure 3: Design flow of intelligent adaptive interface

Step1 : Requisite modal consist of low cost microphone with capacity of 6-12 DB. Similarly to recognize movement of hand camera of 8-12 MP cameras is supposed to initialize.
Step2 : In this valid input for respective speech and hand is supposed to recognize. For this propose false acceptance and false rejection rate are calculated.
Step3:To validate speech depending on peach, pronunciation, vocal quality resulting in formation of speech frames.
Step4:To validate hand gesture depending on tone, movements, shape of hand resulting in formation of image frames.
Step5 : Valid input are recognize and filters are supposed to remove noise related to speech and hand gestures.
Step6 : Execution of command with respect to an input is carried out in this step. The task province is essential to make the challenge of building a natural interface for gesture interpretation system (or other application domains) a tractable problem.

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Within this context, cognitive systems engineering has proven to be an effective methodology for understanding the task domain and developing interface technologies to support performance of tasks. Consider scale and needs before settling on a single framework, making it important to consider a variety of approaches in designing a collaborative multimodal gesture interpretation System.

Intelligent user interfaces versus intelligent systems An often-made mistake is to confuse an IUI with an intelligent system. A system exhibiting some form of intelligence is not necessarily an intelligent interface. There are many intelligent systems with very simple non-intelligent interfaces and the fact that a system has an intelligent interface does not say anything about the intelligence of the underlying system

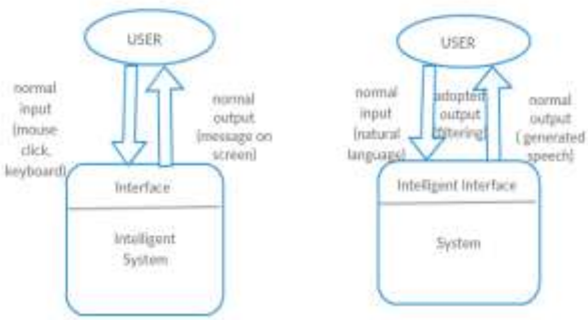

Figure 2 : An Intelligent system versus an Intelligent interface

Unfortunately, the boundary between a system and its interface is not always very clear. Often the technology used in an IUI is also part of the underlying system, or the IUI may even form the entire system itself. For example, a speech recognition system can be part of an intelligent interface to a system, but it can also be the complete system depending on how you look at it. If an IUI can be regarded as a system on its own, then it is by definition an intelligent system.

Non-sinusoidal periodic signals are made up of many discrete sinusoidal frequency components. The process of obtaining the spectrum of frequencies h(f) comprising a time-dependent signal h(t) is called Fourier Analysis and it is realized by the so-called Fourier Transform (FT). Smoothing operations can be carried out by Fourier analysis. The Fourier Transform´s ability to represent time-domain data in the frequency domain and vice-versa has many applications. One of the most frequent applications is analyzing the spectral (frequency) energy contained in data that has been sampled at evenly-spaced time intervals.

Attainment of valid input of predefined speech and gesture commands by user is expected. The resulting multimodal "language" thus would have to be interpreted by a mainframe. Although, most gestures are closely linked to speech, they still present meaning in a fundamentally different form of speech. Studies in human-to-human communication, psycholinguistics, and others have already generated a significant body of research on multimodal communication. A vision-based framework allows the users to identify gesture of hand postures, being the system adaptable to different light conditions and backgrounds. However, they usually consider a different granularity of the problem. The patterns from face-to-face communication do not automatically transfer over to HCI due to the "artificial" paradigms of information displays. Vocalization identification improving performances in voice recognition can be done taking into account to dimension, spontaneous degree of speaking, dependence on the speaker, system accommodating time at new speakers, recognition rate etc.

IV. PURPOSED METHODOLOGY

Intelligent adaptive interface uses computer based decision support system depending upon various factors. For this purpose it can make use of human interfacing which brings many benefits due to its accuracy, powerful calculation software and automation. Electronics is involved in the detection of the environment parameters (humidity, temperature, in soil and in the air, wind direction, rain sensors, clouds detection, colour of the plant leaves), in the management of the inputs (water level control, mixing the fertilisations), system control (pressure control, cleaning of tanks) and data processing (data storage, computation, data reports, real-time clock).

A purposed system will:

a. monitor the state variables within the interface system,
b. compare the state variables with their desired or target values,
c. decide what actions are necessary to change the state of the system,
d. carry out the necessary actions.

The electronic equipment to control the automated interactive system comprises a central processing unit, a data acquisition unit and a driving unit. The central processing unit is supposed to be around a microcomputer structure which embedded software that will supervise the control elements and will drive the execution elements accordingly to manage the irrigation process. The microcomputer-based control system consists of a combination of hardware and software that acts as a supervisor with the purpose of managing interface and other related practices such as fertilization and pesticide treatments. The central processing unit will be provided with a robust, easy-to-use interface for an external operator, and with an intelligent machine specifically programmed to react properly to any changes of parameters monitored by sensors. The automatic functions are activated by feedback from field units (sensors) and will make corrections in the flow parameters by controlling devices in the irrigation system until the desired performance level is attained. This automatic system will also perform auxiliary functions such as stopping irrigation in case of rain. The embedded software will process data acquired from user through sensors in real time. It will be interactive, which means that they can be seen, modified, printed, etc.

The data acquisition unit will collect information from distributed multichannel, multipurpose sensors. The information is transferred into the central unit either directly, from sensors in the pipeline, or from intermediate data acquisition unit which collects the data from a number of sensors and then process and store them temporarily for further transfer to the central unit. All kind of input parameters like air temperature, soil moisture, radiations and humidity are collected and modelled. Various sensors, tensiometers, relative humidity sensors, rain sensors, temperature sensors control these processes scheduling. These sensors provide feedback to the controller to control its operation.

The driving unit will be the interface between the central processing unit and other elements of the system such as pumps, electro valves. The field devices such as valves, regulators, pumps, etc. are fitted with electrically operated servo-devices which enable actuation of the pumps, closing and opening of valves, and adjusting pilot valves of flow regulators. This type of system will also permit the system to govern flow from the central computer a by controlling flow parameters such as pressure and flow rate, according to specific needs at the given time, and to receive immediate feedback on the response of the system. The system has also features that enable an operator to transmit commands back to the various control units of the irrigation system.

V. IMPLICATIONS

A two-dimension conceptual model is proposed in this research. The two dimensions are the intelligence level of the user interface (SLI) and cognitive mode (CM). The user interface intelligence has three levels: low, medium, or high.

At a low-intelligence-level the user interface is device-oriented. Users complete tasks by manipulating each device directly on the user interface. At the medium-intelligence-level the user interface is task-oriented. A task is divided into several actions. The smart home would ask for the user’s confirmation before each action. Furthermore, if there is more than one way to finish the task, users need to choose the preferred method on the user interface.

At the high-intelligence level the user interface is also task oriented. The difference from the medium level is that the completion of tasks is more automated, meaning that the smart home would automatically carry out all actions in a task without any advance confirmation from the users. If there is more than one way to perform the task, the smart home will choose one instead of providing choices for the users.

At the middle level, rule-based mode, human performance is governed by conditional rules. Behaviors at this level require conscious preparation: first recognition of the need for action, followed by retrieval of past rules or methods, and then composition of new rules through either self-motivation or instruction. The rule-based mode is slower and more cognitively demanding than the skill-based mode.

At the highest level, the knowledge-based mode, human performance is governed by a thorough analysis of the situation and a systematic comparison of alternative means for action. Goals are explicitly formulated and alternative plans are compared rationally to maximize efficiency and minimize risks. Alternatives considered and tested either physically, by trial and error, or conceptually, by means of thought experiments. The knowledge-based mode is even slower and more cognitively demanding than rule-based mode, since it requires accesses to an internal or mental model of the system as well as laborious comparisons of work methods to find the optimal one.

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