DEMONSTRATION OF VISUAL-BASED AND AUDIO-BASED HCI SYSTEM

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Abstract
This paper is an attempt to provide a bird's eye view to the concept of Human Compute Interaction (HCI). The intention is to focus on the uni-modal architecture of HCI; especially the HCI system based on visual-based and color-based communication channels viz-a-viz color recognition and speech recognition. We have developed a Graphical User Interface (GUI) for the same using MATLAB; one push button assigned for color input (through webcam) and the other push button assigned for speech input (through microphone). In color recognition, primary colors i.e. RGB are detected in frames captured in real time or images uploaded offline. Subsequently, desired operation is executed (we have set commands to open D drive). In speech recognition, audio input through microphone is compared with a pre-stored audio file and then an operation is performed automatically (here, we have set commands to open Google web browser). The respective algorithms of these two processes have been described with flow-charts and snapshots of MATLAB results have been displayed.

Keywords: Human Computer Interaction, Uni-Modal Architecture, Color Recognition, Speech Recognition

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1. INTRODUCTION

In earlier days, computing was only restricted to research in scientific and astronomical laboratories. Only highly trained specialists of these fields could handle computers. And also, in the name of computers, there were massive expensive computing machines which required programming and functioning by skilled veterans. But today, we can make out that from gigantic unhandy electronic machines to slim laptops and i-pads in our bags, computers have come a long way! Unlike the 1980s, majority of computer users today have not received any specialized training in computer programming, though they can effectively interact with computers for a broad range of utilities.

Human Computer Interaction (HCI) is the study of the 'interaction' between humans and computers. The definition doesn't end there. The word 'interaction' used above must be clarified with the phrase 'easy interaction to obtain effective and desired results'. It is a study of the ways in which man handles or utilizes computer technology in order to influence his life with a target of simplifying things. It is about creating a software or any other technology that people will want to use, will be able to use and will find effective when used. The Curriculum Development Group of the ACM Special Interest Group defines HCI as 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'.

As evident from above, HCI can be defined in numerous ways. But all the definitions hover around the concept of 'interfacing'. Utilizing computers has always required easy interfacing. Over a few decades, the methods of interfacing with computers have changed drastically. Thus, HCI has become a ubiquitous research area attracting many professionals from various fields. The main focus though has always been on functionality and usability. Both of these terms are interconnected. Functionality of a certain system is defined as the range of operations that can be run or performed, i.e. the services that it provides to its users. However, functionality can only be considered when the system can be efficiently and adequately utilized by the users. Here comes the issue of usability. Usability is a quality attribute that inspects how easy user interfaces are to use. In short, it can be defined solely as ease-of-use. These two attributes jointly determine the importance and need of a certain HCI system.

1.1 Architecture of HCI Systems

An HCI system is usually defined by the behavior and diversity of its inputs and outputs. These inputs and outputs are the key attributes which form the basic outline of the way in which interaction is occurring between human and the computer. This is the very aspect defined by the architecture of an HCI system. It can be classified into two types:

1.1.1 Uni-modal HCI systems

An HCI system which depends on only one genre of inputs is known as a uni-modal HCI system. The independent channels are also known as modality. Thus, a uni-modal system comprises on one modality. A lot of new ways to provide input to HCI systems have been evolved; for example, visual-based, audio-based, sensor-based, sixth sense-based etc. In this paper, we intend to cover only uni-modal HCI systems; especially visual-based and audio-based. These are expounded later on in other sections of this paper.

1.1.2 Multi-modal HCI systems

In these types of HCI systems, different modalities are engaged, i.e. there are a variety of communication channels. A combination of two or more modalities can be used to design a multi-modal HCI system

1.2 Literature Survey

Learned basics digital image processing concept from the book of digital image processing by gonzalez and woods [1]. The overview of HCI(Human Computer Interaction) is studied from International Journal On Smart Sensing And Intelligent Systems, VOL. 1, NO. 1, March 2008 [2]. Color detection methodology has being taken from Real-Time Object Tracking Using Colour Feature, Basic Geometric Shape And Primary Colour Detection Using Image Processing On MATLAB [3] [4] [5]. Speech recognition

has been included from An HCI Speech-Based Architecture for Man-To-Machine and Machine-To-Man Communication in Yorùbá Language[6]

1.3 Color Detection and Speech Recognition

We are performing two techniques for color detection that are offline and online. Offline color detection can be done by selecting predefined colors in the computer, for this we have taken snapshots of blue green and red color in rectangle shape and for online color detection webcam is used to capture real time image of the object and basic color are being recognize and message is being displayed in both the cases of offline and online.

Speech is a means of communication. When we talk about interaction with computers, intially it started with devices like mouse, keyboard etc via electromechanical means, eventually it upgraded to a more natural way that is speech; and for this we need a speech recognition system. In this paper we have described about the application of the speech recognition system. With the use of speech recognition we have opened web page by browsing certain sound which we have already stored; detection of the sound is done in real time and if it is matched with the stored sound, desired work is done according to the back end programming. Speech recognition is a hierarchy of level in which the process is compiled.

2. ALGORITHMS

The algorithm for color detection is:

Step1: Graphic user interface (GUI) is made with two push buttons, namely, offline and online as shown in fig.2.

Step2: When we press offline: three colors already stored in our computer's memory is displayed and by clicking on any of the color message is further of red, blue, or green as shown in fig.3.

Step 3: By pressing online named push button we will observe that web camera will start and the process will start to detect the basic colors as shown in fig.5.

Step 4:In case of offline color, the colored image is being converted into gray scale and then the gray image into binary .

Step 5: In case of online color, web camera is configured and frames are set to manual and returned type color space to RGB.

Step 6: By switching for different colors we apply same algorithm for three basic colors.

Step 7: Initially it is converted into gray color and then filtering is done to avoid noise after this the image is being converted into black and white.

Step 8: Then the region properties like Bounding Box and Centroid are used.

**Step 9:** Plot the image and message box showing the color detected.
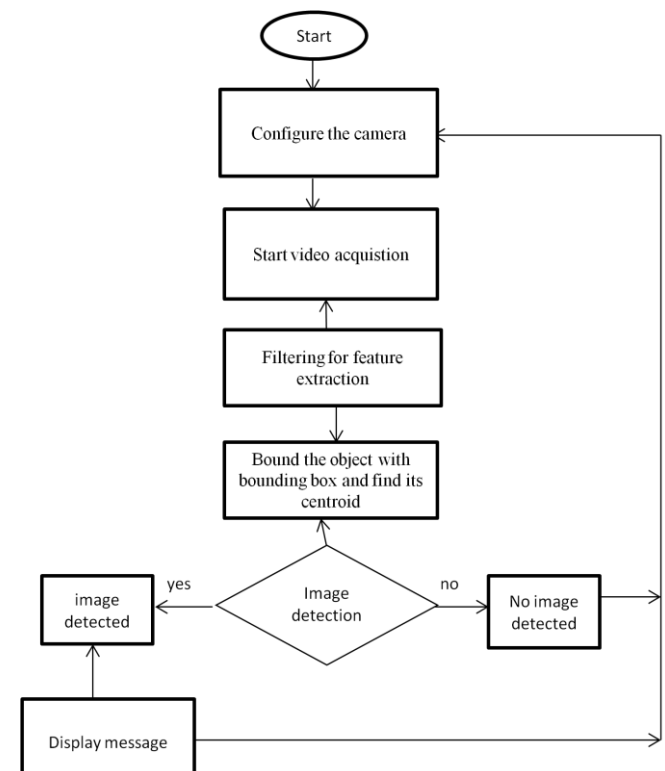
Algorithm for speech detection:

Step 1: Record the sound using a microphone for the desired time as already stated in the programme.

Step 2: Save the sound recorded as shown in fig.7.

Step 3: During speech recognition, real time speech is recorded; and is checked with the already recorded sound.

Step 4: As soon as sound is matched with the pre-recorded sound, the work alotted to that particular sound is done (opening of D drive and web browser page) as shown in fig.6 and fig.8.
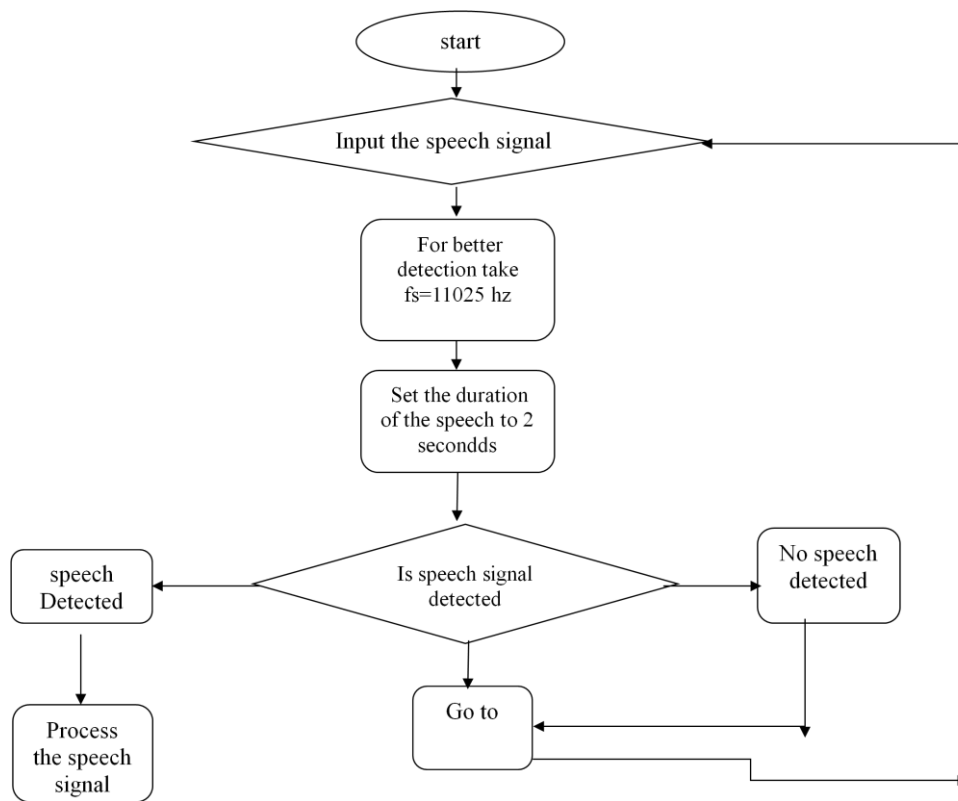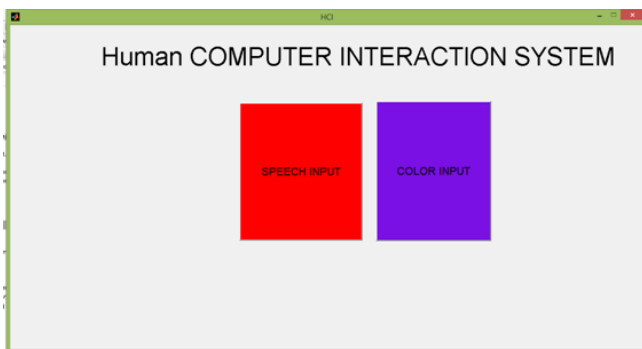
MATLAB results:

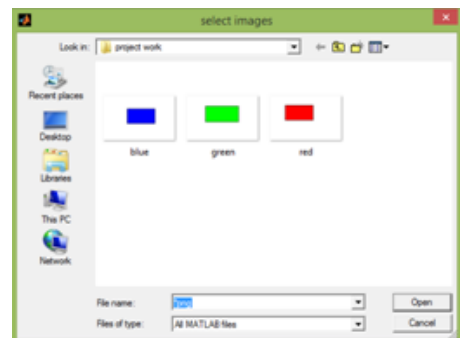**Fig 1.** GUI of human computer interaction system

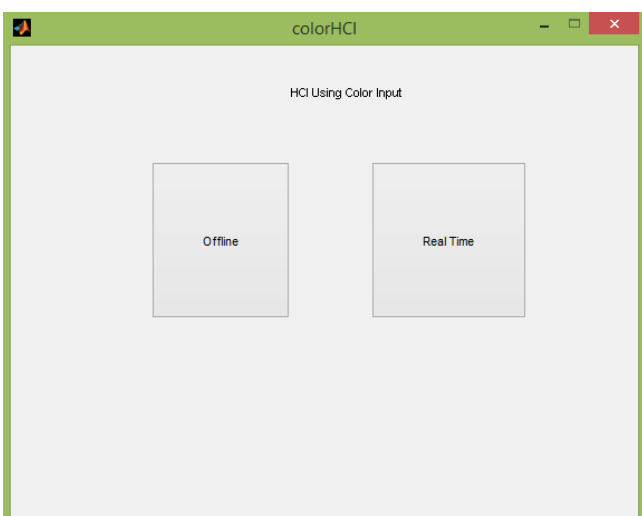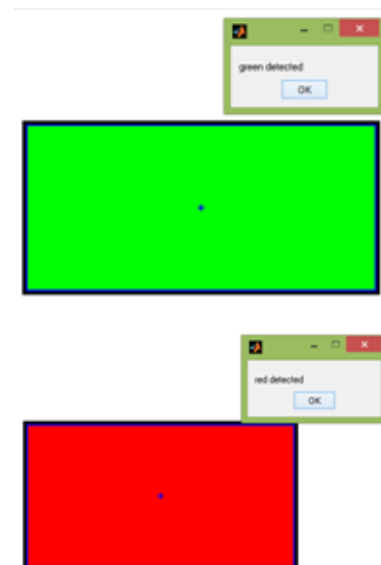**Fig 3.** Offline color acquisition from database
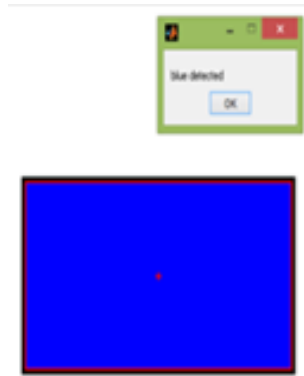

Fig 2. Color acquisition GUI

Fig 4. Outputs of Color recognition in offline mode
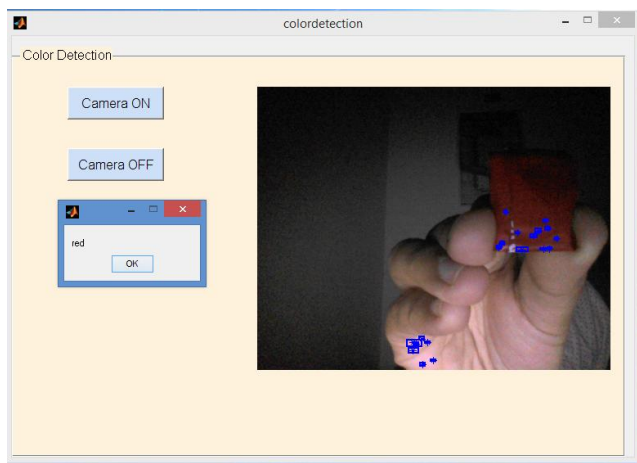

Fig 5. Real time color detection
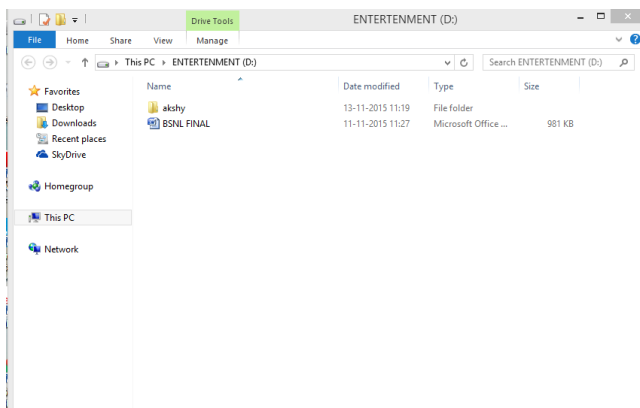

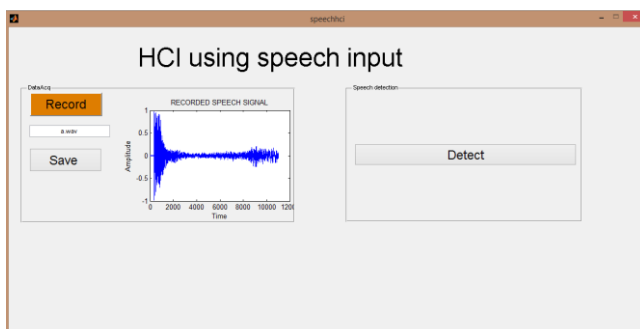**Fig 6.** Output as local disk D
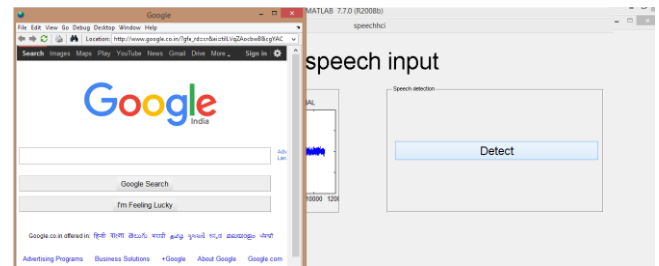

Fig 7. Speech acquisition GUI

Fig 8. Output as google web browser

3. CONCLUSION

Human computer is basically description of ways in which a man can interface with machine in the most efficient and easiest way. This technology has reached to an extent where an individual just have to make an gesture to perform a particular task, like in sixth sense technology just an gesture of taking a picture results in an image, also words from hard soft can be transferred to soft copy for further processing, in addition to this just a plane sheet of paper can help user to play a racing game making it very interesting and easy. Our day to day life activities can be automated. This made us work on the project similar to this technology. We have researched regarding speech recognition and color detection. It holds immense importance in today's era; boon for people with disabilities making their work easier and saves time as we would not have to go through a large set of steps. Instead we can do it by just speaking a word. One of the significant feature of speech recognition is rhythm, which may generate a conspicuous change, thus we need to look after it. It can be removed effectively with the use of concatenative synthesis. Storing words and their attributes for efficient detection which may slow down the system due to large database. In color recognition, lightning effect play a major role. In order to identify color correctly. We need to have proper light and less or no noise background. We have achieved 98% efficiency in color detection with considerable noise, thereby getting correct results. The major drawback is that the programming required is very complex.

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