Human Computer Interaction using Motion of Coloured Objects

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Abstract— State-of-the-art object detectors use shape information as a low level feature representation to capture the structure of the object. The high technological object motion detectors use 3D pattern of IR lights to detect and capture motion. This paper aims at providing a new alternative to Interact with the Computer by implementing color detection of objects. This paper implements the use of color attributes as an explicit representation for object detection. Color attributes are compact, computationally efficient, and provide accurate results for object detection.

Key words: 3D Pattern, IR Lights, HSV

I. INTRODUCTION

Until the late 1970s, the only humans who interacted with computers were information technology professionals and dedicated hobbyists. This changed disruptively with the emergence of personal computing in the later 1970s. Personal computing, including both personal software and platforms, made everyone in the world a potential computer user, and vividly highlighted the deficiencies of computers with respect to usability for those who wanted to use computers as tools[1].

With the highly advance developments made in the fields of computer science along with those made in technological fields, the ways through which humans interact with the computers has evolved from punch cards to electronic qwerty keyboards. It further progressed to touch and speech recognition. As a part of evolutionary research using motion detection to interact with the system is the sole idea behind the paper. Without the use of any expensive and over the top devices to detect the motion through IR, the paper aims to use colors as the primary tool to detect motion of any colored object.

The webcam is used to capture the motion of the colored object. The webcam is used to identify the frames continuously in which the colored objects are detected after performing various enhancements and setting the thresholds of the image colors. The designed system uses blue colored objects to detect motion.

II. METHODOLOGY

A. Image Processing:

Each frame that is captured is converted into HSV [Hue, Saturation and Value] from the captured RGB [Red, Green, and Blue] format. This is because the R, G, and B components of an object's color in a digital image are all correlated with the amount of light hitting the object, and therefore with each other, image descriptions in terms of those components make object discrimination difficult. Descriptions in terms of hue/lightness/saturation are often more relevant [2].

After the above transformation the threshold to detect a particular color is set. The threshold is set to make it a binary image with the color we want to detect. In the suggested system the threshold for blue color is set in order to recognize only objects pertaining to blue and related shades by a close proximity. The range of blue color specified in HSV chosen for implementation are:

lower_blue = [110,100,100]

upper_blue = [130,255,255]

Fig 1.1: Original Captured Frame

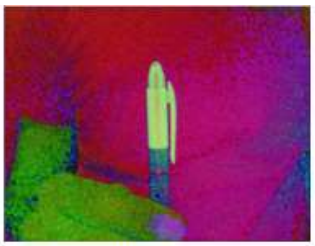

Fig 1.2: RBG converted in HSV

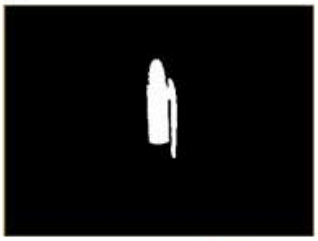

Fig 1.3: Frame after threshold for Blue Color is set.

B. Detecting the position/ Contours:

Contours can be explained simply as a curve joining all the continuous points (along the boundary), having same colour or intensity. The contours are a useful tool for shape analysis and object detection and recognition. [3]

- We use binary images so before finding contours, we apply threshold.
- After applying threshold the object to be detected should be white and background should be black.

The contours thus obtained from the image show all such areas which share a same intensity of the blue color or similar shades. These contours are used to track the location of the moving blue object.

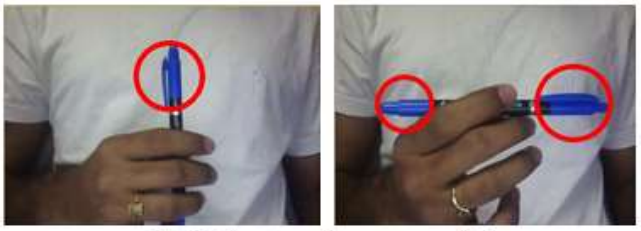

Fig 2: Contours drawn around the detected blue objects.

A high quantity of contours are detected even from a small dot which resembles the color blue. Thus out of all the obtained contours the correct and the more focused contour should be identified and be selected as our required object. This sort of filtration was enabled through:

- Arc Length of the contour

– Area of the contour

The minimum arc length and the area of the contours were suitably selected in order to eliminate majority of the contours that were not needed.

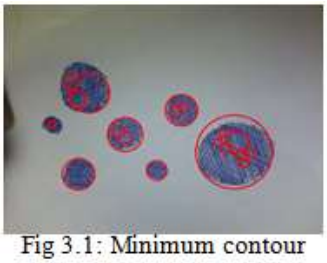

Fig 3.1: Minimum contour area 100px

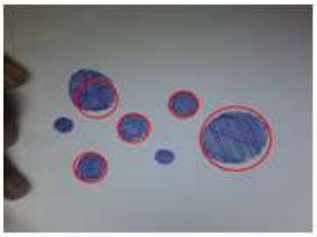

Fig 3.2: Minimum contour area 1000px

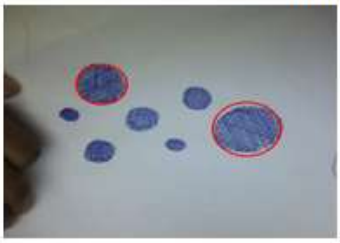

Fig 3.3: Minimum contour area 2000px

C. Relating the Contour Movement to the Cursor Movement:

The contours were drawn to know the position of the colored object which in turn would be used to set the position of the cursor. The center of the Minimum Enclosing Circle of the contour is selected as the position of the contour. The sensitivity of the movement of the object which causes very fast and uncontrollable movement of the cursor is eliminated by allowing only those changes in the contours which were different from their previous counters by at least 5 pixels. This there by eliminated all the movements where the difference between the positions of two consecutive contours was very little that might have been caused due to the unintentional motion of the object.

The position of the contour is to be inverted in order to cope up with the inversion of the image during image capture through webcam.

D. Requirements:

– Computer with a webcam
– Any blue colored object

III. Proposed System

The designed system enables the movement of the cursor in accordance to the movement of the colored object. More functionalities are proposed to be added to this system such as:

– Enabling click operations
– Selection of the color of the object to be detected i.e. if the user does not have a blue colored object around him to use, he can choose the color that he wishes to use.
– Enabling various other gestures and related operations.
– Controlling the sensitivity of the cursor to a finer amount.

IV. Conclusion

On the complete implementation of the proposed system the interaction between the humans and computers will reach a state when we can take a pen out of our pockets and wave it in the air to operate the computer. This paper proposes to establish color as an effective method to implement object detection which can enhance the existing models of Human Computer Interaction.

References

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[2] http://en.wikipedia.org/wiki/HSL_and_HSV#Use_in_image_analysis
[3] OpenCV Documentation

