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VIRTUAL KEYBOARD: AN INTELLIGENT INTERACTION SYSTEM FOR DESKTOP USING STANDARD CAMERA.

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ABSTRACT

A virtual keyboard is a type of keyboard which doesn't require any external physical support and can be operated by simply moving fingers, rather than typing on the physical keys of keyboard. Camera tracks the finger movements of typist to get the correct keystroke. The software and hardware type recognizes the typed characters and passes to the computer. The Proposed system is performed as: the typing will be captured by camera and the object can be discernible from background using BLOB Analysis. Then we estimate the location of user's fingertip by fingertip detection. By using Shadow analysis, we check whether the fingertip is in contact with the table keyboard mat. Mapping the touch to keystrokes and recognize the character and finally, sending the keystroke to the display screen.

KEYWORDS: Virtual keyboard, Camera, BLOB Analysis, Shadow analysis and Fingertip Detection.

INTRODUCTION

The significant problem in normal QWERTY keyboards is its size, as they are large in size and it is really not easy for a person to carry the keyboard from one place to another. The chances of breaking are also increased. The most important problematic situation for QWERTY system keyboard is its language restriction user has to install different language software's so as to interact with the system in different language. The invention of computers in recent years has undergone a rapid miniaturization. Disks and components grew smaller in size, but only component of the computer remained same for decades such as keyboard. Since the miniaturization of a traditional keyboard is very difficult we go for virtual keyboard.

A virtual keyboard is basically a keyboard that doesn't have any physical support and operated by the user via typing i.e. by simply moving fingers on the paper rather than typing on the physical keys. It can be a simple projection keyboard projected and touched on the projected image. It is just another example of today's computer trend of smaller and faster processing. The basic idea of virtual keyboard is that the camera tracks the finger movements of the typist to get the correct keystrokes. Then the software hardware type recognizes the typed characters and passes it to the computer to display the typed key by the user. The keyboard is projected optically on a flat surface and, as the user touches the image of the key, the optical device detects the stroke and sends it [1].

The idea of creating the Virtual keyboard is very simple and understandable. It lets people to have multilingual writing content on existing platform. The keyboard presented in this paper is small, well designed, handy and very easy to operate, that results in the perfect solution for cross multilingual text input. The earlier technique the keyboard was projected on an area and selected keys were transmitted as wireless signals using Bluetooth technology. With the approach, of the virtual keyboard it is possible for the user of a small smart phone or any other wearable computer to have full keyboard capability. In this paper a virtual keyboard designed which provides a platform of artificial intelligence and solution for multilingual text input

RELATED WORK

Several augmented virtual keyboard systems have been introduced. Jun Hu et al. [1] proposed a novel interactive projection system which enables bare-finger touch interaction on regular planar surfaces with only one standard camera and one projector. Bare finger touch detection recovers the touching information just from the 2-D image captured by the camera. Graphical user interface (GUI) button is projected on the surface and is distorted by the finger when clicked. There is correlation between the button's distortion and the finger's height to the surface. M. Khalilbeigi et al. [2] introduced a rollable display, whose display size can be dynamically changed. It also investigates how physical resizing of the display can be used as an input technique for interaction.

Pico projectors attached to mobile phones allow user to view phone content on large display. ShadowPuppets [3] allows user to cast hand shadow as input to mobile projector phones. Z Mo et al. [4] describes a SmartCanvas technique allows user to perform freehand drawing on a desk with gestures, it requires one camera and no touch sensors. Using hand detection and fingertip detection SmartCanvas is implemented. Touch detection and hand detection [6] is implemented as to make any planer surface a touch sensitive display using a projector and camera.

H Benko and A Wilson [5] introduced depth touch which uses a depth-sensing camera, which reports a range value per pixel in addition to color, to track the 3D position of the user's head and hand through a transparent vertical display screen. A flexible new technique to calibrate the camera is described in [7]. It only requires a camera to observe a planar pattern shown at a different orientation. Moving object is detected [8] using BLOB analysis in which a single mode background model based on BLOB analysis is proposed to segment foreground from image sequences in complex environment. C Jose et al. [8] introduced an approach for extracting features from an image using HSV color model. We have considered several techniques used in the paper for development of the virtual keyboard.

METHODOLOGIES OF PROBLEM SOLVING

In this section, simple and effective algorithms are explained so as to extract information from a 2D image captured by the camera.

BLOB Analysis

BLOB analysis is based on analysis of consistent image regions used for detecting regions in a digital image with different properties. The objects being inspected are clearly distinct from the background. Region is any subset of image pixels and BLOB is a connected region. BLOB is represented using the same region data type. BLOB analysis solution consists of three steps 1) Extraction: Thresholding techniques are applied so as to obtain a region corresponding to objects which are being inspected. 2) Refinement: the extracted region is enhanced using some region transformation techniques. 3) Analysis: the refined region is subjected to measurements and final results are computed. Main advantage of technique is high flexibility and performance.

Hand Detection

The hand images have been used with three colors red, green and blue called RGB values which help in observing images. The value of color Red is very high compared to the other two. There are some regions where this observation doesn't work or is not true like finger nails or veins, but overall result is not affected because hand follows a particular pattern, therefore hand is properly detected. To remove some abnormalities we have used image enhancement methods in the project. At last, detected regions are threshold to white color while rest is black in color.

Fingertip Detection

In this stage we find the maximum fingertips present on the keyboard. We detect the location of user's fingertip. We are also going to detect whether any fingertips are in contact with the tabletop or not as shown in the paper [1], [4] and [6]. The fingertip detection is implemented in this paper to find the location of user's fingertip. Then after detecting the location of user's fingertip we will find the letter present at that position which user desired to type.

Touch Detection

In this stage we estimate the position of the user's fingertips which are in contact with the keyboard-mat. We will use a technique called shadow analysis. Firstly the original image is captured and then the image is brightened according to the lightning situations. This helps in eliminating all the background noises like when shadow is coming from the

multiple sources or keyboard characters or left umbra coming from the shadow. After that hand is obtained which is to be subtracted from the image. This allows having hand shadow.

Figure 1:

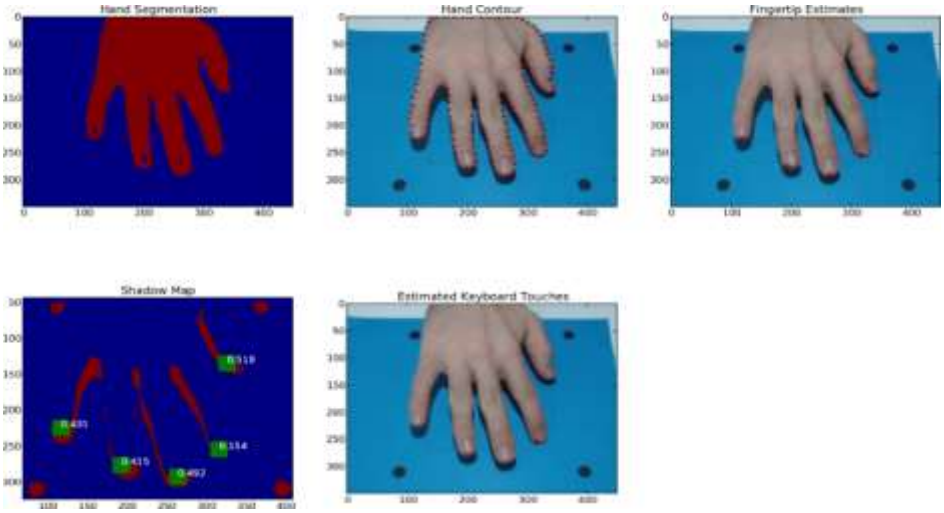

Figure 1: Steps for Hand detection
(Source: http://math.arizona.edu/~jthomas/vkeyboard.html)

PROPOSED SYSTEM: VIRTUAL KEYBOARD

The objective of our project is to develop a desktop application for keyboard, which will require no external hardware and will be easy to use with reconfigurable options. The camera will capture finger movements while typing on the keyboard drawn on blank paper. The main focus of the paper is to know the problems with current virtual keyboard and how to solve these problems using different techniques. We are presenting an idea in which the keyboard will be drawn on blank paper, either a standard keyboard or the keyboard as per the user's flexibility. Firstly, the camera will take the input as an image of the drawn keyboard on the paper and store it in a database. The finger movements of the user on the paper keyboard are recorded continuously from the camera as images and stored in the database. The software will continuously compare the initial drawn keyboard by the user and the images captured with respect to the users finger movements. The image processing in real time for typed letters from the keyboard will be detected using OpenCV. These letters will be displayed on screen. (Figure 2)

Figure 2:

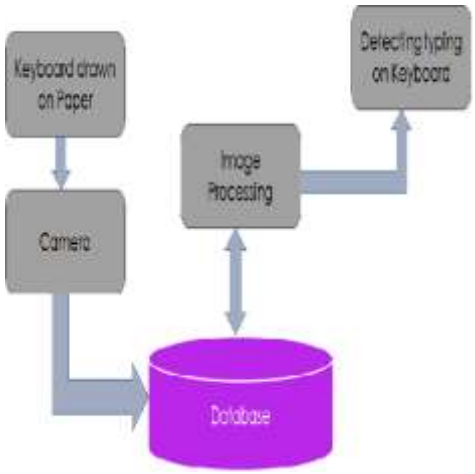

Figure 2: Basic architecture of virtual keyboard.

In the image processing module, the captured images by the camera will undergo through the following analysis to detect the desired letter pressed by the user on the keyboard 1) BLOB Analysis: it is a basic technique of machine vision based on analysis of consistent image regions. In this, the objects being inspected will be clearly discernible from the background. 2) HSV Model: HSL stands for hue, saturation, and lightness, and is often also called as HLS. HSV stands for hue, saturation, and value and is also often known as HSB (B for brightness). A third model, common in computer vision applications, is HSI (I for Intensity).

Figure 3:

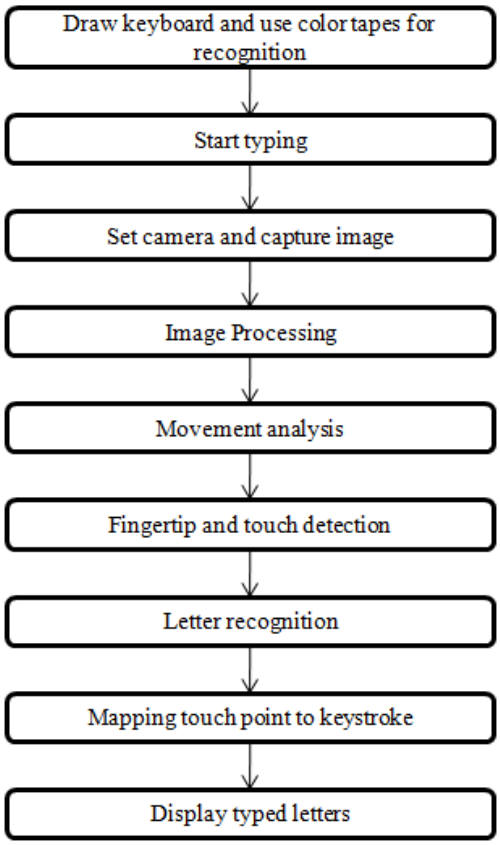

Figure 3: Flow Diagram.

3) Fingertip Detection: Location of the user's fingertips is based on the geometric features of the contours and regions obtained and detect whether the fingertip is in contact with the tabletop. 4) Touch Detection: Shadow analysis technique will detect the contact of the user fingertip with keyboard-mat. 5) Mapping touch point to keystrokes: in this we map touch to keystroke and recognized the character.6) Sending keystrokes: "Robot.java" class is used to generate native system input events for the purposes of test automation, self-running demos, and other applications where control of the mouse and keyboard is needed. The primary purpose of Robot is to facilitate automated testing of java platform implementation. The desired letter will get displayed on the screen.(Figure 3)

CONCLUSION

This paper illustrates about the practical implementation of virtual keyboard (VK). This virtual keyboard demonstrates upcoming tomorrow of human mobile devices as well as human computer interaction in the creation of virtual world. With the increasing demand of small mobile devices, conventional data entry is required that are considerably flexible and easy to use without affecting mainly the important properties like portability and mobility of such devices. A virtual keyboard claims to provide a convenience of compactness. As we are using a blank paper, so that user can draw the keyboard according to his or her comfort. Therefore we can say that these virtual keyboards will make typing easier, faster and almost a pleasure.

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