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Handwritten Digit & Character for Interactive Printing Using Digital Pen

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Abstract**:** *this paper presents a digital pen for handwritten digit and character for interactive printing applications. It is consists of an ARM processor, microphone, & camera. The drawing application lets user draw on any surface by observing the movement of index finger. Also can access or manipulate the information using fingers. Take a photo by Just make a square with fingers using color markers, & highlight that frame, and this system will capture the photo. Arrange these photos using own hands over free space. The device has a large number of applications, it is portable and easy to carry & that can wear it in neck.*
The camera also helps user to take pictures of the scene is viewing and later can arrange them on any surface. This system also used for reading a newspaper. Reading & viewing videos in a newspaper instead of the photos. Live sports can be updates while reading the newspaper. Users can use the pen to write digits or character. Our experimental results have successfully validated the effectiveness of the trajectory recognition algorithm for handwritten digit and character using the proposed digital pen.
Index Terms**:** *ARM processor, camera, microphone, color markers, MATLAB, Human-Computer Interfacing.*

I. Introduction

Explosive growth of miniaturization technologies in electronic circuits and components has greatly decreased the dimension and weight of consumer electronic products, like smart phones and computers, and made them more handy and convenient. Due to the continuous development of computer technology, human–computer interaction (HCI) techniques have become an indispensable component in our daily life. Although the miniaturization of computing devices allows us to carry computers in our pockets, keeping us continuously connected to the digital system, there is no connection between our digital devices and our interactions with the physical world. We use our "devices" like, computers, mobile phones, tablets, etc. to go into the internet and we can get the information that we want. We will use a device no bigger than current cell phones and probably eventually as small as a button on our shirts to bring the internet to us in order to interact with our world! This technology will allow us to interact with our world like never before [1]. We can get information we want on anything from anywhere within a few moments! We will not only be able to interact with things on a whole new level but also with people! One great part of the device is its ability to scan objects or even people and project out information regarding what you are looking at.

II. Hardware Design

A. ARM Processor

The ARM processor collects the analog acceleration signals and converts the signals to digital ones via the A/D converter.

B. Camera

A webcam captures the image and recognizes an object in view and tracks the user's hand gestures using computer-vision based techniques. It sends the data to the ARM processor. The camera acts as a digital eye & camera captures the image that user want to see. It also tracks the movements of the thumbs and index fingers of both of the user's hands. The camera quickly recognizes the objects around user. Images captured from camera will be converted into hsv color space. Hue plane of hsv transform contains color information. So hue plane can be segmented to detected position of color marker in image [2]. The way pen moves along with color marker, its position change is tracked by image processing algorithm and its corresponding x y co-ordinaltes are plotted on matlab window. Characters can be recognized by algorithms like phase correlation.

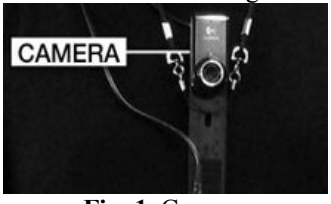


Fig. 1. Camera

C. Mic

Mic interfaced to ADC and microcontroller will give information of touch at paper. Microcontroller is interfaced to pc by serial communication, 8 data bits, 1 start bit, 1 stop bit. When touch is found microcontroller will send 255 to pc, and if not found then it will send 00 to pc. The complete system can be intergrated together and it can be used as digital pen and can be used for printing application.

D. Color Markers

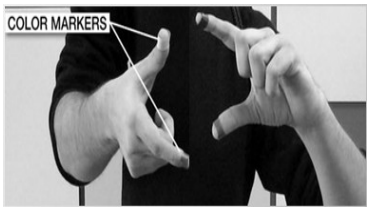


Fig. 2. Color Markers

It is at the tip of the fingers & marked the user's fingers with yellow, red, blue, and green color tape helps the webcam recognize gestures. The arrangements and movements of color makers are interpreted into gestures that act as interaction instructions for the projected application interfaces.

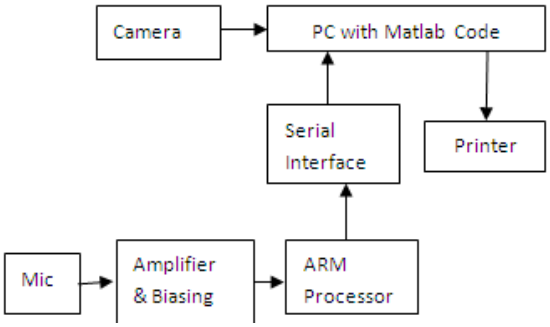


Fig. 3. Block Diagram of Digital pen for handwritten digit & character for interactive printing

III. System Implementation

A. Gesture Recognition using Phase Correlation Algorithm

In this project topic we use the Gesture recognition using Phase Correlation algorithm. Gesture recognition is a topic of computer science and language technology. The goal of Gesture recognition is to interpreting human gestures via mathematical algorithms. Gestures can originate from anybody motion. But this recognition commonly originates from the face or hand. This system uses emotion recognition from the hand gesture recognition. Cameras have been made number of approaches. Gestures can exist in isolation or involve external objects. With respect to objects, we have a large range of gestures that are almost unique, consisting of pointing at objects, changing the shape of object, activate the objects. Gesture recognition is used to understand human body language and also used for human-computer interface, thus building a richer bridge between machines and humans than primitive text user interfaces or even GUIs (graphical user interfaces. Gesture recognition enables humans to interface with the computer (HCI) and interact naturally without any mechanical devices.

Gestures can be used to communicate. These can further be categorized according to their functions. Gesture recognition is used to collect the information about position, motion, pose. Following steps are used for Hand & finger tracking:

Pixel level segmentation

Regions of pixels corresponding to the hand are extracted by color segmentation or background subtraction. Then the detected regions are analyzed to determine the position and orientation of the hand. The color of human skin varies greatly between individuals and under changing illumination. Advanced segmentation algorithms, that can handle this, have been proposed [43][5], however these are computationally demanding and still sensitive to quickly changing or mixed lighting conditions. In addition color segmentation can be confused by objects in the background with a color similar to skin color. Background subtractions only work on a known or at least a static background, and consequently are not usable for mobile or wearable use. Alternatives are to use markers on the fingers [39] or use infrared lighting to enhance the skin objects in the image.

Motion segmentation

Moving objects in the video stream can be detected by calculation of inter frame differences and optical flow. In a system capable of tracking moving objects on a moving background with a hand held camera is presented. However, such a system cannot detect a stationary hand or determine which of several moving objects the hand is.

Contour detection

Much information can be obtained by just extracting the contours of objects in the image. The contour represent the shape of the hand and is therefore not directly dependent on skin color and lighting conditions. Extracting contours by edge detection will result in a large number of edges both from the tracked hand and from the background. Therefore some form of intelligent post processing is needed to make a reliable system.

Correlation:

A hand or fingertip can be sought in a frame by comparing areas of the frame with a template image of the hand or fingertip [4] [25]. To determine where the target is, the template must be translated over some region of interest and correlated with the neighborhood of every pixel. The pixel resulting in the highest correlation is selected as the position of the object. This problem can be addressed by continuously updating the template [4], with the risk of ending up tracking something other than the hand.

Tracking

On top of most of the low level processing methods a tracking layer is needed to identify hands and follow these from frame to frame. Depending on the nature of the low level feature extraction, this can be done by directly tracking one prominent feature or by inferring the motion and position of the hand from the entire feature set.

Flow chart for this system is as follows:

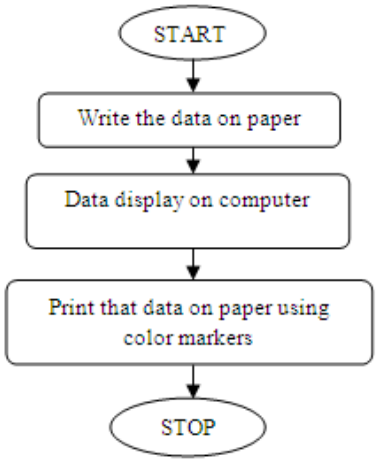
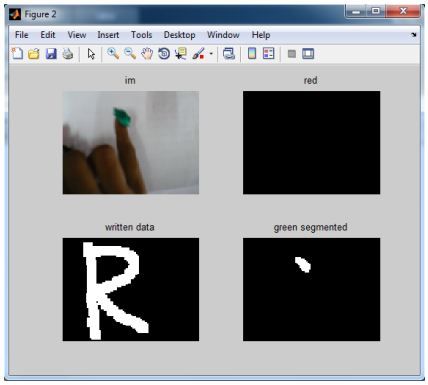


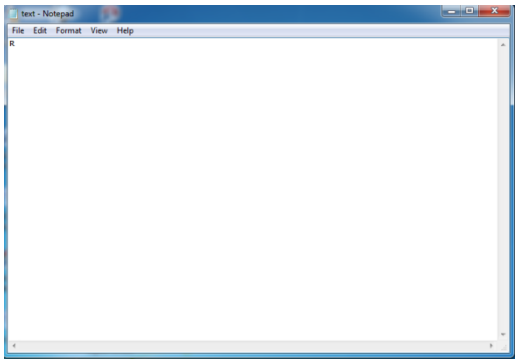
Fig. 4. Flow Chart of Digital pen for handwritten digit & character for interactive printing

IV. Result

Character that user written is displayed on MATLAB & when green color sense by camera then writing is stopped.



The written character is displayed in Notepad.



V. Conclusion

The key recognizes the objects & displays the information automatically and letting you access it in any way you want, in the simplest way possible. Clearly, it is having the potential of becoming the ultimate "transparent" user interface to accessing information around us about everything. If they can get rid of the colored finger caps and it goes beyond the phase of initial development, that is. But as it is now, it may change the way we interact with the real world and truly give everyone complete awareness of the environment around us. This system captures the image or information & displays it on the computer.

VI. Future Scope

- To incorporate projector and camera inside mobile computing device.
- This technology used in various interests like education systems, gaming etc.
- Whenever we place pendant- style wearable device on table, it should allow us to use the table as multi touch user interface.
- To have 3D gesture tracking.
- Additional future improvements would increase the number of applications of hand gesture & digital pen over other systems.
- By using the digital pen with handwritten digit & character for virtual printing system used in industry for conference over other device is become more secure.
- In future this system is useful in various fields & this system also reduces the hardware.

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