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A GESTURE BASED DIGITAL ART WITH COLOUR COHERENCE VECTOR ALGORITHM

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Abstract - Digital art can be purely computer generated or taken from the other sources. Gesture recognition is a technology which is used to identify human gestures with the help of mathematical algorithms. Gesture recognition recognizes the hand, tracks the hand movement and also provides the information about hand position orientation and flux of the fingers. The colour markers are placed at the tip of the user fingers. This helps the web cam to identify the movement of hand, colour of the band and the gesture recognition. The drawing application allows the user to draw on any surface by tracking the fingertip movement. According to the movement of the finger tip, some drawing will be displayed on the screen with the help of Raspberry Pi. Raspberry Pi provides a convenient and unobtrusive means to run digital art. The pictures that are drawn by the user can be stored and replaced on any other surface. The user can also shuffle through various pictures and drawing by using the fingertip movements.

***Key Words*: Gesture Recognition, Wearable Color Marker or tape, Colour Coherence Vector Algorithm, Motion detection, Raspberry pi3.**

1. INTRODUCTION

An **Embedded System** is a combination of computer hardware and software and perhaps additional mechanical or other parts, designed to perform a dedicated function. Every embedded system consists of custom-built, hardware built around a central processing unit. This hardware also contains memory chips onto which the software is loaded. The software residing on the memory chip is also called the 'firmware'. Embedded system can control many devices. Digital art is an artistic work or practice that uses digital technology as an essential part of the creative or presentation process. More generally the term digital artist is used to describe an artist who makes use of digital technologies in the production of art. The techniques of digital art are used extensively by the mainstream media in advertisements, and by film-makers to produce visual effects. A webcam is a video camera that feeds or streams its image in real time to or through a computer to computer network. Colour Coherence Vector algorithm is used at camera to compare colours. The recognized gestures are transferred to the Raspberry Pi. Raspbian is the operating system of the Raspberry Pi. The gesture will display on the LCD screen with the help of python. The development of computer technology, HCI techniques have become mandatory components in our daily life. HCI technologies are able to translate human intention into corresponding commands. HCI device or technique can be understood and operated by user easily. Thus, it will become one of the major considerations when selecting such a device. Technologies are being developed which are able to express user motions such as handwriting, gestures, and human body language.

1.1 Existing system

In an existing system consists of digital pen, microcontroller and display unit. A digital pen is built with inertial sensor. It is similar to a regular ink pen. That writes on regular paper. A computer invention that transmits writing into digital pen. Except it has optimal reader that records motion, images and coordinates. The recorded data is then transmitted to a computer via a wireless transmitter. The pen matrix digital pen is a impressive piece of hardware. Slightly larger than a ballpoint pen. It contains an integrated digital camera, Bluetooth receiver, micro imaging processor, inertial memory and long life battery. Microcontroller is the heart of the system. The microcontroller have fix amount of on-chip ROM, RAM, I/O ports. It is highly addressable.

1.2 Problems in existing system

- Some board is required for writing purposes.
- Gesture code should compared with stored standard patterns.

2. Proposed system

Gesture Recognition is used to identify human gestures with the help of mathematical algorithms. In this system we use colour coherence vector algorithm for gesture recognition. By using this algorithm we subtract the background of the image to get accurate art by erosion and dilation process. In this process erosion means deletion and dilation means enhance. Gesture recognition recognizes the hand, tracks the hand movements and also provides information about hand position orientation and flux of the fingers. The color markers are placed at the tip of the user fingers. This helps the webcam to identify the movement of hand and the gesture recognition. The drawing application allows the user you to draw on any surface by tracking the fingertip movements of the user's index finger. The user can also shuffle through various pictures and drawing by using the hand gesture movements.

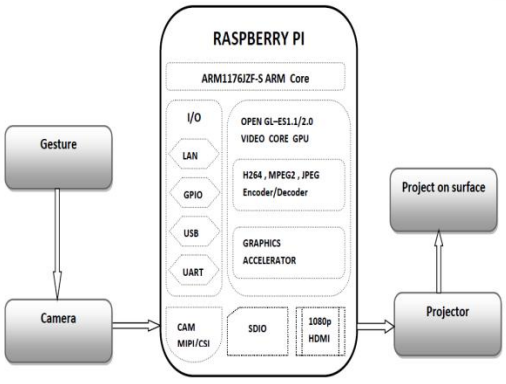

Fig-1: Architecture diagram

2.1.1 METHODOLOGY

Colour Coherence Vector Algorithm

- Consider two images I and I0, together with their CCV's G_I and G_{I0}.
- The number of coherent pixels in color bucket j be αj (for I) and αj 0 (for I0). Similarly, let the number of incoherent pixels be βj and βj0. So,

G_I = h(α1; β1) ; : : : ; (αn; βn)i and
G_{I0} = h(α1 0 ; β1 0) ; : : : ; (αn0 ; βn0)I

Color histograms will compute the difference between I and I0 as,

$$\Delta H = nXj = 1(\alpha j + \beta j) - (\alpha j\ 0 + \beta j\ 0) \quad \rightarrow (1)$$

Our method for comparing is based on the quantity

$$\Delta G = nX\ j = 1(\alpha j - \alpha j\ 0) + (\beta j - \beta j\ 0) \quad \rightarrow (2)$$

From equations 1 and 2, it follows that CCV's create a finer distinction than color histograms. A given color bucket j can contain the same number of pixels in I as in I0,

$$\text{i. e.} \quad Aj + \beta j = \alpha j\ 0 + \beta j\ 0;$$

but these pixels may be entirely coherent in I and entirely incoherent in I0. In this case βj=αj0=0, and while ΔH = 0, ΔG will be large.

In general, $\Delta \leq \Delta G$. this is true even if we use squared differences instead of absolute differences in the definitions of ΔH and ΔG. This is because both

$$d(x) = (j)^2 \text{ and } d(y) = (x)^2 \text{ are metrics,}$$

so they satisfy the triangle inequality

$$d(x + y) \leq d(x) + d(y) \quad \rightarrow (3)$$

If we rearrange the terms in equation 1 we get,

$$\Delta H = nXj = 1(\alpha j - \alpha j\ 0\ ) + (\beta j - \beta j\ 0\ )$$

Applying the triangle inequality we have

$$\Delta H \leq n\mathbf{X}j = 1(\alpha j - \alpha j\ 0\ ) + (\beta j - \beta j\ 0\ ) = \Delta G$$

Here X, means Summation (∑).

2.1.2 MODULES

2.1.2.1 Gesture Recognition

Gesture recognition is a technology with the goal of interpreting human gestures via mathematical algorithm. Gestures can originate from the face or hand. Gestures are a major form of human communication. A primary goal of gesture recognition is to create a system

which can identify specific human gestures and use them to convey information. Gesture recognition enables humans to interface with the computer (Human Computer Recognition) and interact naturally without any mechanical device. It is possible to point a finger at the computer screen so that the cursor will move accordingly by using the concept of gesture recognition.

2.1.2.2 Motion Detection

Motion Detection sensor are inbuilt in the camera. Motion Detection is a process of detecting a change in the position of an object (colour tape) relative to its surroundings or a change in the surroundings relative to an object. Motion Detection can be achieved by either mechanical or electronic methods. In this system, basically concern on the use motion detection application using camera for security purpose. In the camera selection the user first of all initialize the camera then specify the frame size. The saved image stored as frame.

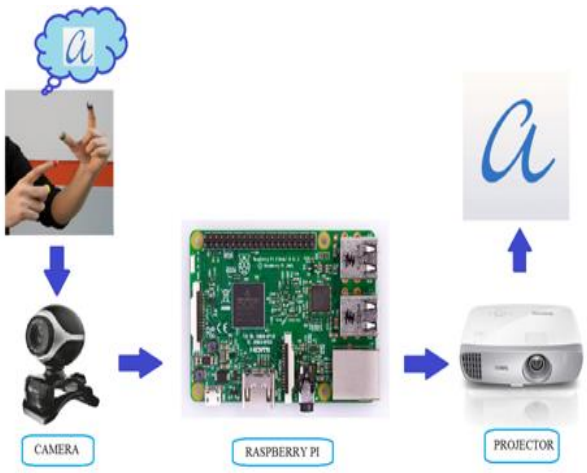

Fig. Gesture based Digital Art

2.1.2.3 Image Transfer

A image captured by the camera will transfer to the Raspberry Pi. Images may consist of two types one is two dimensional (2D) such as or screen display another is three dimensional(3D) such as statue or hologram. They may be captured by some optical devices such as cameras, mirrors, lenses, microscopes etc., and also captured by natural objects and phenomenon, such as human eye or water. Images may have several types volatile image, mental image, still image and film still.

2.1.2.4 LCD Display

A liquid crystal display (LCD) is flat-panel display or other electronic visual display that uses the light - modulating properties. The recognized image will be displayed on the screen via HDMI cable (interface) from Raspberry Pi. LCDs are available to display arbitrary images or fixed images. LCD have several range of applications including computer monitors, televisions, instrument panels, etc., Small LCD screens are common in digital cameras, watches, calculators and mobile phones, smart phones etc.,

3.1 SOFTWARE AND HARDWARE

Hardware:

- Raspberry pi
- Camera
- Monitor
- SD card

Software:

- Raspbian Jessie OS
- Open CV
- Python language

3.2 OUTCOMES

The expected outcome of the project is:

- User can quickly sketch what the brain has already seen.
- User can draw on any surface by tracking the fingertip movements.
- It is portable and time consumption.

CONCLUSION

By using this application person can easily interact with computer anywhere, and they can also use this application for virtual classroom and drawing applications with the help of Raspberry pi and web camera. We can use this application for virtual reality, sign language, signature authentication without use of remote controls.

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