Industrial Engineering Journal
ISSN: 0970-2555
Volume : 53, Issue 8, August : 2024

Interactive Paint Application Using Edge-Based Hand Gesture Recognition

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Abstract— In software industry there are many painting software's are available which have their own pros and cons but they have common interference which is traditional pointing devices such as keyboards and mouse. Here we introduce a paint box which eliminates the hardware interface and controlled by hand gesture movements. User do not require any external hardware pointing device to draw. Instead of that we use fingertips are used for drawing purposes with associated actions. Disadvantages of traditional pointing devise are overcome by touchscreen technology. Next evolutionary technology will be gesture technology which aims to provide more accurate output with less cost and saves user time by eliminating hardware interfaces. By using gesture communication with system, we have unlimited ways to pass different messages to system. Using OpenCV library helps to capture the hand tracking and with associate actions to draw on paint screen.

Keywords*— *Hand Gesture, Pointing devices, Hardware Interface, OpenCV, tracking;

I. INTRODUCTION

Most of the people are familiar with various painting software. In the digital social media where photos or images got much importance, the need of a user friendly painting software is essential. The traditional painting software require a hardware pointing devices or a touch sensitive screen for interaction. In most cases we need a hardware medium for interacting with the software system. Use of hand gestures directly as input to system to draw a different functions or shapes such as line drawing, thick line, and thin line based on the gestures movements. It will be more user friendly if the computer system can be controlled using hand gestures.

This project propose direct computer and human interaction system in which movements of user's hand is directly involved in creating and manipulation of art (painting). Here we prefer the standard image processing library Open CV. The reason is by comparing various aspects of our proposed system, Open CV is more flexible than that of Matlab. In our system we have included interactive art for improving the educational experience. The related gesture interactive mechanism include Interactive art system for multiple users based on tracking hand The proposed HCI system captures video of people's hand movements using a high resolution camera and then converted into necessary drawing.

II. LITERATURE REVIEW

Hand Gesture Real Time Paint Tool Box: Machine Learning Approach [1], they discussed about gesture based paint tool box which has 6 gestures to draw line, draw circle. This paper states various approaches through which a paint tool box accuracy can be achieved. To achieve more accuracy than any other approach they have used machine learning approach. According to the survey Machine learning approach gives 96% accurate result.

Gloved and Free Hand Tracking based Hand Gesture Recognition [2], they discussed about continuous hand gesture recognition. It reports the robust and efficient hand tracking as well as segmentation algorithm where a new method, based on wearing glove on hand is utilized. We have focused on another tracking algorithm, which is detects your palm part of the hand i.e. free hand tracking.

Low cost approach for Real Time Sign Language Recognition [3], in this paper gives clear understanding regarding communication between people who are not able to talk with another human being. So to improve their communication among themselves and other human beings sign language will be more efficient way. Using obtained result user can study them and practice the signs.

Human Computer Interaction Using Face and Gesture Recognition [4], they discussed and present a face and gesture recognition based human-computer interaction (HCI) system using a single video camera. Different from the conventional communication methods between users and machines, they combine head pose and hand gesture to control the equipment. They can identify the position of the eyes and mouth, and use the facial center to estimate the pose of the head.

Hand Gesture Recognition for Indian Sign Language [5], they discussed about hand gesture recognition system to recognize the alphabets of Indian Sign Language. Cam shift method and Hue, Saturation, Intensity (HSV) color model are used for hand tracking and segmentation. For gesture recognition, Genetic Algorithm is used. We propose the easy-to-use and inexpensive approach to recognize single handed as well as double handed gestures accurately.

Real Time Sign Language Recognition using consumer depth camera [6], they discussed about recognition of different hand gestures for 24 alphabetic letters. For classification purpose they have used multi-layered random forest (MLRF). This reduces training time and memory consumption which reduces forest automatically in very short time a home computers. Used MLRF technique is potentially high accurate and takes very short time for training and memory.

Vision Based Hand Gesture Recognition [7], they discussed about glove based hand recognition through a wearable glove called as cumbersome glove-like device which has sensors used to sense the movements of hands and fingers. Collected data through sensors is then send to the computer. This approach has high accuracy and fast reaction speed but data gloves which are used are very expensive. It costs around $12,500 which is as much as high configured supercomputer. Through this technology 85% accuracy can be achieved.

The Vision-Based Hand Gesture Recognition Using Blob Analysis [8], this paper discussed about Human Computer Interaction and hand gesture classification captured through contact-based and vision-based devices. For classifying the gestures they have used Blob Analysis method. For contact based devices user require to wear external hardware while vision based devices not require any external hardware support. They also studied problem regarding skin color recognition process depending on illumination adjustment.

Real Time Hand Gesture Recognition for Human Computer Interaction [9], in this paper they mentioned about different pointing devices which will successfully replace existing devices such as hardware interfaces. Using OpenCV it becomes easy to track the hands gesture and easily loads camera permissions. Hand and palm can be easily configure using OpenCV library. OpenCV library is available over cross platform. They proposed a system for desktop application which is implemented by using OpenCV library in C++. In this system Depth Segmentation and Hand Color Model used for detecting hands. After they have configured palm and hand as separate detection technique according to the gestures will be varied.

Hand Gesture Recognition Using Different Algorithms Based on Artificial Neural Network [10], this paper discussed about edge detection and skin detection algorithm with their differences. According to discussion edge detection algorithm working is capture the video converted into image frames which helps for grayscale transformation which helps to plot histogram which helps for edge detection of hand. Fill image implement that drawing shape with boundary of that shape. For capturing the edges and borders of the diagram vectorization is used.

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III. EXISTING SYSTEM

There are various paint software's available depend on requirement they have their usage and limit but all should be use with traditional hardware interface. The system is developed in Python. Python provides libraries which ease the development and execution of system in efficient manner.

IV. PROPOSED SYSTEM

This project propose easy way for computer human interaction system in which movements of user's hand is directly involved in creating and manipulation of art (painting). Here we prefer the standard image processing library Open CV. The reason is by comparing various aspects of our proposed system, Open CV is more flexible than that of Matlab. In our system we have included interactive art for improving the educational experience. The related gesture interactive mechanism include Interactive art system for multiple users based on tracking hand. The proposed HCI system captures video of people's hand movements using a normal resolution camera and then converted into necessary drawing.

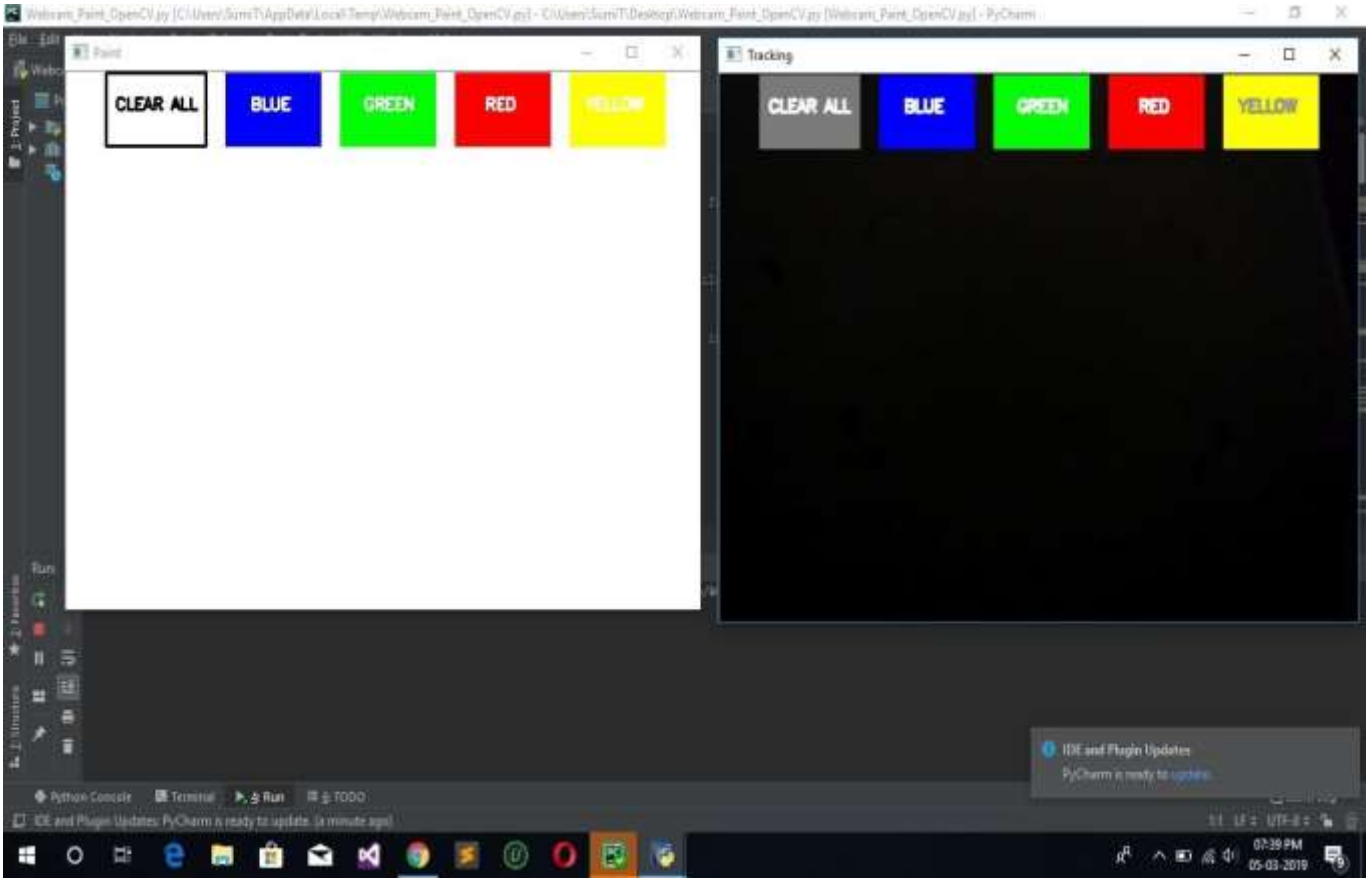

Fig. 1 Paint Box and Camera Module

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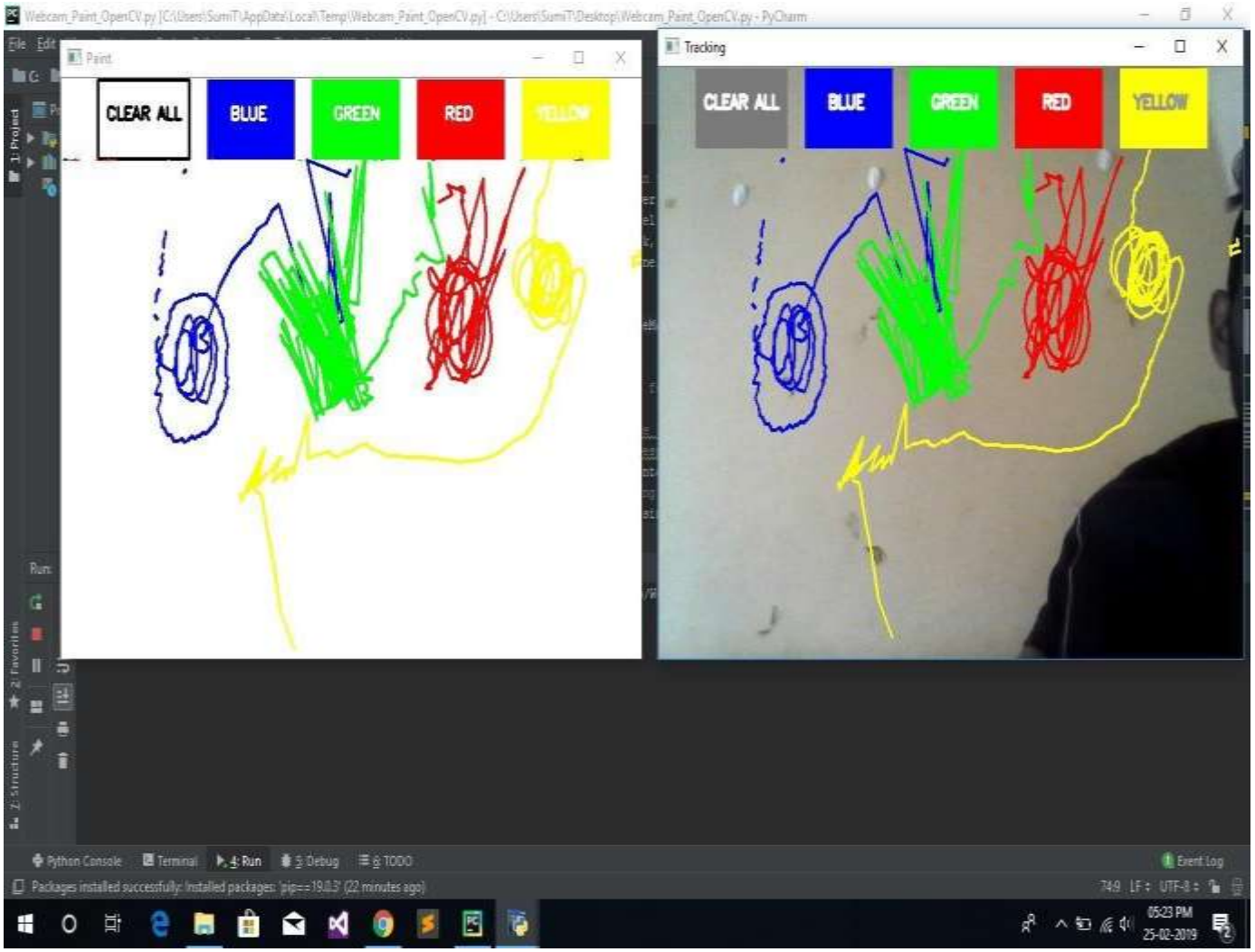

Fig. 2 drawing using Hands

V. System Architecture

A. *Description*

The system consist of 3 modules mainly camera, screen and user. User module consist of gestures which performed by user then camera module captures that gesture and with help of defined actions. Actions are reflected on screen in the form of drawn line with color selection or other form. Captured gesture are pre-processed by comparing with database. After that, color pixel finding and tracking of hand to achieve result which then plotted on screen. Distance maintain is 20 cm to 50 cm for accurate result and shape will be drawn on the screen. In pre-processing gesture is compared with database and then match with color pixel finding, it will be drawn on screen according to obtained tracking output.

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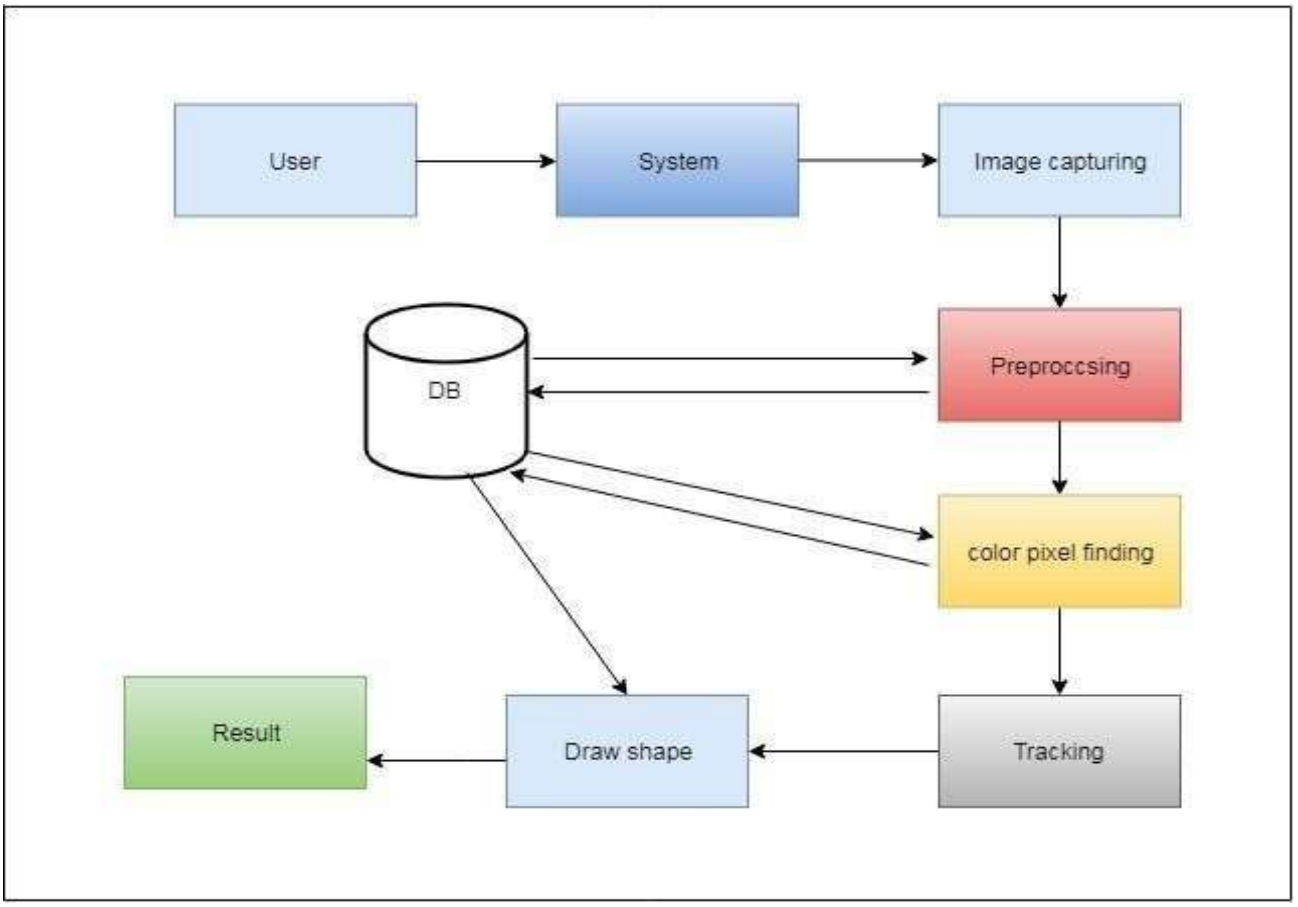

Fig. 3 System Architecture

VI. METHODOLOGY

A. *Edge Detection*

Edge Detection algorithm used for detection of hands which can be captured by webcam or other camera module. Edge detection algorithm have three types: Horizontal, Vertical, and Diagonal. Captured image will be sharpen to produce better result. Its accuracy is better with python language which can be improved by sharpening method of edge detect. Detected hand image is two dimensional which then plotted on three dimensional graph. If independent viewpoint is captured and plotted easily then it will reflects three dimensional objects, which may be a surface shape or markings. Independent viewpoint can be easily plotted but if viewpoint is dependent edge then it reflects geometric scenes. Edge detection of hand is based on threshold value which decides edges with ten detection points.

B. *Haar-Like Classifier*

Haar-like classifier is used for classifying various body parts such as eyes, hands, face etc. After that, it will be easy for any algorithm to detect desired body part. Haar-like features used in object recognition. If the captured image matches with haar like classifier's image which has similarities it will forward the pre-processing. Haar-like classifier is designed for detection of hands, eyes, fingers, face. It is specially design for body organs and their tracking movements. This classifier can be easily integrate with machine learning approach. Haar-like classifier is the most popular classifier and mostly used offices where access cards, fingerprints used for check in and check out.

VII. ADVANTAGES

Our proposed system replaces the traditional pointing devices and has the following benefits.

Infinite ways to communicate with the system-The user will be capable of explore the system in infinite ways.

No additional workspace is needed - The proposed system use only camera for interacting with the system.

Easy to use – Users can vary the direction and tempo of hand movements, making it easy and intuitive to create and interact with system.

Simple installation – User doesn't require any external hardware or software requirements for executing our system.

VIII. CONCLUSION & FUTURE WORK

The proposed system helps the user to perform hand gesturing in an efficient and cost effective manner. After system is setup, the User interaction can be increased drastically, which makes it even easier for a user because they can interact easy and effectively with the system, rather than usage of tradition software products.

Our approach has better performance than those proposed in the previous applications. With small modification to the proposed system it can be used in many other fields. In other words it can replace every existing user interacting devices.

IX. REFERENCES

[1] Vandit Gajjar, Viraj Mavani, Ayesha Gurnani "Hand Gesture Real Time Paint Tool – Box: Machine Learning Approach" In IEEE International Conference on Power, Control, Signals and Instrumentation Engineering.

[2] Dharani Mazumdar, Anjan Kumar Talukdar, Kandarpa Kumar Sarma "Gloved and Free Hand Tracking based Hand Gesture Recognition" Dept. of Electronics & Communication Engineering In ICETACS 2013.

[3] Matheesha Fernando, Janaka Wijayanayaka "Low cost approach for Real Time Sign Language Recognition" In 2013 IEEE 8th International Conference on Industrial and Information Systems, ICIIS 2013, Aug. 18-20, 2013, Sri Lanka.

[4] Yo-Jen Tu, Chung-Chieh Kao, Huei-Yung Lin "Human Computer Interaction Using Face and Gesture Recognition" In Department of Electrical Engineering, National Chung Cheng University, Chia-Yi 621, Taiwan, R.O.C.

[5] Archana S. Ghotkar, Rucha Khatal, Sanjana Khupase, Surbhi Asati, Mithila Hadap "Hand Gesture Recognition for Indian Sign Language" 2012 International Conference on Computer Communication and Informatics (ICCCI -2012), Jan. 10 – 12, 2012, Coimbatore, INDIA.

[6] Alina Kuznetsova, Laura Leal-Taix´e, Bodo Rosenhahn "Real Time Sign Language Recognition using consumer depth camera" In 2013 IEEE International Conference on Computer Vision Workshops.

[7] Yanmin Zhu, Zhibo Yang, Bo Yuan "Vision Based Hand Gesture Recognition" In 2013 International Conference on Service Science.

[8] Thittaporn Ganokratanaa, Suree Pumrin "The Vision-Based Hand Gesture Recognition Using Blob Analysis" Department of Electrical Engineering, Chulalongkorn University, Bangkok, Thailand In 2017 IEEE International Conference Science and Technology.

[9] Rishabh Agrawal, Nikita Gupta "Real Time Hand Gesture Recognition for Human Computer Interaction" In 2016 IEEE 6th International Conference on Advanced Computing.

[10] Shweta. K. Yewale, Pankaj K. Bharne "Hand Gesture Recognition Using Different Algorithms Based on Artificial Neural Network" Prof. Ram Meghe Institute of Technology & Research, Badnera, India