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Hand Gesture Technology Using Image Processing

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ABSTRACT: The project consists of a system used for human-computer interaction (HCI) using simple hand gestures. The system has 3 phases: hand gesture detection, gesture recognition, and command execution. The system allows for better and simplified HCI than thatcompared to a traditional mouse and keyboard control. The algorithms used are for higher accuracy and faster gesture recognition. This project provides a cost effective and simple interaction than the current 3D based technologies. The gestures can be extended for other purposes which can be further programmed in the computer. During the HCI stage, we develop a simple strategy to avoid the false recognition caused by noises - mostly transient, falsegestures, and thus to improve the reliability of interaction. The developed system is highly extendable and can be used in humanroboticor other human-machine interaction scenarios with more complex command formats rather than just mouse and keyboard events.

KEYWORDS: Gesture recognition, human-computer interaction, mouse keyboard control.

I.INTRODUCTION

In this modern era computers are being used by a large number of people and its demand is stillgrowing. In accordance with the Moore's Law, it is being expected that the technology will advance at a very high rate and computers will be in reach of common people. With the advancement in ubiquitous computing the emphasis on use of natural user interface is required. Today mouse,
keyboards and pens are not enough for interaction with machines. Gestures are being used in HCI since many years. Earlier, hardware based gesture recognition was more prevalent. User had to wear gloves, helmet and other heavy apparatus. Sensor, actuator and accelerometer were used for gesture recognition. But the whole process was difficult in real time environment.

Recent trend is to use Computer Vision techniques for gesture recognition. Principal component analysis is being used for hand gesture recognition. However, this made the whole system slower and required more memory. For head gesture recognition, Hidden Markov model is being used. But this requires training of head gestures. Many multimodal HCI based system are also being developed, most of them uses a combination of hand and facial expression or hand and speech recognition or facial expression and speech recognition. Very little work in the area of multimodal HCI using hand and head is being done.

The objective of our work is to develop a vision-based multimodal human computer interaction method where hand and head can be simultaneously used to control any computer application. Shape recognition algorithm is being used for hand gesture recognition. Hand contour is being made and the number of defects, orientation and direction of movement of hand is being observed. For head gesture recognition optical flow is being used to observe the direction of movement of head. Thereafter, finite state automata are being used for head gesture recognition.

II.LITERATURE REVIEW

Title: Review on Image Segmentation Based on Colour Space and Its Hybrid [2016]
Author:Maheswari . S

- They proposed an efficient method for capturing images using RGB-HSV hybrid combination rather than RGB or HSV, which provides better information even in poor background with improved color preservation.The RGB colour space is not trust worthy or accurate for computer vision applications. It is hence not suitable for an application like human hand tracking and gesturing.

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Title:Hand Gesture Recognition Based on Hog Feature Extraction and K-NN Classification [2017]
Author: Tejashree P. Salunke
- The author proposes a static hand gesture recognition in real-time that facilitates effective and effortless human-computer interaction.This system does not makes use of traditional methods for hand gesture recognition such as by using hand-gloves, markers, rings, pens or any other devices.
The image captured from the input data is then processed and then histogram of oriented gradients features is extracted from it. The processed image is then compared with the database of gesture images.

III.PROBLEM STATEMENT

The main problem in the existing system is that user need to be in front of the laptop to use it. If they are busy with some other work and need to any application in the laptop, they need to go in front of the laptop and perform the operation. This causes reduction in user control especially in a productivity and fast environment. There is a need for faster input to a computer and which can be performed from a distance or even remotely. Also there is a need to check if the operation specified by the user is executed and the user can visually verify the output.

IV.EXISTING SYSTEM

The various HCI Interfaces that are being used since earlier times having some demerits. They block the improvement of computer dependent devices or systems. It is now a general tendency to lessen human efforts and overcome the usual, traditionally being used computer dependent devices. There are various technologies which uses different sensors and hardware to control computers. Instrumented data glove approach involves the use of sensor devices to recognize the hand gestures Sixth Sense Technology is a wearable gestural interface. Coloured Markers approaches are gloves that are worn by the human hand.

V.PROPOSED SYSTEM

The proposed system is used to control the mouse cursor and implement its function using a real-time camera. We implemented mouse movement, selection of the icons and its functions like right, left, double click and scrolling. This system is based on image comparison and motion detection technology to do mouse pointer movements and selection of icon. The proposed system is a real time video processing that is based on a real time application system.
This can replace one of the traditionally used input device i.e. mouse so that simply by using the hand gestures the user will be able to interact naturally with their computer. The goal is two-fold. First, gesture recognition can complement other forms of human computer interaction (keyboard and mouse), but provides such control at a distance without touch. Second, it can be used as a convenient computer interface to the millions of people who are unable to adequately use typical computer interaction techniques. The system uses a standard windows PC and an inexpensive commercially available USB camera. This arrangement does not require any connection to the user.

A.SYSTEM ARCHITECTURE

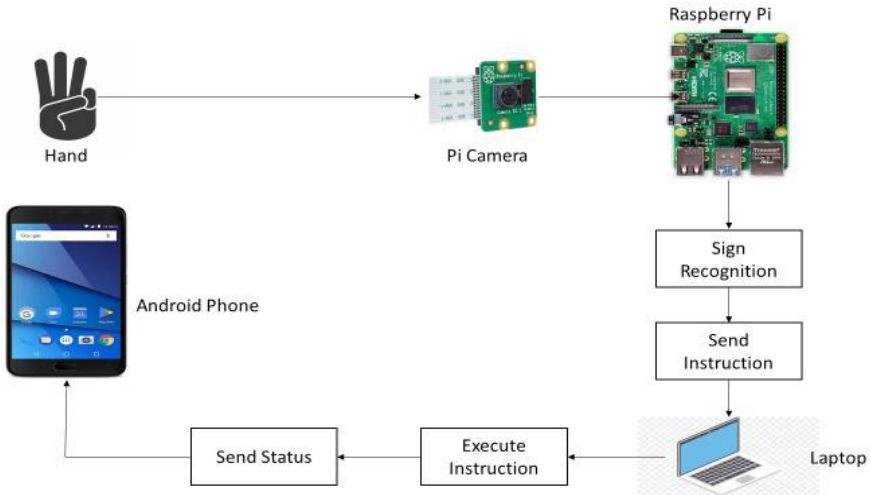

Fig1: System Architecture

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The system consists of 5 parts. The hand is used for input to the system in the form of gesture commands. The pi camera is connected to the Rasberry Pi which collects the input and relays it to the Rasberry Pi setup. This is placed in a remote location and can be operated wirelessly. The Pi module processes the image in 5 steps: Input image from webcam, preprocessing and segmentation, feature extraction, classification, and Result analysis. It completes and converts the image in the readable format.

The laptop obtains the processed image and compares it with its trained and tested data samples. On match of the image it executes the operation related to the image and shows the output on the screen. The user if present in a remote location and wish to operate the system can view the output using an android app for verification. After execution of the command the live screenshot is forwarded to the laptop.

*B.**WORKING***

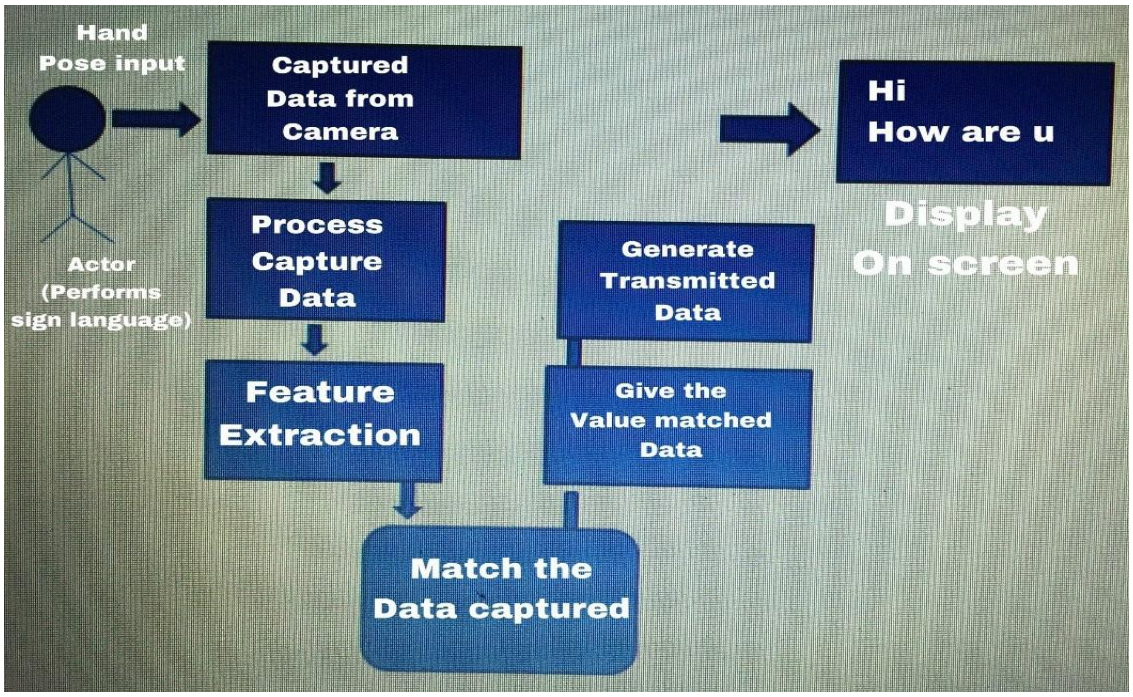

Fig2 : Steps Needed to Process the Gesture Input of the User

The following shows the step by step implementation of the system. These are based on the images shown in the above figure.

The steps start from capturing data from camera, processing data, feature extraction, match captured data, give values of matched data, generate transmitted data and show the output. This is summarized in the following steps:

1) The Pi camera is connected to the Rasberry pi.
2) The Raspberry pi is connected to a power supply, the Rasberry module then executes the Gesture recognition software.
3) The camera setup is positioned and connected to the Apache Tomcat server. The Server-Client Transmit software is run, this creates a connection between the laptop and the Rasberry module so that the module can transmit the final images to the laptop.
4) The laptop is also connected to the Tomcat server. The laptop runs a Client-Server receivesoftware which is used to receive the images from the raspberry pi.
5) This is hence used to establish a gateway where both the Rasberry pi module and the laptop are connected to the same network ensuring that the images only get transmitted to the laptop.
6) The laptop executes the train and test python program. This converts the images into gesture based commands which is already loaded into the laptop.
7) These gestures can be to open the browser, execute a script, play a media file or other server based commands.

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8) The user's hand shows the gestures to the camera, this can be simple commands which is already trained by the system and fed as training data. The hand image is captured and the image is processed.
9) The laptop executes the instruction and shows the requested command output.
10) The user also receives an acknowledgement via the mobile Android app.

There are two options:

- If the user wishes to see the final output screenshot, this is useful when operation is simple.
- If the user wants to see a process running, then by selecting the View Live can see the operation being streamed to the app from the laptop or computer.

VI.HARDWARE REQUIREMENTS

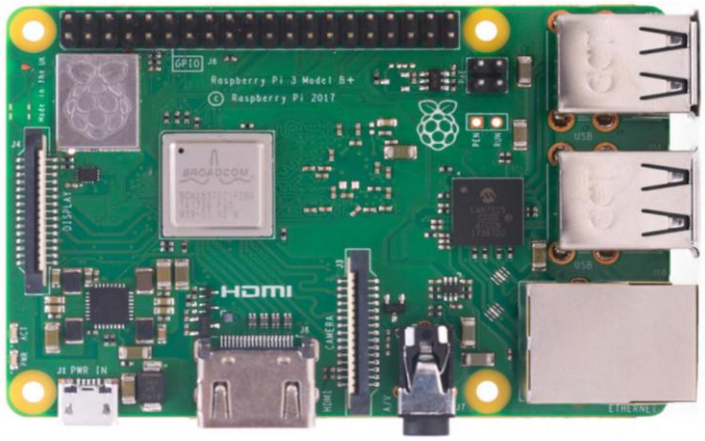

Fig 3 : Raspberry pi

The Raspberry Pi device looks like a motherboard, with the mounted chips and ports exposed, but it has all the components you need to connect input, output, and storage devices and start computing.It is a capable device that enables computing, and used to learn how to program in languages like Scratch and Python.

Here are the various components on the Raspberry Pi board:

- **ARM CPU/GPU** -- This is a Broadcom BCM2835 System on a Chip (SoC) that's made up of an ARM central processing unit (CPU) and a Videocore 4 graphics processing unit (GPU). The CPU handles all the computations that make a computer work (taking input, doing calculations and producing output), and the GPU handles graphics output.
- **GPIO** -- These are exposed general-purpose input/output connection points that will allow the real hardware hobbyists the opportunity to tinker.
- **RCA** -- An RCA jack allows connection of analog TVs and other similar output devices.
- **Audio out** -- This is a standard 3.55-millimeter jack for connection of audio output devices such as headphones or speakers. There is no audio in.
- **LEDs** -- Light-emitting diodes, for all of your indicator light needs.
- **USB** -- This is a common connection port for peripheral devices of all types (including your mouse and keyboard). Model A has one, and Model B has two. You can use a USB hub to expand the number of ports or plug your mouse into your keyboard if it has its own USB port.
- **HDMI** -- This connector allows you to hook up a high-definition television or other compatible device using an HDMI cable.

- **Power** -- This is a 5v Micro USB power connector into which you can plug your compatible power supply.
- **SD cardslot** -- This is a full-sized SD card slot. An SD card with an operating system (OS) installed is required for booting the device. They are available for purchase from the manufacturers, but you can also download an OS and save it to the card yourself if you have a Linux machine and the wherewithal.
- **Ethernet** -- This connector allows for wired network access and is only available on the Model B.

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Fig 4 : Pi Camera

Pi Camera

Pi Camera Module. The Pi camera module is a portable light weightcamera that supports RaspberryPi. It communicates with Pi using the MIPI camera serial interface protocol. It is normally used in image processing, machine learning or in surveillance projects.

1. **ANDROID APP:**

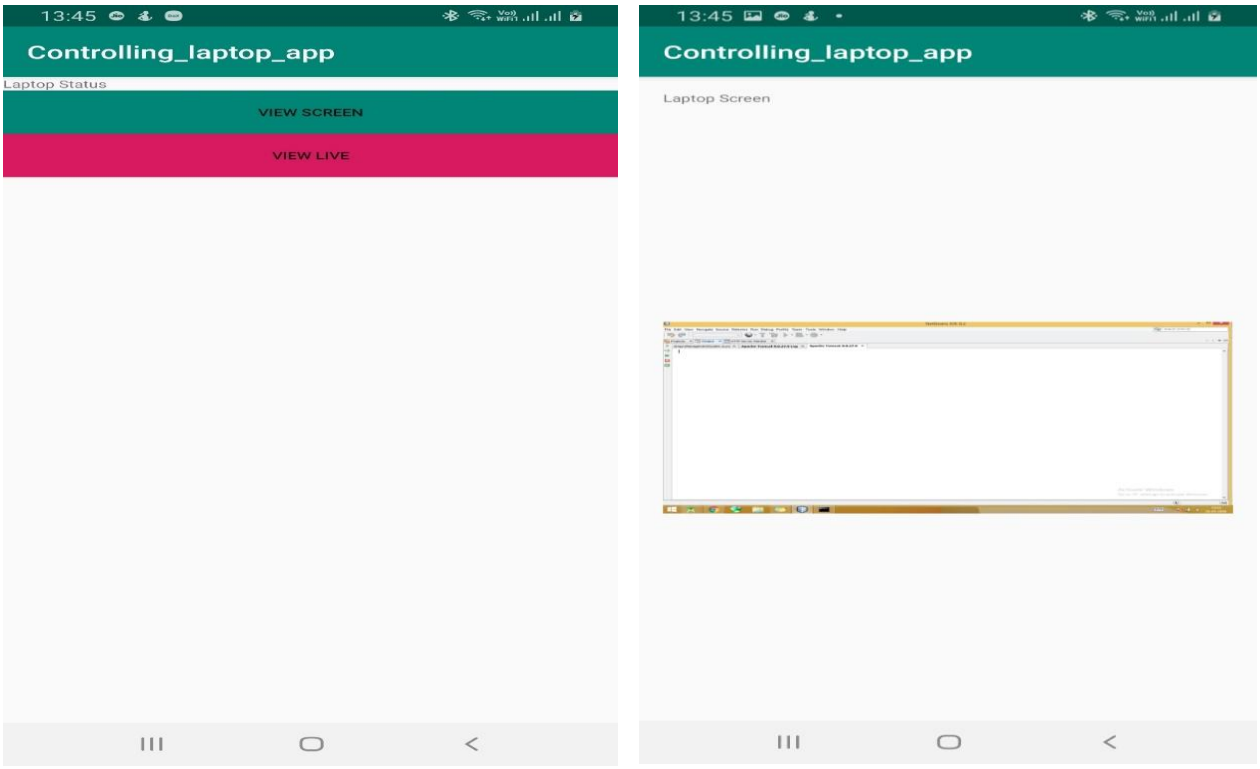

Fig 5 : Android App to display the output acknowledgement

In the figure, the Android App is used to collect the output from the laptop and display it to the user. The first image shows the menu to View the screen and View Live. The second image shows the streaming video of the operation.

VII.RESULT AND IMPLEMENTATION

In this modern world, where technology is at the peak, there are many facilities available for offering input to any applications running on the computer systems, some of the inputs can be offered using physical touch and some of

them without using physical touch (like speech, hand gestures, head gestures etc.). Using hand gestures many users can handle applications from distance without even touching it.

But there are many applications which cannot be controlled using hand gestures as an input. This technique can be very helpful for physically challenged people because they can define the gesture according to their need. The present system which we have implemented although seems to be user friendly as compared to modern device or command based system but it is less robust in detection and recognition as we have seen in the previous step.
We need to improve our system and try to build more robust algorithm for both recognition and detection even inthe cluttered background and a normal lighting condition. We also need to extend the system for some more class of gestures as we have implemented it for only 6 classes. However, we can use this system to control applications like power point presentation, games, media player, windows picture manager etc.

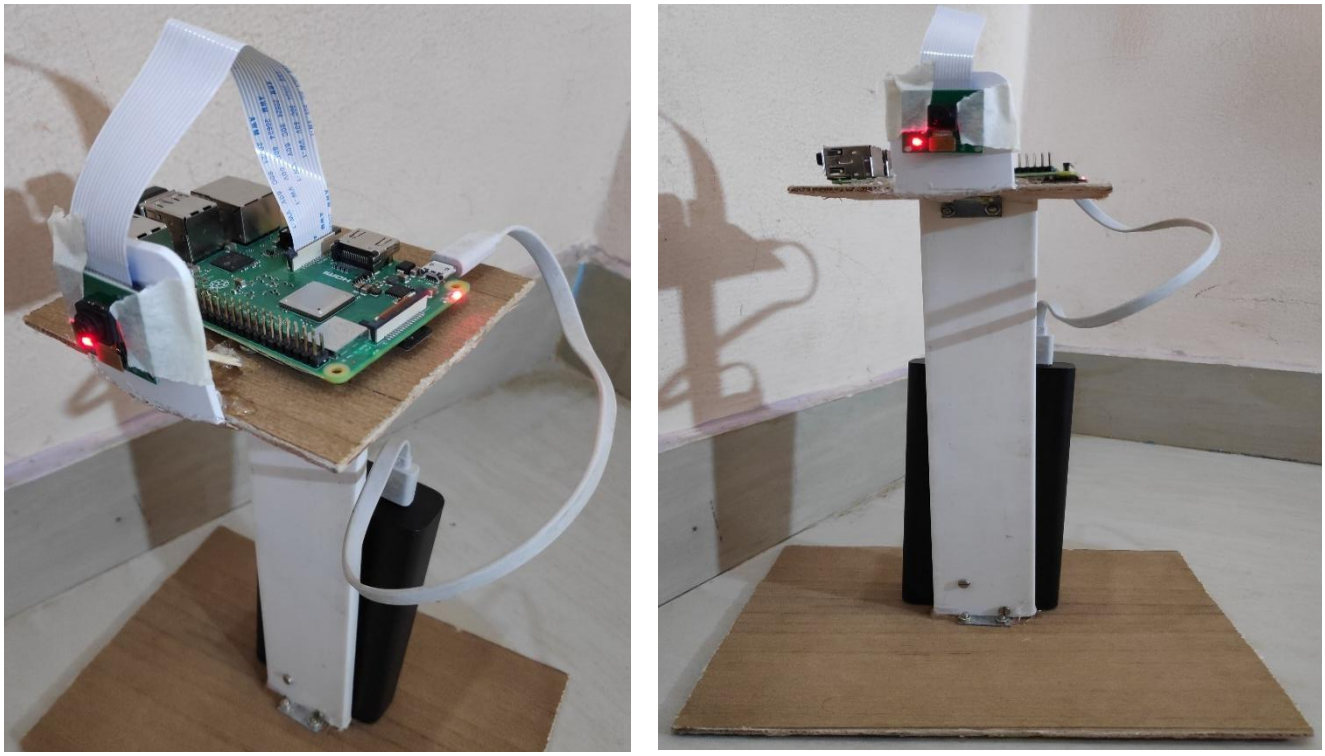

Fig 6 : Shows the setup of the Raspberry image capturing setup

Fig 7 : Shows the accuracy score of training

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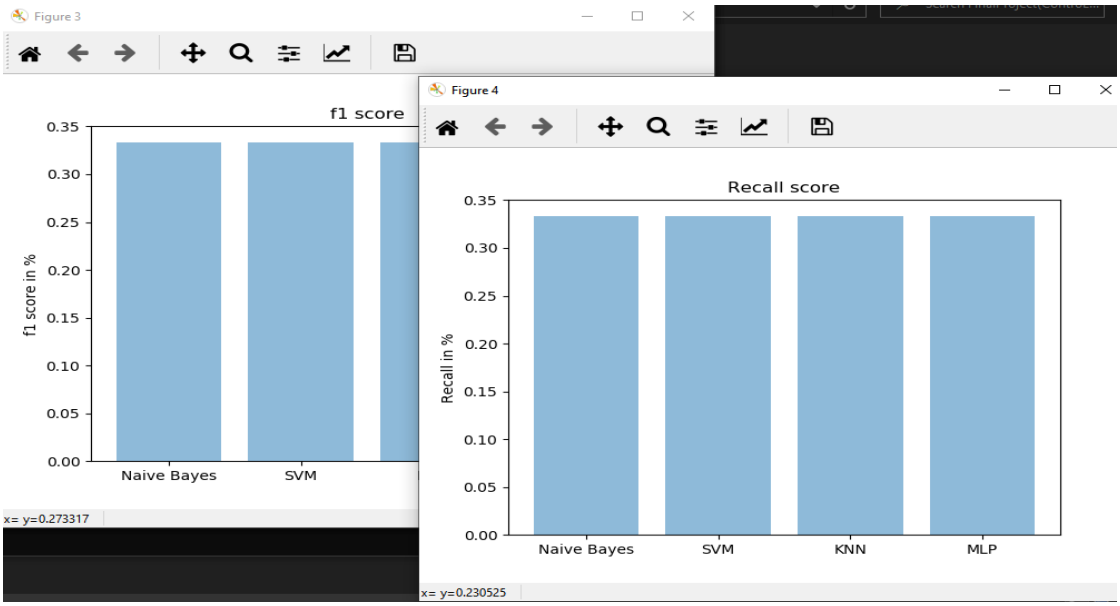

Fig 8 : Shows the score performed by each Algorithm

VIII.CONCLUSION AND FUTURE WORK

We were able to create a hand gesture recognition system that did not utilize any markers, hence making it more user friendly and low cost. In this gesture recognition system, we have aimed to provide gestures, covering almost all aspects of HCI such as system functionalities, launching of applications and opening some popular websites.

In future we would like to improve the accuracyfurther and add more gestures to implement more functions. Finally, we target to extend our domain Hand Gesture Technology Using Image Processing scenarios and apply our tracking mechanism into a variety of hardware including digital TV and mobile devices. We also aim to extend this mechanism to a range of users including disabled users.

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