Image Processing Based Device Control

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Abstract— **The primary goal of Gesture Recognition is to create a system which can recognize specific human gestures and can be used to convey information or for device control. Gesture means an image of part of body. Gesture/posture Recognition is the technology that recognizes the posture of body. It recognizes hand, arms, head or any part of the body. So the goal of Gesture Recognition is to provide interface of human body with computer via mathematical algorithm.**

In this project we propose python based hand gesture identification and control system for the said purpose. Basically, this project is combination of a software and hardware, in which Python is the key language which we are using in software part. This project works with hand gestures through authorised person. Shown gestures are decoded by server using Python script and then, resultant output switches on the respective machine for allotted time period. Here, we are proposing Digital image processing based algorithms using python for control and identification applications. Gesture means an image of part of body. Gesture/posture Recognition is the technology that recognizes the posture of body.

Keywords:hand gesturess, paython script, digital image processing, gesture recognisation.

I. INTRODUCTION

Interaction between human and computer has become an important part in day to day life. It is concerned with the design, evaluation and implementation of interactive computing systems for human use. The most popular devices that are used for communication are keyboard, mice, light pen, trackball, keypads etc. These devices are familiar but not so natural for communication. Due to the development of vision-based interface, now computers are able to see, which makes the human computer interaction rich. This employs a new communication and controlling facility that is more reliable, user-friendly and time saving. Plenty of research work has been done on hand gesture recognition based on different methods and techniques. The main purpose of using gestures is to provide a more natural way of controlling and provides a rich and intuitive form of interaction with the robotic system. This mainly involves Image Processing and Machine Learning for the system or application development.

- "Speech" and "gestures" are the expressions, which are mostly used in communication between human beings. In human communication, the use of speech and gestures is completely coordinated. Therefore we have used 'Gesture' as key thing in our project.
- A number of hardware techniques are used for gathering information about body positioning; typically either image-based (using cameras, moving lights) or device based (using instrumented gloves, position trackers).

II. LITERATURE REVIEW

Image process is taking part in a very important role in automation across all the sectorslike construction, military, medical, manufacturing, etc. Currently days, in big industrythere are machines which are placed long distance and if we wish synchronization then itwill be difficult to manage.Previous work on image processing was Scikit-image is an image processing librarythat implements algorithms and utilities for use in research, education and industry applications.It is released under the liberal Modified BSD open source license, providesa well-documented API in the Python programming language, and is developed by anactive, international team of collaborators.

The most important advantage of the usage of hand gesture based input methodthe user can interact with the application from a distance without using the keyboardor mouse. The application of manipulating objects through hand gestures in virtualenvironment is being proposed and implemented in the present paper provides a suitableefficient and user friendly human computer interface.

Python is a general-purpose interpreted, interactive, object-oriented, and high-levelprogramming language. In our project we are using python for coding purpose in applicationssuch as decoding the sign and to give the commands to enable the devices .Thistutorial gives enough understanding on Python programming language.

The computer vision techniques used in the application for manipulation of objectsin virtual environment have been implemented in C++ with the use of Open CV Library.The virtual objects (front end) have been designed using OpenGL library. The hardwarerequirements of the application to be implemented include computer with 1.99 GHz processor.The web cam used in the experimental setup captures image sequences at theresolution of 320x240. Practical experiments show that our application is implementedwell in environments with little noises i.e., existence of objects whose color is similar tohuman skin and with the balanced lightning condition. First, the user places his hand infront of the web-cam. The web-cam then detects the users hand by creating a rectanglearound it as shown in figure.

Fig no.1 Hand detection

III. FUNCTIONAL UNITS

The working components that formed the basis of our model are listed under this section. A general description of each component or unit is followed by the specification of the same used in our device.

A. Camera

Camera is used for image link and its permit computer for video conference station .Mostly webcam used for World Wide Web .We can use webcam for capturing image input from finger of user. For this we decide certain circumference of the camera. Webcam consist lens, image sensor, support electronics. The camera is connected to frame of the Wheelchair. The camera has to provide the User monitoring drive of the wheelchair Capabilities According to the JTAG Standard

B. PC

The image of the Gesture is received by the camera connected to the PC. In PC image is processed and the signal is given to the microcontroller and the motor is drive accordingly

C. Microcontroller

This is the CPU (central processing unit) of our project. We are going to use a microcontroller of 8051 family. The various functions of microcontroller are like:
I. Send signal to device.

D. Light Emitting Diode

It is a two lead semiconductor light source. It is a p-n junction diode which emits light when it gets activated. With high power LED lights, it is possible to save a high percentage of energy. They have low maintenance costs. We used six strips of LED lights (blue colour) in our model.

E. Motor Driver:L293D

Here we use two L293D circuits. One is used to drive the robot and other one is used for the movement of the pick and place arm. In the first circuit all the four input pins are connected to the digital pins of PIC 16CXX and the four outputs are connected to the DC motors of the robot. In the second circuit all the input four pins are connected to the digital pins of an Arduino and the four output pins are connected to DC motors of the pick and place arm. In both the circuits enable pins are used to enable input/output pins and Vcc is used for supplying external power to the DC motors.

F. DC motor 60 RPM

60RPM Centre Shaft Economy Series DC Motor is high quality low cost DC geared motor. It has steel gears and pinions to ensure longer life and better wear and tear properties. The gears are fixed on hardened steel spindles polished to a mirror finish. The output shaft rotates in a plastic bushing. The whole assembly is covered with a plastic ring. Gearbox is sealed and lubricated with lithium grease and require no maintenance. The motor is screwed to the gear box from inside. Although motor gives 60 RPM at 12V but motor runs smoothly from 4V to 12V and gives wide range of RPM, and torque. Tables below gives fairly good idea of the motor's performance in terms of RPM and no load current as a function of voltage and stall torque, stall current as a function of voltage.

Specifications

・ DC supply: 4 to 12V

・ RPM: 60 at 12V

・ Total length: 46mm

・ Motor diameter: 36mm

・ Motor length: 25mm

・ Brush type: Precious metal

・ Gear head diameter: 37mm

・ Gear head length: 21mm

・ Output shaft: Centred

・ Shaft diameter: 6mm

・ Shaft length: 22mm

・ Motor weight: 100gms

Fig no. 2 DC Motor

G. Relay

A relay is an electrically operated switch. An electrical contact is a component found in relays. Normally Open (NO) contact is a contact that is open or in a non-conductive state when it, or device operating it, is in non-energized state. A total of four relays were used in the circuit.

H. MAX 232

The MAX232 IC is used to convert the TTL/CMOS logic levels to RS232 logic levels during serial communication of microcontrollers with PC. The controller operates at TTL logic level (05V) whereas the serial communication in PC works on RS232 standards (25 V to + 25V). This makes it difficult to establish a direct link between them to communicate with each other. The intermediate link is provided through MAX232. It is a dual driver/receiver that includes a capacitive voltage

generator to supply RS232 voltage levels from a single 5V supply. Each receiver converts RS232 inputs to 5V TTL/CMOS levels. These receivers (R1 & R2) can accept ±30V inputs. The drivers (T1 & T2), also called transmitters, convert the TTL/CMOS input level into RS232 level. The transmitters take input from controller's serial transmission pin and send the output to RS232's receiver. The receivers, on the other hand, take input from transmission pin of RS232 serial port and give serial output to microcontroller's receiver pin. MAX232 needs four external capacitors whose value ranges from 1μF to 22μF
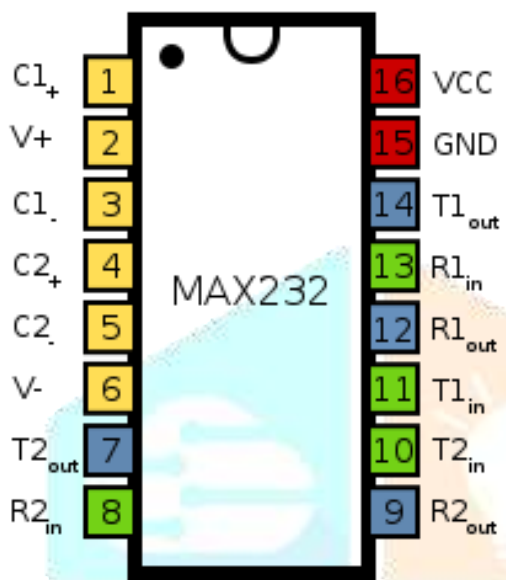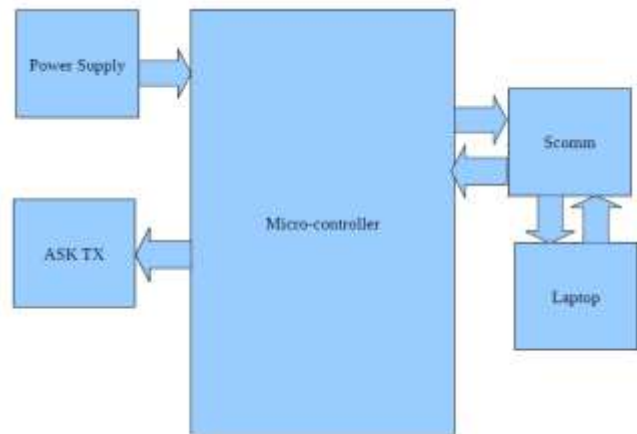
.

Fig no.3 IC Max 232

IV. RESEARCH METHODOLOGY

Fig no.4 System Block Digram

Tx side:

Fig No. 5 Transmitter Side

RX side:

Fig No. 6 Receving Side
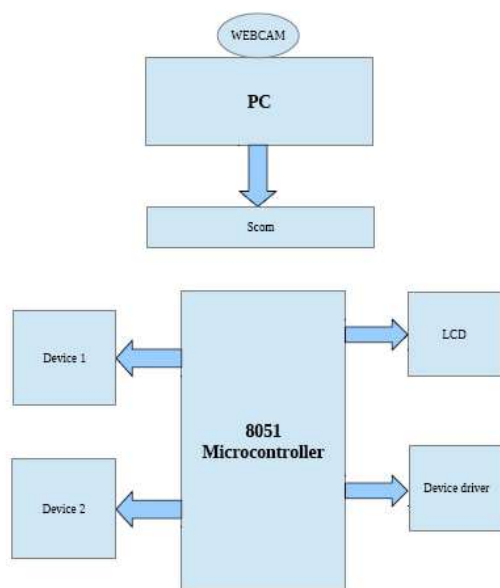
V. DESIGN AND DEVELOPMENT

A. Design and Working

The Open CV is a free and open-source library targeted on amount of your real time imagemethod. It can detect and acknowledge an outsized variety of objects, but our focuscurrently can be to use techniques and methods to detect and acknowledge the gestures ofhuman hand. We convert an image from RGB to gray scale and then to binary in order tofind the ROI i.e. the portion of the image we are further interested for image processing.By doing this our decision becomes binary: "yes the pixel is of interest" or "no the pixelis not of interest". By blurring, we have a bent to provide sleek transition from one colourto unique and cut back the edge content. We use thresholding for image segmentation, toform binary images from gray scale images. We now find convex points and defect points.The convex points unit typically, the tip of the fingers. But there are other convex pointstoo. So, we have a bent to find convexity defects that is the deepest purpose of deviationon the contour. By this we are going to find the amount of fingers extended then we aregoing to

perform different functions in line with the amount of fingers extended. The aimof the project was to device a program that is able to detect out hands, track them inreal time and perform some gestures recognition. It is to be through with simple signalmethod performed on images obtained from a daily personal computer web-camera. Itwas an under 2 week project so threshold values in the code including the canny filterneeds to be tweaked a bit more. It does not work well with changing background. Ifa much better background detection and subtraction rule is utilized, you can get betterresults.

B.Algorithm for Movement of Device

1. Start
2. Grab an image
1. Blurring the image
2. Convert RGB to HSV
3. Take HSV Thresholding
4. Finger detection
5. Gesture recognition
6. END

C. Flow Chart:

IMAGE GRAB

↓

BLURRING

↓

RGB TO HSV CONVERSION

↓

HSV THRESHOLDING

↓

FINGER DETECTION

↓
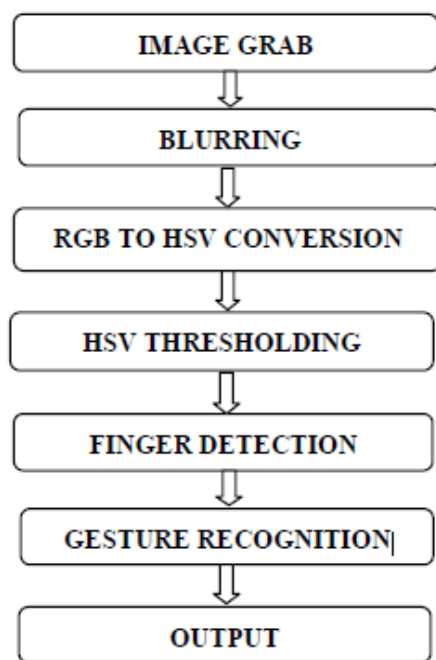
GESTURE RECOGNITION

↓

OUTPUT

Fig no. 7 Flow Chart of System

1 Detecting Background

Given the feed from the camera, the 1st thing to do is to remove the background. We use running average over a sequence of images to get the average image which will be the background too. This equation works because of the assumption that the background is mostly static. Hence for those stationary item, those pixels aren't affected by this weighted averaging and. Hence those pixels that are constantly changing are not a part of the background, hence those pixels will get weighed down. Hence the stationary pixels or the background gets more and more prominent with every iteration

while those moving gets weighed out. Thus after a few iterations, you get the above average which contains only the background. In this case, even my face is part of the background as it needs to
detect only my hands.

2.Background Subtraction

A simple method to start with is we can subtract the pixel values. However this will result in negative values and values greater than 255, which is the maximum value used to store an integer. And what if we have a black background? Nothing gets subtracted in that case. Instead we use an inbuilt background subtract or based on a Gaussian Mixture-based Background ForegroundSegmentationAlgorithm. Background subtraction involves calculating a reference image, subtracting each new frame from this image and thresholding
The result which results is a binary segmentation of the image which highlights regions of non-stationary objects. We then use erosion and dilation to enhance the changes to make
it more prominent

3.Contour Extraction

Contour extraction is performed using Open CVs inbuilt edge extraction function. It uses a canny filter. You can tweak parameters to get better edge detection. Tracking and Finger Detection, thus the defect points are most likely to be the centre of the finger valleys as pointed out by the picture. Now we find the average of all these defects which is definitely bound to be in the centre of the palm but it's a very rough estimate. So we average out and find this rough palm centre. Now we assume that the palm is angled in such a way that it's roughly a circle. So to find the palm centre, we take 3 points that closes to the rough palm centre and find the circle centre and radius of the circle passing though these 3 points. Thus we get the centre of the palm. Due to noise, this centre keeps
Jumping, so to stabilize it, we take an average over a few iterations. Thus the radius of the palm is a indication of the depth of the palm and we know the centre of the palm. Using this we can track the position of the palm in real time and even know the depth of the palm using the radius. The next challenge is detecting the no of fingers. We use a couple of observations to do this. For each maxima defect point which will be the finger tip, there will be 2 minimal defect points to indicate the valleys. Hence the maxima and the 2 minimal defects should form a triangle with the distance between the maxima and the minima have to be more or less same. Also the minima should be on or pretty close to the circumference of the palm. We use this factor too. Also the ratio of the palm radius to the length of the finger triangle should be more or less same. Hence using these properties, we get the list of maximal defect points that satisfy the above conditions and thus we find the no of fingers using this. If no. of fingers is 0, it means the user is showing a fist.

4.Tracking and Finger Detection

Thus the defect points are most likely to be the centre of the finger valleys as pointed out by the picture. Now we find the average of all these defects which is definitely bound to be in the centre of the palm but it's a very rough estimate. So we average out and find this rough palm centre. Now we assume that the palm is angled in such a way that itsroughly a circle. So to find the palm centre , we take 3 points that closes to the

rough palm centre and find the circle centre and radius of the circle passing though these 3 points. Thus we get the center of the palm. Due to noise, this centre keeps jumping ,so to stabilize it , we take an average over a few iterations. Thus the radius of the palm is a indication of the depth of the palm and we know the centre of the palm. Using this we can track the position of the palm in real-time and even know the depth of the palm using the radius. The next challenge is detecting the no of fingers. We use a couple of observations to do this. For each maxima defect point which will be the fingertip, there will be 2 minimal defect points to indicate the valleys. Hence the maxima and the 2 minimal defects should form a triangle with the distance between the maxima and the minima to be more or less same. Also the minima should be on or pretty close to the Circumference of the palm. We use this factor too. Also the ratio of the palm radius to the length of the finger triangle should be more or less same. Hence using these properties, we get the list of maximal defect points that satisfy the above conditions and thus we find the no of fingers using this. If no of fingers is 0, it means the user is showing a fist.

Fig no. 8 Design Model of Overall System

E. *result*

Sir no.	Image	Device	Accuracy
1		Fan On	100%
2		Fan Off	100%

VI. CONCLUSION

In this paper we have tried to control the device in a novel method. Gesture control being a more natural way of controlling devices, makes control of robots more efficient and easy. We have used finger count techniques for giving gesture input. In which each finger count specifies the command for the device to navigate in specific direction in the environment.

After gesture recognition command signal is generated and passed to the device, it moves in a specified direction.

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