



A New Frame Work of Hand Gesture Recognition for Far-Flung Assistance

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Abstract: The idea of gesture recognition plays a vital role in human machine interaction in which the perception of human gestures by a computer is utilized. The main usage of gesture recognition research is in detecting a particular human gesture and convey the information related to each gesture to the user. After the identification of specific gesture of interest from the collection of gestures, clear-cut command for execution of action can be given to remote system. It is intended to make the computer understand human body language, thereby removing the gap between machine and human. Without depending on conventional input methods we can make use of gesture recognition to enhance human-computer communication. Using this approach, it is aimed to improve the effectiveness and efficiency of gesture recognition by providing an alternative method with some advancement in gesture identification and rectification using the calculations related to slop.

Keywords: Human-machine interaction, Gestures, Image processing, Gesture recognition.

I.INTRODUCTION

Communication is the way of conveying intended meanings from one entity or group to another through the use of mutually understood signs and semiotic rules. For many years, research efforts are made to enhance the role of communication over human-machine interaction. The procedure followed includes generating The forming of communicative intent, message construction, message encoding, transmission of the encoded message as a sequence of signals using a specific channel or medium, acquiring signals, recreation of the original message at receiver side ,understanding the reconstructed message. To enact this, human message signals are hired. The method needs to be universal, easy to learn and easy to understand. One easy way to achieve this is by the help of gestures

A. Gesture signal processing

The field in computer science and technology which uses mathematical algorithms for interpreting human gestures called gesture recognition. Gestures can come from any state but commonly from the face or hand..simple gestures can be used to control or interact with devices without having physical contact. Efforts have been made with the help of cameras many such sensor devices to identify gestures. Gesture recognition can used as a method for systems such as computers to identify the content that human tries to communicate, thus it creates a link betweenmachines and humans other than the common text inputting using keyboard or even using graphical user interfaces.

Features of Gesture Recognition:

- Greater accuracy
- More stable
- Easiness to unlock a device

Gesture Recognition-The major application areas in current scenario:

- Automotive sector
- Transit field
- Gaming field
- Smartphone unlocking

Gesture recognition permits humans to communicate with the machine (Human Machine Interaction) and interact naturally without the support of any mechanical devices. It is even possible to point a finger at the computer screen so that the cursor will move accordingly using the concept of gesture recognition. Gesture recognition technology has more relevance nowadays since it reduces the time for communication. It is not needed to remember the security measures like passwords for any device, with the help of gesture recognition the person can unlock its device without any work. Mainly hand gestures are applicable nowadays and it can be conducted with techniques from computer vision and image processing.



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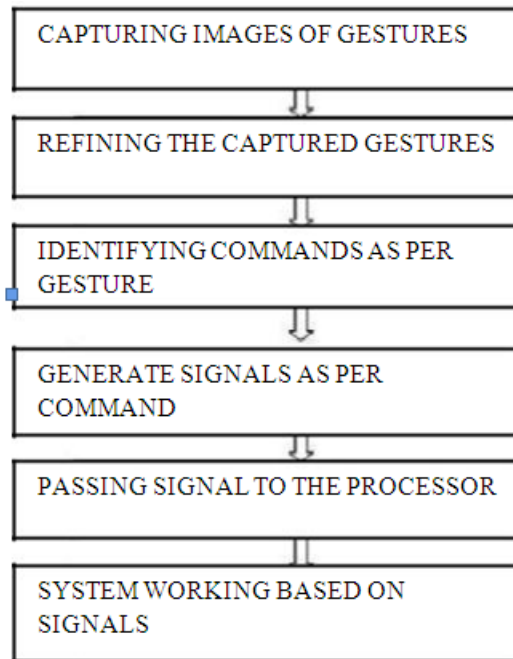


Fig. 1. Flow diagram of working of any system using hand gesture

B. Algorithms

Depending on the type of the data that we take as input, the approach for interpreting a gesture could be done in different ways.

1) 3D Model-Based Algorithms:

The 3D model approach uses either volumetric or skeletal models, or can even use a combination of the two. Computer vision purposes such as in computer animation industry uses volumetric approach, models are generally created from some convoluted 3D surfaces- NURBS or polygon meshes are some of the examples.

Computational intensiveness and systems for real time analysis are yet to be developed etc can be thought of as drawbacks of this method. It is really interesting that this approach would be to map simple primitive objects to the person's most important body parts like cylinders for the arms and neck, sphere for the head etc and analysis is done in such a way how these interact with each other. The exciting thing about this approach is that it has got simple Parameters for these objects. We make use of some conditions and hierarchies between our objects in order to better model the relation between these.



Fig.2

2) Skeletal-Based Algorithms:

One can use a simplified version of joint angle parameters together with segment lengths other than using intensive processing of the 3D models and dealing with a number of parameters, which is called as skeletal representation of the body. In this approach a virtual skeleton of the person is computed and mapped with parts of the body to certain segments. Position and orientation of these segments and the relation between each one of them can be utilized for analysis as an example the angle between the joints and the relative position or orientation can be considered.

Advantages of skeletal models usage:

- Only key parameters are analyzed, hence algorithms are faster.



- Pattern matching against a template database is possible
- To focus on the significant parts of the body using key points allows the detection program

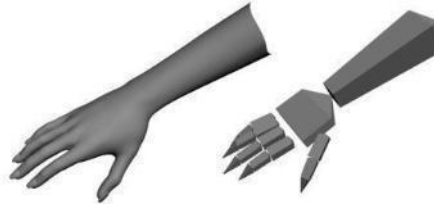


Fig.3

3) Appearance-Based Models:

These models acquire the parameters directly from the images or videos using a template database so that it doesn't use a spatial representation of the body. Some are based on the sets of points on the outline of an object, whose joining traces out the object's outline approximation of the human parts of the body, particularly hands. One of the simplest method, which finds out an average shape from point set and identifies the gesture from that. These models are mostly used for hand-tracking, but could used for simple gesture classification. Image sequences as gesture templates used in second approach for gesture detecting using appearance-based models. Parameters can be either the images themselves, or certain features derived from these images.



Fig.4

C. Challenges

Gesture recognition software faces many challenges associated with the accuracy and usefulness, for example the equipment used and image noise etc are some of the limitations on image-based gesture recognition. Background features, lighting constraints affect the recognition quality of images or videos. An algorithm which is suitable for one camera may not work for a different camera. Tracking and recognition difficulties occur when the amount of background noise increases. More than that, variations in recognition accuracy caused by the distance from the camera, and the camera's resolution and quality.

D. Strengths

- Can be used in difficult conditions where direct human interpretation is not possible.
- Useful for military operationAid for the disabled,
- Industrial applications
- Useful in surgical operations.

E. Limitations

- Range of camera

II.EXISTING SYSTEM

The research paper by Harish kumar kaura let.al defines gesture controlled robot using OpenCV as a software tool was developed in which the identification of gesture was done in two ways-Finger count based and Direction of hand position based. It uses a Wi-Fly shield to wirelessly control a robot using thresholding, [1].The pattern matching method is used for comparing the generated gesture with the previously stored data base values in an approach. Around Ten gestures are identifiable in this which utilizes matlab as a software tool [2]. Calculating the gesture by a mathematical approach for given was presented in [3]. This involved finding centroid of palm, and then covering a circular region of some intended radius around for counting the number of fingers. An approach which utilizes method



of colour component extraction for gesture recognition uses matlab as a software tool for processing images.[4].utilization of microcontroller ATMEGA 328 as the processor and colour scheme based gesture recognition process was made into practice[5]. An alternative approach for gesture recognition was made into practice with the help of Microsoft's Kinect sensors, which are capable of capturing both RGB data and depth data. In this approach hand motions in addition are recognized to full body motion for more easily understandable gestures. This is a high cost approach because kinect sensors are costly[6].Hand detection is achieved using OpenCV as a working platform and is used for human computer interaction. The software tool detects a count which was generated by convexity defects from a contour of hand drawn and developing convexity hull with the help of image processing[7]. In a spy robot, control signals, human hand gestures are used .The basic five gestures used for the operation of spybot. Mainly the 5t gesture commands which are forward, backward, left, right and stop[8] matlab is used as a software tool for processing the images and identifying the gestures.

III.PROPOSED SYSTEM

- MATLAB causes some processing delay The no of gestures identifiable is limited
- Ease of hand motion limited by the additional wearable equipments
- Proper lighting required for proper detection gesture

A new method is proposed to a system in which human can control a unit such as robot using hand gesture as a medium. MATLAB as software platform for image and video processing is used for the processing of gesture commands. As soon as our system detects the gesture, it generates the command for the unit to work or navigate in specific direction or perform some other action as per the command. A laptop's webcam is used as a sensor to capture the gestures. At first the webcam is appropriately placed so as to detect the gesture .now a video input is taken under proper lighting conditions so that the gesture should be recognized. After that the video is divided into a stack of frames. The segmentation of the video into frames should be accurately done. Information of the gesture is obtained by the analysis of each frame. It is attached different colour markers to the fingers for colour identification such as red, in order to perform better gesture identification and to improve the precision of the process; a particular colour component of an image is focused at a time. Next a median filter is used to filter out the noise in the gesture image. The filtered image is then converted into binary image. After that centroid of the highlighted areas are calculated.(Fig.5)

(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

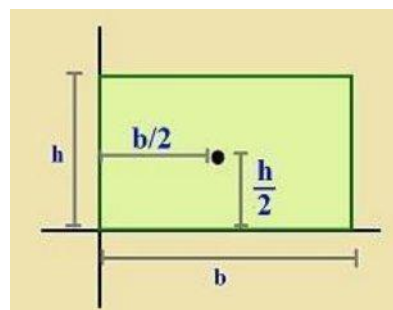


Fig.5

The figure is then divided into a 6 X 6 matrix so that we can detect the coordinates of each cell as (x,y).

For the line having coordinates (x1,y1)and (x2,y2) value of SLOP= (y2-y1)/(x2-x1).

The slop among the centroid of the finger colour marker and the centroid of the wrist colour marker. For a particular slop value a gesture is associated. These commands are then serially sent to microcontroller of the unit which we want to control. Programming is done in such a way that when command is read by microcontroller, it makes the corresponding pin high and thus by using motor driver circuit, we are able to run our motors.



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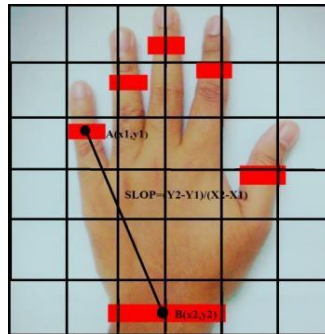


Fig.6

(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	(1,6)
(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	(2,6)
(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	(3,6)
(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	(4,6)
(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	(5,6)
(6,1)	(6,2)	(6,3)	(6,4)	(6,5)	(6,6)

Fig.7

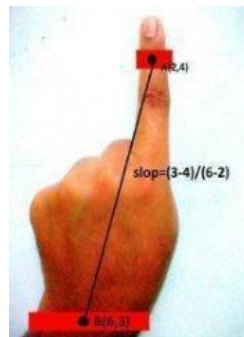


Fig.8

Algorithm:

- 1) Start
- 2) Initialize the webcam.
- 3) Initialize serial communication between matlab and arduino.
- 4) Set properties of video object.
- 5) Start video acquisition.
- 6) Get snapshot of current frame.
- 7) Convert image to gray scale.
- 8) Subtract red component.
- 9) Filter the noise
- 10) Convert image to binary image.
- 11) Calculate centroid of the extracted components.
- 12) Calculate the slop between centroid of marker in wrist and that of finger
- 13) Allocate commands related to each and every slop
- 14) Compare with database.
- 15) Send command signal.
- 16) Stop

TABLE 1 POSSIBLE GESTURES

Sl	(x1,y1)	(x2,y2)	slop	command
1	(3,2)	(6,3)	0.33	Move left
2	(2,4)	(6,3)	0.25	Move forward



3	(1,3)	(6,3)	0	Stop
4	(2,4)	(6,3)	-0.25	Backward
5	(4,5)	(6,3)	-1	Move right

IV.CONCLUSION

The main aim is to create a unit that is sovereign and can be easily controlled with the help of hand gestures. For efficient human computer interaction a new technique is proposed in the current system. These provided techniques can be used efficiently and accurately by some constraints. Adding additional number of gestures for efficient communication can be considered as a future work.

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