STM JOURNALS

Journal of Artificial Intelligence Research & Advances
ISSN: 2395-6720(online)
Volume 2, Issue 2
www.stmjournals.com

To Control Home Appliances Using Hand Gesture Recognition

Dr. Bhupesh Kumar Singh*, Sangeeta
Department of Computer Science and Engineering, Rawal Institute of Engineering and Technology, Faridabad, India.

Abstract

Now a day, Remote Control System (RCS) is popular to control home appliances. At same time, Hand Gesture Recognition (HGR) has superseded remote control system with rapid growth in technology. There are various approaches that are applied to Hand Gesture Recognition. Most of approaches are based on three Stages: Preprocessing, Feature-Extraction and Classification. These approaches require hand gesture as an input to system; perform wide variety of mathematical algorithm to get an output for a particular gesture. In this Paper, we have proposed a System to control home appliances by using Hand Gestures. By pointing fingers, the system can be used for controlling A/C based home appliances.

Keywords*: Classification, EmguCv, hand gestures, segmentation*

**Author for Correspondence* Email: dr.bhupeshkumarsingh@gmail.com

INTRODUCTION

Computer & Computation is most important part of life. We use it for our work or for entertainment. A number of Input & Output devices have been used to provide interface between humans and Computers or HCI (Human – Computer Interaction), the two most popular devices are Keyboard and Mouse. As the Complexity of humans has been increasing, there is a need to ease the communication between humans and computers. At the same time, this can be done by using Gesture based Recognition like Hand Gesture Recognition, Face Recognition, Iris Recognition and many more. Gesture recognition is a topic in computer science and language technology with the goal of interpreting human gestures via mathematical algorithms. Gestures can originate from any bodily motion. The most common Gesture Recognition is Hand Gesture Recognition. We can make use of Fingers, Palm and number of poses also for Hand Gesture Recognition.

The Researcher defines Hand Gesture Recognition as:

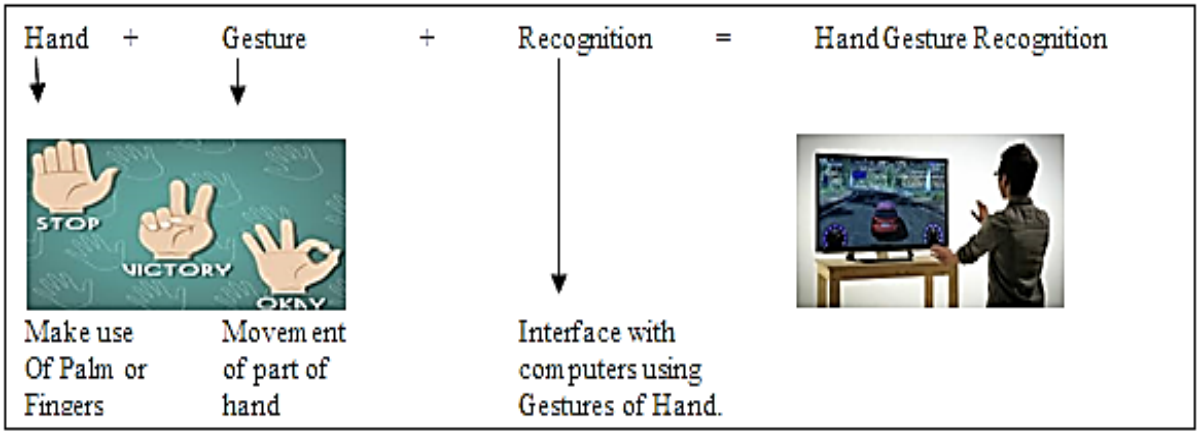


Fig. 1: *Layout of HGR.*

We can also use Hand Gestures in real life applications like switching channels without a T.V Remote, Automated Home, Driving to Safety etc. Basically the purpose of this paper

is to develop new perceptual interfaces for human-computer-interaction (HCI) based on visual input captured by camera or computer vision systems, and to investigate how such interfaces can complement or replace traditional interfaces based on keyboards, mouse, remote controls, data gloves or speech. We have proposed the paper to control electrical Appliances by making use of Hand Gestures.

LITERATURE REVIEW

Gesture recognition the term collectively refers to the whole process of tracking human gestures to their representation and conversion to semantically meaningful commands as discussed in [1]. Simple remote controlled gadgets can be operated to change a TV channel or to tune radio by finding the key on hand held remote control and pressing it as discussed in [2].

Nowadays, many home appliances are controlled by remote controllers. However, it is cumbersome because it requires the user to keep remote controllers close to him/her and select the appropriate one every time he/she wants to control some appliances.

For the elderly or disabled people, these inconveniences are more serious. Recently, studies on gesture cognition to control home appliances have been attempted, but few of them focused on hand recognition to control multiple home appliances in the unstructured environment as discussed in [3].

The goal of gesture interpretation is to push the advanced human-machine communication to bring the performance of human-machine interaction close to human-human interaction as discussed in [4].

Hand Gesture Recognition is topic in computer vision because of more application, such as HCI, sign language interpretation, and visual surveillance. Primary goal of gesture recognition is to create a recognition system that can identify specific human gesture and use them to convey meaningful information or to control devices which is used in HCI as discussed in [5]. It is almost impossible for home inhabitants to go for a day without interacting with the home appliances. Although remote control of home appliances such as TV, DVD, windows, lights, etc. serves well for ordinary people with acceptable physical or emotional comfort, they can provide more for the dignity, security, and well-being of elderly or disabled people. One can imagine a situation where a person has lost some of his/her physical mobility.

In the absence of suitable controls, he/she would need a caregiver to assist with the operation of home appliances, with the attendant expense and loss of independence and privacy. But with adequate assistance, this person might be able to live independently at his/her home as discussed in [6]. Gestures are expressive, meaningful body motions involving physical movements of the fingers, hands, arms, head, face, or body with the intent of: 1) conveying meaningful information or 2) interacting with the environment. They constitute one interesting small subspace of possible human motion. A gesture may also be perceived by the environment as a compression technique for the information to be transmitted elsewhere and subsequently reconstructed by the receiver as discussed in [7].

Hand gesture recognition is used in TV controlling, robot control, human computer interaction (HCI), education, daily information retrieval etc. Hand Gesture can be classified as static and dynamic (means run time). Static movement means hold the hand with a specific pose e.g. a victory sign, thumbs up.

Static hand gesture recognition requires training and it has less computational complexity than dynamic hand gesture. Whereas dynamic hand gesture requires no training, it recognizes the hand gesture dynamically. Dynamic hand gesture is more complex but it is more useful than static hand gesture as discussed in [8].

PROPOSED SYSTEM

The primary goal of hand gesture recognition is to create a system which can identify specific hand gestures and use them to convey information or to send signal to control device. The flow of system is described as:

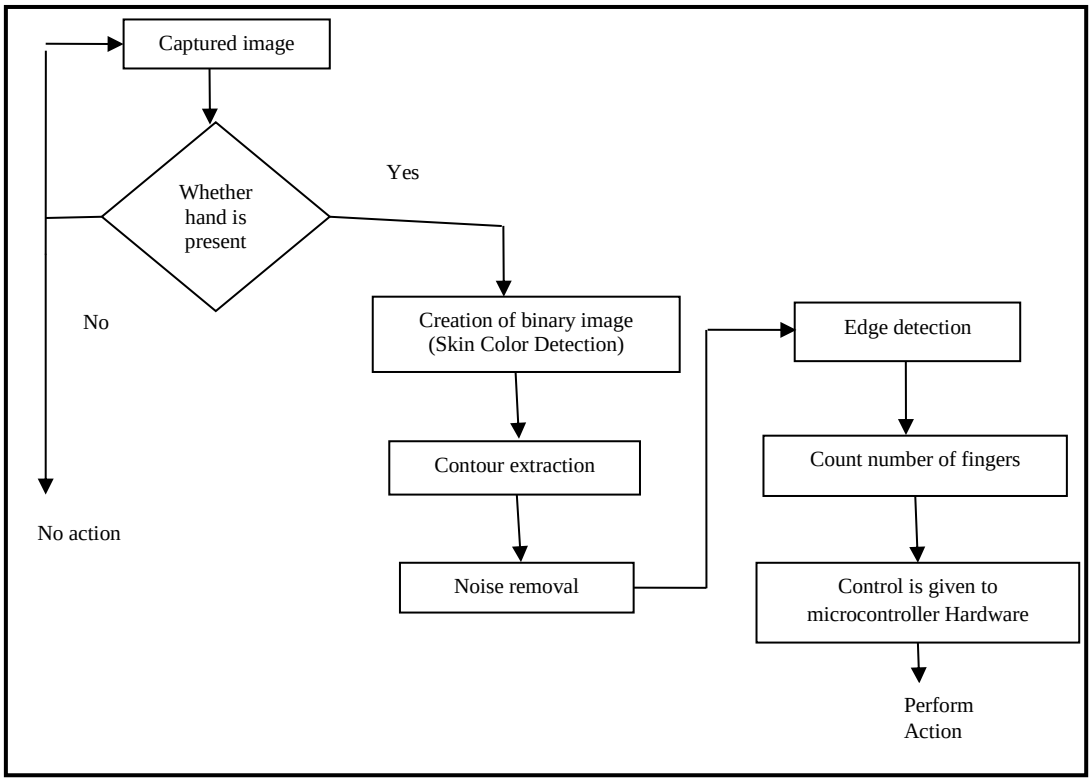


Fig. 2: *Proposed System.*

Gestures can be static (posture or certain pose) which require less computational complexity or dynamic (sequence of postures) which are more complex but suitable for real time environments. Different methods have been proposed for acquiring information necessary for recognition gestures system. Some methods used additional hardware devices such as data glove devices and color markers to easily extract comprehensive description of gesture features. Other methods based on the appearance of the hand using the skin color to segment the hand and extract necessary features, these methods considered easy, natural and less cost comparing with methods mentioned before [9].

Gesture Recognition System is mostly based on three stages: Preprocessing, Feature-extraction and classification.

Preprocessing

Preprocessing is required to extract the hand portion from an image. After extracting hand portion, it is necessary to remove noise and unwanted features from an image so that processed image can be converted to binary image and can get edges from filtered image.

Feature – Extraction

In this stage, features are extracted from binary image to form a feature set for classification. Both raster (skin tone blobs, colored gloves, shape signature etc.) and vector information (input geometry, facial animation parameters etc.) form the basis of feature extraction.

Classification

Classification stage classifies the reported features belonging to certain pre-stored category.

These stages are described in Figure 3.

Proposed Algorithm

1. Capture the image using camera.
2. After capturing the image, the system is divided into three stages:

- Preprocessing
- Feature Extraction and
- Classification.

2.1. The first step is further divided into three parts:

- Segmentation,
- Filtration and
- Edge Detection.

2.1.1. Segmentation is used to convert the image into binary image. For this, we have used Skin Color Detection method. Skin Color Detection method is depending on threshold value (described in Figure 4) that we have taken between 0 and 255. If the value is between 0 and 100; the result is 0 otherwise result is 1. 0 represent black pixel and 1 represent white pixel.

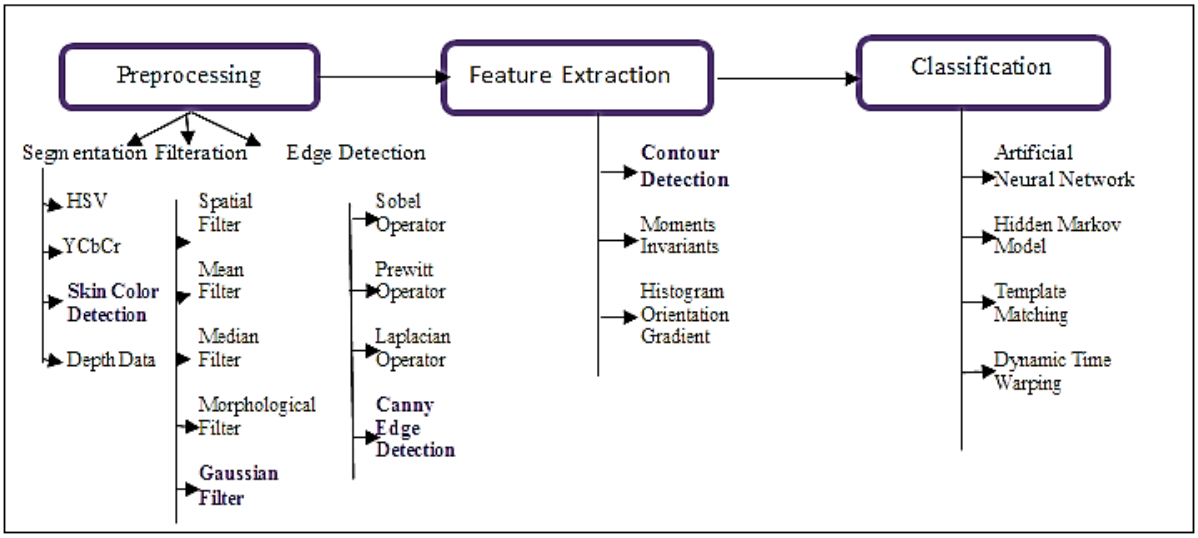


Fig. 3: *Flowchart of HGR.*

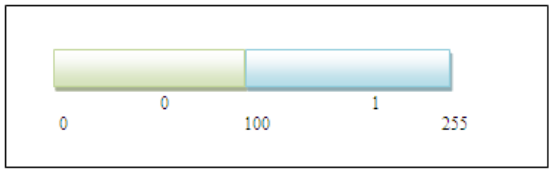


Fig. 4: *Proposed Threshold Value.*

2.1.2. Noise can be removed from binary image using Filteration method. For this, we have used Gaussian Filter method.

2.1.3. Edge Detection is used for image analysis object identification and filtering. For this, we have used Canny Edge Detector method.

2.2. To find the most differentiate information in the recorded image, Feature Extraction Stage is used. For this, contour Detection method is used.

2.3. In Classification stage, new feature vector can be classified after system is trained.

Implementation Details

The application is designed in C#.Net for real time image processing. The image is captured using Camera that is given to software application. After performing various functions on image, the data is sent to microcontroller board. The hardware sends the signal to desired appliances.

Software

For implementing application, we have used C#.Net. To process an image, an open source library i.e. Emgu CV is used. The System is used to control Electrical Appliances using Hand Gesture Recognition. It consists of a Computer with Webcam to run software application and a microcontroller Board to perform an action. The Microcontroller Board contains one Fan and one LED as described in Figure 5. Each Finger has its unique code to perform an action. If user wants to Turn-ON Fan, She/he will point one, Software recognize it and send the signal to microcontroller Board to Turn-On Fan. Only the signal of Turn-On the Fan will be enabled.

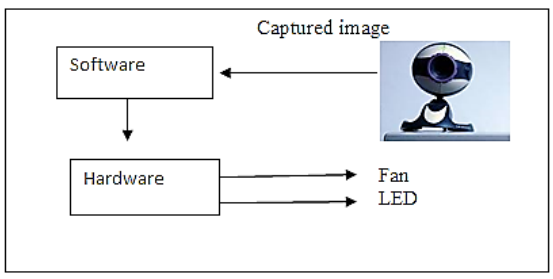


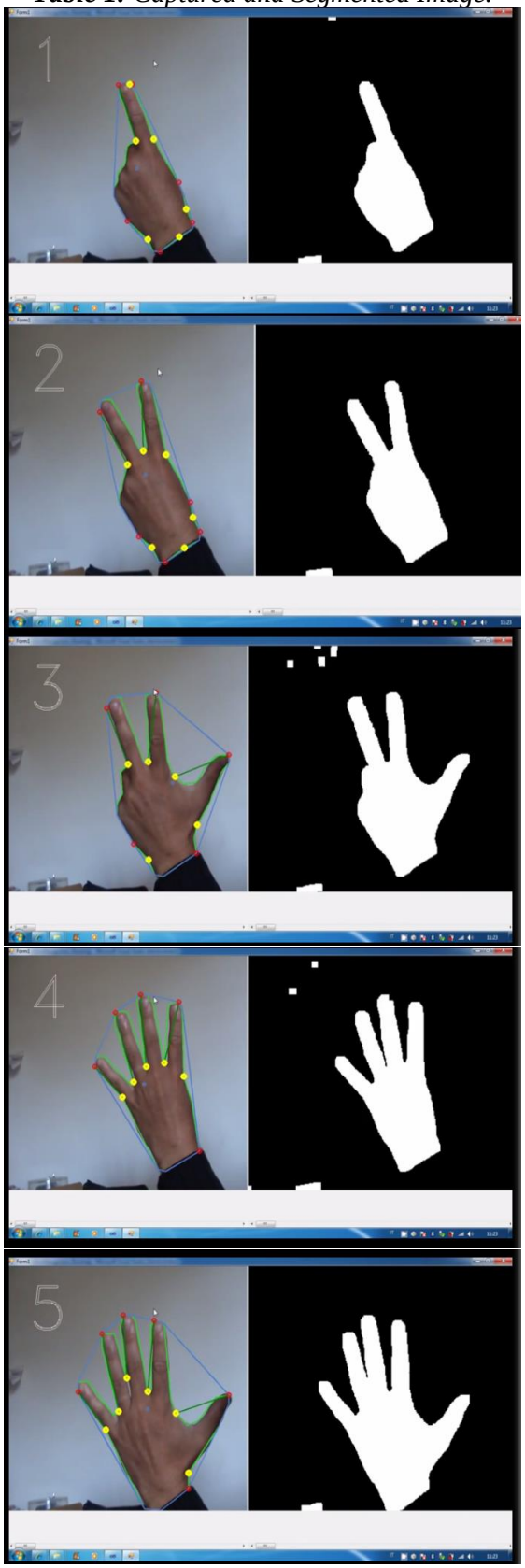
Fig. 5: *Working of HGR.*

TESTING AND RESULTS

In this System, Emgu Cv is used for image processing. One web-cam is used to capture

image. In Table 1, finger counting of captured images and segmented images are shown:

Table 1: *Captured and Segmented Image.*



Accuracy of counted finger is shown in table 2:

Table 2: *Efficiency of Counted Finger.*

Number of Fingers	1	2	3	4	5
Efficiency	97%	96%	92%	89%	94%

CONCLUSION AND FURTHER WORK

Building less number of lines of code with maximum efficiency is another requirement which should be attained. We have used OpenCV technique to attain the same and utilizing max amount of inbuilt code to ease out the code process and emphasizing more on the objective rather than statements with optimal accuracy rates. In future we expect such algorithms which are easy to be implemented and require less space and time with efficient cost break up would be developed and one day would reach within the hands of common man for every day usage and enjoying the technology by just sitting at one place.

ACKNOWLEDGEMENT

I would like to thank my professor Dr. Bhupesh Kumar Singh for their guidance, advice and encouragement throughout my researched work.

REFERENCES

1. Athavale Swapnil, Deshmukh Mona. Dynamic Hand Gesture Recognition for Human Computer interaction: A Comparative Study. *International Journal of Engineering Research and General Science*. 2014; 2(2): 38–55p.
2. Solanki Utpal V, Desai Nilesh H. Hand gesture based remote control for Home Appliances. *IEEE*. 2011: 425–9p.
3. Seung-Eun Yang et al. Advanced Soft Remote Control System in Human-friendliness. *SCIS&ISIS2006 @ Tokyo, Japan*. 2006; 20(24): 218–22p.
4. Mahmoud Elmezain, Ayoub Al-Hamadi, Michaelis Bernd. Hand Gesture Recognition Based on Combined Features Extraction. *World Academy of Science, Engineering and Technology* 60. 2009: 395–400p.

5. Panchal Jignasha B, Kandoriya Karshan P. Survey on Hand Gesture Recognition Methods. *IJARCSSE*. 2014: 271–278p.
6. Bharambe Apoorva, Chanekar Divya, Naik Divya, Prof. Vitekar A. B. Automatic Hand Gesture Based Remote Control for Home Appliances. *IJARCSSE*. 2014: 567–71p.
7. Mitra Sushmita, Acharya Tinku. Gesture Recognition: A Survey. *Ieee Transactions On Systems, Man, And Cybernetics—Part C: Applications And Reviews*. 2007; 37(3): 311–24p.
8. Mutha Samata, Dr. Kinage K.S. Study on Hand Gesture Recognition. *IJCSMC*. 2015; 4(1): 51–7p.
9. Khan Rafiqul Zaman, Ibraheem Noor Adnan. Hand Gesture Recognition: A literature review. *IJAIA*. 2012; 3(4): 161–73p.

Cite this Article
Dr. Bhupesh Kumar Singh, Sangeeta. To Control Home Appliances Using Hand Gesture Recognition. *Journal of Artificial Intelligence Research & Advances*. 2015; 2(2): 29–34p.