Home Automation and Document Controlling using Hand Gestures

Prof. Anand Mannikeri¹, Sachin Raikar², Amruta Malwade³, Swati Bansode⁴
Assistant Professor¹, BE Student², ³, ⁴
Department of Information Science and Engineering
KLE Institute of Technology, Hubballi, Karnataka, India

Abstract:
Hand Gesture Recognition System is a branch of Human Computer Interaction in which Human hand gestures are recognized by the computer system and then perform pre-defined task as per the application for controlling software as well as hardware. The main goal of gesture recognition research is creation of a system that can identify specific human hand gestures and use them to convey information or for device control as well as document control. Owing to the rapid development of hardware and software, new types of HCI methods have been required. In particular, technologies such as speech recognition and gesture recognition receive great attention in the field of HCI. Being able to interact with the system naturally is becoming ever more important in many fields of Human Computer Interaction. Both non-vision and vision based approaches have been used to achieve hand gesture recognition. A home automation system will control lighting, climate, entertainment systems, and appliances. In this paper we proposed the hand gestures can be used to automate home applications and also control documents in the system. The model is trained using training images to improve the accuracy of the model.

Keywords: Gesture, Recognition, Interaction, Controlling.

I. INTRODUCTION

Home automation or domestics building automation for a home, called a smart home or smart house A home automation system will control lighting, climate, entertainment systems, and appliances. It may also include home security such as access control and alarm systems. When connected with the Internet, home devices are an important constituent of the Internet of Things. Hand Gesture Recognition System is a branch of Human Computer Interaction in which Human hand gestures are recognized by the computer system and then perform pre-defined task as per the application for controlling software as well as hardware. As we know, the vision-based technology of hand gesture recognition is an important part of human-computer interaction (HCI). In the last decades, keyboard and mouse play a significant role in human-computer interaction. However, owing to the rapid development of hardware and software, new types of HCI methods have been required. In particular, technologies such as speech recognition and gesture recognition receive great attention in the field of HCI. Being able to interact with the system naturally is becoming ever more important in many fields of Human Computer Interaction. In the model, we require at least a set of 20 images to train the model of the hand gesture recognition system. In the model, we require at least a set of 20 images to train it. Higher the number of training images used, higher is the accuracy.

II. OBJECTIVES

1) To develop an automated hand gesture recognition system.
2) To identify the current technology and methodology used in hand gesture recognition and home automation system.
3) To design and develop an application to train the hand gesture training set.
4) To design an application to recognize the hand gesture and perform action accordingly.
5) To build a user friendly and secured interface for easy access by the user.
6) To control a document using hand gestures

III. ARCHITECTURAL DESIGN

Figure 1 shows the architectural design of the system

Figure.1. Design of the hand recognition system

1) The first step is to obtain all the training images required to train the model of the hand gesture recognition system. In the model, we require at least a set of 20 images to train it. Higher the number of training images used, higher is the accuracy.
2) These images are then processed and the noise in the image is reduced to get better quality images.
3) All the parts of the image are then associated with appropriate labels and then the labelled data is obtained.
4) These labelled images are then sent to a machine learning algorithm which uses machine learning and deep learning concepts to classify the images.
5) These images can then be used to classify future images, the testing images.
6) After training, the testing images undergo similar procedure of data obtaining and quality enhancement.
7) The testing images are then classified using the model.
8) The probability of the classification is obtained and the testing images are then classified.
9) After the classification process, the hand gesture is recognized and the associated action is performed by the model.

IV. FLOW DIAGRAM OF THE HAND GESTURE RECOGNITION SYSTEM AND STEPS

![Flow diagram of the hand recognition system and steps](image)

Data obtaining
In the above figure initial move is to capture the image from camera and to define a region of Interest in the frame, it is important as the image can contain a lot of variables and these variables can result in unwanted results and the data that needs to be processed is reduced to a large extent.

Data Pre-processing
Pre-processing method can be completed 2-steps process:
• Segmentation
• Morphological filtering

Hand Tracking
The movement of the cursor was controlled by the tip of the index finger. In order to identify the tip of the index finger, the centre of the palm must first be found. The method used for finding the hand centre was adopted from and it has the advantage of being simple and easy to implement.

Capturing Frames and Convert to Gray Scale
![Capturing Frames and Convert to Gray Scale](image)

V. STEPS IN PROCESSING THE HAND IMAGE

1. The image of the hand is taken using a camera.
2. Next the hand area from the image is detected and cropped.
3. The image goes image pre-processing steps such converting image to binary image, image thresholding, gray-scaling.
4. Next step is giving adding the convex points and detecting the extension of fingers

![Steps in classifying the input image](image)

VI. SOFTWARES TOOLS AND TECHNOLOGIES USED

![Raspberry pi structure](image)

Figure.4.Raspberry pi structure

Figure.5.Raspberry pi structure

Figure.6.Relay used in this proposed work

Figure.7.Relay circuit
The complete hardware and raspberry and relays

VII IMPLEMENTATION

Training the images

from ecapture import ecapture as ec
print("Capturing Gesture")
ec.capture(0, False, "image.jpeg")

The above figure shows capturing the image.

< width >
+----------------------+
| | <width, crop%> |
| | +--------+ |
| +--------+

The above figure shows cropping the image

Scaling
Scaling is a lot like cropping, except that the bounding box is always cantered and its size varies randomly within the given range.

Arguments used here are:
flip_left_right: Boolean whether to randomly mirror images horizontally.
random_crop: Integer percentage setting the total margin used around the crop box.
random_scale: Integer percentage of how much to vary the scale by.
input_width: Horizontal size of expected input image to model.
input_height: Vertical size of expected input image to model.
input_depth: How many channels the expected input image should have.
input_mean: Pixel value that should be zero in the image for the graph.
input_std: How much to divide the pixel values by before recognition.
This function returns the jpeg input layer and the distorted result tensor.

VIII EXECUTING THE PROGRAMS FOR TRAINING THE IMAGES

Ubuntu uses the terminal to execute any program code; similarly we use the Ubuntu terminal to train the images and obtain a text file containing the contour co-ordinates of each of the images.

Figure.8Commands for training the set of images of each gesture

Figure.9Output of running the commands, the images are trained

Various Gesture images

Figure.11 Ashirvad, Give, Shanka, spidy & super gestures
The following is a step-wise working of the model
1) The first step is to export the path and then run the "./run_test.sh" command in the terminal. This runs the program and we are provided with a set of options as shown in the figure 6.14.
2) Show the desired gesture of the required action to be performed. Make sure that you are connected to the internet if you want to use the spidy gesture to open the link in chrome.
3) Press enter while holding the gesture in front of the system’s camera. This will record the image and store it in the specified destination. One can also go into the folder and check the captured image if he/she wants to verify the image captured.
4) The system will process the captured image and run the programs and classify the image as either “Ashirwad”, “Spidy”, “Shanka”, “Give”, “Super”, “One”, “Two”.
5) After classifying the image, the system shows the type of gesture along with the accuracy of the classification. If the accuracy is satisfactory, further action can be performed.
6) The system gives an option to enter “1” or “0”-
   (a) If “1” is entered, the system runs the particular home automation device or the file.
   (b) If “0” is entered, the system exits from the running state and no further action is performed.
7) After successful completion, you can either close the command prompt or use the command to perform other actions.

VIII. APPLICATIONS
1. Managing all of your home devices from one place
2. Flexibility for new devices and appliances
3. Maximizing home security
4. Remote control of home functions
5. Increased energy efficiency
6. Improved appliance functionality

IX. CONCLUSION
This work investigates the different techniques used for hand gesture recognition and also tells about the various advantages of it. It tries to deploy a well-known machine learning algorithm to solve the problem of gesture recognition. The project also proposed to pre-process the data using different computer vision techniques to improve the accuracy. It is now evident that the project can find its applications in many fields such as cheque read automation, Autonomous driving vehicles etc.

X. REFERENCES


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