

Hand Recognition and Gesture Control Using a Wi-Fi Application in Smart Toye's

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ABSTRACT

Hand gesture recognition is one of the systems that can detect the gesture of hand in a real time video. The gesture of hand is classified within a certain area of interest. In this, designing of the hand gesture recognition is one of the complicated jobs that involves two major problems. Firstly, is the detection of hand. Another problem is to create the sign that is suitable to be used for one hand in a time. This project concentrates on how a system could detect, recognize and interpret the hand gesture recognition through computer vision with the challenging factors which variability in pose, orientation, location and scale. To perform well for developing this project, different types of gestures such as numbers and sign languages need to be created in this system. The image taken from the real-time video is analyzed via Haar-cascaded Classifier to detect the gesture of hand before the image processing is done or in the other word to detect the appearance of hand in a frame. In this project, the detection of hand will be done using the theories of Region of Interest (ROI) via Python programming. The explanation of the results will be focused on the simulation part since the different for the hardware implementation is

the source code to read the real-time input video. The developing of hand gesture recognition using Python and OpenCV can be implemented by applying the theories of hand segmentation and the hand detection system which use the Haar-cascade classifier.

Keywords Hand detection, Gesture recognition, Deep Learning, Python, OpenCV.

I. Introduction

Computer technology has come an extended way within the past 20 years. the items which will be done, and therefore the time spent on electronic devices has increased tremendously also. they need infiltrated every aspect of our lives; from how we learn, to how we share experiences with others. Although the devices are advancing quickly, the methods of interacting with these devices are largely neglected – so far. With numerous aspects of our lives being suffering from computers, people began to wonder if there was a far better, more natural thanks to interact with devices, aside from using the normal devices. This led to the emergence of a replacement field:

Human Computer Interaction (HCI). The impact of HCI is often seen within the first iPhone, which revolutionized the mobile device industry with its intuitive touch screen. A newer example of such a revolution is voice commands, through products like Google Now and Apple's Siri, which allowed for hands-free controls. It is often said that both of those methods of interaction succeeded because they were so natural, so familiar to us – it had been much more natural to point and tap on an icon using our finger, than to shift a mouse to maneuver a cursor to click on an icon. because the industry places its specialize in Virtual and Augmented Reality, the importance of HCI will grow even more. People will desire A level of interaction that befits the term “virtual reality” – it's to mimic reality, where we use our limbs, five senses and voice to interact with the planet around us. Hence, starting with the foremost basic interaction, we might want to use our hands to maneuver and ‘touch’ things. In other words, we'd like hand gesture recognition as the basis of HCI in virtual reality. This report aims to explore the prevailing options for hand gesture recognition during a common context. most of the people nowadays own a laptop with a front-facing camera. If we could tap into this, we could possibly bring a more natural method of interaction to the masses. Moreover, as computer game devices become more common, the laptop camera can also become a viable complementary interaction device, capturing a field of view break away the computer game device.

II. Problem statement

The proposed system is based on programming languages-based image recognition which will identify the gestures of user and after identification this gesture can be used in multiple

applications like controlling the multimedia player in which we can control the volume zoom are we can see the playback of this multimedia. Also, where connecting one external device

which microcontroller based which can receive the commands from the computer and can be used to control any other devices or can be coupled with the television to control the channels

as well as the volume on the television. So, this is team will be useful for all the peoples not only controlling the computer as well as controlling the external devices using the simple plug and play device. Lots of research and literature are present, Literature survey regarding to this topic is completed.

III. Methodology

Hand gesture recognition project is done using Python programming language and OpenCV as library. Python programming language produces simple and easy system code to understand. Also, Python package used here is Numpy. The image that is captured using web camera will be processed in a region called as Region of Interest (ROI) where act as a region of wanted area while ignoring the outside region, called background. segmentation is done to convert gray scale image into binary image so that only two objects in image which one is hand and other is background. Otsu notes again, this algorithm is used for segmentation purpose and gray scale images are converted into binary image consisting hand or background. A very good segmentation is needed to select an adequate threshold of gray level for extract hand from background for example there is no part of hand should have background and background also should not have any part of hand. In general, the selection of an appropriate segmentation algorithm depends largely on the

type of images and the application areas. The Otsu segmentation algorithm was tested and found to give good segmentation results for the hand gesture. Otsu algorithm is nonparametric and unsupervised method of automatic threshold selection. Otsu’s thresholding method involves iterating through all the possible threshold values and the measurement of spread for the pixel level for each side of the threshold is calculate for example pixels that either fall in foreground or background. The aim is to find the threshold value where the sum of foreground and background spreads is at its minimum. Fig. 1 shows how the threshold image.

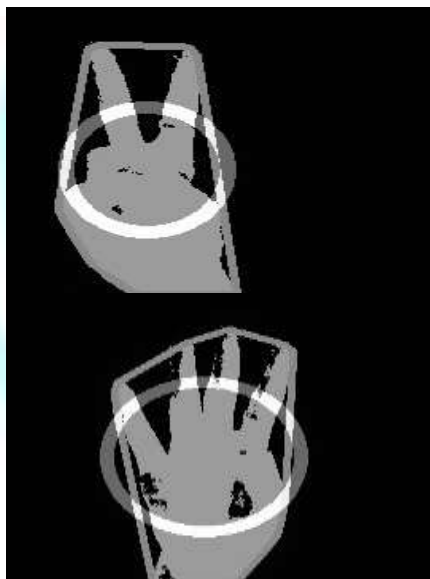


Fig. 1. Threshold image

Region of Interest, or commonly abbreviated as ROI, is a region that will be considered as the region of wanted area while ignoring the outside region, called background. As proposed by Sander [14], to detect the availability of hand recognition, the detected region must be located the same as the region of interest. In other words, as the classifier tracks the wanted object, in this case the bounding rectangle around the hand contour, the area of hand must overlap with the region of

interest. By using the conditional method of overlapping region, the system can identify whether the region selected, in this case the rectangle around the hand contour, is overlap with other active region, in this case the hand itself. By developing this theoretical part of ROI to the simulation and hardware implementation, the process of detecting the appearance of hand will be much simplified compared to the other method like in Fig. 2 shows the criteria for ROI to overlap that can be considered as overlapping ROIs. These criteria are needed to make sure that the program can identify the detection of hand gesture.

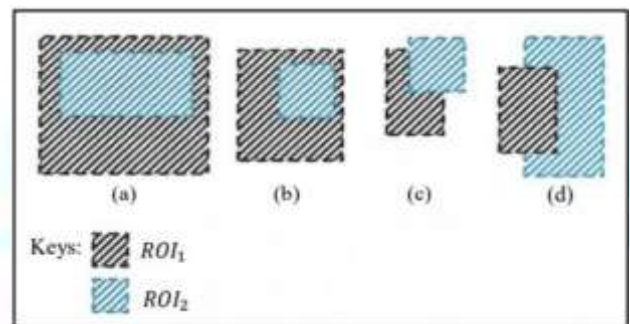


Fig. 2. Overlapping Region of Interest (ROI)

For this project the Region of Interest (ROI) is used to see the gesture of hand because the implementation for the ROI is suitable to detect the overlapping two regions on it. Besides, the system will detect only two outputs for each hand gesture recognition. This can be explained in Table 1 as follow:

Table 1. Application of Region of Interest (ROI).

Region of Interest (ROI)	Region implemented for
ROI ₁	An active region, in this case the hand itself.

ROI ₂	The rectangle sub window on screen. This region is static or not movable outside the frame of the real-time video and it highlights the area that involves.
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main program action to detect the appearance and the gesture of hand is by using the theory of Region of Interest (ROI). For programs to track the rectangle around the hand contour, the program required to identify whether the selected area of interest, referring to the case of the project, the rectangle will overlap with the detection of hand.

Implementation

The detection of hand gesture was calculated through the space consumption within the area between the convex hull and contour of hand. Convex hull is applying to find the edge of user hand by forming descriptor in which the smallest convex set contains the edges. In this project, the OpenCV library files that is suitable for any of image processing techniques are used.

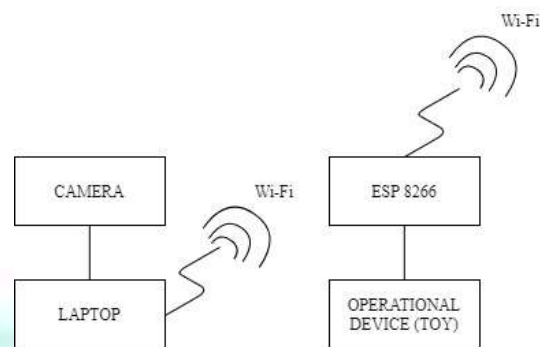


Figure 3. Block of hand gesture recognition

The gesture detected is then sent over Wi-Fi to the ESP 8266 which is use for operate the device in our case it is a small robot. This system can be used for multiple application like multimedia control and presentation control.

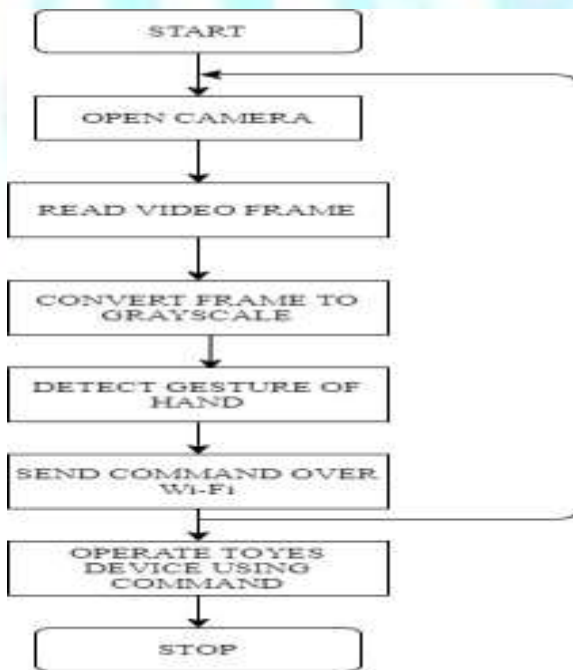


Figure 3. Flowchart of hand gesture recognition

By referring to the flowchart in Figure 3, generating a Python file for both simulating and hardware prototype can be implemented. The

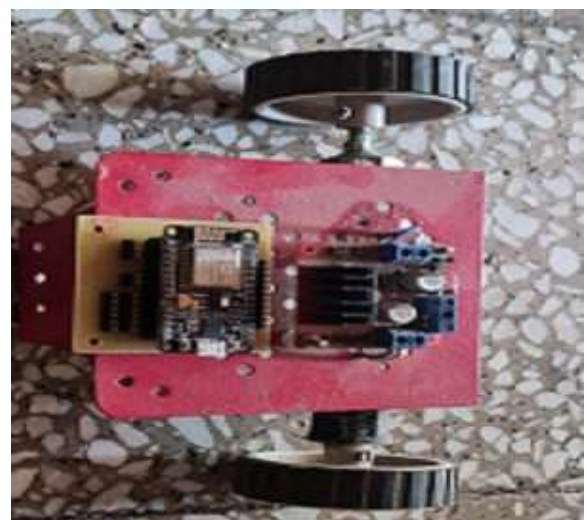


Figure 4. Toy Robot

IV. Results

The explanation of the results will be focused on the simulation part since the different for the hardware implementation is the source code of the real-time input video. These results are analyzed throughout the project scope. The proposed hand gesture recognition requires a webcam to capture the user's gesture, preferably with clear background. The test is done under normal lighting, the system can recognize and track the user's hand movement. The segmentation process is able to detect user's movement and count the contours. Each signal differentiates using different ROI.

Conclusion

The proposed system is based on programming languages-based image recognition which will identify the gestures of user and after identification this gesture can be used in multiple applications like controlling the multimedia player in which we can control the volume zoom are we can see the playback of this multimedia. Also, where connecting one external device which microcontroller based which can receive the commands from the computer and can be used to control any other devices or can be coupled with the television to control the channels as well as the volume on the television. So, this is team will be useful for all the peoples not only controlling the computer as well as controlling the external devices using the simple plug and play device. Lots of research and literature are present, Literature survey regarding to this topic is completed.

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