

# HAND GESTURE RECOGNITION FOR WEBCAM APPLICATION BASED ON DESKTOP

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## Abstract

Automatic picture taking has always been an inconvenience in daily life. When people want to take a group picture or take a picture from far distance and there is no one around to help, the webcam operator needs to set the timer on the webcam and quickly run into the view of the picture to be taken. If multiple shots are wanted, the camera operator will have to make multiple trips back to the camera, which is very troublesome. Some webcams support remotely controlled picture taking, but it is not convenience. Thus, it is very desirable to have more efficient webcam application with automatic commands. HanGestCam is webcam application based on desktop with hand gesture recognition feature. The purpose of this application is to minimize physical contact between user and the computer. The main feature of this application is to capture image with hand gesture recognition. This application uses the EmguCV library that implements the Skin Color detection method for the hand gesture recognition. This application makes the user to control the webcam commands easier.

*Keywords : hand gesture recognition, webcam, picture*

## 1. Introduction

In human computer interaction, keyboards, mice, joysticks etc are most commonly used devices for designing interactive applications. The disadvantage of the above devices is the absence of flexibility due to different spatial limitations. The interactive applications deals with interaction with different devices in a dynamic environment, therefore it becomes difficult for user to use mouse and keyboards which generated different limitations for interaction.

Computer vision based technique provides a solution for interaction in dynamic environment which uses one or more webcams and cameras for capturing users hand and body gestures and further processes and analyzes to generate abmeaningful command or vocabulary. This vision based technique helps in acquiring the user gestures in an easier manner which will play as an input for different interactive applications.

There are many webcam applications for computer, but there are no webcam applications that use hand gesture to capture the image. Nowadays, people use the webcam to capture their own picture either it is own self picture

or group picture. Sometimes people who use webcam to take group picture and there is no one who could press the capture button or the webcam application does not have timer in it. In this research, the webcam is using hand gesture as the capture command. If there is no one who could press the capture button, the picture taking can be done automatically by using hand gesture.

The primary step in gesture recognition systems is the detection of hands and the segmentation of the corresponding image regions. This segmentation is crucial because it isolates the task-relevant data from the image background [3].

The characteristic shape of hands has been utilized to detect them in images in multiple ways. Much information can be obtained by just extracting the contours of objects in the image. If correctly detected, the contour represents the shape of the hand and is therefore not directly dependent on viewpoint, skin color and illumination. On the other hand, the expressive power of 2D shape can be hindered by occlusions or degenerate viewpoints. In the general case, contour extraction that is based on edge detection results in a large number of edges that belong to the hands but also to irrelevant background objects. Therefore,

sophisticated post-processing approaches are required to increase the reliability of such an approach. In this spirit, edges are often combined with (skin-)color and background subtraction/motion cues.

In order to segment the hand in the image from the background, it is needed to detect the skin color. Skin-colour detection aims at determining whether a colour pixel has the colour of human skin or not. This type of classification should overcome difficulties such as different skin tones (white, pink, yellow, brown and black), scene illuminations and the fact that background pixels can have the same colour as skin [4]. The problem of the RGB color space is that it does not provide the correct information about skin color due to the problem of luminance effects[2].

Many algorithms have been used to track, detect and recognize hand gesture, such as Skin Color Detection and Haar Cascade Classifier. In comparison to the other algorithm, the Skin Color Detection algorithm, in which tend to be more easy to be implemented will be used as the basic for hand recognition in this research.

The purposes of creating this application:

- Create a webcam application that is effective to use when users want to take photo from far distance or take group photo.
- Create a webcam application that the commands can be controlled by hand gesture.

### 2. Methodology

In order to develop the application, the methodology that is used is Rapid Application Development (RAD). "Rapid application development (RAD) is a software development methodology, which involves iterative development and the construction of prototypes." This is accomplished by focusing on streamlining the build process, called the "development cycle." The RAD system is split into four separate phases: Requirements Planning, User Design, Construction and Implementation [1].

### 3. Discussion

HanGestCam Application is intended to help the user taking picture automatically by using hand gesture recognition in webcam. This application will run on desktop by using webcam and hand gesture recognition to make the application take the picture automatically. The use-case diagram of HanGestCam is shown in Figure 3.1.

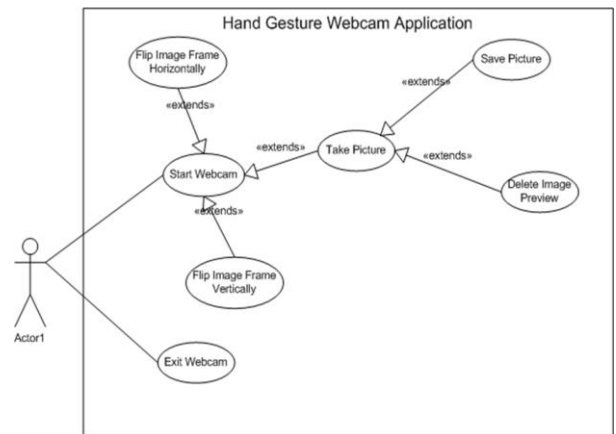


Figure 3.1. Use-Case Diagram of HanGestCam

As shown in Figure 3.1. There are one actor and seven use-cases. The actor is the user who using the HanGestCam Application. There are several actions that can be done by user, which are taking a picture with hand gesture recognition, set picture size, save and discard picture.

The activity diagram for taking a picture is shown in Figure 3.2 where after the user starts the program and camera is already on, user showing hand gesture number five in front of webcam,, system will start tracking the hand gesture number five, if there is hand detected, system will recognize the hand and start counting the finger number that is detected, if it succeed recognizing hand number five it will automatically capture the image. If there is no hand detected system will keep tracking the hand and count the finger number.

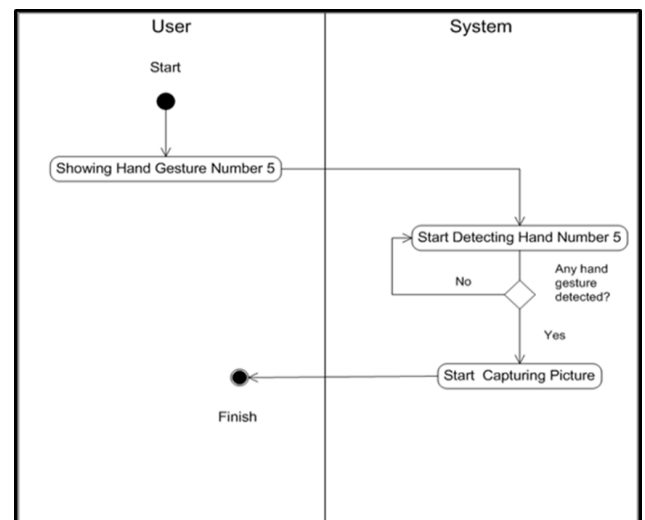


Figure 3.2. Activity Diagram for Taking a Picture

If the user showing hand gesture number four in front of webcam, system starts detecting hand gesture number

four, if there is hand detected, system will recognize the hand and automatically capture the image. If there is no hand gesture detected system will keep tracking the hand. After image has been taken, system will start detecting hand gesture again, and if there is hand detected, system will recognize the hand and automatically save the image, the activity for saving a picture is shown in Figure 3.3.

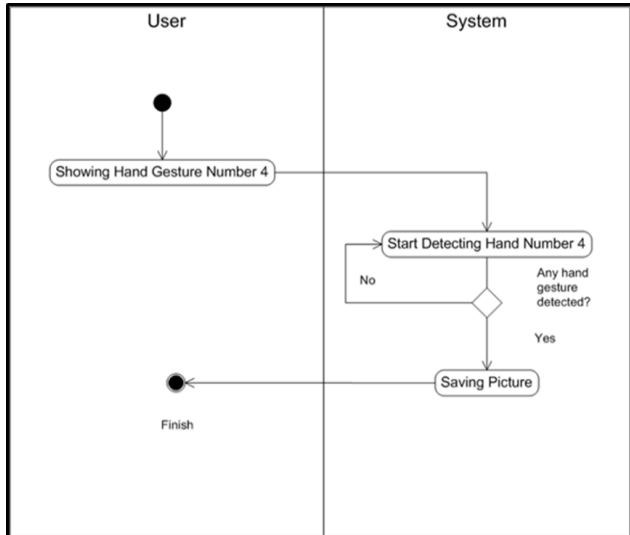


Figure 3.3. Activity Diagram for Saving a Picture

For deleting image preview, the user showing hand gesture number three in front of webcam, then system start detecting hand gesture, if there is hand gesture detected, system will recognize the hand and will delete the image preview, if the user deletes the image preview, the image preview of the image that is already taken is disappear from the image preview box. The activity diagram for deleting image preview is shown in Figure 3.4.

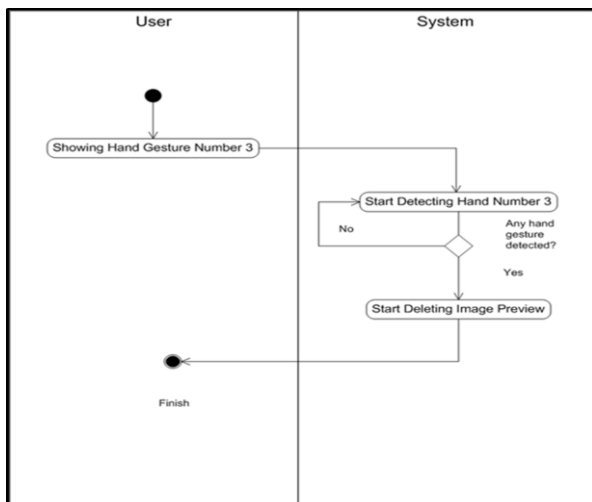


Figure 3.4. Activity Diagram for Deleting Image Preview

In order to flip image horizontally, user showing hand gesture number two in front of webcam, system starts detecting hand gesture number two, if there is hand detected, system will recognize the hand gestures and count the finger number to flip the image horizontally. To flip the image horizontally is finger number two. While to flip image vertically, user showing hand gesture number one in front of webcam, system starts detecting hand gesture number one, if there is hand detected, system will recognize the hand gestures and count the finger number to flip the image vertically. To flip the image vertically is number one.

The interface design in HanGestCam will contain one window. The window contain main menu window. Main menu window is the main window of this application. The main menu window contains of some menu. The menus are: Webcam Frame Box, Image Preview Box, Application Features Panel, capture button and save button.

Figure 3.5 shows the main menu interface. When user start the application the webcam is already on and the system will search for the hand contour to detect and recognize hand gesture. In the main menu window there are webcam frame, save button and delete image preview button, image preview box and application's features description box.

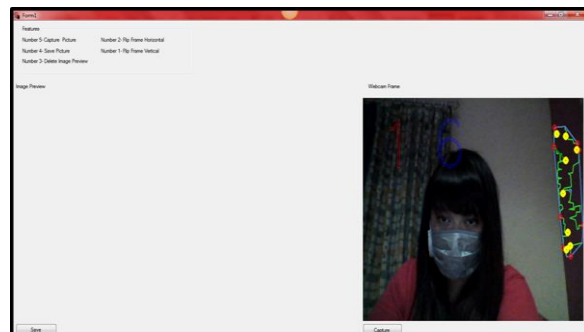


Figure 3.5. The Main Menu Window

Figure 3.6 shows the webcam frame display on the application. Webcam frame is the streaming of the webcam.

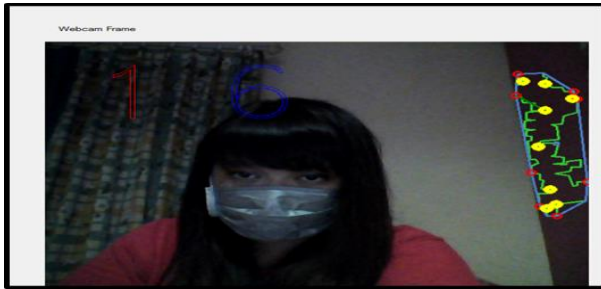


Figure 3.6. Current Frame(Webcam Frame)

Figure 3.7 shows the result of the finger number that is detected by the system after it is converted to string, for example Figure 3.6 shows that hand gesture number one is being detected, so number one is shown in the webcam streaming frame.



Figure 3.7. Finger Number

Figure 3.8 shows the timer that counts finger number, for example in Figure 3.6 the timer is count the finger that is detected until 6 seconds, so number six is being displayed in the webcam streaming



Figure 3.8. Timer

Figure 3.9 shows the panel of application features description.



Figure 3.9. Application Features

Image preview box is null when there is no picture that is being taken. If there is a picture in the image preview box, the image will be converted into bitmap and will be saved as jpeg format.

In Figure 3.10, the image preview box is showing the image preview of the image that is already taken by the user from the webcam. If user already take a picture, the image preview box is not blank because user already take a picture from the webcam.

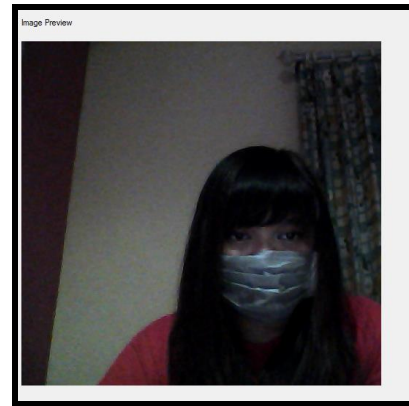


Figure 3.10. Image Preview Box(After Captured)

After user has taken a picture, the image box will show the image preview of the picture that has been taken by user. If the user already save the image, notify icon will appear in the taskbar

Figure 3.11 shows the folder of the image storage, after the user already save the image, there will be image file with the name of the date and time the picture was taken, for example in Figure 3.10 the image file name is Apr21025.

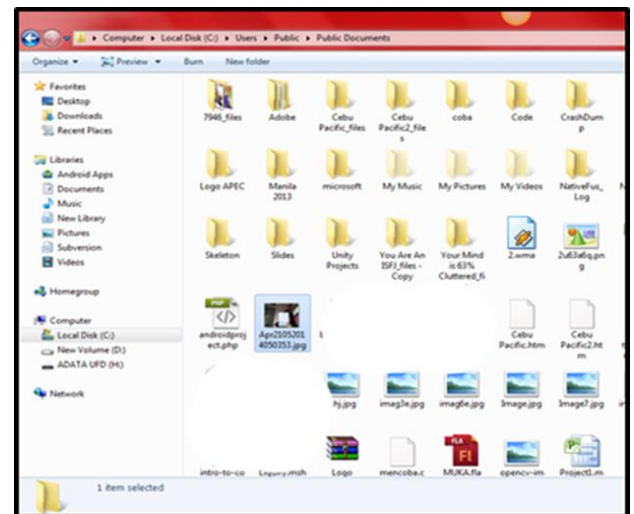


Figure 3.11. After Save Folder

Save File Dialog will appear if the user click the save button, image will be saved as JPEG format.

The HanGestCam project is evaluated for its performance in the hand gesture recognition. The performance evaluation will check if the application could recognize each number of fingers from the hand gesture recognition properly and track the hand gesture to be recognized by the system. However, the application performance has dependency on the user's hand and the environment. Table 3.1 explains the performance evaluation and its result.

**Table 3.1** Performance Evaluation Scenario

No	Scenario	Expected Result	Evaluation
1	Hand Gesture-Finger Shape Number 1	Flip image frame vertically	Work properly
2	Hand Gesture-Finger Shape Number 2	Flip image frame horizontally	Work properly
3	Hand Gesture-Finger Shape Number 3	Deletee image preview	Work properly
4	Hand Gesture-Finger Shape Number 4	Save image	Work properly
5	Hand Gesture-Finger Shape Number 5	Capture image	Work properly

[2] Mykyta Kovalenko, Svetlana Antoshchuk, Juergen Sieck, “Real Time Hand Tracking and Gesture Recognition using Semantic-Probabilistic Network”, 2014 UKSim-AMSS 16th International Conference on Computer Modelling and Simulation, Vol. 15 No.4, 2014

[3] Rios-Soria ,David J. , Schaeffer, Satu E. . Garza-Villarreal, Sara E. Hand recognition. IEEE Journal Hand-gesture recognition using computer-vision techniques.

[4] Y. Tayal, R. Lamba and S. Padhee, “Automatic Face Detection Using Color Based Segmentation,” International Journal of Scientific and Research Publications, Volume 2, Issue 6, June 2012 Edition.

**4. Conclusions**

HanGestCam Application is a desktop based webcam application. This application is built under the C# framework as a desktop application. This application can run without dependency with internet connection. This application can detect hand gestures to operate some webcam commands, which are:

- User can take picture automatically, with the system detect the hand gesture and recognize the finger number five to take the picture automatically.
- User can save the picture automatically, with the system detect hand gesture and recognize the finger number four to save the picture automatically.
- User can delete the image preview automatically, with the system detect hand gesture and recognize the finger number three to delete the image preview automatically.
- User can flip the image frame horizontally, with the system detect hand gesture and recognize the finger number two to flip the image frame horizontally.
- User can flip the image frame vertically, with the system detect hand gesture and recognize the finger number one to flip the image frame vertically.

This application can run at its best state when:

- User takes picture with clear background.
- The background color is white.
- The background lighting is not too bright.
- The distance between the user and webcam is around 1 meter.

**References**

[1] Aries, Benjamin. RAD Life Cycle Model, Retrieved November 15, 2013, from ehow.com: [http://www.ehow.co.uk/how-does\\_5272396\\_rad-life-cycle-model.html](http://www.ehow.co.uk/how-does_5272396_rad-life-cycle-model.html).