

Dsaa End-Evaluation

Final Report (Analysis)

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Abstract:

Virtual Mouse, is an execution of known phenomenon based on the concept of color detection and Hand Action Recognition. In the eld of computer technology development, Virtual Mouse is an idea of implement a user convenient interaction device than a mouse by overcoming the restrictions and enriching the experience of interaction .The main functional aspect of the particular project is to use a regular web cam to sense the movement by the hand on which a colored paper is placed. The cursor is moved as a result of the movement of the color on the nger. A snapshot from the real time video is captured and the flipped image is converted into binary image. The specific color is detected and the gray scale image is converted into binary scale image. The cursor is moved to the centroid of the detected color area. The signal is transmitted between a user and the computer screen by means of the mouse that has been developed by the authors Where the desired instructions are given by means of the movement of the system via the hand of the user and are subsequently recognized by the system and the instruction is executed accordingly. The entire basis of the prototype is to have an interfacing system that would be operating as a mouse which is used in our daily life. But it is in a total new paradigm keeping the convenience and ease of use in context of the user. It is user convenient and low cost prototype.

Keywords—Colour detection, Image acquisition, Image processing, Converting to binary-image.

Introduction:

Nowadays there is rapid development in computer technology, the importance of interaction between computer and human has increased enormously. Nowadays most of the mobile devices are using touch screen technology. However, this technology is still not cheap enough to be used in desktop systems. Creating a virtual human computer interaction device such as mouse or keyboard using a regular web cam and computer vision techniques can be an alternative way for such a requirement. In this report, a color tracking based virtual mouse application has been designed and implemented using a common web cam. The main motivation of the report was to create an object tracking application to interact with the computer, and develop a virtual human computer interaction device.

Most of the researchers in the human computer interaction

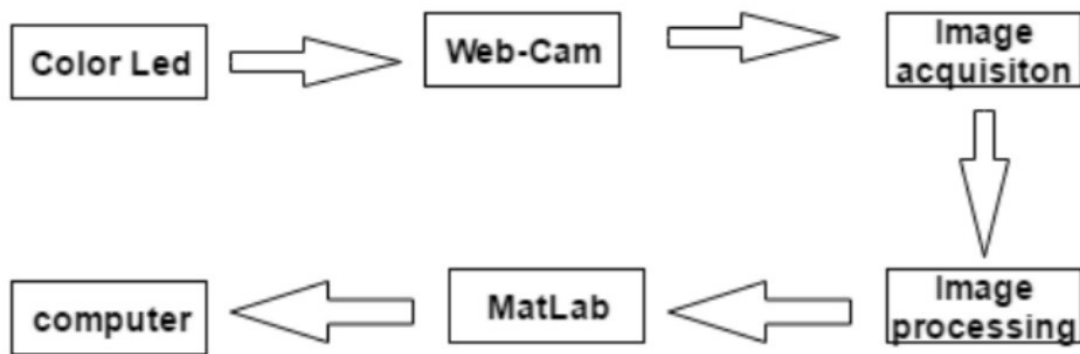


Fig. 1. Block diagram of the proposed virtual mouse and keyboard

and robotics fields have been trying to control mouse movement using video devices. However, there are many different methods to track the clicking event. We used approach of color tracking that is going to control the motion of the mouse cursor. In general methods, click of the mouse button was implemented when a user's hand passed over the region.

Virtual Mouse and Keyboard work on the same phenomenon. In case of virtual mouse, we are marking specific area for mouse pad. If the Red color is detected in those specific co-ordinates, that particular command is given to the computer for that key. In this report, coloured pointers has been used for the object recognition and tracking. Left and the right click events of the mouse along with mouse scrolling been achieved by detecting the allotted colors on the image.

In this report, we are going to use 3 colours Red, Blue and Green. While red color detection points to the mouse cursor and blue color points to the right and left clicks, green color scrolls the page or pages up and down. A specific region is allocated for the mouse pad i.e, coordinates of the mouse pad are noted. So, the virtual mouse will only work in the allocated area. However in our project we simulated the virtual mouse or trackpad.

Painting being one of the applications of this virtual trackpad is also implemented along with virtual trackpad where the end-user is provided option to paint in three different colors creating a whole new experience for users to paint with the movement of their hand without actually touching any device(i/o device).

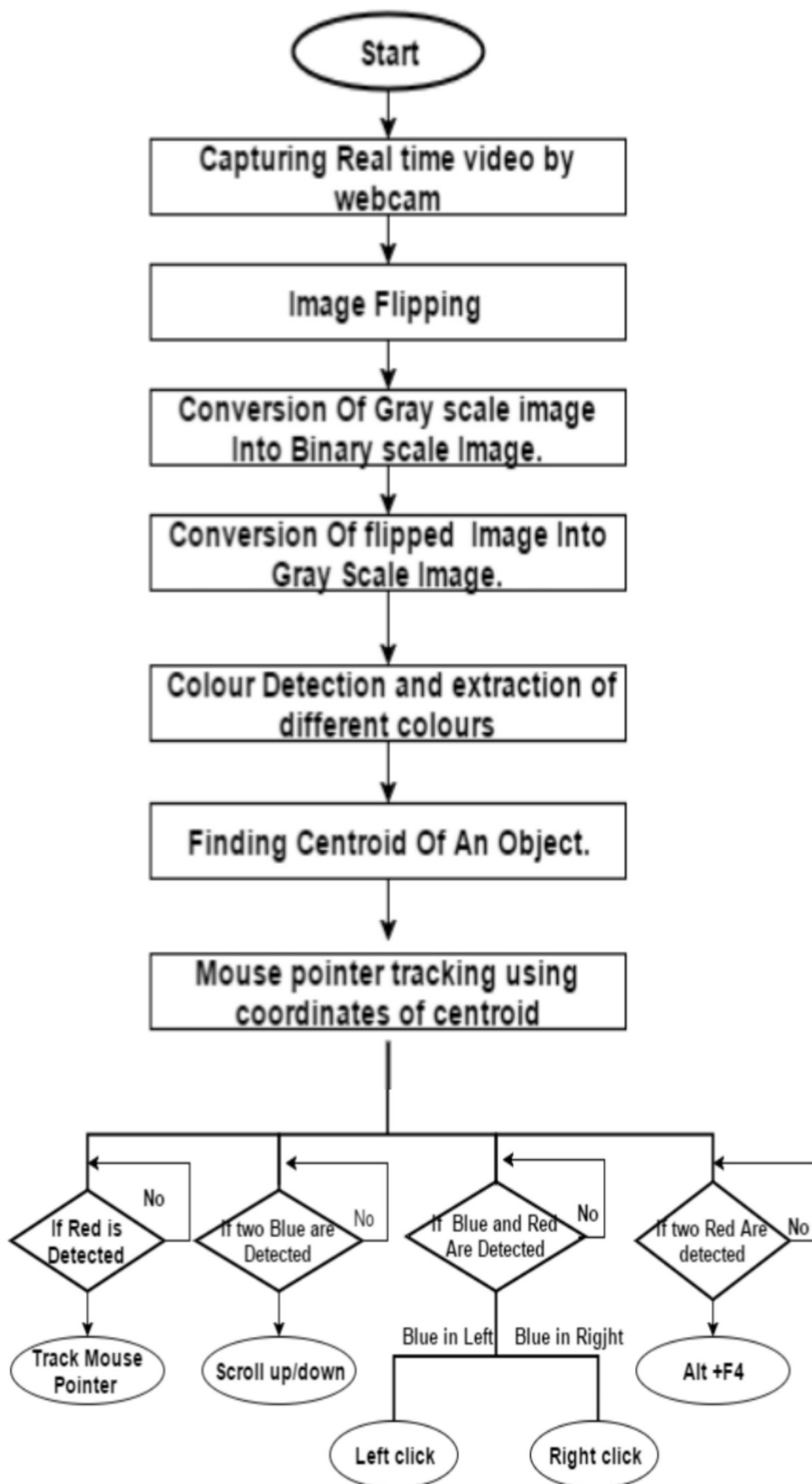
Image acquisition:

Interior structure of object is built in photographic images by using image acquisition. The processing, compression, storage, printing, and display of images are often dealt by image acquisition.

Waves whose attenuation is variable, as they pass through or reflect off objects, that conveys the information that constitutes the image is a classifying factor for digital imaging. The information carried by an image is converted into digital signals that are processed by a computer and outputted as visible image. A portion of visible light spectrum allows digital imaging. Digital imaging is possible for X-rays. For example, radiography, fluoroscope. Digital imaging are also possible for gamma rays.

Image processing:

Image Processing is processing of images using mathematical operations by using any form of signal processing for which the input is an image, a series of images, or a video, such as a photograph or video frame; the output of image processing may be either an image or a set of characteristics or parameters related to the image. Most image-processing techniques involve treating the image as a two-dimensional signal and applying standard signal-processing techniques to it. Images are also processed as three-dimensional signals where the third-dimension being time or the z-axis.

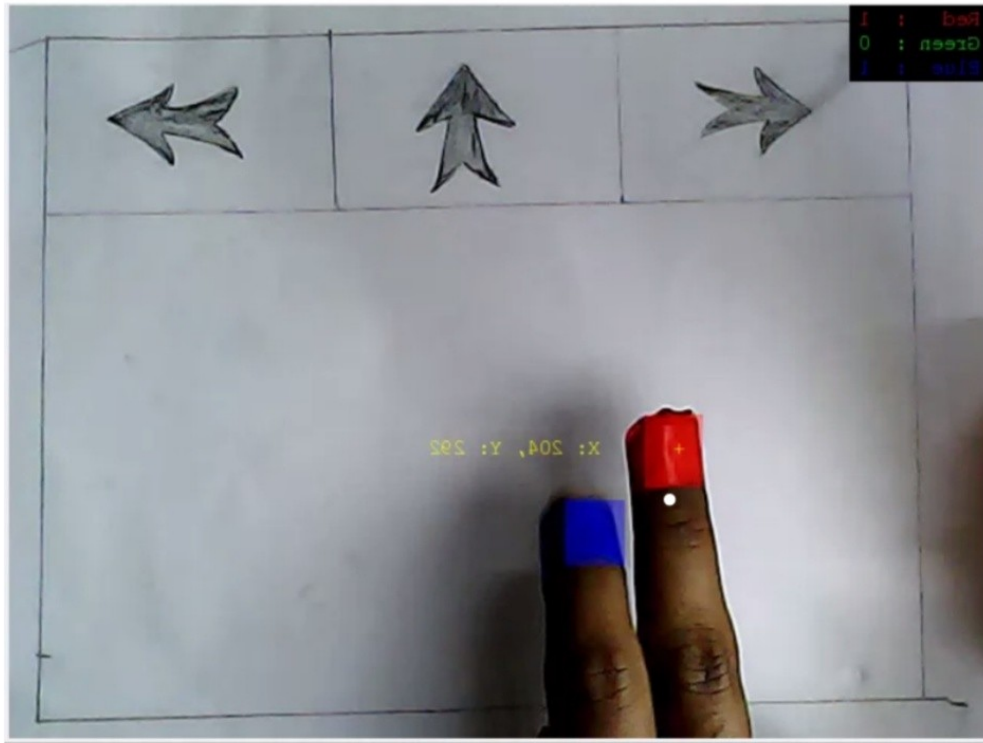


Controlling mouse:

(a) Moving Mouse Cursor:

We are using the movement of red color as the mouse controller to position our mouse cursor along the screen. Red colour will map the cursor to appropriate position and the movement of the colour influences the position of mouse cursor along the screen. We have allotted a specific region on the screen for the movement of the cursor. Image is converted into Grey-scale image and then to binary image. Now centroid of all contiguous areas is calculated and now mouse is moved to centroid of polygon made by centroids. The processing time of each function in algorithm to move cursor, sometime takes more time than it should take in real time. There is also a problem of retrieving red color from background which might cause some distortions in positioning of the mouse cursor. So, we used image enhancement techniques like using a filter to remove noise, sharpen and brighten the image. This makes it better to use in real-time. The below images show moving of mouse pointer with red color and double clicking with one blue pointer.





(b)Right and left clicking :

The movement of the red color defines the movement of the mouse pointer and the occurrence of blue color in the image defines the click. If blue colour is in its bounding box then left click operation happens. If two blue colours are in bounding box, then right click operation happens.

(c)Scrolling up and down:

Detection of 1green color performs the scroll up operation. Detection of 2 green colours performs scroll down operation.Using the Jrobot in matlab we have set up an option for scrolling up and down.Image needs a green contagious objects to enable scrolling option.Scrolling up and and down are dependent on both the current position and previous positions of the green objects. The scrolling operation is acheived through the jrobot and java funcions with arguements as speed value.

Experiments and observations:

TABLE I. EXPERIMENTALLY CALCULATED DELAY VALUES
(A) USERS (B) TIME DELAY FOR LEFT CLICK
(C) TIME DELAY FOR RIGHT CLICK (D) TIME TAKEN FOR CURSOR

(a)Users	(b)Left Clicking in sec	(c)Right Clicking in sec	(d)Cursor in sec
User 1	0.73	0.62	1.10
User 2	0.56	0.59	0.92
User 3	0.81	0.69	1.30
User 4	0.91	1.01	0.95
User 5	0.64	1.13	0.76
Average	0.73	0.80	1.006

(a)Experiment – 1: (Delay Values)

We are evaluating the performance of designed mouse by calculating the delay time for a particular operation. We have tested it in a few aspects. In first aspect we measure the time taken by the cursor to reach top left corner to bottom right corner. In the second aspect time required to show the drop down menu after clicking the icon is noted that is time taken for a left click. In the third aspect, time taken to open a folder that is time taken for a right click.

(b)Experiment – 2: (Rate of clicks)

We are evaluating the performance of designed mouse by calculating the number of mouse clicks for a given time. In this experiment number of keyboard strokes in 10 seconds is calculated repeatedly for five times. Through the result obtained, average number of mouse clicks in 10 seconds is 8.

Discussions:

In the above report, we discussed the working of the virtual mouse along with its functionalities and painting using it where the user was provided the option to paint in three colors namely red, blue and green.

The delay time vary slightly from one user to other. The delay time may vary from one system to another system also because it might run slower on some of the certain Desktops or Laptops with low specifications such as the computational capabilities. This delay time is because it a lot of complex calculations will involve in a small amount of time. However, a standard computer or desktop has minimum computational requirements, the delay time may be decreased slightly.

Applications:

This project aims to increase human computer interaction. It has huge scope in gaming. The gaming industry is moving towards gestures and movement to control characters in games. Also, this brings ease to the user in performing day to day operations like scrolling up/down, painting.

One of the applications of this trackpad being able to paint without actually touching any input output device is being implemented successfully in our project with only problem being limitation of color (only 3 colors used). precision of pointer is **circle of 0.1 cm diameter**.

Main findings of the project:

The scrolling functions were implemented using the java libraries and this project provided the chance for us to explore and learn about them.

Increased accuracy and decreased response time as compared to existing codes by changing the structure of algorithm and improvising it.

Using the available functions in a more efficient way using jrobot and other java functions.

Painting in multiple colors (3 for now) and providing user the choice of color he wants to paint in.

The analysis of the results have been provided in the tables above indicating various response times for various functions of virtual trackpad.

Difficulties faced during working on project:

We couldnt initially move the mouse pointer in the second half of computer screen due to code compatibility and resolution issues on our computers and this took us a while to solve the issues with thorough lookup on some sites and help from ta and professor.we presented this as our work for first evaluation and left click functionality of the mouse.

We were given the target to finish the right click functionality for next evaluation along with corrected version of left click.

We were able to finish it along with proper response time and good compatibilty in different operating systems. The working of matlab on different operating systems being a problem earlier.

We faced various troubles with scrolling part of code since we werent able to control the scrolling speed. However we were able to decrease it to 1 from 100 and needs further refinement.

For implementing painting using these pointers there was initially a problem with painting using single color and that too pre-defined. We were able to modify it to be used in three different colors according to the choice of the user.This was implemented by taking certain values of code as user input just before initialising the program.

Problems unresolved:

- restarting matlab each time the program is run
- reducing the speed of scroll
- painting with more than three color.(providing end-user the choice of color.)

Summary:

This report concludes by developing a virtual mouse using image processing techniques like object tracking using a camera. Our system is developed in Matlab using image acquisition toolbox. As an object blue,green,red colors are very well detected by the camera. Therefore, motion tracking of the objects worked very well.

We were able to implement the above mentioned functionalities of the mouse along with the implementation of one application(painting).In painting we were able to implement it in three different colors namely red,blue and green.