Interfacing Raspberry Pi With Led to interact with hand gestures in MATLAB: A Research

[1]Maninderpal Singh,[2]Neha,[3]Gagandeep Singh

1-M.tech student,Deptt of ECE;Chandigarh Group of Colleges Technical Campus

2- -M.tech student,Deptt of ECE;Chandigarh Group of Colleges Technical Campus

[1]e-mail:manindersandhu13@gmail.com, 9914898800
[2]email:nehakashyap606@gmail.com

Abstract — In this paper a device named as Raspberry Pi is used which is less expensive, credit-card sized computer that plugs into a computer, monitor or TV and it uses a standard keyboard and mouse. Raspberry Pi board is also called system on chip. This research aims to provide a remote free approach to control a LED by allowing the user to interact in a more natural way by using hand gestures with the help of raspberry pi. Gestures are processed using image processing and data acquisition toolbox.

Keywords-Raspberry Pie, Models , Detection ,Gestures, Normalized, GPIO, LINUX

1) INTRODUCTION

The **Raspberry Pi** is a small-sized single-board computer developed using Raspberry Pi in UK. Whose purpose is to support the teaching of basic computer science in schools . The Raspberry Pi has a Broadcom BCM2835 system on a chip (SoC), which has an ARM1176JZF-S 700 MHz processor, Video Core IV GPU and was originally shipped with 256 megabytes of RAM, later improved (Model B & Model B+) to 512 MB. It does not include a built-in hard disk . It has SD card which is used for booting and continous storage, with Model B+ using a Micro SD card. Raspberry Pi behaves as a computer. It has different kind of processor in it, so Microsoft Windows can't install on it. Instead of Microsoft Windows, we install number of versions of Linux operating system seems like Microsoft Windows. Internet surfing is also done using raspberry Pi and also we can send an email and many more. It is easy to use, robust, reasonable, the Raspberry Pi is the ideal tool for pursuing computer scientists.[1]

1.1) Models-The Raspberry Pi is available in three editions:

The Model A
The Model B
The Model B[+]

Named for the differing editions of the classic BBC Micro from British computing giant Acorn, the two models differ only in their capabilities: the B has a 10/100M Ethernet jack and two USB ports to the A's single port and lack of any form of on-board networking. For now, only the Model B is being produced. At its heart is a Broadcom BCM2835 system-on-chip processor running at 700MHz, with a Video Core IV GPU running at 250MHz.[1]

MODEL A : Primary model of raspberry-pi. It has maximum two USB ports. It doesn't have Ethernet port so for having Ethernet connection, but there is a need of USB cable with Ethernet connector. So, It is not much efficient.

MODEL B : Secondary model of raspberry-pi. It has 4 USB ports, and also have Ethernet port. It has audio out port but do not have video out port. It is costlier than MODEL A.

MODEL B+ : Tertiary model of raspberry-pi. It also contains 4 USB ports and do have a Ethernet port. It contains both audio out and video out port. It is costlier than the above two. MODEL B+ is used in this project.[1]

1.2) Specifications-
Table no.1: specifications of raspberry pi [1]

	MODEL A	MODEL B	MODEL B+
Memory(SDRAM)	256 MB	512 MB	512 MB
Power Ratings	300 mA	700mA	600 Ma
Power Source	5 v via micro USB	5 v via micro USB	5 v via micro USB
Size	85.60 mm x 56 mm		

1.3) Colored Object Tracking -

As we know that colored object is easier to track than a hand, the different algorithms were applied on color objects. This object was detected in the live video stream by using color detection eg. Red color and the direction of its motion was determined with the help of raspberry pie board. The algorithm used to detect colored objects and estimate their direction of motion is discussed below in flow chart.

1.3.1) Color Detection-

As the frames came from the webcam were in RGB format. These RGB values were converted to normalized RGB form to remove the effects caused because of varying light intensities coming from different areas of the same object. This color scheme is used for further calculations in this paper due to the same reason. The conversion of RGB values to their normalized form was carried out by using the following formulae:

$r = R / (R+G+B).$ (1)

$g = G / (R+G+B).$ (2)

$b = B / (R+G+B).$ (3)

where r, g, b are normalized RGB color coefficients. The normalized frames were searched for the particular color and based on a threshold value, binary images were formed with white pixels indicating the presence of the object.

1.3.2) Direction Estimation- Direction estimation is done using a simple yet effective method using the board. In this method, the object moving in a certain direction if in eight successive frames acquired, the object's centroid moves in the same direction continuously and shows in a particular spatial window. For example, suppose the centroid moves up continuously in eight successive frames and lands at a particular distance above the initial location with a small amount of horizontal movement, then, the direction of motion is taken to be upwards.

1.3.3) Hand Detection- In order to calculate the differences between two images, background removal technique is used, one of which is a stationary background.   Only the object present in the foreground is detected and the stationary background gets cancelled off. A background image is captured in the beginning for this purpose. Skin regions are segmented in this image by using the skin color that is already determined. This results in a skin segmented binary background image. After this process is complete, a combination of skin segmentation and background removal schemes is applied to the images acquired to detect the presence of hand. For this, a binary image is constructed, for every image acquired, with the white pixels representing the presence of skin color. Every such binary image is subtracted from the original skin segmented binary image. The absolute difference in the two images is taken to be the final binary image representing the hand. Skin segmentation helps in detecting the errors due to motion of any other colored object in view while background removal helps in detecting moving objects only.[2]
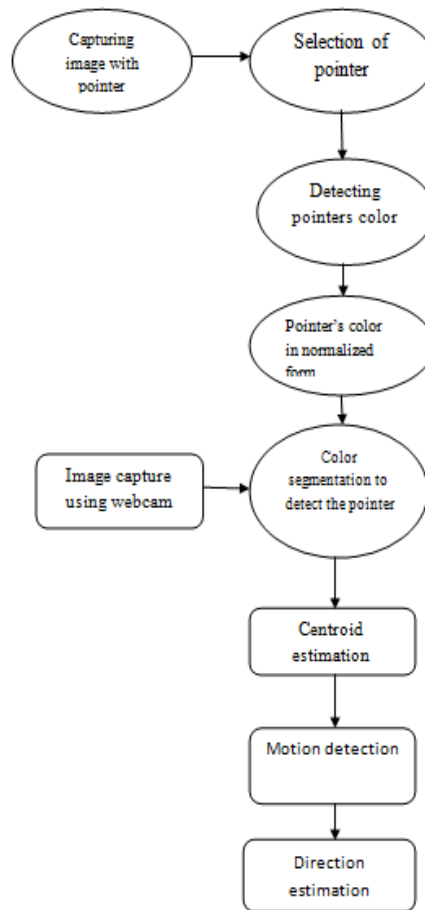
Fig-1: Systematic block diagram showing procedure for gesture recognition.

2.RESEARCH MEHODOLOGY

Step 1- Install SD card formatter in raspberry pie.

Step 2 –Connect cable and display .

Step 3 – Install raspberry pie hardware.

Step 4- Install webcam.

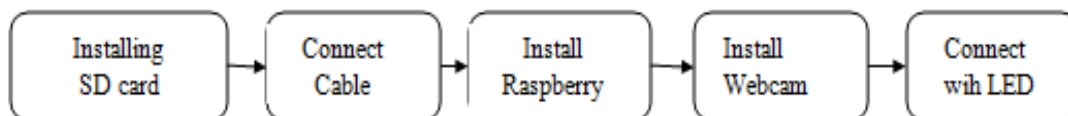**Step 5** – GPIO pin used to connect LED .

Fig 2: Research methodology used shown in 'appendix-A'

4. RESULTS

 LED'S are glowing by showing the gestures using raspberry pi as interfacing with matlab. This research aims to provide a remote free approach to control a LED by allowing the user to interact in a more natural way by using hand gestures with the help of raspberry pi. Gestures are processed using image processing and data acquisition toolbox.

5. CONCLUSION

Raspberry pi interfacing with led shall be used as wearable technology. It is remote free approach to control a LED set by allowing the user to interact in a more natural way by using hand gestures with the help of **raspberry pi** and also used in number of operations in our daily life like. We should lock or unlock the car door with simply wearing this device using gestures. Control music player with gestures. Playing games with   gestures. Useful   technology for blind persons. Camera controlling using gestures.

REFRENCES:

[1] Raspberry_ pi_ educational manual.pdf

[2] Saranya.K.C *, Sachin Kumar, Shubham Bajpai, Chaitanya Goel and Sukanya.K.C "Real Time Control of a Television Set Using Hand Gesture Recognition" International Journal of Applied Engineering Research, ISSN 0973-4562, Vol. 8, No. 19 (2013)