Raspberry Pi Based Color Speaker

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ABSTRACT : *This paper describes the design and implementation of the image processing based color speaking system using Raspberry Pi and USB Camera. This design is a minimized electronic gadget which identifies the color of an object image and speaks out the corresponding color. The model uses hardware components such as Raspberry Pi (Model B) and USB webcam. Matlab Simulink tool boxes are used to implement the project. The proposed gadget works in standalone mode without the necessity of PC once programmed. We used rapid prototype technique approach of image processing for real-time application using Matlab Simulink support package meant for Raspberry PI.*

Keywords - *Raspberry Pi, Image processing, Color Speaker, Real time application, colorblindness, Matlab, Simulink, assistive technology, visually impaired.*

I. INTRODUCTION

Throughout the world, there are many people who are visually impaired. Especially in India there are many people who are blind and many people are color blind. Braille is the script which was developed in the 19th century for the blind people for reading and writing text in the books. But this method cannot identify the color of an object. Identifying the color of an object is very important because, color indicates the status of objects especially objects and fruits. All the personal gadgets and home appliances are indicated through the bicolor led's Red & Green. Color vision is very much important in everyday tasks, such as driving a car, choosing the cloths. People with this deficiency face many problems in school or at work. Color vision deficiency may cause the loss to many career opportunities like color painting, color photography, multimedia jobs etc.. because, color plays vital role , for these jobs People with abnormal color vision can even be dangerous in certain situations such as rail and water navigation. For this reasons, person with color vision defects are excluded by from certain occupations.

To identify the color of those indicators we need some electronic gadget which can identify color and speak out. Although some of the developed countries have designed such type of gadgets, but it is not affordable to all people in the India. India is a multilingual country which has 13 official languages and many unofficial languages. The main purpose of this paper is to develop such small electronic device that identifies the color of an object and which offers low cost and easy to implement in hardware. This will be useful for the blind and color vision people. We use the Raspberry Pi (Model B) and USB Web cam which is available in markets, and interfacing between them is done. Image processing algorithms are implemented in Mat lab Simulink software. This type of paper can be used for Localization purpose. The main advantages of this paper are 1) Small size gadget, 2) low power consumption, 3) low cost and flexible designed.

II. LITERATURE SURVEY

The color identification system has been widely enforced in many fields and in various approaches. In [1] Alfa sheffildi Manaf implemented the technique for recognition of the color of an object by using the fingure interaction. This system was developed in specific operating system windows embedded system 2009.He used thresholding method for skin clustering and point to sound reality feature which provides direct interaction with fingure interaction between user and color object. Several software's like .net framework and open CV library are used to determine color. [2] Mr. Neel Kabirpanthi had approached in different way by using sensors and microcontrollers and speech chip. In his approach he used the color sensors of TRSX77 and some photodiodes. The functionality of these diodes works on principle of reflection of light. He had developed software by using the ANSI 'C' language. Xiaodong Yang [3] developed a clothing pattern recognition system for visually challenged people. In this approach camera capturing of the image, microphone and a computer and Bluetooth headphones as the hardware layers. They used Radon transform, discrete wavelet transforms, and SIFT methods for identification of clothing patterns and he used normalized color histogram method for the detection of colors, based on saturation and intensity of pixels in an image. Zhi-Song Qin1 [4] proposed the color identification system by using the TCS230 color sensor which is a programmable light – to frequency sensor. They implemented high quality algorithm using the embedded c program to identify the RGB colors and displayed on LCD This system includes automated LED sorting in industrial applications for the visually impaired

people.[5] Worked on the neural network model for determination of the color recognition of the ripeness of the banana. Three steps are used to approach this system. In preprocessing stage banana image is captured and some heuristic and histogram methods are used for the feature extraction. Artificial neural networks are applied for determination of color. The input form in this neural network model is performed by using the Matlab software. Kim, Xiaoli Yang [6] used computer vision method of recognition of traffic light system for color blind people. This method uses camera and PC which helped in detection and tracking colors of the traffic lights. This method uses thresholding algorithm and median filters and RGB component adjustment for identification of traffic lights. [7] Explains the development of color blind aid system using image processing techniques augmented reality technologies.

III. IMPLEMENTATION

The proposed work is Real time color detection of an object by using Raspberry pi and USB Webcam. The main objective of this research is to identify the color of an object image and to correspondingly speak out the color. Firstly the object image is captured by using a USB webcam. Then the image processing algorithms are implemented to identify the color and sound the color of an object with the help of speakers. In this methodology we have made an unique arrangement in the form of a cone, so that the camera is fixed to it and also fixed some standard reference color on a sheet of paper and fitted to that cone, so that when an object is captured from the Polaroid correspondingly it captures the reference colors, so that it compares object color with reference colors and detect the color of an object as per the program written in the software implementation.

Implementation of the proposed work is done in two steps

A. Hardware Implementation.
B. Software Implementation

A. Hardware Implementation

The implementation of the system hardware consists of mainly four parts. Raspberry Pi, USB camera, Power supply, Audio speakers. The following figure shows the block diagram of the proposed work.

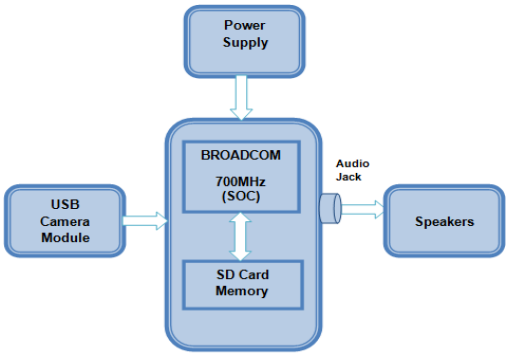


Fig .1. Block diagram

1. Raspberry Pi (Model B)

The design of this paper uses Raspberry PI. It is a mini computer that is designed in single board with all the essential peripherals required for running an operating system. [8][9] It is based on a Broadcom BCM2835 System on chip which includes ARM1176JZF-yS 700 MHz processor as its core and it was initially with 256 MB of RAM, and later upgraded to 512MB. It does not have a built-in hard disk or solid-state drive; instead it uses an SD card for booting and long-term storage.

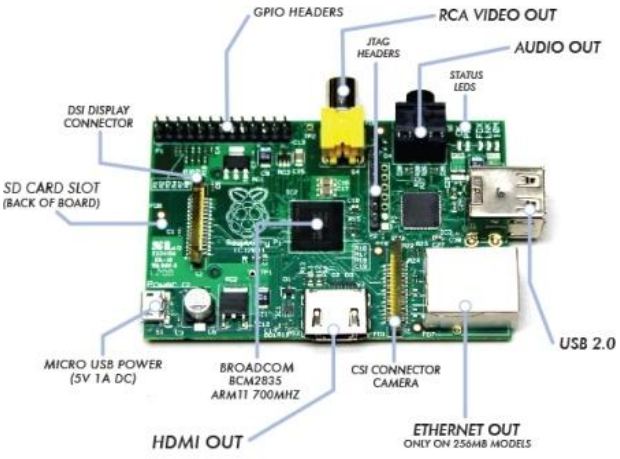


Fig. 2. Raspberry PI Model B

This board is equipped with a wide variety of connectors, interfaces and ports and has rich resources, USB 2.0 ports, Camera module interface, GPIO, UART, Serial Peripheral Interface Bus, Power supply, Ethernet Port, HDMI, 3.5mm Audio Jack. This RPI comes without a display unit, but it can be used to help of our normal NTSC or HDTV display or PAL standard TV screen. It consists of an Ethernet port which allows Raspberry to be connected to a network. Operating

systems from Mac, Linux and Windows, Raspian, can be loaded in the Raspberry pi.

2. Power Supply

The power supply system for the Raspberry Pi is quite simple. It directly uses 5V power, by using several voltage regulators, this 5V power supply can be reduced to 3.3V, 1.8V and 1.25V.

3. USB Camera

The USB Web cam is the important component in this research work. OD 203 USB webcam is used. This camera consists of a high quality CMOS sensor. It supports up to 25 mega pixels of an image and the frame rate up to 30fps. It also supports video resolution is about 640X480. This Camera Module is attached to the Raspberry Pi to the USB port interface.

B. Software Implementation

Software implementation of this work uses Raspberry Pi, and Matlab software. The programming is developed in Matlab, Simulink which supports the Raspberry Pi packages. The programming is done in two steps.

1. First part includes capturing the image and identifying the isolated blobs of an image for the special calibration by using the image segmentation process.

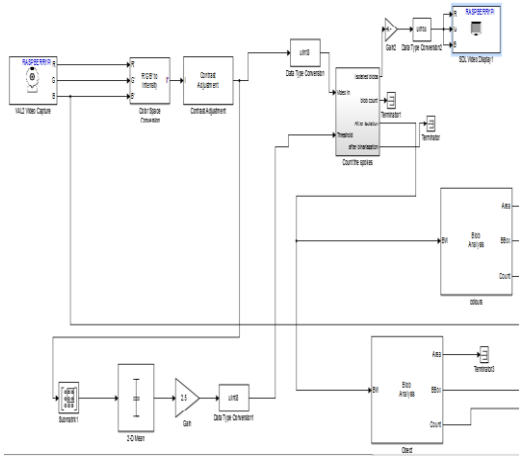


Fig:.4. simulink model for isolating the blobs

2. Secondly by taking the coordinates of isolated blobs and used the weighted Euclidean distance formula for identification of the color of an object.

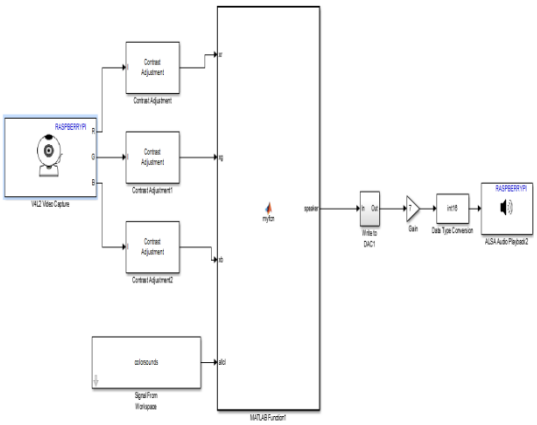
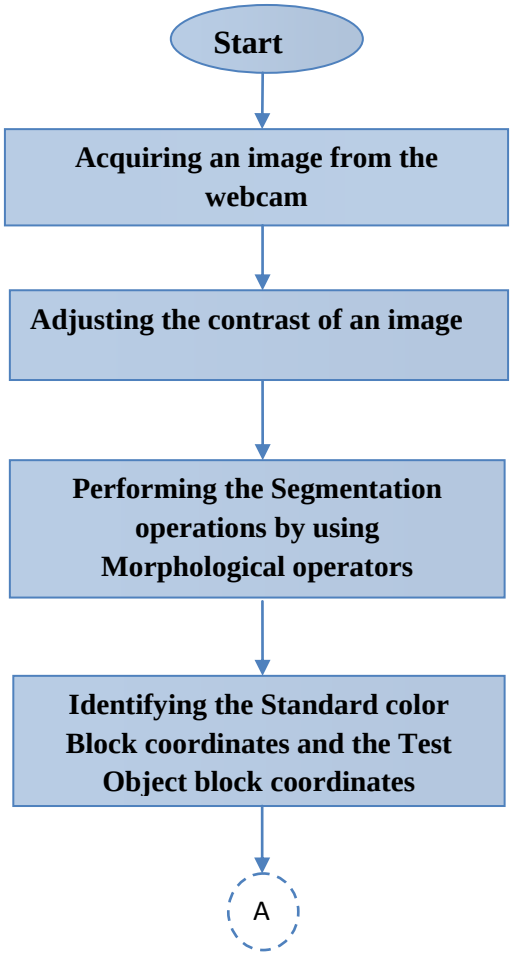
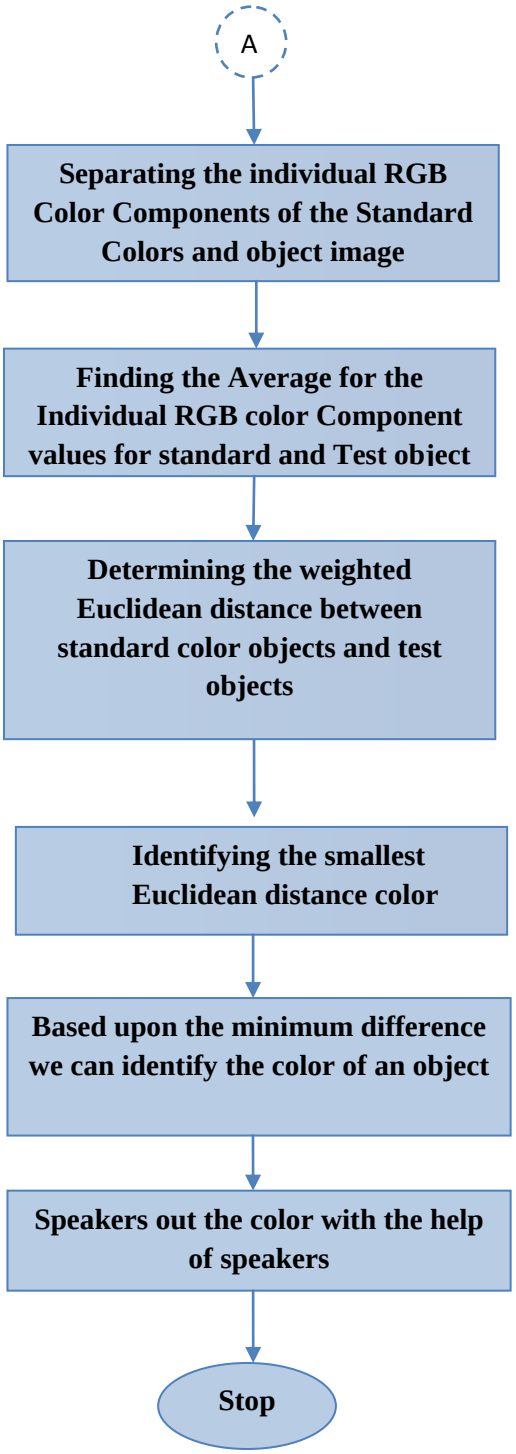


Fig.3. Simulink Model for detecting the color of an object.

C. FlowChart





IV. EXPERIMENTAL RESULTS

The graph below explains the recognition of the colors by taking 25 samples with a time gap of one minute for each color. In this experiment we considered the samples of 8 colors of cloths pieces and tested. The colors Green, Yellow, pink and white colors have given the perfect recognition, i.e. 100% accuracy in the experimental results. But for the Red color, we got 96% of the result. i.e. for 25 times we got 24 times accurate result and onetime as green. For Blue color, we got 22 times as blue and 3 times as cyan, and for black we got 20 times as black and five times as red color. Cyan color gives 20times as cyan, 3times as white and 2times as green. The total experimental values are shown in below table.

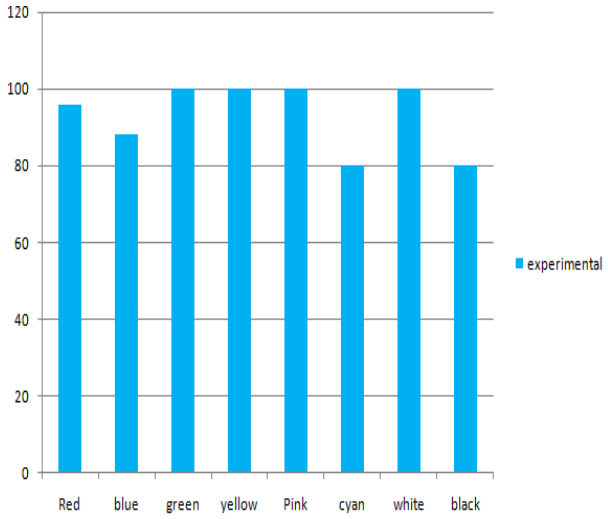


Fig : Recognisation of Color using 25 samples

Colors	Number of attempts								
Actual	Red	Blue	Green	Yellow	Pink	Cyan	White	Black	% accuracy
Red	24							5	96
Blue		22							88
Green	1		25			2			100
Yellow				25					100
Pink					25				100
Cyan		3				20			80
White						3	25		100
Black								20	80

Table.1. Experimental values for the different color samples

V. CONCLUSION

In this Research, we have designed and implemented a Real time Color Speaker using Raspberry Pi. In the previous works they had employed to design using color sensor and micro controllers to indicate the colors of an object. In

this we have designed a novel method to make easy to identify the color of an object image and correspondingly it speaks out an object color. This system works in standalone mode without the necessity of PC, and it is portable, less weight and can be moved easily. Hence, we have reduced the complexity when compared to the previous research. Test was done and satisfied with some standard colors. . Finally, we reasoned that we have designed in a simple way, to execute this research work. Further we are thinking to extend our project with different shades of colors and also to extend with fuzzy logic for optimization purpose and for better realization.

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