

Blood Group Detection By Using Raspberry Pi-3

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Abstract— Determining of blood types is very important during emergency situation before administering a blood transfusion. Presently, these tests are performed manually by technicians, which can lead to human errors. Determination of the blood types in a short period of time and without human errors is very much essential. This paper presents a new methodology for determine blood group by taking image of blood sample contend added chemical such as Anti clonal A, B, D and by processing this image in raspberry pi 3 we can get the blood group. Phenotyping based on Raspberry pi and python 3.5 for detection of blood group using image processing. The image processing techniques such as thresholding and morphological operations are used for the basic operation on the images. By using the standalone system based on the raspberry pi we can easily take the image of blood sample process it and the result will be shown on the LCD. Depending on the agglutination rate we can classify the blood group. Thus, the developed automated method determines the blood type using image processing techniques. The developed method is useful in emergency situation and also used when number of people are large.

Keywords—Anticlonal A,B,D; Raspberry pi-3; Webcam; Opencv 3.3.0; Lcd Display; python 3.5;

i. INTRODUCTION

An ABO incompatibility reaction can occur if you receive the wrong type of blood during a blood transfusion. It's a rare but serious and potentially fatal response to incompatible blood by your immune system. Human error is the most likely cause of an ABO incompatibility reaction. If your transfusion uses the wrong blood type, it could be the result of mislabeled blood, incorrectly completed forms, or a failure to check donated blood before the transfusion. There is a scope for determining blood types using image processing techniques. Image segmentation algorithm for blood type classification and various image processing parameters are analyzed image quantification such as variance, mean value, variance etc. The slide test consists of the mixture of one drop of blood and one drop of reagent, being the result interpreted according to the occurrence or not of agglutination. The combination of the occurrence and nonoccurrence of the agglutination determines the blood type of the patient. Thus, the software developed in image processing techniques allows, through an image captured after the procedure of the slide test detect the occurrence of agglutination and consequently the blood type of the patient. by using the raspberry pi we can show the result on LCD

ii. PHENOTYPING DET ERMINAT ION.

The attainment of human blood transfusion requires compact-ability for the two main Blood group antigen systems, namely ABO and Rh. Blood group is determined, by the presence or absence of three antigens (A, B, O) segregating at a single genetic locus on the surface of red blood cells of Use

The following are the blood samples of various blood groups taken under the microscope after adding the antigens

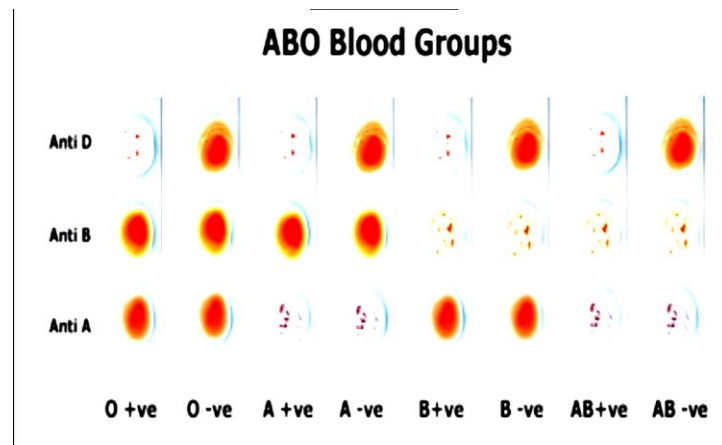


Fig 1. Blood classification table

iii. EXISTING BLOOD GROUP TEST

To work out blood group of a person, red cells of that person are mixed with different antibody solutions. If, for example, the solution contains anti-B antibodies and the person has B antigens on cells, it will clump together. If the blood does not react to any of the anti-A or anti-B antibodies, it is blood group O. A series of tests with different types of antibody can be used to identify blood group. If the person has a blood transfusion, the blood of the person will be tested against a sample of donor cells that contains ABO and RhD antigens. If there is no reaction, donor blood with same ABO and RhD type can be used. It indicates that the blood has reacted with certain antibody and is therefore not compatible with blood containing that kind of antibody. If the blood doesn't agglutinate, it indicates that blood doesn't have antigens binding the special antibody in the reagent. In existing system, blood group is determined manually. In this system, adding solutions such as anti-a, anti-b, anti-d to the three samples of blood took place. After some time, agglutination may or may not occur. Depending upon the agglutination, blood group can be determined by the person manually. Disadvantages of this system are more chances of human errors are possible. Only experts can tell the blood type by seeing at the agglutination process.

iv. PROPOSED SYSTEM

In our proposed system, reagents are mixed with three samples of blood. After sometime, agglutination may or may not occur. After the formation of agglutination, the slide is captured using the raspberry camera module and using raspberry pi-3 module processing of image is carried out such as morphology, thresholding, segmentation, quantification etc. finally result is display on the LCD.

i. Pre-processing techniques

In this system by adding the antinodes in the three-sample of blood .Then the slide is put under the camera and image is capture this image is in color format we need to do some basic operation on the image so that we can get the better image so that this image can be process further .In Raspberry pi terminal we can capture the image with fix size format 1000*500p.The image is taken by the camera is stored and preprocess in Raspberry pi.



Fig4.1. Blood Samples

ii. Thresholding

Image processing includes It includes several functions for image processing. Contrast increase by static or dynamic binarisation, lookup tables or image plane separation. Resolution reduction via binning. Image rotation. An image $f(x,y)$ is composed of light objects on a dark background. This technique is used to extract the light objects from the dark background. It is done by using a threshold value T . Any image point (x, y) at which $f(x,y) > T$ is called an object or foreground point; otherwise, the point is called background point.

The threshold of a binary image is defined as,

$$g(x, y) = \begin{cases} a, & \text{if } f(x, y) > T \\ b, & \text{if } f(x, y) \leq T \end{cases} \dots \dots \dots (1)$$

When T is constant over an entire image, the preceding equation is referred as global thresholding. When the value of T changes over an image, it is called as variable thresholding. The term local or regional thresholding is also used to denote variable thresholding in which the value of T at any point (x,y) in an image depends on properties of neighborhood of (x, y) . If T depends on the spatial coordinates (x, y) themselves, then variable thresholding is often referred as dynamic or adaptive thresholding. Thresholding may be single or multiple. In single thresholding, the image consists of a single light object on a dark background. But in multiple thresholding, image consists of two or more light objects on a dark background. This multiple thresholding method classifies the pixel at (x,y) as belonging to the background if $f(x, y) \leq T1$, to one object class if $T1 \leq f(x, y) \leq T2$ and to the other object class if $f(x, y) \geq T2$.The threshold of a multiple threshold image is given by,

$$g(x, y) = \begin{cases} a & \text{if } f(x, y) > T2 \\ b & \text{if } T1 < f(x, y) \leq T2 \\ c & \text{if } f(x, y) \leq T1 \end{cases} \dots \dots \dots (2)$$



Fig4.2. Threshold image

iii. Segmentation

Segmentation is the process of extracting ROI (region of image) from the image. We need to extract the information form the image so we need to segment the image into three parts.

- a) Image first: - In this blood sample the antinode A is mixed which is shown below

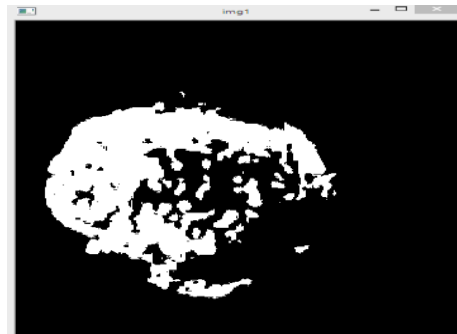


Fig4.3. Sample 1st

- b) Image second: - In this blood sample antinode B is mixed which is shown below



Fig4.4. Sample 2nd

- c) Image third: - In this blood sample antinode D is mixed which is shown below

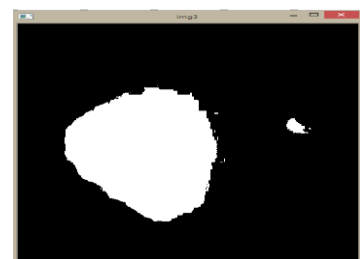


Fig4.5. Sample 3rd

iv. Morphological Operations

Morphology is a tool of extracting image components that are useful in the representation and description of region shape, such as boundaries, skeletons, and the convex hull. In morphological operation, there are two fundamental operations such as dilation and erosion, in terms of the union of an image with translated shape called a structuring element.

This is a fundamental step in extracting objects from an image for subsequent analysis. The fundamental operations in morphological operations can be listed

i. Dilation: -

Dilation is the process that grows or thickens the objects in an image and is known as structuring element. Graphically, structuring elements can be represented either by a matrix of 0s and 1s or as a set of foreground pixels. The dilation of A by B is set considering all the structuring element origin locations where the reflected and translated B overlaps at least one element. It is a convention in image processing that the first operand of AB be the image and the second operand is the structuring element, which usually is much smaller than the image.

ii. Erosion: -

Erosion shrinks or thins objects in binary image. The erosion of A by B is the set of all points z. Here, erosion of A by B is the set of all structuring element origin locations where no part of B overlaps the background of A. In image processing applications, dilation and erosion are used most often in various combinations. An image will undergo a series of dilations and erosions using the same, or sometimes different, structuring elements. The most important combinations of dilation and erosion are opening and closing.

V. SYSTEM DESIGN

i. Raspberry Pi-3 :-

Raspberry Pi board is a miniaturized fascinating computer having ample processing speed and size not bigger than credit card. Incredible things can be done by using it. Firstly, To work with raspberry pi, we need a list of things to get desired operation and functioning.



Fig5.1. Raspberry Pi-3 Module

The main reason of using raspberry pi is the low-cost signal processor or image processor. The cost of other DSP processor is very cost so we need to select the processor which is less cost and also portable so that we can create one standalone system. Following are some content related to raspberry pi :

a. Ethernet port

The traditional way to connect to the internet is via a wire called an Ethernet cable. You'll find a few similar ports like

this at the rear of your router at home that will let you connect the Raspberry Pi directly into it. This method is easier to set up than WiFi and may provide faster internet, but you're then limited by the length of the cable. While doing programming we need to use the ethernet cable to access raspberry pi on laptop or desktop.

b. HDMI port

This is an HDMI port, the kind you'll find on the back of most modern TVs and computer monitors. Use a standard HDMI cable to connect your Raspberry Pi to your chosen screen, to see (and hear) whatever it's doing. You'll definitely need to plug it in to set up the Pi

c. GPIO header

This comprises the general-purpose input/output (GPIO) pins. They're a set of connections that have various functions, but their main one is to allow you to connect to the Raspberry Pi with an electronic circuit. You can then program the Pi to control the circuit and do some amazing things with it

ii. Camera Module

This camera module is used to capture the image of blood sample and it will capture automatically and this image is then stored in raspberry pi and process further.

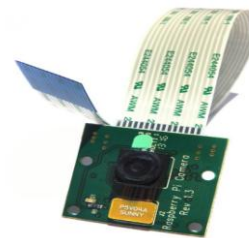


Fig 5.3. Camera Module

iii. LCD 16*2

LCD is used to display the result .it has 2 rows and 16 Column An LCD is an electronic display module which uses liquid crystal to produce a visible image



Fig 5.2. LCD 16*2

VI. SOFTWARE DESIGN

i. Raspbian OS: -

In this R-Pi 3 we install Raspbian stretch operation system .it has many advantage than the Debian operating system. It is free of cost and can be easily install on raspberry pi 3

ii. Installation of OpenCV python 3.3.0: -

Originally an Intel research initiative, OpenCV is a cross-platform open source computer vision library, mostly employed for its real time image processing performance. It aims to provide well tested, optimised, open source implementations of, state of the art image processing and computer vision algorithms. The library is written in C, ensuring fast and portable code, and has been compiled for many embedded platforms. Python is a general-purpose programming language started by Guido van Rossum, which became very popular in short time mainly because of its simplicity and code readability. It enables the programmer to express his ideas in fewer lines of code without reducing any readability.

Following are some snapshot of installation process of OpenCV: -

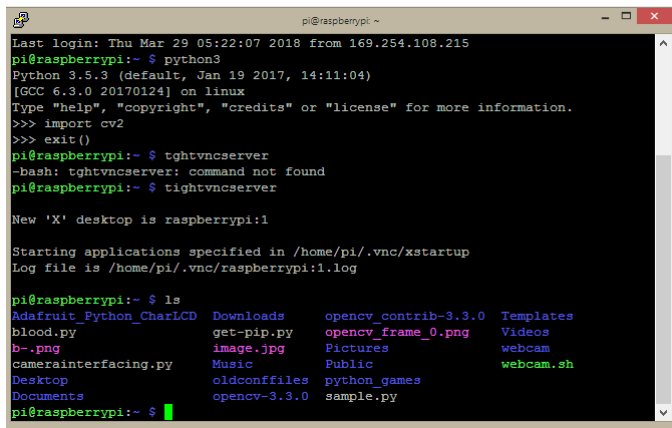


Fig.6.1 OpenCV 3.3.0 installed on Raspberry pi

iii. Python Idle 3.5

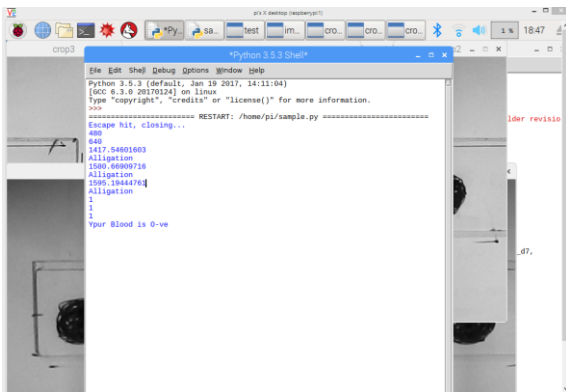


Fig. 6.2 Result shows on python shell

VII. QUANTIFICATION

It is through this function that detects the occurrence of agglutination or nonoccurrence in each of the three blood samples and reagent, such being essential to value of the standard deviation. It was found that in samples where no agglutination occurs, the variance values do not exceed 1000,

and in general samples with variance values between 0 and 1000. Moreover, samples where agglutination occurs present variance values greater than or equal to 1000, and in general samples with values of variance between 1000 and 1200. No samples non-agglutinated was found with values of variance greater than 1000 or equal to 1000, or samples agglutinated with variance values below 1000. Thus, it was established as a threshold value for classification of variance 1000, in which samples with variance value below 1000 are classified as samples where no agglutination occurred and samples with variance values greater than or equal to 1000 are samples classified as agglutination occurred.

Result from the Python 3.5 Shell

```
1368.01106385
Alligation
892.765350444
MIXED
905.098113362
MIXED
1
0
Your Blood Group is B+ve
```

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