NON INVASIVE BLOOD GROUP DETECTION

Panjavarnam B [1], Saranya P [2], Anitha S [3], Surya R [4]
[1]Assistant Professor, Department of Electronics and Communication Engineering, Sri Sairam Engineering College Chennai, India
[2,3,4]UG Scholar, Department of Electronics and Communication Engineering, Sri Sairam Engineering college Chennai, India

***Abstract*-Fast and accurate identification of blood types is very important during emergency situations before administering a blood transfusion. At present the blood culture is done using automated blood analyser. When blood is drawn for blood test it may cause bleeding under the skin, fainting, and infections at the particular region. The proposed idea is a non-invasive method for the identification of blood group of a patient without pricking the skin of the patient. This method is used to automatically determine human blood type by applying image processing algorithms to the optically captured images of superficial capillaries underlying the skin surface. The technique embeds Light scattering method, as light passes through the capillaries for dynamically classifying blood cells based on specific antigen shapes present on the Red Blood Cell (RBC) surface such as A antigen, B antigen and AB antigen. Optically sensitive web camera is used to capture the scattered light pattern, from the red blood cells to determine the blood type without drawing the blood samples from the body of patient. The process is simple and convenient to determine ABO blood group instantly, so it can be economically used for undertaking blood tests in hospitalized conditions, emergencies, war fields and it is more comfortable for infants.**

***Index Terms* - Blood types, Optical Sensors, Camera, Photo-detectors, Multi wavelength Light, Light scattering, Image Processing, Pattern matching, Filters.**

I. INTRODUCTION

Blood typing is a technique to identify what specific type of blood a person has. The differences in human blood are due to the presence or absence of certain protein molecules called antigens and antibodies. The antigens are located on the surface of the red blood cells and the antibodies are in the blood plasma. Individuals have different types and combinations of these molecules.

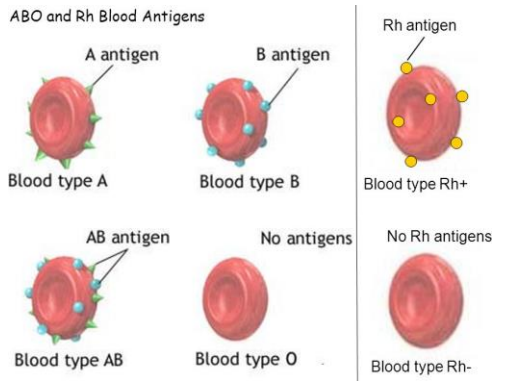

Fig.1.Different types of antigen

Various blood group types are present among which the ABO is the common blood type.

Table 1.Blood group systems

Name	Symbol	Number of antigens	Gene name	Chromosome
ABO	ABO	4	ABO	9
MNS	MNS	43	GYPA, GYPB, GYPE	4
P	P1	1	P1	22
Rhesus	Rh	49	RhD, RhCE	1
Lutheran	LU	20	LU	19
Kell	KEL	25	KEL	7
Lewis	LE	6	FUT3	19
Duffy	FY	6	FY	1
Kidd	Jk	3	SLC14A1	18

According to ABO and Rh blood grouping systems, a person can belong to either of following 8 blood groups: A Rh+, A Rh-, B Rh+, B Rh-, AB Rh+, AB Rh-, O Rh+ and O Rh-. The blood grouping is done by technicians in laboratories by slide test which is a manual method. Most of the techniques applied are still based on the principle of interaction between antigen and antibody and subsequent agglutination (i.e. clumping) of RBCs (positive result).The absence of agglutination indicates the lack of interaction (negative result). The following figure depicts it:

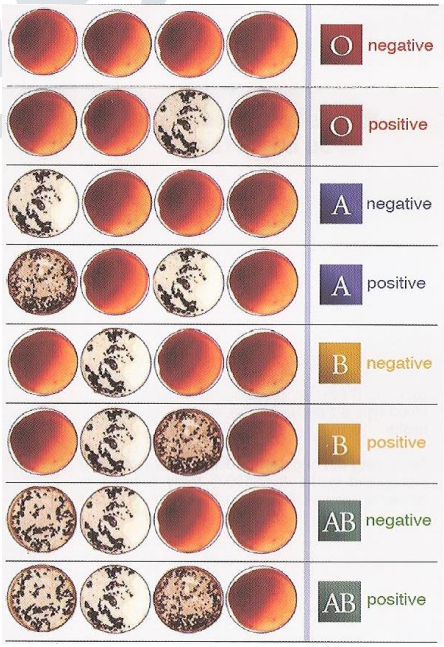

Fig 2.Results of all ABO groups

This manual blood grouping procedure presents undesirable drawbacks: slowness and non standardized accuracy since it depends on the operator's capabilities and

tiredness. Hence, it is necessary to develop an automated system for blood group identification.

II.AN OVERVIEW OF IMAGE PROCESSING

Image processing is a method to perform some operations on an image, in order to get an enhanced image or to extract some useful information from it. It is a type of signal processing in which input is an image and output may be image or characteristics/features associated with that image. Nowadays, image processing is among rapidly growing technologies. It forms core research area within engineering and computer science disciplines too.

Image processing basically includes the following three steps:

- Importing the image via image acquisition tools;
- Analysing and manipulating the image;
- Output in which result can be altered image or report that is based on image analysis.

There are two types of methods used for image processing namely, analogue and digital image processing. Analogue image processing can be used for the hard copies like printouts and photographs. Image analysts use various fundamentals of interpretation while using these visual techniques. Digital image processing techniques help in manipulation of the digital images by using computers. The three general phases that all types of data have to undergo while using digital technique are pre-processing, enhancement, and display, information extraction.

III. LITERATURE REVIEW

1.Title : AUTOMATED BLOOD GROUP DETECTION SYSTEM USING IMAGE PROCESSING
Author: Vinay M
Abstract:

This paper aims to develop an embedded system which uses Image processing algorithms to perform blood tests based on ABO and Rh blood typing systems. Initially data set of various blood groups which is obtained by means of slide test is collected. In real time the results of slide test are captured by a camera consisting of a color image composed of the blood sample and reagent. Then the captured image undergoes various transformations. Metrics of the captured image is calculated and compared with data set which is used to identify whether the image is agglutinated or non-agglutinated from which blood group typing can be determined. This method is time consuming and involves addition of Chemical reagents, pricking of skin, high throughput analysis.

2.Title: IDENTIFICATION OF BLOOD GROUP USING LASER TECHNOLOGY.
Author: Priyadharshini.R
Abstract:

This paper proposes a laser technology to determine the blood group. In this technique, electronic devices such as Laser light, Photocell and comparator are used. First, the blood samples are taken on test slide and the laser light is passed through blood sample. Photocells which are placed below the test slides sense the light and generate some amount of voltage/current. Then finally voltage level is compared with the help of comparator. The observed voltage level is different for different blood types. In this way the blood groups has been analysed. The drawback of the system is that it consumes more time as it is an invasive method.

3.Title: NON INVASIVE BLOOD GROUP DETECTION USING LIGHT EMITTING DIODE
Author: Gayathri T , Rekha M , Naizathul Akmha S, K.Nithyakalyani
Abstract:

This paper discusses about a non-invasive method for identifying the blood group without puncturing the skin. Light act as a source for optical signals which is allowed to pass through the finger and detector detects the varying voltage. As the optical property of blood varies for different antigen present on the RBC, the voltage value obtained also gets varied. Depending upon the output voltage of the detector, blood groups are determined. The process is uncomplicated and convenient to determine ABO blood group in a short period of time, So it can be economically used for blood test during hospitality, emergencies, war fields and for infants. But one of the major drawback of this method is that voltage variation between different blood groups is small which can lead to inaccuracy.

4.Problem Identification

The above discussed papers have many disadvantages such as time consumption, pricking of skin, addition of chemical reagents, inaccuracy and high throughput analysis. To overcome these limitations, a non invasive method is used. The result of the project is useful since it does not involve blood samples obtained from pricking of the skin, which could be a limitation for new born infants. And the serious risk of administration of incompatible blood groups could be avoided.

IV. PROPOSED ARCHITECTURE

We have proposed a system which will detect blood group using image processing techniques. Steps to detect the type of blood group using image processing techniques are discussed Fig.1 shows the block diagram of proposed architecture.

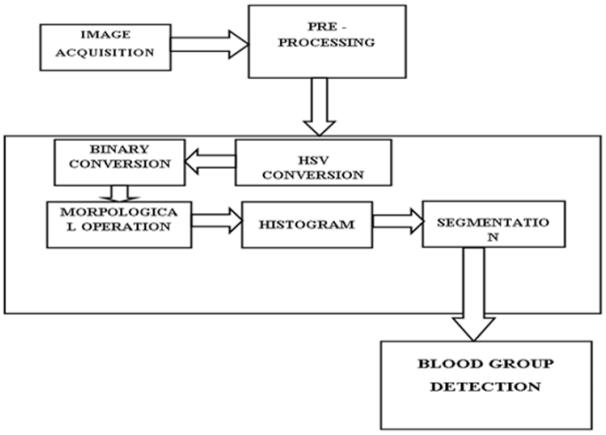

Fig.3. Block diagram of proposed architecture

1. IMAGE ACQUISITION:

Digital cameras generally include specialized digital image processing hardware – either dedicated chips or added circuitry on other chips – to convert the raw data from their image sensor into a colour-corrected image in a standard image file format.

2. PRE-PROCESSING:

Pre-processing is an improvement of the image data that suppresses unwilling distortions or enhances some image features important for further processing, although geometric transformations of images. In this project, data pre-processing includes cleaning, Instance selection, normalization, transformation, feature extraction and selection.

3. HSV CONVERSION:

Hue' represents the colour, 'Saturation' represents the amount to which that respective colour is mixed with white and 'Value' represents the amount to which that respective colour is mixed with black (Gray level).In RGB, we cannot separate colour information from luminance. HSV or Hue Saturation Value is used to separate image luminance from colour information. In this project, the obtained pre-processed image undergoes HSV conversion to separate image luminance from colour information.

4. MORPHOLOGICAL IMAGE PROCESSING

Morphological image processing is a collection of non-linear operations related to the shape or morphology of features in an image. Morphological techniques probe an image with a small shape or template called a structuring element. The structuring element is positioned at all possible locations in the image and it is compared with the corresponding neighbourhood of pixels. The basic morphological operators are erosion, dilation, opening and closing. In this project morphological operation is performed for extracting feature and to remove imperfection as well as noise.

5. HISTOGRAM:

Histogram is the type of graph that has wide applications in statistics. It provides visual representation of numerical data by indicating the number of data points that lie within a range of values. It is a technique for adjusting image intensities to enhance contrast. The objective is to give a linear trend to the cumulative probability function.

6. SEGMENTATION:

Image segmentation is the process of partitioning a digital image into multiple segments i.e sets of pixels. The goal of segmentation is to simplify and/or change the representation of an image into something that is more meaningful and easier to analyse. Image segmentation is typically used to locate objects and boundaries in images. More precisely, image segmentation is the process of assigning a label to every pixel in an image such that pixels with the same label share certain characteristics.

V. WORKFLOW DESIGN

The required flow of the entire proposed system is as shown in the figure. Thus by following the flow, the required output is obtained.

1) The optical device is placed on the patient's fingertip in a similar way as to how pulse oximeters are used in hospitals to measure blood oxygen levels – Device is turned on to fire multi wavelength light onto the skin surface.

2) The sensitive photo-detector traces the path of light on being deflected or absorbed by the red blood cells.

3) When illuminating at certain frequencies, light is absorbed by the haemoglobin in the red cells, and at the same time due to coherent nature of illumination – light gets scattered by small margin on hitting the edges of the antigenic determinants having specific structure/shape.

4) The pattern of this light scattering is captured by keeping the optical device ON for certain specified time to capture the after-effects of scattering – Multiple images are taken by the device in a succession to trace/track scattered light.

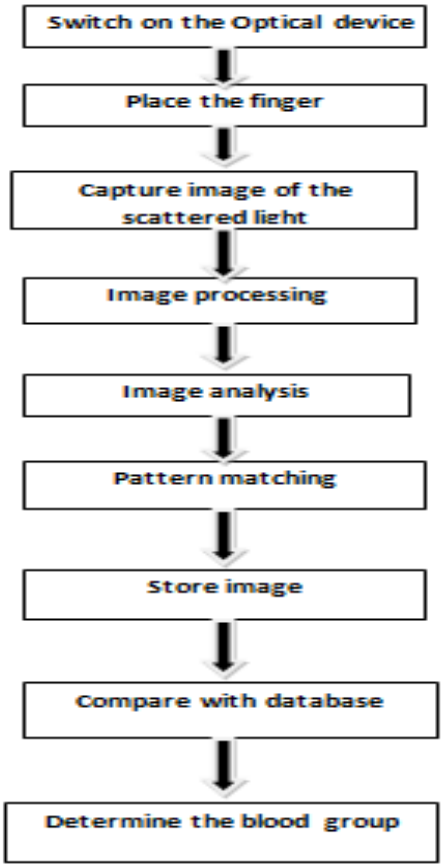

Fig.4.Required flow of the entire proposed system

5) Subsequently, image processing algorithms recognize these scattering events and record the pattern/distribution of scattered light – which depends on the molecular shapes of epitopes of various antigens like antigen A, antigen B, Rh antigen – The MWL is highly sensitive to size, shape, and composition of RBC occurring due to the presence of epitopes of different antigens.
6)The recorded pattern is then compared with the dataset collected, which provides an estimate of blood type.

VI.COMPONENTS

Following are the list of hardware and software components used in the project:

HARDWARE

- WEB CAMERA
- LED LIGHT

SOFTWARE

- MATLAB R2018A

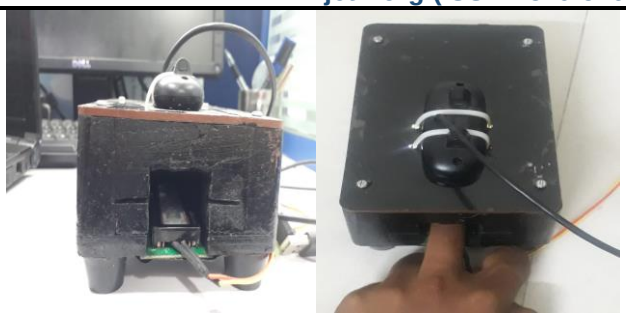

Fig 5.Experimental setup

VII.CONCLUSION

The project is a prototype of blood group detection using image processing. The methodology presented in this work, allows determining the blood type of a patient, safely within a short interval of time without the necessity of taking blood samples, thereby eliminating the pain of being stuck with a needle. The process is useful in emergency situations, blood transfusions, etc.as it greatly reduces the time and hassle of manually testing blood compatibility for the patient. The hardware kit is small in size. The cost of production of the project is Low. Eventually the blood group detection using image processing involves no side effects. It is efficient robust, reliable and fast in detection. The limiting factors which affects the accuracy of blood group detection are the external light intervention, lack of large dataset and low sensitivity of camera. To increase the accuracy of the project, the number of samples could be increased to thousands per blood group. Also by increasing the sensitivity of the image capturing camera more appropriate blood group detection could be done. Further, in order to get better results, the process could be done in a dark room.

VIII.FUTURE WORK

The proposed method could be extended to any commercial optical equipment like camera, etc. with minor modifications to the device. The technique could further be extrapolated to Smartphone cameras (equipped with image processing or neural networks) for obtaining results at low cost and within a short-time. The portability factor could therefore add a commercial value to the innovative solution.

IX.REFERENCES

[1] Vinay M, "Blood AUTOMATED BLOOD GROUP DETECTION SYSTEM USING IMAGE PROCESSING," Armenian Journal of Physics, 2011, vol. 4, issue 3, pp. 165-168.

[2] Priyadharshini.R, "A Novel Approach in Identification of Blood Group Using Laser Technology," International Journal of Research in Engineering and Technology (IJRET), vol.3, issue 11, pp 20-24, June 2014.

[3] Vijay A. Kanade, "Bio-Optics: Blood Type Determination based on Image Processing Techniques by utilizing an Optical Sensor Device," International Journal of Science and Research (IJSR), Volume 5 Issue 7, July 2016.

[4] Gaurav S. Mehare, Chetan G. Pinjarkar, Anup V. Tembhe, Prof. Nitin S. Khachane4 "A Non-invasive Way to Determine Blood Type Based on Image Processing ", International Research Journal of Engineering and Technology (IRJET), Volume: 05 Issue: 04 | Apr-2018

[5] M. M. Murphy and D. H. Pamphilon, "Practical Transfusion Medicine," 3rd ed. Wiley-Blackwell, 2009

[6] Robert I. Handin, Samuel E. Lux, Thomas, Blood: Principles and Practice of Hematology, Volume 1

[7] S. M. Nazia Fathima, "Classification of Blood Types by Microscope Color Images," http://www.ijmlc.org/papers/342-L472.pdf International Journal of Machine Learning and Computing, Vol. 3, No. 4, August 2013.

[8] Gayathri T , Rekha M , Naizathul Akmha S, K.Nithyakalyani, , "NON INVASIVE BLOOD GROUP DETECTION USING LIGHT EMITTING DIODE", International Journal of Pure and Applied Mathematics Volume 119 No. 15 2018, 565-574.

X.WEB REFERENCES

1. http://www.ncbi.nlm.nih.gov/pubmed/15447021
2. http://www.ncbi.nlm.nih.gov/pubmed/15447021
3. http://diamedil.info/diamed/Inserts/100910