

A Non-invasive Way to Determine Blood Type Based on Image Processing

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Abstract - Fast and accurate identification of blood types is very important during emergency situation before administering a blood transfusion. At present the method based on image processing technology to determine blood type has been widely used in the automated blood analyzer. In this paper, the proposed idea is a non-invasive method for the identification of blood group of a patient without breaking the skin of patient. The technique embeds Light scattering method as light passes through the capillaries for dynamically classifying blood cells based on specific antigens shape present on the Red Blood Cell (RBC) surface. Camera is used to capture the scattered light pattern, scattered from the red blood cells to determine the blood type without drawing the blood samples from the body of patient.

Key Words: Blood types, Camera, Laser Light, Light scattering, Image Processing, Pattern matching, Blood Transfusion.

1. INTRODUCTION

Blood Grouping system is basically used to determine the blood group that the person possesses. Human by nature has any one of the Blood group namely A, B, AB and O. The blood group 'AB' is called the Universal acceptor and the person with the 'O' group are called Universal donor. Blood Detection is most important and essential activity to ensure blood transfusion safety. In the case of emergency blood transfusion, rapid identification of the type of blood is essential, which is directly related to the life of the patient.

According to ABO and Rh blood grouping systems, a person can belong to either of following eight blood groups: A Rh+, A Rh-, B Rh+, B Rh-, AB Rh+, AB Rh-, O Rh+ and O Rh-. To determine the blood type of patient, several techniques are available, such as, the plate test, tube, micro plate and Card ID [1], [2]. The plate test is widely used and suitable for emergencies allowing fast results. However, manual tests can feature the risk of human error associated with the procedure as well as with the reading and interpretation of results. Thus, though it gets rapid results with a good accuracy, it has this disadvantage of not being currently used in hospital laboratories [4], [5].

This manual blood grouping procedure and automated systems presents undesirable and unwanted drawbacks such as requires more time and non standardized accuracy

since it depends on the operator's capabilities. Hence, it is necessary to develop a new non-invasive system for blood group identification [7].

Presently, an average of 200 to 300 blood samples is analyzed within 2 to 3 hours which can be carried out only by technician [2]. If the proposed system is used, the same task can be completed within a short period of time. One more advantage of this proposed system is of affordable cost.

2. BACKGROUND

Antigens are usually proteins and polysaccharides which are present on external surface of RBC having many epitopes of different structure. This is because the proteins are usually thousands of amino acids long and are composed of 20 different amino acids.

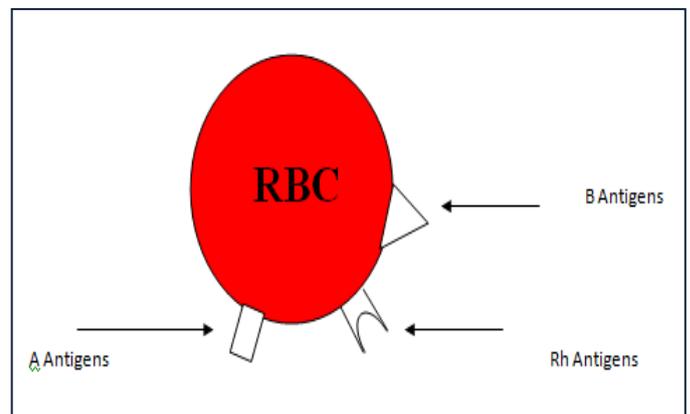


Fig -1: A red blood cell (RBC) with different antigens on the surface of its membrane.

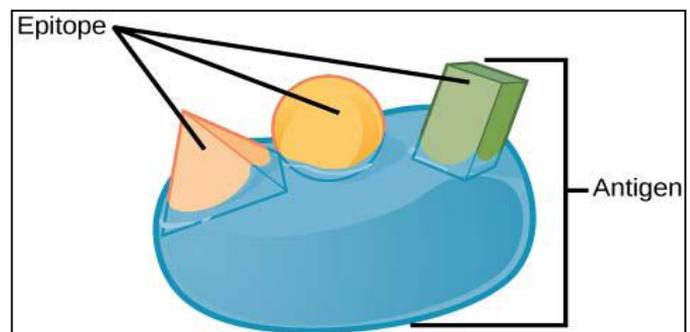


Fig -2: Epitopes is a part of an antigen molecule to which an antibody attaches itself –antigenic determinant

Now, blood type is identified according to the presence or absence of these antigens found on red blood cells and in the plasma that allow your body to recognize blood as its own.

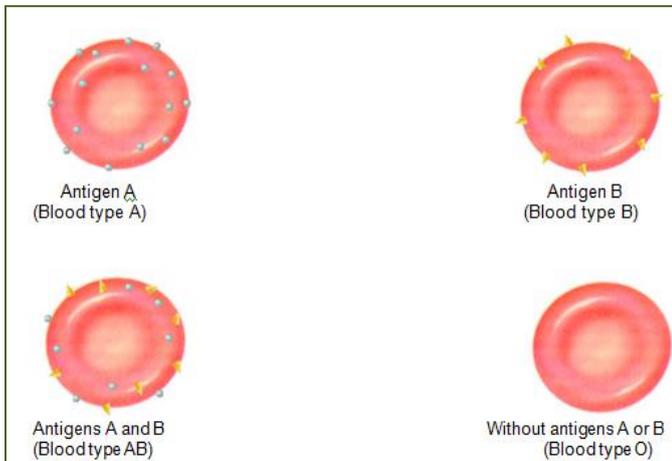


Fig -3: Antigens with their respective shape/structure

3. LITERATURE SURVEY

Priyadharshini.R [2], A Novel Approach In Identification Of Blood Group Using Laser Technology. In this technique, Laser light, Photocell, comparator such electronic devices are used. First, the blood samples are taken on test slide and the laser light is passed through blood sample, which is placed on the test slide. Photocells which are placed below the test slides which 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 analyzed. The drawback of the system is that it takes little more time since it takes blood sample on test slide to determine the blood type.

4. PROPOSED SYSTEM

The proposed system deals with light scattering mechanism for automatically classifying blood cells depending on the presence/absence of antigenic components on the surface membrane of the red blood cells [9]. The light from the optical device passes through antigenic substances, epitopes of antigens, and thereby allowing light to pass/deflect/diffract/reflect completely. This scattered light is detected with the help of camera by capturing multiple images of a specific focus area. These captured images reveal the blood type based on scattered light pattern picked up by the camera.

4.1 ALGORITHM

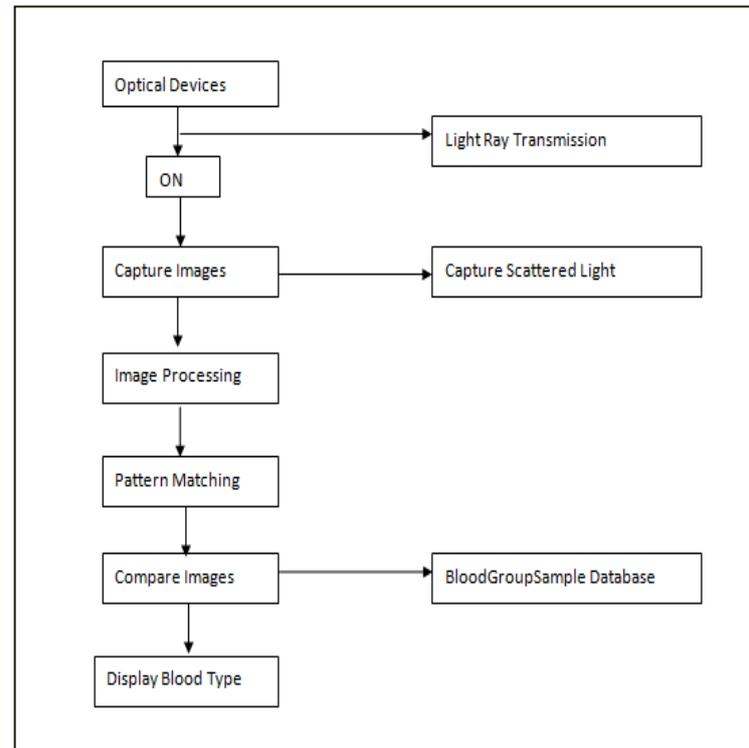


Fig -4: Flowchart of blood group determination system

4.2 Technique

4.2.1 Steps

- 1) First, the patient's thumb will be placed on the hole, present on the top of the box. Box contains Laser light and camera - Device is turned on to fire laser light onto the skin surface.
- 2) When illuminating at certain frequencies, light is absorbed by the hemoglobin in the red cells, and light gets scattered after hitting on the edges of the antigenic determinants having specific structure/shape.
- 3) 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.
- 4) The recorded pattern gives an estimate of the type of antigens in the blood cells - which provide an estimate of the blood type.

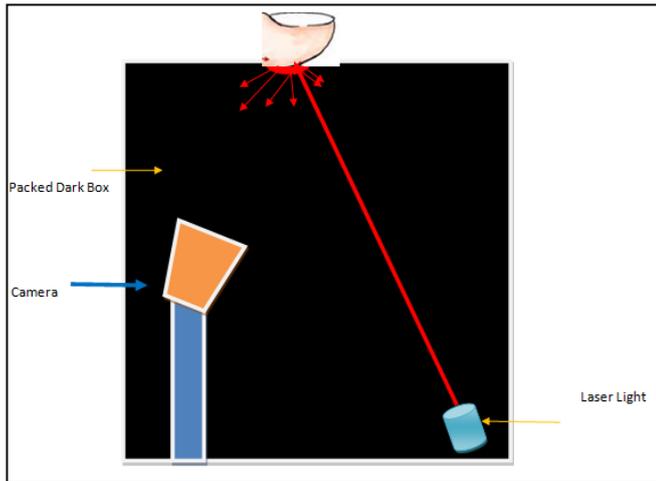


Fig -5: Internal box structure to capture scattered light

5. IMAGE PROCESSING

This step involves identifying the repetitive pattern in the images by using various pattern matching algorithms. Here we have compared the captured images of patient's thumb with the available Sample blood type images, stored in the database, by applying Pixel by Pixel pattern matching algorithm on it. The lesser difference between image pixels states the blood type of patient. For example, if the pixels difference between patient's images and 'A+' Blood type sample images is less as compared to other blood group type images then patient's blood group will be 'A+'. In this way the blood type has been analyzed.

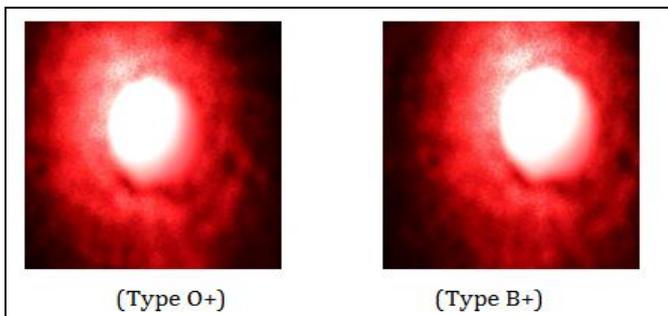


Fig -6: Captured image for processing

6. CONCLUSION

Generally, the blood group testing is done by manual process. Nowadays, Image Processing plays a prominence role in medical field. This paper has proposed a non invasive way of blood group identification. The corresponding patient's blood group can be identified by using the reflected/scattered light from RBC. This system has appreciable advantages like small in size, lower in cost, no side effects, less time consumption, overcomes the present difficulties of manual process and also no problem of bleeding, since it does not make use of blood sample. If we implement this system to test blood type of patient then it would be a great change in medical field.

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