BLOOD TYPE DETECTION USING IMAGE PROCESSING

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***Abstract*—**Hospitals require blood for saving patients life and knowing the blood group can avert a crisis and can spare the life of a patient. Advancements in technology is progressing rapidly such that human error can be avoided. Innovation has created image processing techniques for identifying blood group. Blood group identification is done for blood transfusion in emergency circumstances or blood donations. It is a fast and simple way to guarantee that you simply receive the proper kind of blood amid surgery or after an harm. In case you're given incompatible blood, it can be deadly causing agglutination. Thus, it is necessary to perform tests before blood transfusion. Microscopy has irregularly demonstrated it being inefficient due to its time consumption and difficulty in reproducing results. Due to these reasons, computerization of such tests is of high necessity. Based on the analysis of images captured during a slide test, a program is developed to analyze and determine the blood group without human involvement. Resultant images are then obtained to check for blood clumping and blood group is determined. Thus, it will be useful in determining the blood group.

INTRODUCTION

To determine which blood type will be given during a blood transfusion, it is necessary to determine the blood types of humans. There are several blood group types. The two fundamental types are Rhesus blood group and the ABO blood system. Australian Rand Steiner developed the ABO system, which is essential for blood transfusions. There are eight distinct blood groups based on ABO and Rh blood types. Basically, the Blood Typing System is used to ascertain an individual's blood group. The most crucial and critical task is blood detection. The presence or lack of specific molecules, antigens, and antibodies can be used to determine a person's blood group distinctions. When combined with a collection of intricate big protein molecules, the antigen can trigger an immune response on its own. The immune system produces antibodies to protect our bodies from harm, particularly when a foreign body enters the body. They are hence our body's protectors. Based on the presence or lack of antigen on the surface of Red Blood Cells (RBCs), there are four main blood types. Antigen A is present on the blood cells in Group A. While AB group's blood cells include both Antigen A and B, Group B's blood cell only contains B Antigen.Neither Antigen A nor Antigen B are present on the blood cells of Group O. The blood transfusion is carried out based on the blood types' compatibility. Blood groupdetermination is required since not all blood types get along with one another.Currently, lab staff identify blood groups manually. This method has the disadvantage of taking longer and, in certain cases, increasing the risk of mortality if blood groupidentification is not done correctly. In a split second, an automatic blood type detection device will identify the blood type.

Image Processing Techniques

There are many stages of Image processing techniques used in this. They are Green Plane Extraction, Auto Thresholding, Adaptive Thresholding, Morphological Operations: Filling holes, Remove Small Objects, Histogram and Quantification. The combined working of these mentioned techniques helps us to predict the blood group.

Green Plane Extraction

Green Plane Extraction is used in image processing to remove a picture's green component. In digital color images, each pixel is composed of three-color components: red, green, and blue (RGB). Green plane extraction involves isolating the green component of animage by removing the red and blue components, leaving only the green channel. This process is often used in applications such as computer vision, where the green component of an image is particularly useful for detecting and tracking objects.

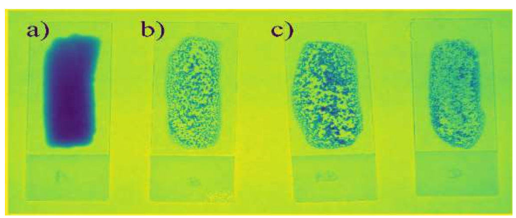

Figure 1: Image captured which is then put through Green plane extraction. A-Reagent anti-A, b-Reagent anti-B, c-Reagent anti-AB, d-Reagent anti-D.

Auto Thresholding

In image processing, auto thresholding is the technique of automatically figuring out the best threshold value to divide a picture into foreground and background areas. By setting the threshold value, a grayscale image can be transformed into a binary image, in which the background is made up of all pixels where if the intensity value is beyond the threshold value, are turned to white.

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ISSN: 1005-0930

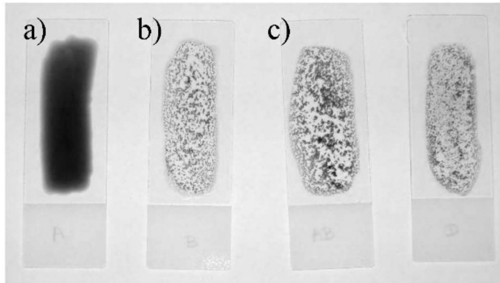

Figure 2: Image acquired using AutoThresholding to figure 1.

Thresholding (Otsu Algorithm)

When there is a deep and distinct valley between the two peaks of the histogram and the distribution is bimodal, Otsu's approach works effectively. Otsu's method performs poorly in situations with high noise, tiny object sizes, uniform lighting, and greater intra-class variance than inter-class variance, just like all other global Thresholding techniques. Local Otsu technique adaptations have been created in those circumstances. Even if these presumptions are not true, Otsu's Thresholding may still produce results that are satisfactory.

Adaptive Thresholding: NI Black

Adaptive Thresholding is a process used in image processing to threshold an image using a local threshold value that varies across the image. Adaptive thresholding considers the local variations in image intensity, in contrast to global thresholding, which applies a single threshold value to the entire image. Adaptive thresholding involves moving a sliding window, or kernel, over the image and computing a threshold value for each pixel inside the window based on its immediate neighbourhood. Pixels over the threshold are set to white, and pixels below the threshold are set to black. This threshold value is then used to binarize the pixel value.

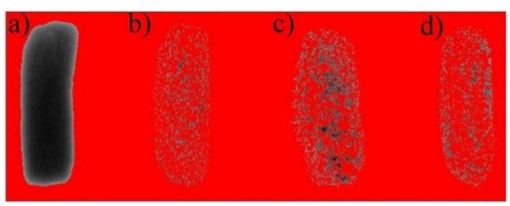

Figure 3: Image acquired after processing it with Adaptive Thresholding: NIBlack.

Morphology Operations: Fill Holes

Filling holes is a common operation in image processing used to remove small gaps or holes in an object or shape. Morphological filling is a technique used to fill these holes using binary morphological operations such as dilation or closing. The basic idea behind filling holes using morphological operations is to dilate or close the object until the holes are filled.

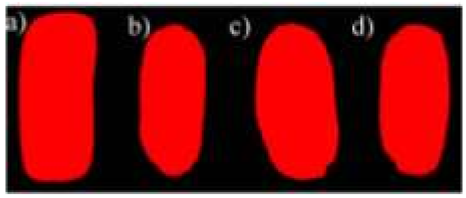

Figure 4: Image acquired after the implementation of Morphology operation: Fill Holes.

Morphology operations: Remove Small Objects.

Removing small objects is a common operation in image processing used to eliminate noise or unwanted small regions in an image. Small items in a binary image can be eliminated by using sophisticated morphological procedures like opening and shutting.

Histogram

A histogram is a graphical depiction of the distribution of pixel values in an image used in image processing. Each pixel's intensity value is plotted according to how frequently it occurs in the imageThe individual pixel intensity values are charted on the x-axis and the number of pixels in the image that have that intensity value is displayed on the y-axis. Histograms can be used to gain insight into the contrast and brightness of an image, as well as its overall tonal range. For example, an image with a high contrast will have a histogram with a high peak at both ends of the x-axis, representing the high and low intensity values in the picture. A low contrast image, on the other hand, will have a histogram with a peak in the middle of the x-axis.

Quantification

The quantification process is expressed using a measure or number. The intensity is only measured for the area of interest. Area (percentage of the total image surface examined), mean (average pixel value), standard deviation, and lowest and maximum values are used to quantify pixel intensity. Additionally, region attributes are removed. The standard deviation value is used to determine the blood group by determining when agglutination occurs. "This idea of determining quantifiable features from medical images to assess the severity, status, or deviation from normal of an accident, disease, or chronic condition is known as quantitative imaging. The creation, standardization, and improvement of atomical, functional, and molecular imaging acquisition methodologies, data analysis techniques, presentation strategies, and reporting frameworks are all included in quantitative imaging.

system design

A block diagram is a systematic diagram in which where the primary elements or operations are shown as blocks which are connected by lines that show how the blocks are related to one another. In engineering, they are widely utilised in process flow diagrams, software, hardware, and electronic design. Block diagrams are typically employed in less technical, more general explanations that try to convey broad concepts without delving into particulars on their

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ISSN: 1005-0930

implementation.In contrast, electrical engineering uses schematic and layout diagrams to illustrate the physical construction and implementation details of electrical components.

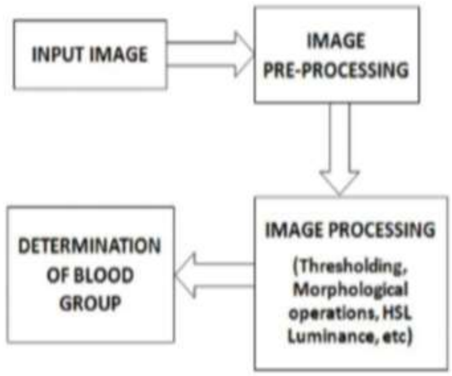

Figure 5: Shows the block diagram of the complete working process.

This block diagram explains the complete working of the techniques that are used in this. The initial stage of the concept is to carry out the input image and process it with Image pre-processing. This stage is carried out manually as such to check if the image is in the correct format and to see if the required image is received or not. The second stage is the most complex and crucial stages of the project. The image processing techniques that are used will manipulate and analyze the image to the desired output that the algorithm requires to determine the blood group. Automated techniques include morphological procedures, HSL, luminance, and thresholding. We can easily determine the blood group when these approaches are used correctly.Techniques that are already available, provides an easy solution to this implementation.

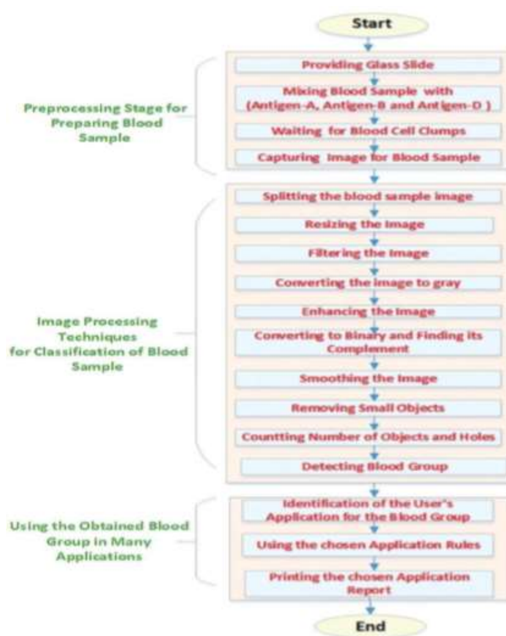

Figure 6: Flow chart showing the three stages followed by the sub stages shown in categorical order.

input and output design

The input and output design are critical for the working of this project. Input design will explain the stages of input, which will be provided for preprocessing as well as processing as explained in figure 5 because the project's output will include a fully functional graphical user interface (GUI) that enables the user to pick the blood group and make necessary changes, the output design is essential.The implementation of these steps will make the blood group detection accessible for the public without any extra knowledge.

Input Design

The process of transforming the users orientation is called input design. input into a format used by computers. Encouraging logical, error-free, and simpler data entry is the aim of input design. The input design controls errors in the input data. The quality of the input dictates the quality of the system output. Each interactive data entry panel lets the user enter data directly based on the messages that are shown.Additionally, the user can enter data directly in accordance with the prompted prompts. Furthermore, users can select the necessary input from a list of values. This will reduce the number of errors that would otherwise most likely happen if the user entered the data. Input design is one of the most imputdesign crucialphases in system design. Input design is the act of organising and creating the input that the system receives in order to get the necessary data.The practice of planning and designing input into a system to obtain the information needed from users while removing unnecessary data is known as input design.

Output Design

Output design is very important as it helps to portray the output of the findings as well as give a clear cut view to the outcome of the study. Here the output is GUI which is developed in python for showing the results. The GUI will have options to select the blood samples, which are the antigens and a control reagent. This can be inputted into the GUI with a selection box. After the selection the program will identify the blood group from the images uploaded. Along with that a dialogue box will can be prompted from the menu section showing the outputs of various stages of the image processing. Output allows us to view and understand what has happened in a manner that isn’t hard to understand. Pictorial representation allows the message to be conveyed in the most efficient wayThe system output is available as printed copies or on a screen. Output design aims to communicate the results of users' processing. The reports must be produced at the proper levels. The outputs of our project are produced as HTML pages using ASP. Because of how user-friendly the web application output is created, it will typically be viewed through a screen. The reports must be produced at the proper levels. The outputs of our project are produced as HTML pages using ASP. Because of how user-friendly the web application output is created, it will typically be viewed through a screen.

Vol. 21, No. 1, (2024)
ISSN: 1005-0930

System testing and implementation

System Testing

The experimental findings from this work are shown in this section. According to Figure 1, agglutination did not occur in samples a), b), or c; however, it did occur in sample d). It is established that there are no antigens AB in the blood sample under analysis after confirming that there is no agglutination in the anti-A, B and AB reagents. However, agglutination with the anti-D reagent happened, confirming the presence of antigens Rh in the blood sample under analysis. Therefore, it can be concluded that the patients blood sample is of O positive blood group.

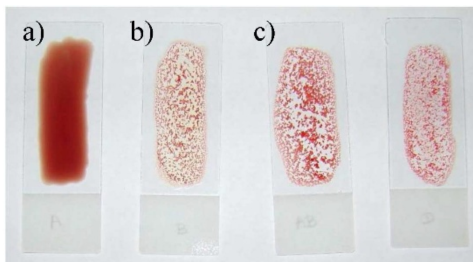

Figure 7: A-Reagent anti-A, b-Reagent anti-B, c-Reagent anti-AB, d-Reagent anti-D.

Implementation

Implementation is the most crucial stage in developing a successful system and gaining user trust in the viability and effectiveness of the new system. Putting into practice, a modified application to take the place of an existing one.As long as there aren't any significant systemic changes, handling this kind of discussion is really simple. The computer system and its surroundings are tested to the user's satisfaction, and each program is tested separately at the time of development using the data to confirm that the programs linked together as described in the program specification.The designed system has been approved and shown to meet the needs of the user.Thus, the system will be put into use very soon.

Conclusion

The technique employed in this study shows promise in identifying the patient's blood type and detecting agglutination. By using image processing techniques, we can quickly (about 5 to 10 minutes after the blood sample is collected) determines the blood group of the patient based on the presence of agglutination, allowing for faster situational adaptation. The image processing techniques like segmentation, color image extraction, NI-Black Thresholding, morphological de-

Vol. 21, No. 1, (2024)
ISSN: 1005-0930

noising and filling methods are used. This study demonstrates how blood type can be ascertained by technological means. Using this for requirements at home is simple. It is a low-cost technique that aids in accurate and timely blood detection. HIV, hepatitis, and other illnesses can be prevented with blood testing and diagnosis. This project is useful in situations where there is an urgent need for quick blood detection. This initiative is a significant step towards the technology that the world is advancing towards in every industry. The project consists of three stages: obtaining the images, preprocessing them, and finally converting them to binary. Unwanted sounds in the image are eliminated during the preprocessing step. A non-linear technique for digital filtering called the median filter is used during the pre-processing stage. We employ the median filter because, in contrast to other filters, it is less sensitive to boundary values and can therefore preserve it while eliminating undesired noises. Other filtering techniques include the mean filter, Gaussian filter, adaptive filter, etc. In order to eliminate all sounds, both hidden and unseen, we first introduce some noise into the system. After the image has been enlarged, specific properties that aid in the separation of blood groups are extracted from its pixels in the following stage. With the use of the Grey Scale Co-occurrence matrix, features are extracted. Following the derivation of the traits, the blood groups are categorised as O+, A+,B+, AB+, O-, A-, B-, and AB-. The presence or lack of the rhesus antigen in particular blood types determines the negative and positive readings.

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ISSN: 1005-0930