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AUTOMATED BLOOD GROUP DETECTION SYSTEM USING IMAGE PROCESSING

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***Abstract*— Determination of blood type is important before administering a blood transfusion in an emergency situation. Currently, these tests are performed manually by technicians in the laboratory, when the test is handled with a large number of samples, it is monotonous to do and it may lead to human errors. In this paper, the proposed idea is to replace the manual work in clinical laboratories for identifying the blood group. . The proposed system aims to develop an embedded system which uses Image processing algorithm to perform blood tests based on ABO and Rh blood typing systems. . The proposed system aims to develop an embedded system which uses Image processing algorithm to perform blood tests based on ABO and Rh blood typing systems.**

***Index Terms*— Antigen, Blood Samples, GPU, Histogram, LBP (local binary pattern), Nearest Neighbour Classifier, Image Processing, Pattern Matching.**

I. INTRODUCTION

Blood Typing system is basically used to determine the blood group that the person possesses. Blood Detection is most important and essential activity. The differences in the blood group of individuals are due to presence or absence of certain protein molecule named as antigens or antibodies. The antigen is any foreign substance that causes an immune response either alone or it forms a complex with a large protein molecule. Antibodies are the proteins produced by the immune system to defend against the foreign substances that may cause harm to our body, therefore, they are the guards of our body.

There are 4 major blood groups based on presence or absence of antigen on the surface of RBC (Red Blood Corpuscles) Group A has only the A Antigen on the blood cells. Group B has only the B antigen on the blood cells. Group AB has both Antigen A and Antigen B on their blood cells. Group O has neither Antigen A nor Antigen B on their blood cells. Based on the compatibility of blood groups the blood transfusion is done. Not all the blood groups are compatible with each other. So for safe transfusion of blood determining the blood group is mandatory [1][2][3].

Nowadays blood group detection is done manually by lab technicians but there are some drawbacks of this traditional method like this technique consumes more time. Also in some cases if appropriate blood group is not detected then it may result in the death of an individual. An automated blood detection system will detect the blood group within a fraction of a second. Also, the manual intervention is less so human errors are completely eradicated

II. PHENOTYPING DETERMINATION

The attainment of human blood transfusions requires compatibility 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

The following are the blood samples of various blood groups taken under the microscope after adding the antigens [4].

A. O Positive Group

Fig.1 shows the O Positive blood group sample on adding Antigen-A, Antigen-B and Antigen-D and a sample without adding any antigen is taken we call it as control it is taken as a reference to check if the blood is not mixed with any other thing respectively.

Fig 1: O positive blood sample.

B. O Negative Group

Fig.2 shows the O Negative blood group sample on adding Antigen-A, Antigen-B, and Antigen-D respectively.

Fig 2: O negative blood sample.

C. B Positive Group

Fig.3 shows the B Positive blood group sample on adding Antigen-A, Antigen-B, and Antigen-D respectively.

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Fig 3: B positive blood sample.

D. B Negative Group

Fig.4 shows the B Negative blood group sample on adding Antigen-A, Antigen-B, and Antigen-D respectively

Fig 4: B Negative blood sample.

E. A Positive Group

Fig.5 shows the A Positive blood group sample on adding Antigen-A, Antigen-B, and Antigen-D respectively

Fig 5: A positive blood sample.

F. A Negative Group

Fig.6 shows the A Negative blood group sample on adding Antigen-A, Antigen-B, and Antigen-D respectively

Fig 6: A negative blood sample

G. AB Positive Group

Fig.7 shows the AB Negative blood group sample on adding Antigen-A, Antigen-B, and Antigen-D respectively

Fig 7: AB positive blood sample.

H. AB Negative Group

Fig.8 shows the AB Negative blood group sample on adding Antigen-A, Antigen-B and Antigen-D respectively.

Fig 8: AB negative blood sample.

I. Invalid blood sample

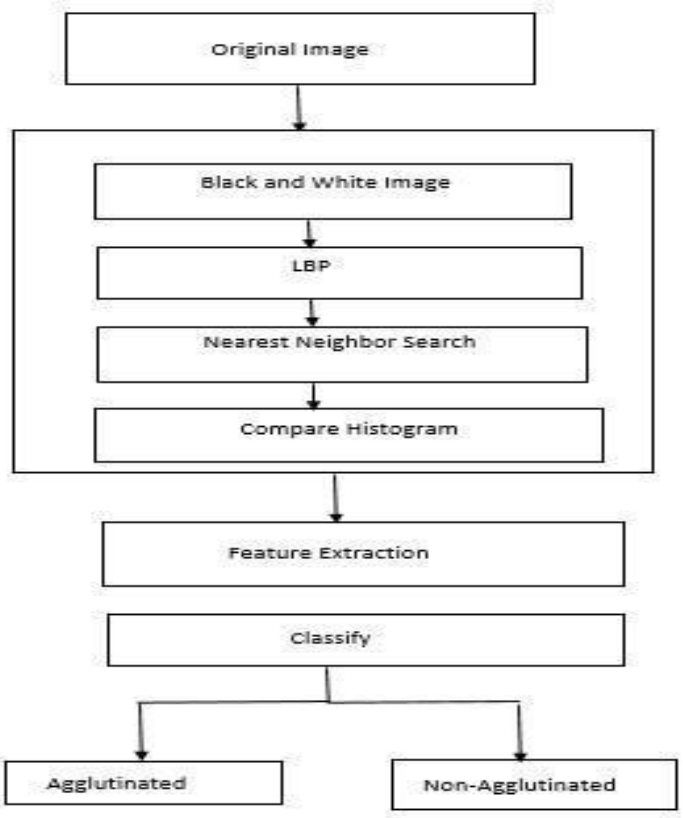
Fig.9 shows the invalid state of a blood sample on adding Antigen-A, Antigen-B and Antigen-D respectively.

Fig 9: Invalid blood sample.

III. PROPOSED METHOD

The results of slide test are captured by a camera consisting of a colour image composed of the blood sample and reagent. This image goes under various transformations as below:

- The Raw Image of Blood Samples is stored in computer buffer.
- These images are converted into gray scale images .
- A local Binary Pattern i.e. (LBP) is applied to this images:



LBP is The local binary pattern (LBP) operator was developed as a gray-scale invariant pattern measure adding more information to the "amount" of texture in image Local Binary Pattern-Local binary patterns (LBP) is a type of visual descriptor used for classification in computer vision. LBP is the particular case of the Texture Spectrum model proposed in 1990. LBP was first described in 1994. It has since been found to be a powerful feature for texture classification.

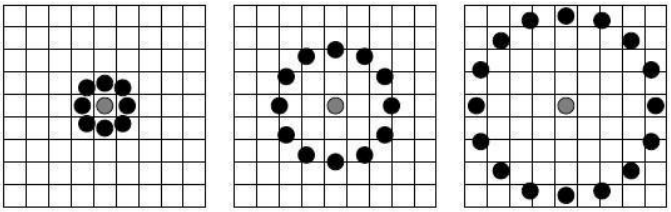


Figure 11 Circularly symmetric neighbour sets of LBP[9]

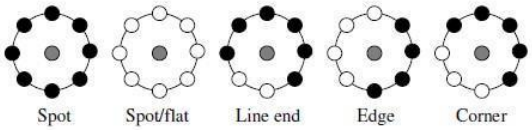


Fig12Different texture primitives detected by the LBP[9] .

- Nearest Neighbour search is performed on the image to identify the agglutination of the blood sample. This step is performed to calculate the histogram of the blood sample.
- Then perform chi-square histogram comparison operation To compare two histograms (H1 and H2), first we have to choose a metric d(H1, H2) to express

$$d(H_1, H_2) = \sum_I \frac{(H_1(I) - H_2(I))^2}{H_1(I)}$$

This step compares the blood sample with the data set and identifies whether the image is agglutinated or non-agglutinated. If images are agglutinated it represent 1 else it represent 0.

- The images are then checked against the following Table 1 to identify blood group of a patient.

Table1: binary output and its corresponding blood group.

Anti A	Anti B	Anti D	Blood group of Individuals
1	0	1	A positive
1	0	0	A negative
0	1	1	B positive
0	1	0	B Negative
1	1	1	AB Positive
1	1	0	AB Negative
0	0	1	O positive
0	0	0	O Negative

IV. SYSTEM DESIGN

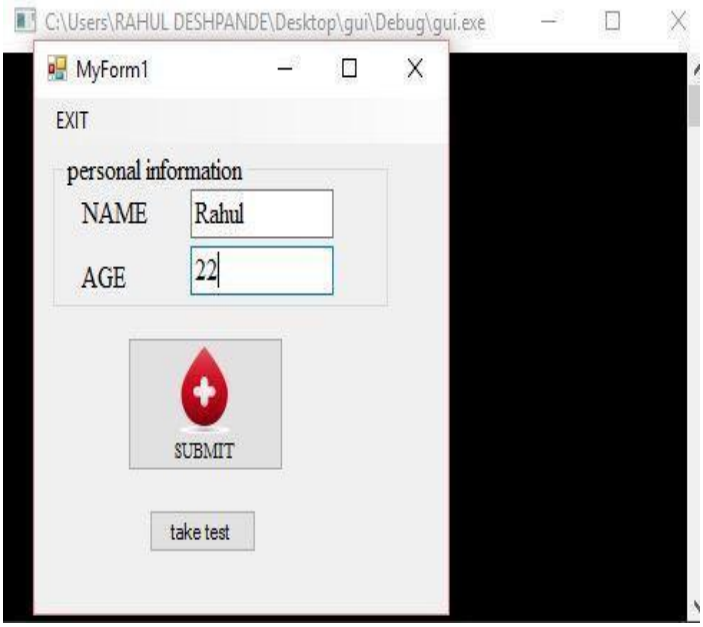
The system was made for the determination of person's blood group using blood sample images. In this proposed technique, the individual's blood group can be decided on the basis of variations in the blood images Because of antigen and antibody reaction in the blood, or we can say agglutination reaction occurs.

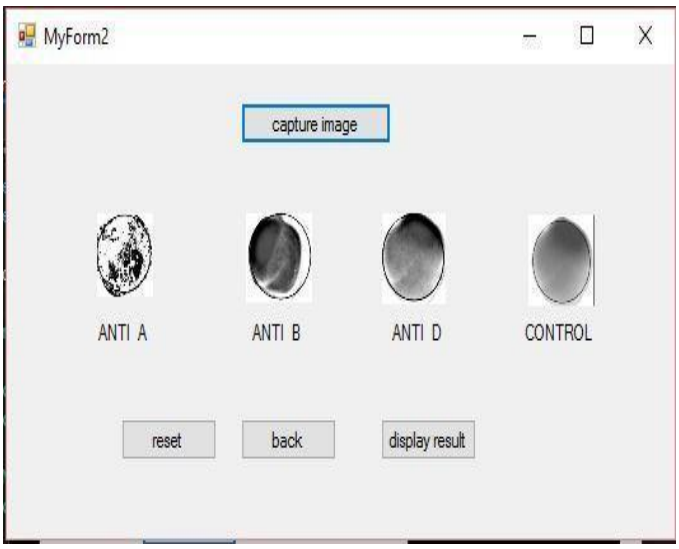
Structure of hardware developed is as shown below:

Hardware consists of an embedded board a camera module and motors for controlling.

The software developed has a GUI interface to interact with the system.

GUI of the system is as below:





V. DATABASE

To store the information resulting from the analysis of the agglutination detection performed through the image processing techniques and the result of the classification algorithm (blood type), a database was constructed.
The database was developed with the Microsoft Office Access 2007, since this was compatible with the software used to process the images, IMAQ Vision 2010 and the software used to develop the classification algorithm Lab View, both from National. Instruments.

based on ABO and Rh blood typing systems. The input taken to this system is a blood sample whose images are captured and forwarded to the image processing algorithm. It uses SVM for Classification of images and pattern matching algorithms for matching of images. It makes use of GPU for faster computation of the process of blood detection. If the proposed methodology will be implemented in a real time work, it can able to make great change in a medical field.

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VI. CONCLUSION

The proposed system aims to develop an embedded system which uses Image processing algorithm to perform blood test

VINAY M studying in Siddaganga institute of technology tumkur in Electronics and communication branch and i am a final year student. I have presented a paper on the topic IoT Based Trash management system in national level technical symposium sit tumkur. And fields of interest are image processing , artificial intelligence.