Non-invasive Approach for Blood group Detection

Zulfeen Shaikh[1], Rajashree Shinde[2], Samina Khan[3], Srushti Patil[4],Proff.Nitin Ujgare[5]

[1]UG Student, Dept. of IT, MVP Samaj's Karmveer Baburao Thakare College of Engineering, Nashik.

[2]UG Student, Dept. of IT, MVP Samaj's Karmveer Baburao Thakare College of Engineering, Nashik.

[3]UG Student, Dept. of IT, MVP Samaj's Karmveer Baburao Thakare College of Engineering, Nashik.

[4]UG Student, Dept. of IT, MVP Samaj's Karmveer Baburao Thakare College of Engineering, Nashik.

[5]Associate Professor Dept. of IT, MVP Samaj's Karmveer Baburao Thakare College of Engineering, Nashik

---

Abstract -The determination of an existent's blood group is essential during transfusions and transplants. The previously developed system involves drawing blood samples and conducting an antigen- antibody response, which is time consuming and requires chemical reagents. In this study, we propose a non-invasive system for relating blood groups using light as a source of optic signals passed through the cutlet, which is also detected by an optic sensor. As the optic parcels of blood vary for different antigens present on the RBC, the voltage attained also varies. Depending on the affair voltage of the sensor, blood groups can be determined without puncturing the skin, making it an accessible and uncomplicated process.

Key words: Blood Group, Antigen, Optical Properties, LED, Optic Sensor

1. INTRODUCTION

Blood groups are one of the most crucial factors that determine the compatibility between donors and recipients during blood transfusion. In 1901, Karl Landsteiner, an Austrian immunologist, first identified the ABO blood group, which revolutionized the field of blood transfusion and transplantation. Before this discovery, these procedures were risky and potentially fatal due to the lack of knowledge about blood groups. Today, the knowledge of blood groups has become essential in ensuring safe blood transfusions and reducing the risk of unexpected transfusion reactions. During blood transfusions, typing is carried out to identify the blood group of the donor and recipient.

Humans has four major blood types: A, B, AB, and O. The presence or absence of A and B antigens on the surface of red blood cells determines a person's blood type. People with type A blood have A antigens on their red blood cells, while those with type B blood have B antigens. People with type AB blood have both A and B antigens, while those with type O blood have neither. Blood group detection is a vital aspect of medical practice, especially during transfusions and transplants. The conventional method of determining blood groups involves drawing blood samples and conducting an antigen-antibody reaction, which can be time-consuming, invasive, and require chemical reagents. Moreover, the conventional method is not suitable for infants, and the risk of infection and discomfort can also discourage some patients from undergoing this procedure. To overcome these limitations, we have proposed non-invasive approaches for blood group detection.

These approaches aim to provide a more convenient, less painful, and less risky way of determining blood groups. Several non-invasive methods have been developed, including using saliva, sweat, tears, etc.

2. PROPOSED SYSTEM

For non-invasive approach we try to build a device which is less time consuming and try to be more effective with less effort.

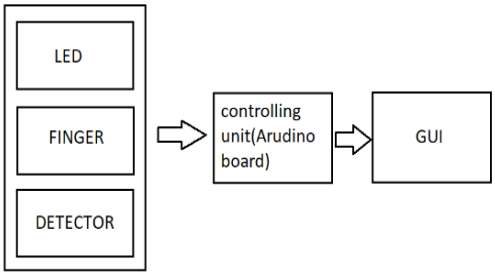
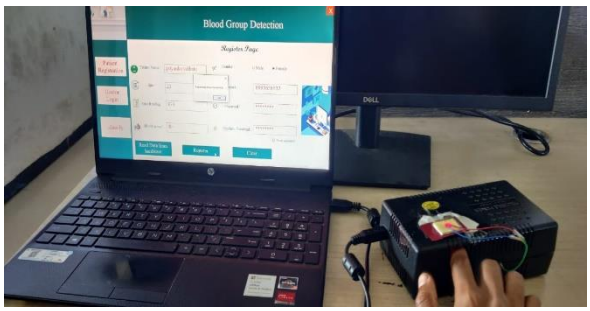
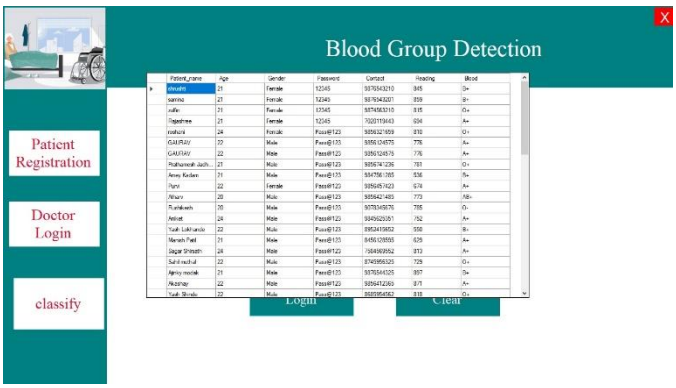


Fig 1: Block Diagram

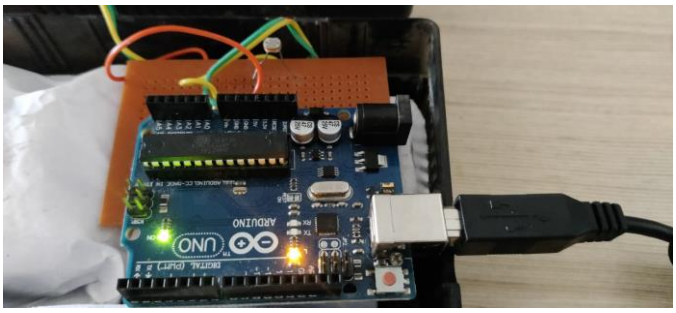
[1] Firstly, with the help of GUI we try to register the new patient.
[2] Once patient is registered, data is uploaded on the firebase cloud
[3] Through doctor login, doctors can check the details of the patients
[4] Now to identify the blood group, patient need to put the finger on LDR detector
[5] LDR will convert the input into electric resistance.
[6] After reading data from the hardware, we try to load the data.
[7] Next step is to Classify the data.
[8] Lastly, the Blood group we will be predicted.





3. IMPLEMENTED SYSTEM

i. Hardware implementation

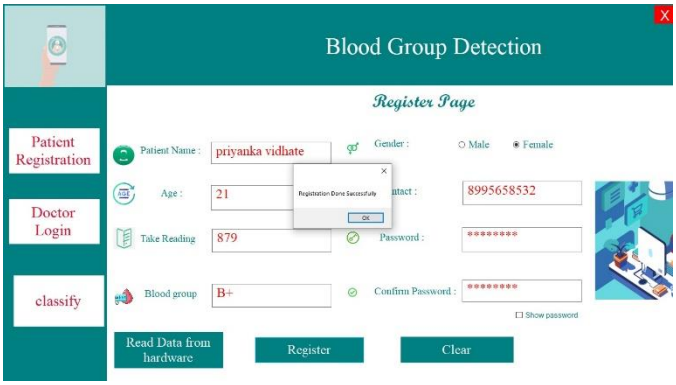


ii. Home Page

Home page consist of three main component that is Patient login, Doctor login and Classification. After clicking any one of the buttons we get navigate to their respective page.

iii. Registration Form

Here we implement a system for a hospital. Through which we save the data on cloud system securely without duplicate data. So here we created registration form for patients. Where they can enter personal information like their name, contact, Blood group, age, gender, and password they can register themselves on our system.



iv. Login Form

By using registration details i.e., contact and password patient can login to the system. If patient is not register earlier, he cannot login. At bottom of the page there is register button through which he navigates to registration form

v. Classify Page

In this, Patient must fill basic credential like gender, age and take reading from hardware and load data on cloud and finally blood group will be predicted.

4. MATHEMATICAL THOERY

- The Manhattan distance between two vectors is equal to the one-norm of the distance between the vectors. It is used extensively in a vast area of field from regression analysis to frequency distribution. It was introduced by Hermann Minkowski.
- The Manhattan distance as the sum of absolute differences [{a, b, c}, {x, y, z}]

$$= Abs[a-x] + Abs[b-y] + Abs[c-z]$$

- Manhattan distance is a special case of Minkowski distance, when P=1 for Minkowski distance, we get Manhattan distance.
- Manhattan distance[j]= $\sum_i 1 \mid xi - yi|$

$$=|x_1 - y_1|+|x_2 - y_2|+...+|x_n - y_n|$$

$$= \sum_{i,j}^{a,b} |Tji - Qi|$$

Were,

a= Number of Length

b= Feature length

Feature length depends of three factors:

1) Binary Classification for Gender (Male or Female)
2) Age
3) Reading from hardware

5. RELATED WORK

[1] Bhuvaneswari K et al. suggested their work on "IoT Based Non-Invasive Approach for Blood Group Detection using Led." In this paper they give an idea about how optical signal from the LED is sent through the fingertip and reflected signals are detected using LDR placed beside. The blood groups are determined by analyzing the variation of voltage level. Using IoT technology we can easily give and get blood in emergency situations.

[2] Prof. Dimpal Khambhati et al. suggested their work on "Identification of Voltage Level Present in Blood during Mistransfusion of Blood" which explain idea is a non-invasive method for identifying blood group. Light act as a source for optical signals which is allowed to pass through the finger and detector detects the varying voltage

[3] Siddhesh Khanvilkar et al. suggested their work on

"Automatic Detection of Human Blood Group System using Deep Learning and Image Processing" which explain about the system aims at developing results in shortest possible duration with precision and accuracy along with storage of result for further references

[4] Patil N. Vijaykumar et al. suggested their work on" A Novel Approach to Predict Blood Group using Fingerprint Map Reading" which explain The HFDU06 fingerprint scanner-based work presented here shows significant efficiency which constitutes the image processing tasks such as image to binary and thinning for correcting and normalization of fingerprint patterns.

[5] K.Nithyakalyani et al. suggested their work on "NON-INVASIVE BLOOD GROUP DETECTION USING LIGHT EMITTING DIODE" which explain about Noninvasive and Invasive technique like Image Processing, Bio-Optics method for blood typing are discussed.

SYSTEM COMPONENTS

I. Hardware requirements

a. Light Dependent Resistor

Light Dependent Resistor (LDR), also known as a photoresistor, is an electronic component whose resistance changes with varying light levels LDRs are typically made of a semiconductor material that exhibits photoconductive properties. They consist of a thin film of this material that is sandwiched between two electrodes. LDRs are made of semiconducting materials that exhibit a higher resistance in the dark and lower resistance in the presence of light.

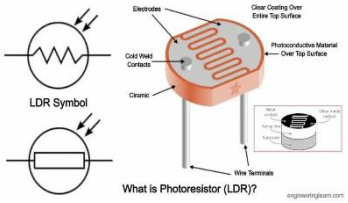


Fig-2: LDR

b. Lazer diode

The laser diode is a semiconductor device that emits coherent light through stimulated emission. Laser diodes are constructed using semiconductor materials, and they require a laser diode driver circuit for proper operation. They are available in various wavelengths and power outputs, producing a narrow and focused beam of light. Laser diodes can be modulated and should be handled with caution due to potential hazards to the eyes and skin.

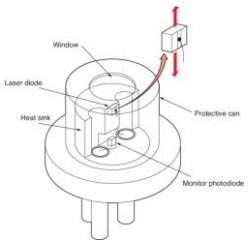


Fig 3: Lazer diode

c. Arduino

It is an open-source electronics platform based on easy-to-use hardware and software. The microcontrollers on the board are typically programmed using a dialect of the C and C++ programming languages, and the Arduino project provides an integrated development environment (IDE) based on the Processing language

Fig 4: Arduino

d. Resistor

Resistors are passive electronic components that impede the flow of electric current in a circuit. They are commonly used to limit current, divide voltage, provide biasing, and control the flow of signals. A 10k resistor refers to a resistor with a resistance value of 10,000 ohms

Fig-5: Resistor

II. Software requirements

a. Programming language - C#.NET

C# is a programming language developed by Microsoft as part of the .NET framework. C# is an object-oriented language that offers a combination of strong typing, garbage collection, and scalability. Visual Studio is used as Integrated development environment (IDE). It is supported on Windows, macOS, Linux, iOS, Android, and more. It provides a rich set of features and libraries that make development efficient and productive.

b. Firebase Cloud

Firebase Cloud is a cloud-based platform developed by Google that provides a variety of services and tools to help developers build and scale their applications. It offers a wide range of features, including real-time

database, authentication, hosting, storage, cloud functions.

4. ADVANTAGES & LIMITATIONS OF THE SYSTEM:

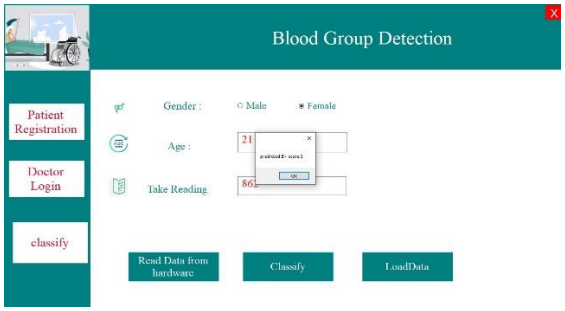
Advantages of the system

- Time saving approach for detection of blood group.
- Low cost so that anybody can afford it.
- Portability means it is compact in size so that we can bring it anywhere.
- Requires less efforts as compare to traditional methods

Limitations of the system

- LDRs are used for precise light measurements, as their response can be influenced by factors like temperature and ambient conditions
- Patient having long term diseases high Blood pressure, diabetes, skin conditions, etc maybe leads to provide inaccurate result.

5.RESULT



Srno	Blood Group	Voltage Level (Analog values)
1	A+	636-720
2	AB+	732-820
3	B+	874-950
4	O+	790-870

6. FUTURE SCOPE

It provides a significant contribution to the field of medical practice, and the potential benefits of this method are clear. With the development of new technologies and continuous research, the reliability and accuracy of this method could be improved, making it a practical solution for blood group detection in various aspect. The potential benefits of this method in various medical settings cannot be overstated, and further studies and tests are required to validate its accuracy and reliability.

7. CONCLUSIONS

Non-invasive approaches for blood group detection becoming increasingly popular due to their convenience and ease of use. While this method may not be as accurate as traditional blood-based tests, they can still provide reliable results and have the potential to be more widely accessible. More research is needed to fully validate their accuracy and reliability. It is also important to note that non-invasive tests may not be suitable for all situations, such as in cases where a more detailed blood analysis is necessary. Overall, non-invasive approaches for blood group detection have the potential to provide a convenient and accessible alternative to traditional blood-based tests, but their accuracy and suitability for different situations should be carefully considered.

ACKNOWLEDGEMENT

With all respect and gratitude, we would like to thank all people who have helped us directly or indirectly for the completion of this project. We express our heartily gratitude towards Mr. N. S Ujgare for guiding us to understand the work conceptually and for her constant encouragement to complete this work on "Blood Group Detection". We also express our thanks to Dr. V. R. Sonawane Head of IT department for providing necessary information and required resources. Last but not the least we thanks to all the teaching, non-teaching staff members of Information Technology Engineering Department for providing necessary information and required resources. We are ending this acknowledgement with deep indebtedness to our friends who have helped us.

REFERENCES

[1]"IoT Based Non-Invasive Approach for Blood Group Detection using Led". International Journal of Engineering Research & Technology (1JERT) ISSN: 2278- 0181

[2] Sandip D. Sahane, Uttam M. Chaskar. "To Provide an Easy and Fast Means of Identification of Blood Group Using IR Sensors 2nd IEEE International Conference on Recent Trends In Electronics Information & Communication Technology. Volume: 978-1-5090-3704, Year: 2017.

[3]. Kanada V. Bio-optics: blood type determination based on image processing techniques by utilizing an optical sensor device. Int J Sci Res.2016;5(7):214–217.

[4]"IoT Based Non-Invasive Approach for Blood Group Detection using Led". International Journal of Engineering Research & Technology (1JERT) ISSN: 2278- 0181

[5]"Novel optical biosensor method to identify human blood types using free-space frequency modulated wave of NIR photon technology -Dovepress

[6] Ala Eldin Oner, George Shaker, Safieddin Safavi-Nacini. Kevin Murray, and Richard Hughson, "Glucose Levels

Detection using -Wave Radar Published in: IEEE Sensors Letters (Volume: 2, Issue: 3, Sept. 2018).

[7]1. Tang, K. Hung. "Design of a non-contact body temperature measurement system for smart campus", IEEE International Conference on Consumer Electronics. Volume: 978- 1-5090, Year: 2016.

[8] Shyqyri Haxha, Senior Member, IEEE, and Jaspreet Jhoja, "Optical Based Non-invasive Glucose Monitoring Sensor Prototype. IEEE Photonics Journal, Volume 8, Year: 2016,

[9] Blood groups and Red cell antigens, Dean L.Bethasda(MD) National centre for Biotechnology Information(US);2005

[10] Vijay A. Kanade, Bio-Optics: Blood Type Determination based on Image Processing Techniques by utilizing an Optical Sensor Device. Index Copernicus Value (2013)