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APPLICATION OF THE BINARY NUMBER SYSTEM IN BLOOD GROUP TYPE CHECKING BASED EMBEDDED SYSTEM

Ricki Ananda[1], Muhammad Amin[1] , Parini[2]
[1]Sistem Komputer, STMIK Royal Kisaran
[2]Sistem Informasi, STMIK Royal Kisaran
email: *[1]anandaricki@yahoo.co.id

Abstract: The Indonesian Red Cross or abbreviated as PMI, is one of the organizations in Indonesia engaged in the humanitarian field. PMI has branches in all cities in Indonesia such as the red cross in Asahan district. Currently, the Asahan district red cross has a blood donation stock of ± 100/360 cc per bag. The purpose of designing a blood group type reader is to increase the certainty of blood types that are tested by experts or medical workers from PMI Asahan, according to the testing of the tool design. This study used a qualitative type of method, namely data taken in the form of data on the condition of the blood when rhesus fluid was given, so that the data will be calibrated with the test results so that the right test results can be decided. The results of testing the device design with blood and fluids, found that blood group A+ got an LDR value of 19.5 and 4 with a bina-ry condition of 101, while for blood group B+ got an LDR value of 19, 4 and 4 with a bi-nary condition of 011, blood group AB+ got a value LDR 19, 3 and 4 with binary condi-tion 111, blood type O+ found LDR values 19, 2 and 4 with binary condition 001. Mean-while for basic conditions, or not detecting blood type, LDR conditions 20, <=4, <=4 and binary value is 000. After testing, all results of testing the design of the tool are in full ac-cordance with the results of the conclusions of the PMI Asahan medical personnel about the type of blood group

Keywords: binary**;** blood donation; blood type detector

Abstrak: Palang Merah Indonesia atau disingkat PMI, merupakan salah satu organisasi di Indonesia yang bergerak dalam bidang kemanusiaan. PMI memiliki cabang di seluruh kota di Indonesia seperti palang merah di kabupaten asahan. Saat ini palang merah kabupaten asahan memiliki stok sumbangan darah ± 100/360 cc setiap kantong. Tujuan dirancang nya alat pembaca jenis golongan darah untuk menambah kepastian jenis darah yang diuji tenaga ahli atau medis PMI Asahan, sesuai dengan pengujian dari rancangan alat. Penelitian ini menggunakan jenis metode kualitatif, yaitu data yang diambil berupa data kondisi darah ketika dikasi cairan resus, sehingga data tersebut akan dikalibrasi dengan hasil pengujian sehingga memutuskan hasil pengujian tepat. Hasil pengujian rancangan alat dengan darah dan cairan, mendapati bahwa untuk golongan darah A+ mendapati nilai LDR 19, 5 dan 4 dengan kondisi biner 101, sementara untuk golongan darah B+ mendapati nilai LDR 19, 4 dan 4 dengan kondisi biner 011, golongan darah AB+ mendapati nilai LDR 19, 3 dan 4 dengan kondisi biner 111, golongan darah O+ mendapati nilai LDR 19, 2 dan 4 dengan kondisi biner 001. Sementara untuk kondisi dasar, atau tidak mendeteksi golongan darah, kondisi LDR 20, <=4, <= 4 dan nilai biner 000. Setelah dilakukannya pengujian, maka disimpulkan seluruh hasil pengujian rancangan alat sepenuhnya sesuai dengan hasil kesimpulan tenaga medis PMI Asahan tentang jenis golongan darah.

Kata kunci: biner; donor darah; pendeteksi golongan darah

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INTRODUCTION

The Indonesian Red Cross (PMI) is an organization engaged in the social and humanitarian field. Currently PMI is es-tablished in many cities throughout Indo-nesia, one of which is PMI in Asahan dis-trict.

Currently, PMI Asahan is not only en-gaged in the social sector, but is also an organization capable of providing blood for hospitals. Blood is a tissue in the form of serum and has two parts. The two parts are plasma as much as 55%, and the solid component or corpuscles as much as 45% [1].

Meanwhile, blood plasma consists of 91% water, 8% dissolved protein and 1% organic acids and 1% salt [2][3]. to determine blood type, a small blood sample is needed. Medical personnel will use a needle to take a blood sample through the fingertip. After the blood is taken, the needle puncture site will be covered with a plaster [4][5]. Based on the results of observations made at PMI Asahan, which is located on Jalan Cokro Aminoto, they still use a manual blood group checking tool by us-ing a glass, lancing device, and anti-A monoclonal, anti-B monoclonal, and anti-D IgG/IgM [6][7]. Weaknesses in the blood group checking system at PMI Asahan include frequent disagreements between staff and medical personnel on duty at PMI Asahan due to different perceptions about the conclusion of blood group types. Apart from that, sometimes the condition of the blood group that is given rhesus serum also makes the nurse or medical staff confused to draw conclu-sions, the type of donor's blood group is because the serum does not mix or sepa-rate, and the condition of the blood and serum is not comparable.

There are several studies that discuss the application of microcontrollers in the health sector, such as research conducted by Banar and friends. The research he did read blood type by utilizing the arduino R3 type controller. The results of his re-search look at the voltage data sent by sensor A and sensor B [8]. Dany Pratmanto, and friends, the research they conducted discussed blood type readings by looking at changes in the analog digital converter data on the sensor. In addition, the draft or results of the blood group reading are printed in the form of a receipt [9]. Aditya, dan kawan kawan membahas tentang penggunaan microcontroller untuk membaca tekanan darah, dimana sensor untuk pembaca tekanan darah menggunakan Sensor piezo yang terhubung ke arduino 2560 [10]. Umi in her research discussed the formation of an oximeter with a microcontroller. Research conducted found that the adc signal from the sensor is converted into waves to read oxygen levels in the blood [11].

Based on this, a blood group reading tool was designed using Arduino type microcontroller technology and using sensors.

The microcontroller used is the Arduino Nano type, the function of the controller here is to control the results of sensor reading decisions and data comparison modules [12]. The sensor used in this study uses the LDR sensor, the LDR sensor will read analog data starting from the smallest data 0 and the highest is 1023adc, so if the data is blocked by blood it will change [13].

The purpose of designing a blood type reading device is to increase accuracy and compare the results of medical personnel's decisions with the design of the device made.

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METHOD

The method used in this study is the quantitative method, that is, all data from blood will be tested on the LDR and button sensors, so that testing the condition of the blood that is given Rhesus fluid will be processed again as a determinant of the blood group variable.

In designing the tool, all VCC pins from sensors ldr1, ldr2, ldr3, button 1, button2, button3, LCD2004, laser 1, 2 and 3 are connected to the Arduino 5V pin. Meanwhile for GND the entire circuit is also connected to Arduino GND. As shown in Image 1 below.

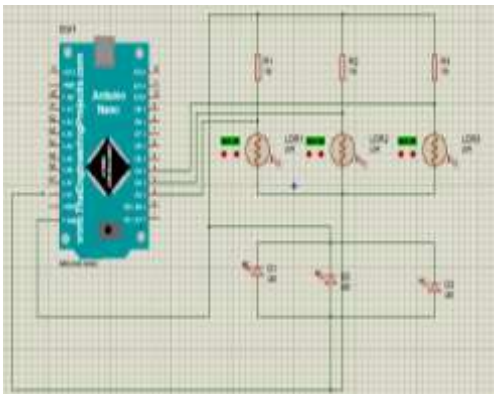

Image 1. LDR circuit and laser diode as a blood reader

The working system of the tool design is that staff or officers take blood group samples, and place rhesus fluid, then the blood group samples are placed into the device design, after that LDR will read the light resistance value which is blocked by blood type, so that the blood type display will be displayed on the LCD. if the officer is unsure about blood type, then the officer just presses each button which represents the condition of blood conditions A, B and C (if the blood clots the button is 1 or pressed, and if the blood breaks, or does not clot then the button condition is 0, or button is not pressed) so that this condition will later display the same condition as the reading from the LDR sensor.

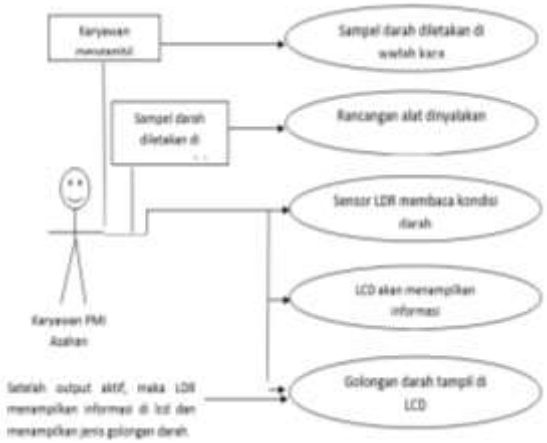

Image 2. Use case diagram of employee process with tool design

From Image 2 it explains where the officer or nurse takes a blood sample, and the sample is placed on the design of the tool, then the LDR sensor will read the condition of the blood, by reading the ADC value sent so that the sensor decides the type of blood type.

RESULTS AND DISCUSSION

Blood fluid mixed with serum must be placed between the LDR sensor and the laser diode, then the laser diode turns on the light, and the analog digital converter intensity value on the LDR sensor will be read and concluded by the controller whether the blood type is A or B or other blood groups.

The design of the tool in the form of a blood type detection device will automatically be placed or applied at the Asahan PMI office, then the tool will be operated by a special officer who can op-

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erate the device design, without having to choose officers from health agencies or agencies related to blood, but the officer who is able to turn on and place the blood sample on the tool being made. After that the tool will work automatically.

Image 3 physical appearance of the blood group reader

Image 4. laser diode irradiation with ldr sensor to read analog digital converter data

Table 1. Serum testing for blood with an LDR sensor

No	Gol Darah	Serum	The LDR condition is blocked by Serum	LDR conditions are not blocked by Serum	Information
1	A	Anti A monoclonal	355	450	Serum breaks down
		Anti B monoclonal	2	5	Fluid clot
		Anti D/Resus	477	466	Serum breaks down
2	B	Anti A monoclonal	200	460	Serum clumps
		Anti B monoclonal	5	5	Serum breaks down
		Anti D/Resus		666	Serum breaks down
3	0	Anti A monoclonal	355	140	Serum clumps
		Anti B monoclonal	2	5	Fluid clot
		Anti D/Resus	400	466	Serum breaks down
4	AB	Anti A monoclonal	366	450	Serum breaks down
		Anti B monoclonal	400	430	Fluid clot
		Anti D/Resus	400	466	Serum breaks down

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Tabel 2. Blood Test Results With LDR Data Reading

No	biner	LDR			Keterangan	Tampilan Goldar
		1	2	3		
1	101	19	5	4	Pecah, gumpal, pecah (A+)	
2	011	19	4	4	Gumpal, pecah pecah (B+)	
3	111	19	3	4	Pecah, pecah, pecah (AB+)	
4	001	19	2	4	Gumpal gumpal pecah (O+)	
5	000	20	<=4	<=4	-	Nilai dasar rancangan alat

Table 2 explains the condition of the blood taken to be a blood group sample and the initial data is converted into binary, then it can be read by the system. The condition for this value has not been distributed to the highest value, so you get the smallest result to approach binary.

Based on table 2, it explains that all the blood tested found third serum or D serum to produce 1 binary data, or if seen from the LDR value it is in the ADC range of 4, and the conditions in the field explain that it is in a clotted state. So that when in the field, there are two blood conditions when the serum is given, namely clots and rupture. The results of these conditions are converted into binary form, 0 and 1 so that a binary condition is obtained, or when the ADC value is 1023, it is reduced to find data close to 0 and 1, namely the highest data is 20, and the lowest data is 2, then analyzed, and converted into the form blood group type.

CONCLUSION

If the condition value of ldr 1 is in the range of 19, ldr 2 is in the range of 5 to ldr 3 is in the range of 4, then the condition or categorized as type A+ blood, so to compare blood type condition data, you must compare the ldr value when not given a blood group with the condition ldr given a blood group when given a separator liquid.

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