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Detection of Blood and Rhesus With Arduino Uno Mega 2560

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ABSTRACT

Detection of blood type is usually done manually by the process of testing red blood cells with the serum to see Whether clots will occur or not clot. The purpose of this study is to design a tool that will be used to detect blood types. In this study, the detection of groups was designed with electronics using ABO blood groups. This tool is designed using the Arduino Mega 2560 Module as a device, three light sensors, LED as a transmitter and a diode as a receiver. Clumping or non-clumping sensors from serum samples have been mixed. Furthermore, it will send a voltage to be conditioned by a comparator circuit and then sent to the Arduino for processing and the results will be displayed on the LCD, From testing 25 samples the percentage level can be calculated that is 100%.

1. Introduction

Human blood is grouped based on the presence or absence of antigens A and B. In the membrane of red blood cells (RBCs) type A contains antigen A; Group B contains eritrositnya membrane antigen B; AB blood type has A and B on the surface of the red blood cell membrane; and blood type O does not have A or B in the red blood cell membrane.

With blood type test, ABO and Rh antigens can be found in the blood donor and blood person who will receive. This test is used to determine the blood group of pregnant women and newborns. ABO, Rh factor, and the cross-linking reaction is reviewed here.

The detection of blood groups and rhesus usually can be done manually through the process of testing red blood cells with antisera (serum) to see whether the blood that has been given antisera (serum) occurred agglutination (clumping) or non-agglutination (not clot) .In this study, detection of blood groups and rhesus designed electronically using ABO and rhesus system. [1] [2]

During this time the blood test is done manually, by dripping a liquid reagent into the blood sample to see the level of blood clots using eye. This method can only be done by a person skilled in the art. To avoid error readings, necessary to make a device that has a standard use of technology such as sensors and a microcontroller to detect blood group automatically. The purpose of this study was to design and develop automated blood group detection device that is portable so it is easy to carry and use. [3] [4]

Now, detection of blood group still checked manually and wait for the results with longer periods of time. It is very inefficient, because the checker must wait a long time to get the result cuku. This study designed a blood group detection devices with voice output and sms. This tool uses a microcontroller ATMega 8535 and sonsornya photodiode, microcontroller will process the data and the results will come out through the speakers and sms .. [5]

At the beginning of the problems in the can is, blood group detection system is very time-consuming public to visit in advance and had to wait quite a long time, and especially with the relatively expensive cost issues that make people not want to detect blood type. With the above problems, the authors designed a blood type detector with arduino uno, with this tool so people can easily detect their blood group without taking considerable time and without spending big.

This blood group detection device used to detect blood groups that are usually done manually by the process of testing red blood cells with the serum to see if it would happen clotting or clumping. In this study, the detection of classes designed to electronics using ABO blood group. This tool is designed to use Module Arduino Mega 2560 as a tool, three light sensors, LEDs as transmitters. Sensor clotting or clumping of samples that have been in serum mix. Next, he would send for conditioning your voltage by comparator circuit then sent to the arduino to the process and the results will be displayed on the LCD.

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In this design, set how the circuit will be created. Creating a program using the existing instructions on the arduino so that the output can be directly displayed on the LCD.

2. Research Methods

The original method used is quantitative deskribtif method is by using sample testing using blood group card (KGD), therefore updated with SDLC method.

Design applications using the System Development Life Cycle (SDLC) waterfall model, this model provides a software approach life forms in sequence starting from problem identification, data collection, analysis of system requirements, system design, implementation, testing, analysis of test results.

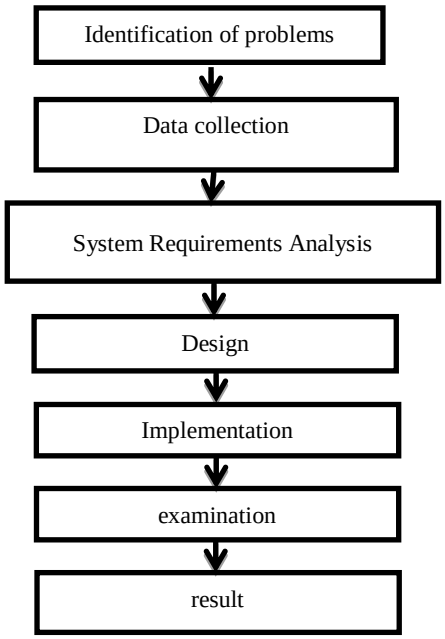

Figure 1. Flow Method

1) Identification of problems
   The first step taken to analyze and identify problems. In this step will result in the formulation of the problem, research objectives and benefits of research.
2) Data collection
   Collecting data in this study using literature obtained from books and journals on similar research.
3) System Requirements Analysis

Requirements analysis is needed to determine the needs of users as follows:
The hardware requirements are as follows.

a) Module Arduino uno atmega 2560.
b) 3 Light sensor.
c) LED
d) LDR
e) LCD

The software needs of the application are as follows.

a) Arduino Ide

4) System planning
   This stage consists of two processes, namely the process design and process design interface.Rancangan that make DFD and ERD as the design of the database to be created.
5) Implementation

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Phase system implementation is the stage of the application or system installation that is ready for operation.

6) examination

Testing is done after the encoding process selesai.Testing for this system using the black box testing.

7) result

a) Flow chart

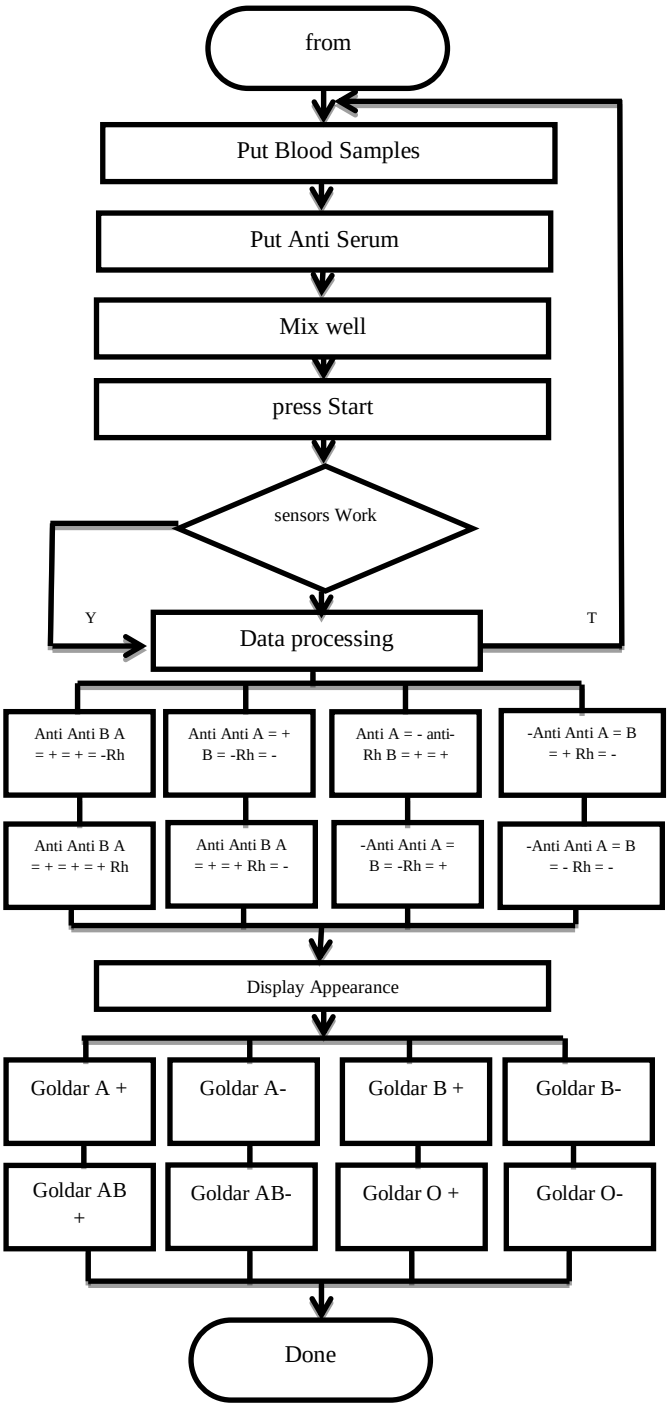

Figure 2. Process Flowchart Detection of Blood

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explanation Flowchart

1) Start,
2) Put a blood sample, after entering the sample,
3) Put anti-serum,
4) Mix well, then enter into the tool drawer tool,
5) Then press start to begin the process of checking
6) After that the sensor will work, when the sensor starts working if yes then the process continues to,
7) Processing of the data, if the data does not go well, then the process is returned to No. 2 that is input samples returned, if the data goes well then,
8) Will appear outputs the results of the blood group

b) White Box Testing

White-box testing is to look at the programs that have been in use can function or not.

Table 1.
White Box Testing

node	*Command*	*source code*	*Information*

1	Sampling	int menu = 0, sp1, sp2, data1 = 0, data2 = 0;
		int antiall, antial, antiahh, antiah, antibll, antibl, antibhh, antibh, rhesusll, rhesusl, rhesushh, rhesush, antiasp, antibsp, rhesussp, count = 0, play, timeouts;
		avg2 float, avg1, val1, val2, val3, back;
		void setup () {
		// put your setup code here, to run once:
		Serial.begin (9600);
		lcd.init ();
		lcd.backlight ();
		antiall = EEPROM.read (1);
		antial = EEPROM.read (2);
		antibll = EEPROM.read (3);
		antibl = EEPROM.read (4);
		rhesusll = EEPROM.read (5);
		rhesusl = EEPROM.read (6);
		antiahh = EEPROM.read (7);
		antiah = EEPROM.read (8);
		antibhh = EEPROM.read (9);
		antibh = EEPROM.read (10);
		rhesushh = EEPROM.read (11);
		rhesush = EEPROM.read (12);
		pinMode (start, INPUT_PULLUP);
		pinMode (cal, INPUT_PULLUP);
		pinMode (home, INPUT_PULLUP);
		pinMode (check, INPUT_PULLUP);
		pinMode (LED, OUTPUT);
		pinMode (buzzer, OUTPUT);
		digitalWrite (led, LOW);
		digitalWrite (buzzer, HIGH);
		delay (100);
		digitalWrite (buzzer, LOW);
		delay (100);
		digitalWrite (buzzer, HIGH);
		delay (100);
		digitalWrite (buzzer, LOW);
		}
			valid

2	Voice output	void song () { digitalWrite (buzzer, HIGH); delay (100); digitalWrite (buzzer, LOW); delay (100); digitalWrite (buzzer, HIGH); delay (100);	valid

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node	*Command*	*source code*	*Information*
		digitalWrite (buzzer, LOW); delay (100); digitalWrite (buzzer, HIGH); delay (100); digitalWrite (buzzer, LOW); }	

3	LCD display	tampilcal void (int a) {
		val1 = map (analogRead (Antia), 0,1023,0,99);
		val2 = map (analogRead (antib), 0,1023,0,99);
		val3 = map (analogRead (rhesus), 0,1023,0,99);
		lcd.setCursor (0.0);
		if (a == 1) {
		lcd.print ("Retrieve data +");
		}
		if (a == 0) {
		lcd.print ("Retrieve data -");
		}
		lcd.setCursor (0.1);
		lcd.print (val1);
		lcd.print ("");
		lcd.setCursor (5.1);
		lcd.print (val2);
		lcd.print ("");
		lcd.setCursor (10.1);
		lcd.print (val3);
		lcd.print ("");
		}
			valid

4		sampling void () {
		digitalWrite (led, HIGH);
		for (;;) {
		if (play == 0) {
		for (int i = 0; i <= 100; i ++) {
		lcd.setCursor (0.0);
		lcd.print ("Process");
		lcd.setCursor ((i / 10) +6.0);
		lcd.print (".");
		int rawsp1 = map (analogRead (Antia), 0,1023,0,99);
		int rawsp2 = map (analogRead (antib), 0,1023,0,99);
		int rawsp3 = map (analogRead (rhesus), 0,1023,0,99);
		antiasp = rawsp1;
		antibsp = rawsp2;
		rhesussp = rawsp3;
		lcd.setCursor (0.1);
		lcd.print (antiasp);
		lcd.print ("");
		lcd.print (antibsp);
		lcd.print ("");
		lcd.print (rhesussp);
		lcd.print ("");
		delay (100);
		if (i == 100) {lcd.clear ();}
		timeout = timeout + 1;
		if (timeout> 200) {break;};
		}
			valid

5	Calibration sample	void calibrate () {
		digitalWrite (led, HIGH);
		for (;;) {
		tampilcal (1);
		if (digitalRead (cal) == LOW) {
		lcd.clear ();
			valid

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node	*Command*	*source code*	*Information*

		delay (200);
		break;
		}
		}
		antiall = val1- (val1 / 100 * 20);
		antial = val1 + (val1 / 100 * 20);
		antibll = val2- (val2 / 100 * 20);
		antibl = val2 + (val2 / 100 * 20);
		rhesusll = val3- (val3 / 100 * 20);
		rhesusl = val3 + (val3 / 100 * 20);
		for (;;) {
		tampilcal (0);
		if (digitalRead (cal) == LOW) {
		lcd.clear ();
		delay (200);
		break;
		}
		}	

3. Results and Discussion

Preparation and testing of the system is done with the steps - steps as follows:

Step 1 Assembling the Hardware

a) Start stringing tool by means of soldering jumper wires to the PCB board that has been provided.

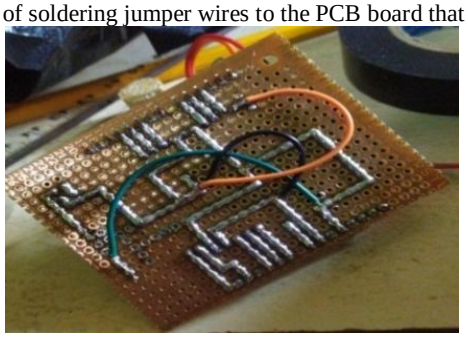

Figure 3, Design Tools

b) From this picture has been assembling and combining between arduino and a box that had been in the raft.

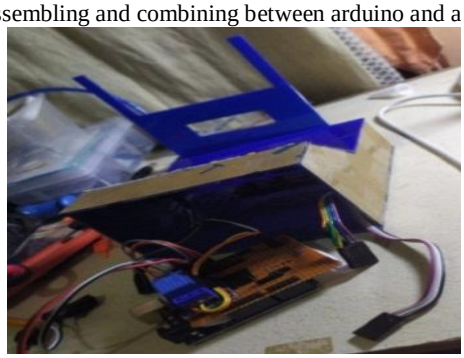

Figure 4.Perancangan Tool

The figure above shows for breadboard mounting in a box made of acrylic.

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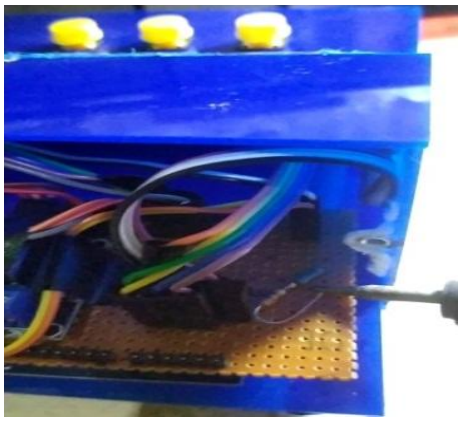

Figure 5, Design Tools

The figure above shows when breadboard installed properly and completing the soldering resistors to the board breadboard.

c) For laying on blood samples, the tools used are simple and simple tools that use the drug that is often sold in shops.

Figure 6, Blood Sample Sites

d) For the whole assembly has been done and put into a box using acrylic materials on the show in the following figure.

Figure 7 Overall Display Tool

Step 2

a) Power on detection tools by means of an electric power cable plugging the appliance backwards. Standby display apparatus as follows.

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Figure 8, Standby Display Tool

b) Before conducting the test, the blood drops to 3rd place that has been provided, then do the blood calibration, the calibration is done to retrieve data that has not been in love blood serum.
c) Take a blood sample that will be tested and then drops at 3 spots of blood that has been provided. Then put into the detection tool.
d) After the drops of serum anti-A, Anti-B and Anti-D in each place that has been in the blood drops.
e) Stir until evenly mixed with the serum, after mixed, insert the tool drawer.
f) Press the start button and wait for the loading process.
g) The series of sensors A, B, and D used to determine agglutination and non-agglutination.
h) The photodiode of the data will be sent to arduino to perform the detection process that will be on display to the LCD.
i) For detection results with the results of A +, the blood clots that occur are a clot, blood does not clot and Rhesus B clot, then the results of the blood occurs A +

Figure 9, Results A + blood

Figure 10, Results A + blood

j) For detection results with the results of B-, the blood clots that occur that A does not clot, blood clot and Rhesus B does not clot, then the result that occurs is B- blood.

Figure 11, Results of blood B-

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Figure 12, Results of blood B-

k) For detection results with the results of O +, the blood clots that occur are A does not clot, blood does not clot and Rhesus B clot, then the results that occur are O + blood.

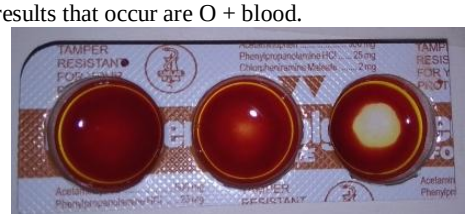

Figure 13, O + blood results

Figure 14, O + blood results

l) For detection results with the results of O-, then blood clots that occur that A does not clot, blood does not clot and Rhesus B does not clot, then the results happen that O- blood.

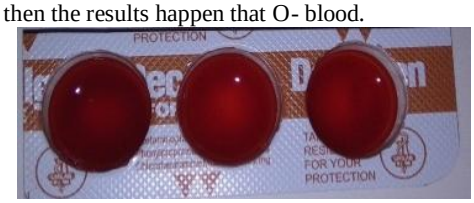

Figure 15, Results of O- blood

Figure 16, Results of O- blood

Measurement Calibration is done on 25 samples in the experiment by comparing the blood group card. Desktriptif quantitative method with the following formula:

$$\% \text{ Compliance } \Sigma ss \text{ KGD: } \Sigma sx \ 100\% \ (i)$$

Information :

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% Concordance = value measurement of the success percentage of suitability blood group card.
Σss KGD = number of samples in accordance with blood type card.
Σs = the total number of samples.

n% Incompatibility Σss KGD: Σsx 100% (ii)

Information :
% Discrepancy = value measurement of the success percentage of suitability blood group card.
Σss KGD = number of samples does not match the blood group card.
Σs = the total number of samples.

Table 2
Testing Blood Samples

No.	Name	KGD	Tool	Information
1	Raka	A +	A +	Corresponding
2	Danang	AB +	A +	It is not in accordance with
3	Reja	A-	A-	Corresponding
4	Nurisa	O +	O +	Corresponding
5	Dimas	AB +	A +	It is not in accordance with
6	Zidan	A-	A-	Corresponding
7	Fauzan	O +	O +	Corresponding
8	Rangga	B-	B-	Corresponding
9	Pious	O-	O-	Corresponding
10	mother Narma	A-	A-	Corresponding
11	Syits	O +	O +	Corresponding
12	Divi	A-	A-	Corresponding
13	Aqil	B +	B +	Corresponding
14	Sukirman	B +	B +	Corresponding
15	Sugiantini	A +	A +	Corresponding
16	anggi	A +	A +	Corresponding
17	mother Suciati	O +	O +	Corresponding
18	arip	O +	O +	Corresponding
19	Vicky	O +	O +	Corresponding
20	mother Sugiono	O +	O +	Corresponding
21	mother's Deli	B +	B +	Corresponding
22	Ibu Entin	O +	O +	Corresponding
23	Mrs. Lusi	B +	B +	Corresponding
24	Mrs. Rini	B +	B +	Corresponding
25	Andy Mahmud	B +	B +	Corresponding

1. n% concordance = Σss KGD: Σsx 100%
   n% concordance = 23: 25 x 100% = 90%
2. n% discrepancy = Σss KGD: Σsx 100%
   n% discrepancy = 2: 25 x 100% = 10%

Table 3
Ranges Clots

No.	Data	number Ranges
1	Clot	0-20
2	does not clot	35-50

4. Conclusion

Based on the results of research testing, and implementation of the application Detection of blood groups and rhesus with arduino, then get the following conclusion:

a) Of the device is in use, it can detect blood type.
b) Results of white-box testing, the program running at 100%.

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c) Results of testing tool used for 25 samples has secured the suitability of the sample of 90% for detection of an appropriate blood type and 10% detection are experiencing a mismatch of blood group which is done when the checking process.

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