

# Design and Fabrication of Smart Blood Group Detector

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**Abstract** – Automation surrounds in our living, regardless of its use for years in banking, retail and different industries, healthcare has lagged at the back of its use of automation. When searching out exact regions to use automation in fitness care environment, a standardization repeatable method is the primary factor to appearance for. Within sanatorium walls, a not unusual place method this is carried out on a huge populace of sufferers on an ordinary foundation like blood typing is a top place to use automation. Blood typing is the technique of figuring out the blood organization of a person. It is achieved previous to blood transfusion Using guide techniques blood kind may be decided in a depend of minutes. But human existence is priceless, there may be a possibility of dropping a existence for the autumn of each minute. Therefore, to conquer such important situation "SMART BLOOD GROUP DETECTOR" is designed and fabricated. It optimally makes use of time and money. The centrifuge on this package aids in agglutination procedure with the aid of using agitating the blood antigen solution. Then it robotically detects the blood institution the usage of shade action sensor. It additionally performs a main position in the course of scientific emergency with the aid of using sending broadcast message to donors of that unique blood institution. Apart from detecting the blood institution, with the aid of using various the velocity it may additionally be used as a cost-green centrifuge.

**Key Words:** Led, Control Unit and PC Display.

## 1.INTRODUCTION

Blood typing is the completed previous to a blood transfusion or while classifying an individual's blood for donation Blood typing is a quick and smooth manner to make certain that the individual gets the proper form of blood at some point of surgical operation or after an harm Not all blood kinds are compatible, so it is essential to realize your blood institution. Receiving blood this is incompatible together along with your blood kind should cause a risky immune reaction. In order decide your blood, a lab technician will blend your blood pattern with antibodies that assault kinds A and B blood to look the way it reacts. For example: in case your blood cells clump collectively whilst combined with antibodies towards kind A blood, you've got a kind B blood. Your pattern will then be blended with an anti-

Rh serum. If your blood cells clump collectively in reaction to the anti-Rh serum, its method which you have Rh effective blood i.e., B effective blood. A whole blood kind could describe every of the 38 blood groups, and a person blood kind is certainly considered one among many viable mixtures of blood-institution antigens. Almost always, a person has the identical blood institution for life, however very hardly ever a person's blood kind adjustments via addition or suppression of an antigen in infection, malignancy, or autoimmune disease. Another greater not unusual place reason of blood kind alternate is a bone marrow transplant. Bone-marrow transplants are accomplished for lots leukemias and lymphomas, amongst different diseases. If someone gets bone marrow from a person who's an exclusive ABO kind (e.g., a kind A affected person gets a kind of bone marrow), the affected person's blood kind will finally convert to the donor's kind. Some blood sorts are related to inheritance of different diseases; for instance, the Kell antigen is every now and then related to McLeod syndrome. Certain blood sorts can also additionally have an effect on susceptibility to infections, an instance being the resistance to unique malaria species visible in people missing the Duffy antigen. The Duffy antigen, possibly because of herbal selection, is much less not unusual place in populace agencies from regions having an excessive occurrence of malaria. Manual techniques like slide trying out technique cannot be relevant to check blood samples inside a quick span of time. Therefore, to conquer such important situation" SMART BLOOD GROUP DETECTOR" is designed and fabricated. It optimally makes use of time and money.

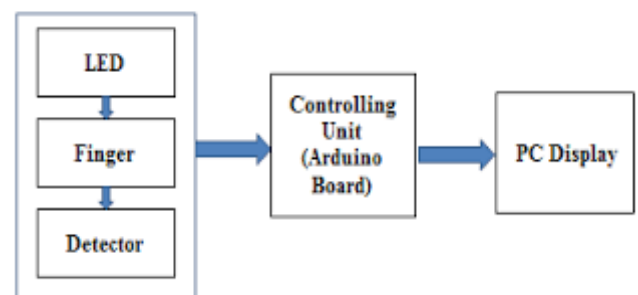


Fig -1: Process of Detector

## 2. METHODOLOGY

Blood group of a person can be determined by adopting the following steps:

Blood samples collected from patients has to be mixed with antigen A, B, D solution. Antigen and blood samples should be mixed in the ratio 1:2, to avoid error. Fidget spinner is used as centrifuge and aids in agitation, it can hold test tubes with samples in range of 1.5-2.0 ml. A stepper motor rotates the spinner in clockwise and counter clockwise direction and agitates the samples. Thus, blood clumping /agglutination occurs. The Arduino controller controls the overall function of the kit. The stepper motor rotates at 120 revolutions for minute every test tube is placed at an angle of 120°, the stepper motor exactly places the agitated blood samples in front of the color sensor. The color sensor senses every sample by observing its frequency change of simultaneously sends the sensed output in the digital form to the controller. Here the non-agglutinated blood samples are assigned as higher bit (i.e.) 1 and the agglutinated blood sample are assigned as lower bit 0.

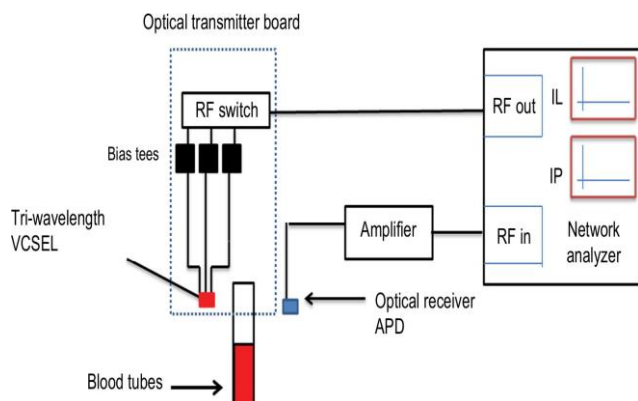


Fig -2: Layout of Working Blood Detector

### 2.1 Blood Transfusion

Transfusion medication is a specialised department of haematology this is involved with the examiner of blood groups, alongside the paintings of a blood financial institution to offer a transfusion provider for blood and different blood merchandise. Across the world, blood merchandise has to be prescribed through a clinical doctor (certified health practitioner or surgeon) in a comparable manner as medicines.

Much of the habitual paintings of a blood financial institution includes checking out blood from each donors and recipients to make sure that each person recipient is given blood this is well suited and is as secure as possible. If a unit of

incompatible blood is transfused among a donor and recipient, an intense acute haemolytic response with haemolysis (RBC destruction), kidney failure and surprise is probably to occur, and demise is a possibility. Antibodies may be exceedingly lively and may assault RBCs and bind additives of the supplement machine to purpose huge haemolysis of the transfused blood. Patients need to preferably acquire their personal blood or type-particular blood merchandise to decrease the risk of a transfusion reaction. It is likewise viable to apply the patient's personal blood for transfusion. This is known as autologous blood transfusion, that's usually like-minded with the patient. The manner of washing a patient's personal crimson blood cells is going as follows: The patient's misplaced blood is accumulated and washed with a saline solution. The washing technique yields focused washed crimson blood cells. The remaining step is reinfusing the packed crimson blood cells into the patient. There are more than one approaches to clean crimson blood cells. The fundamental approaches are centrifugation and filtration methods. This manner may be accomplished with microfiltration gadgets just like the Hem clean filter. Risks may be similarly decreased through cross-matching blood; however, this will be skipped while blood is needed for an emergency. Cross-matching includes blending a pattern of the recipient's serum with a pattern of the donor's crimson blood cells and checking if the aggregate agglutinates, or bureaucracy clumps. If agglutination isn't always apparent through direct vision, blood financial institution technicians normally test for agglutination with a microscope. If agglutination occurs, that specific donor's blood cannot be transfused to that specific recipient. In a blood financial institution, it's far essential that each one blood specimens are efficaciously identified, so labelling has been standardized the use of a barcode machine called ISBT 128.

Rare blood sorts can reason deliver troubles for blood banks and hospitals. For example, Duffy-terrible blood takes place plenty extra regularly in human beings of African origin, and the rarity of this blood kind with inside the relaxation of the populace can bring about a scarcity of Duffy-terrible blood for those patients. Similarly, for RhD terrible human beings there's a hazard related to traveling to elements of the sector in which elements of RhD terrible blood are rare, especially East Asia, wherein blood offerings may also enterprise to inspire Westerners to donate blood.

### 3. CLASSICAL STRATEGIES IN BG TYPING

In habitual scientific analysis, there's an extensive variety of installed techniques and practices for blood typing, in which almost they all address the formation of agglutinates. Even though a number of those classical techniques aren't distinctly sensitive, nonetheless, they nevertheless maintain significance in ABO grouping tests. There is a huge variety of blood typing techniques, which range from every different in phrases of sensitivity, reagents and system required, the time of operation and throughput analysis. Herein, we describe a few standard methods of blood grouping alongside their built-in benefits and drawbacks.

#### 3.1 Slide Method

The slide takes a look at is quite the least touchy technique amongst others for BG determination, however because of it activate effects, it's far very a good deal precious in emergency cases. In this approach, a pitcher slide or white porcelain help is split into 3 parts, as for every part, a drop of donor or recipient blood is blended with anti-A, anti-B and anti-D separately. The agglutination or blood clumping sample may be visually determined from which the ABO and rhesus D (RhD) form of blood may be determined. The take a look at completes in 5–10 min and is inexpensive, which calls for most effective a small quantity of blood typing reagents. However, it's far an insensitive approach and most effective beneficial in initial BG matching for buying an early result. The take a look at cannot be performed for weakly or not often reactive antigens from which the effects are hard to interpret, and additionally, a low titer of anti-A or anti-B may want to cause fake wonderful or fake bad effects. Although the slide takes a look at [6] is beneficial for outside blood typing, it isn't dependable sufficient for absolutely secure transfusion.

#### 3.2 Tube Test

In evaluation to the slide check, the tube takes a look at is extra touchy and reliable; therefore, it may be used readily for blood transfusion. In this method, each ahead (cell), in addition to opposite (serum) grouping is carried out. The ahead grouping indicates the presence or absence of A and B antigens in RBCs, while opposite grouping shows the presence or absences of anti-A and anti-B in serum. In ahead grouping, blood cells are positioned in take a look at tubes together with saline as a diluent media, after which one drop of every anti-A and anti-B is brought one at a time in those samples. These tubes are subjected to centrifugation for few

minutes, after which, the ensuing matrix is lightly shaken for gazing agglutination.

For particular blood grouping, the 2 tubes may be categorized in keeping with the quantity of blood clumping. The cause of centrifugation is to make certain stronger chemical interactions, especially for weaker antibodies to react, for that reason main to agglutination. Some potentiators may also be introduced to sell the agglutination; moreover, the lengthy incubation of tubes additionally favors those reactions without drying of the take a look at samples. In a comparable fashion, opposite grouping may be performed, as here, the blood serum is dealt with in opposition to RBC reagent organizations of A1 and B, and the following agglutination sample is monitored. The grading of agglutinates in each ahead and opposite grouping is beneficial in evaluating the distinction with inside the power of hemolysis reactions. In general, the tube approach is lots extra touchy than the slide takes a look at and calls for a low quantity of reagents, and a few sudden antigens also can be detected; therefore, it's far a higher alternative for more secure transfusions. However, in infants, opposite grouping is particularly hard to perform, due to the fact that they produce inadequate quantities of antibodies to be determined.

#### 3.3 Microplate Technology

Among classical methods, microplate technology is a in addition step with inside the path of more sensitive and speedy blood typing assessment with the feasibility of automation. In this technique, every antibody in blood plasma and antigens on RBCs can be determined. Typical microplates embody a large number of small tubes that contain a few  $\mu\text{L}$  of reagents, which may be treated toward the blood samples. Following centrifugation and incubation, the subsequent agglutination can be examined with the useful resource of the use of an automatic have a look at our device. The microplate technique turns out to be first introduced in early 1950s; however, because of the reality that then, massive inclinations have been made with in the format to decorate the performance. The primary advantage of microplate technology is its speedy response, low reagent volumes and immoderate throughput assessment. Apart from microplates, gel gambling playing cards or strips additionally may be used for blood grouping in contemporary immunoassay machines.

#### 3.4 COLUMN/GEL CENTRIFUGATION

Column agglutination generation or gel centrifugation is a especially cutting-edge method that has received huge hobby

in ABO blood grouping, because it intends to set up a preferred method for quantifying molecular agglutination. Here, the column is manufactured from small microtubes that consists of gel matrix to lure agglutinates. Blood serum or cells are combined with anti-A, anti-B and anti-D reagents in microtubes below managed incubation and centrifugation. The gel debris entice the agglutinates, while non-agglutinated blood cells are allowed to by skip via the column. The evaluation time may be decreased through the use of glass beads in area of gel material, when you consider that on this way, quicker centrifugation speeds may be achieved, which ends up in fast results. This generation is sensitive, honest and comparatively smooth to perform for much less educated personnel.

#### 4. RESULTS AND DISCUSSION

The machine is fixed with the base of rotating element where the mixture is revolved at a high speed. The speed of stepper is 150 rpm and its steps are 200 /rev. It has high tensile strength, which helps it in revolving at a strong force. It requires 12v for its operation. the equipment is highly safe and its output is not influenced by any external or environmental factors. It can deliver flawless output within a period of 27 seconds. when the emergency switch is activated, donors will be intimated with the hospital address with period of 5 seconds thus the "SMART BLOOD GROUP DETECTOR "is designed and fabricated.

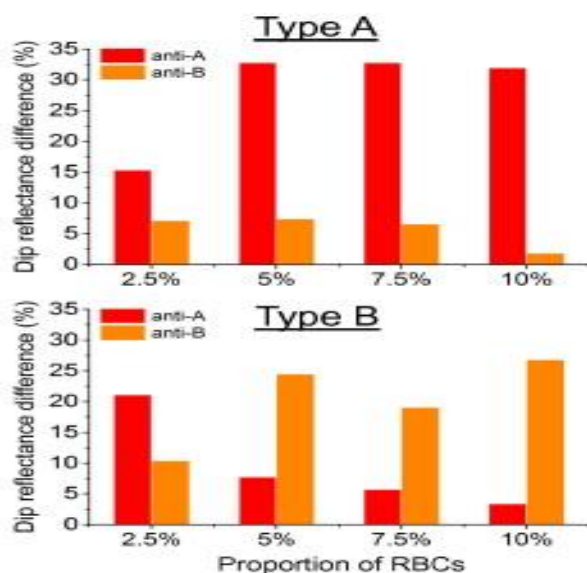


Fig -3: Graph of Type A and Type B Blood

#### 5. CONCLUSIONS

In most of the hospital, there is no common equipment for determining the blood group of people, blood typing is

manually done. "SMART BLOOD GROUP DETECTOR", aids in blood typing also eliminates inaccuracy. The machine is highly efficient and it is capable of rotating the material of different densities and is capable of separating solid and liquid parts of the sample by varying speed, thus it can also be used as cost efficient centrifuge. It places an indispensable role during medical emergency and with the incorporation of multifunction features, it is found to be beneficial to the society.

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