Blood collection monitor

Environment, Electricity

Introduction: B

LOOD COLLECTION MONITOR is an advanced device which is aimed to collect the blood prior to collection with the use of the latesttechnologyin place of earlier, insufficient, conventional methods i. e. without accurate weight by using random movement. The main concept behind this project is the use of mechanically provide rocking movement to blood and proper mixing with anticoagulants. Also, restrict the blood flow from the donor when a particular limit is reached. I. e. 350ml or 450ml. This is done by a load cell and by comparing signal activate the stopping clamp is activated. As the sensing range of the load cell is in mill volts; directly the signal can be given as input to the circuit because it will provide insufficient output. So, it is required to be properly amplified. So, the block diagram is designed taking into account this matter. Then compare it with a reference signal which is decided by many experiments. It activates the clamp and stops the rocking movement of the plate when the weight in the blood bag is presented. It is approximate to the actual design but more function of the instrument by extra features like flow detector, flow rate measurement, etc.

The requirement of the project: As we all know that blood collection monitor is very helpful for the collection of accurate blood, it’s a compact instrument that provides smooth and gentle rocking movement of homogeneous mixing with anti-coagulant, so in modern lifestyle, most of the doctors prefer these types of instrument for collection of blood very accurately. A blood collection monitor is very helpful to donate blood. hat happened in the past that there are no such types of instruments that were present so it is inaccurate random process for doctors to take blood from the donor and also sometimes

improper mixing with anticoagulant lead to waste the valuable donated blood that process may not help to accurately blood collection. With the help of this modern instrument it is very easy for doctors to take the blood from the donor, and through this instrument may also require less effort. Collection of blood accurately and safely.

Generalized block diagram AND CIRCUIT DIAGRAM:

1. Power supply to give DC supply to us and other devices.
2. Mechanical assembly to apply the rocking movement of the plate.
3. Load cell for blood bag weight measure.
4. Instrumentation amplifier for amplifying the signal from the load cell.
5. Comparator for obtaining stopping pulse to clamp.

The whole assembly made such that one side of the plate is joined with DC motor and U shaped bent rod which can able to push and pull the plate from one side as the plate is fixed with assembly from center power to DC motor lead rocking or sea show type movement which we want. It is the most important part of the instrument as mixing blood with anticoagulants properly. Fig 5. DC motor shaft connected to the assembly. Fig 4. assembly to provide rocking movement. Sensing the weight of the blood bag during donating the blood is the most important task as on this basis measuring, displaying, and further stopping of blood flow mechanism works.

To measure the blood weight we used a load cell as a sensor. In load cell according to change in weight input-output in mill volt also changes by using this basic principle weight sensing is done. The load cell has an inbuilt bridge balancing circuit with a weight sensor. Fig 8. Cantilever beam connection. Fig

7. load cell. Fig 6. The internal circuit of load cell. Fig 9. Original datasheet by Rudra sensors. According to the datasheet input 8-12dc volt given to cell and output in changes in millivolts. Below is the datasheet of load cell. This block provides sensor output signal the sufficient amplification so as to drive further circuits properly and without loading. Generally, 3 Op-Amp instrumentation amplifiers are employed in biomedical projects. As load cell senses in the range of mill volts, we have to amplify it in of 1000 gain. Instrumentation amplifiers are actually made up of 2 parts: a buffered amplifier OP1, OP2, and a basic differential amplifier OP3. The differential amplifier part is often essential when measuring sensors. Because a sensor produces a signal between its terminals. The buffered amplifier OP1 and OP2 not only provides gain, but prevents the sensor resistance from affecting the resistors in the op-amp circuit, and vice-versa!

The gain can be calculated by Where; R1= R3 and R5/R4 = R7/R6. (R5= RF).

Gain calculations: Gain (A) = (1+ (2*(R1/R2))*(RF/R4) Taking A= 1000 & diving 1000 as 500*2, 1+2R1/R2= 2 2R1/R2= 1 2R1= R2 Taking R2= 2K, R1 = 1K. Now, RF/R4= 500K R4= 1K, RF= 500K = 1MOhm || 1MOhm = (1000000*1000000)/ (1000000+1000000) = 500 K. 4.

WORKING OF CIRCUIT: The instrumentation amp offers two useful functions: amplify the difference between inputs and reject the signal that’s common to the inputs. The latter is called Common Mode Rejection (CMR). OP1 and OP2 are the two input amp’s and connected in the non-inverting follower configuration. It is the solution for high gain and high input impedance.

Note: This is of the high gain circuit so before soldering it on GPB, connectivity check of all the components as per the circuit diagram twice on the bread-board is advisable. There may chances of unpredictable o/p due to IC saturation.

COMPARATOR: It compares the input signal with the reference signal. When the input exceeds the reference signal it gives positive saturation and negative saturation when less than the reference signal. We are using 1 volt as a reference, as from the experiment we get 1-volt output from the instrument amplifier through a load cell under 350ml blood beg. Basic relay construction A relay is an electrically operated switch. Many relays use an electromagnet to operate a switching mechanism mechanically, but other operating principles are also used. Relays are used where it is necessary to control a circuit by a low-power signal (with complete electrical isolation between control and controlled circuits), or where several circuits must be controlled by one signal. Here in our applications operation is must switch from rocking movement to clamp operation. (As comparator detects particular weight in plate rocking movements stops and clamp activated). Now a day’s almost all hospital doctors prefer these instruments for accurate collection of blood. Through this instrument, we can easily collect the blood of the donor and this instrument is also helpful in mixing the blood with an anticoagulant so blood does not clot and also to collect the accurate amount of blood. Also, indicate flow rate from donor to bag and error in flow rate whether any obstruction in the donor's vein in any case. Doctors and blood bank technicians prefer this instrument for the accurate collection of blood

so we can say that its main application is in the medical field and in hospitals.

Limitation: The blood collection monitor is a useful instrument for doctors and so accurate for the collection of blood so we found no any limitation in blood collection monitors right now. But ours is designed for only 350ml blood collecting, as well as it has no current weight display, flow indications. Our angular rocking movement is slightly large and jerky. In the future, this instrument will be facilities with more necessary parameters like flow rate, blood temp. Detector etc. Though the motor used to rotate the plate not generating much noise it will be removed in the future. Now a day's BCM is a single unit but in the future, it may facilities with some storage space of the bag.

CONCLUSION: For Blood collection monitor we can say that it is a useful instrument for the collection of blood accurately for doctors and safe for donors. And that's why it's being more commonly used in most hospitals now a day. From my side I conclude that designing a single unit of the instrument is not possible without fundamental knowledge of electronics, controlling, basic of simple principles, and last but not the least patience and faith in my work and strength. I also mention that repetitive work on any circuit remove basic doughty and also working problem. My project also teaches me the technical thoughts, human relationships.

Reference

1. www. biomedprogects. com