International Conference on Innovative Trends in Electronics Communication and Applications 2015 [ICIECA 2015]

ISBN	978-81-929742-6-2	**VOL**	01
Website	icieca.in	**eMail**	icieca@asdf.res.in
Received	02 - April - 2015	**Accepted**	15 - November - 2015
Article ID	ICIECA003	**eAID**	ICIECA.2015.003

Blood Group Detection and Mobile Monitoring System

Nishtha Nagar[1], Aesha Shah[1], Aditya Singh[1], Shreya Akotiya[1]
[1]Ahmedabad Institute of Technology,
Ahmedabad.

Abstract: *Patients at disaster scenes can be greatly benefitted from technologies that continuously monitor their vital status & locations until they are admitted to the hospital. We have tried to design & developed a patient monitoring system that integrates vital signs sensors and transfers the same to allow remote monitoring of patient vital-sign status. This system shall facilitate collaboration between providers at the disaster scene, medical professionals at local hospitals & specialists or experts who might be available for consultation from distant facilities. In modern electronic communications, fiber optic system plays a prominent role. The principle of fiber optics is used in many modern medical electronic fields like endoscopic devices. Mistransfusion of blood will lead to many complications. This project provides an easy and fast means of identification of blood groups. Blood groups differ due to different antigens present in them and these antigens have different optical properties such as absorption and change in optical path length of light. The light from the pulsating LED is passed through the blood sample via an optical fiber cable and the transmitted light is then detected and is converted into voltage. The transmitted light from different blood groups will have different intensities and thereby different voltage levels, based on which, blood groups are classified.*

Keywords*:* Blood Group, Mobile, MEF, Fibre optics

INTRODUCTION

Steady advances in wireless networking, medical sensors, and interoperability software create exciting possibilities for improving the way we provide emergency care. The mobile monitoring system, that is being developed, explores and showcases how these advances in technology can be employed to assist victims and responders in times of emergency. The scope of this project covers a subset of the technologies in mobile patient monitoring system. We have developed a system that facilitates collaborative and time-critical patient care in the emergency response community.

During a mass casualty disaster, one of the most urgent problems at the scene is the overwhelming number of patients that must be monitored and tracked by each first responder. The ability to automate these tasks could greatly relieve the workload for each responder, increase the quality and quantity of patient care, and more efficiently deliver patients to the hospital. Our system accomplishes this through the following technologies:

- Sensors to sense and record vital signs into an electronic patient record database. This dramatically improves the current time-consuming process of manually recording vital signs onto paper pre-hospital care reports and then converting the reports into electronic form for the hospitals.

Cite this article as: Nishtha Nagar, Aesha Shah, Aditya Singh, Shreya Akotiya. "Blood Group Detection and Mobile Monitoring System". *International Conference on Innovative Trends in Electronics Communication and Applications (2015)*: 20-24. Print.

• Pre-hospital patient care software with algorithms to continuously monitor patients' vital signs and alert the first responders of critical changes.

Blood Group Detection Using Fiber Optic Cable

Blood group detection has always played a vital role in the medical field, thus detection of blood group is an essential process. In this report we will be seeing a method by which blood can be categorized into different groups (A, B, O, AB) in a smaller amount of time then the conventional methods.

Transmitter generates the electrical pulses to the LED which converts electrical pulses into optical pulses and this light is then coupled into the optical fiber using optical connector and is made to fall on to the passed blood sample. Some amount of light is absorbed by the blood and the transmitted light is then detected using receiver circuit. Different blood groups will have different voltage levels as detected by the receiver and blood groups are identified.

Blood Groups

Blood mainly consists RBC. This is common in all the groups, the differentiation in the groups occur due to the presence of Antigens in the RBC. For E.g. a group consists of A Antigens and B group consists of B Antigens. The presence and absence of these Antigens helps us in the grouping of blood.

Optical Properties of Blood

The principle behind differentiating the blood groups is due to the variation of the optical properties of different blood groups. When light is passes through different blood groups the amount of absorption differs for each thus the transmitted light intensity also changes. The optical path length for each blood group also changes. This helps in differentiating in the blood groups.

DESIGN

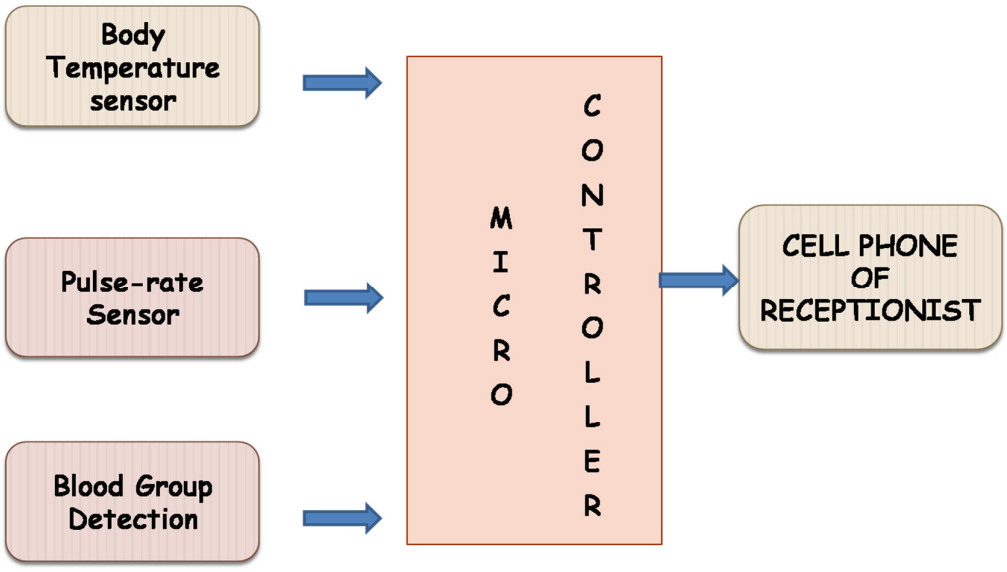

Figure 1. Architecture of patient monitoring system

THE DETAILED DESCRIPTION OF EACH BLOCK

Body Temperature Sensor

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in °C).

Cite this article as: Nishtha Nagar, Aesha Shah, Aditya Singh, Shreya Akotiya. "Blood Group Detection and Mobile Monitoring System". *International Conference on Innovative Trends in Electronics Communication and Applications (2015)*: 20-24. Print.

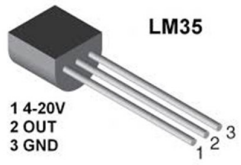

Figure 2. LM35 Body temperature sensor

The temperature sensor is that use substances of various physical properties with temperature variation of the sensor and let the temperature converted to electricity. These regularly change the physical properties of the main body temperature sensor is a core part of the temperature measuring instruments, and a wide variety. In accordance with the measurement method is divided into contact and non-contact two major categories, In accordance with the characteristics of sensor materials and electronic components into the thermal resistance and thermocouple. Used in this experiment is the LM35 temperature sensor.

Pulse-Rate Sensor

Pulse-rate is a very vital health parameter that is directly related to the soundness of the human cardiovascular system. This describes a technique of measuring the pulse rate through a fingertip using Arduino board. While the heart is beating, it is actually pumping blood throughout the body, and that makes the blood volume inside the finger artery to change too. This fluctuation of blood can be detected through an optical sensing mechanism placed around the fingertip. The signal can be amplified further for the microcontroller to count the rate of fluctuation, which is actually the pulse rate. This module detects the light emitted from the IR LED passed through blood and the photodiode detects it.

When your heart pumps the blood and the pressure rises sharply. So the amount of light from the emitter goes to the detector. The detector passes current when it sees more light, which in turn causes voltage drop.

This design uses two consecutive OP-AMPS which amplifies the peak and filters out the noise. Both the OP-AMPS are contained in a single integrated circuit. The IC is LM324 which has four OP-AMPS integrated in it out of which only two OP-AMPs are used in this module. The first OP-AMP will amplify the signal and will pass it on to the next OP-AMP. However, the signal is still weak. This weak signal is the given to the transistor for further amplification. This output is given as input to the Arduino.

Blood Group Detection

In modern electronic communications, fiber optic system plays a prominent role. The principle of fiber optics is used in many modern medical electronic fields like endoscopic devices. The first and foremost thing a doctor does while treating patients met with an accident is to determine patient's blood group. On an average, a doctor takes 10 minutes to find the blood group. In emergency cases, even 10 minutes delay in transfusion of blood may lead to the death of the patient. Hence, determination of blood group of a patient met with an accident, within a very short span of time is a vital factor. So far, blood grouping is done in laboratories or hospitals either by manual method using slide, or tile method or by semi-automated method using gel technology. Whereas all these processes are laborious and time consuming (takes at least 10 minutes). The need for the project is to develop a semi-automated blood grouping device with faster response than any other currently available technologies.

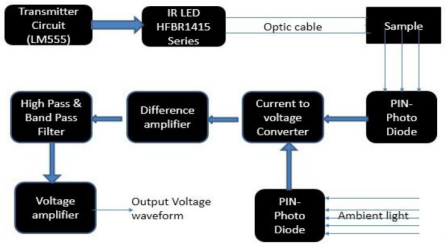

Figure 3. Block diagram of blood group detection system

Transmitter Circuit

The transmitter takes an electrical input and converts it to an optical output from a laser diode or LED. The light from the transmitter is coupled into the fiber with a connector and is transmitted through the fiber optic cable plant. The light from the end of the fiber is coupled to a receiver where a detector converts the light into an electrical signal which is then conditioned properly for use by the

Cite this article as: Nishtha Nagar, Aesha Shah, Aditya Singh, Shreya Akotiya. "Blood Group Detection and Mobile Monitoring System". *International Conference on Innovative Trends in Electronics Communication and Applications (2015)*: 20-24. Print.

receiving equipment. The sources used for fiber optic transmitters need to meet several criteria, it has to be at the correct wavelength, be able to be modulated fast enough to transmit data and be efficiently coupled into fiber.

The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. In our project we are using NE555 timer in astable configuration The NE555 parts were commercial temperature range, 0 °C to +70 °C. In astable mode, the 555 timer puts out a continuous stream of rectangular pulses having a specified frequency. Resistor R1 is connected between VCC and the discharge pin (pin 7) and another resistor (R2) is connected between the discharge pin (pin 7), and the trigger (pin 2) and threshold (pin 6) pins that share a common node.

Black Box Design

The black box is designed to hold the sample, the optical cable and the photodiodes. It is divided into two compartments so that light from the optical cable does not fall on the photodiode which is used for ambient light cancellation. The optical cable is placed in a hole of diameter 2cm and the light is made to fall on the sample which is kept in a Slide and cover slip arrangement and the photodiode is kept behind the sample all of which are kept in a straight line to get the maximum result.

Receiver Circuit

The light from optical cable is then passed through the blood sample which is placed in a specially designed wooden box. In the two compartments two photodiodes are placed. Blood sample is placed in the right compartment and light from the optical fiber is passed through the blood sample and the transmitted light is then detected by the photodiode in that compartment.

The other photodiode in left compartment detects only the ambient light. These two photodiodes converts their respective input lights into voltages and these two voltages acts as an input to the instrumentation amplifier. The purpose of the extra photodiode is to eliminate the effect of ambient light on the main diode. The output of the instrumentation amplifier is then given to high pass filter to eliminate any dc in the signal. The resultant signal is then passed through the band pass filter of 8 to 12 kHz and then amplified to remove noises and for better accuracy.

RESULT

Table 1

Blood Group Voltage Levels

BLOOD GROUP	***VOLTAGE LEVELS GAIN=20***
A	*2.20 – 2.29*
B	*2.00 – 2.198*
O	*2.31 – 2.54*
AB	*2.61 – 3.014*

FUTURE SCOPE AND APPLICATION

The device mentioned above has a tremendous potential market in the field of medical sciences. The blood group detection unit is a quick and easy way for determining the blood group and comes as a great help during the times of emergency. The unit can be used otherwise by laboratories and common people for a hassle-free analysis. Moreover, with development in the unit, the Rhesus factor can be determined which will provide a very precise determination of the blood group.

Moreover, the mobile patient monitoring system is a compact and easy to operate device that can be used in ambulances, hospitals, clinics and also at homes. The device can be used by paramedics during the emergency, by doctors at hospitals and can even be installed at homes to continuously monitor terminally-ill patients.

The complete monitoring system that is aimed for development will be providing a wholesome analysis and monitoring of various vital signs of the emergency victims and terminally-ill patients and thus reduces the work of doctors and nurses to a great extent.

Cite this article as: Nishtha Nagar, Aesha Shah, Aditya Singh, Shreya Akotiya. "Blood Group Detection and Mobile Monitoring System". *International Conference on Innovative Trends in Electronics Communication and Applications (2015)*: 20-24. Print.

ACKNOWLEDGMENT

Project work is something that cannot be completed by the blind efforts of an individual but it is a constant inspiration and help of the people you work around. We are extremely thankful to our college, Ahmedabad Institute of Technology, Ahmedabad and our professors for their valuable guidance and providing with excellent working environment. We are also thankful to our family and friends for their support and encouragement.

REFERENCES

[1] G.Keiser, Optical Fiber Communication, McGraw-Hill, 2000.
[2] J.Senior, Fiber optic communication: Principles and Practice, Prentice Hall, 1992
[3] R. Gayakwad, Op-Amp and Linear Integrated Circuits, Prentice Hall of India
[4] Blood Group Detection Using Fiber Optics, T.M. Selvakumari, Armenian Journal of Physics, 2011, vol. 4, issue 3, pp. 165-168
[5] Blood Group Detection Using Fiber Optics Pramod Kakarla, Murari Yashwanth K, Srikanth PVNK, Rishi Kumar R, Pratibha N, Amrita viswa Vidyapeetham, Coimbatore.

Cite this article as: Nishtha Nagar, Aesha Shah, Aditya Singh, Shreya Akotiya. "Blood Group Detection and Mobile Monitoring System". *International Conference on Innovative Trends in Electronics Communication and Applications (2015)*: 20-24. Print.