Develop Portable Blood Analyzer Based On Temperature And Quantity Level

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Abstract. This technical paper presents a developing portable blood analyzer for monitoring of human blood sample. Perseverance of blood sample in hospitals is important in order to obtain a great quality of blood and therefore it able to determining the human type of disease. This is a life-threatening early step in most medical applications fields such as diagnosis, treatment and medical research. The proposed system consists of three main parts. In the first part, the use of convenient and handy device to deal with the problem of incorrect temperature value and inadequate quantity of blood sample. Most of previous human hospitality services show a fail to handle and properly in time to take human blood sample for diagnosis in a schedule time frame such as not punctual in taking blood sample from a patient in three different times in one day. The consequences is that these blood sample are not in perfect quality for a correct estimation of the human disease towards a pathology unit. The proposed method is a device that uses infrared temperature system and non-contact blood sample quantity detection. In the second part is by combining those two approaches to single programmable electronic modules that are used to minimize the size of the portable device in the resulting techniques to improve the functionality. The third part is accomplished by using a modern technique to produce an interface to provide the value of human blood sample and shows it on display for monitoring purposes. The programmable coding has been test in several different types of sensors and physical part. The experimental results show that this method able to integrate both requirement of human blood sample perseverance with a contactless method towards a blood tube, providing the output value of quality characteristic in a display and making it well-suited for a convenient practical application system. The experimental results in real time applications shows the effectiveness, reliable and efficiency in the proposed approach which able to almost accurately detect and monitor the human blood sample with the ability to detect different types of people gender and blood type. The proposed coding system can be executed at more precise time scheduling which is better than real life human monitoring system.

1. Introduction

This paper is about human blood analysis as the methods take a blood sample and produce a measurement value as an output. Other seemingly terms often used called blood preserving, monitoring and stability action. Only a few standard blood monitoring concepts was explained in detail. Most methods can find the important perception that value of temperature and quantity detection is computed from a human blood sample. In particular, application of sensor for temperature and
quantity of blood sample provides important information regarding quantitative measurement of blood for technically and methodologically demanding. A recent study shows that the effect of temperature and quantity during the storage of blood on DNA that are extracted will have a relationship between intact and molecular weight quality for further molecular diagrams of genetic diseases or other genetic disorders. This system is using temperature sensor for blood monitoring that are preserve and infrared sensor for quantity measurement. Figure 1 shows several syrup mixture that are fill in a plastic tube.

Figure 1. Syrup mixture of different height.

Moreover, this paper will focus on a method to monitoring the quality of blood samples by using a portable blood analyzer that able to detect a volume of blood quantity in a flexible time-frame. Each blood sample which are store in a tube jar are then attach by this portable device so that the blood is in a required distance for sensoring detection. By using this method, a daily blood collected from patient for monitoring purpose can be identify its quality before this blood is transfer to pathology section. The expected result of this study might have a better quality of blood sample preserve can be monitoring using an infrared technology.

An experimental investigation was conducted in the past few years to explore the human blood perseverance. It has played a key part in blood monitoring because they carrying important blood sample quality. Other than that, it is because blood perseverance by infrared technology had a great impact in diverse applications. Besides, blood detection describes the procedures to improve quality for human consumption. In addition, blood sample from hospital is taking from patient to analyze patient’s diseases or any symptoms. This blood sample is frequently taken 3 times per day in a different time for monitoring purpose by the pathology. But, because of some nurse’s apathetic behavior, they only take the blood sample once in the morning and use it for the whole day. Normally, a value of 22 degree celcius blood should be preserve for blood monitoring. But in consequence of nurse’s mistake, it will affect quality of blood since it has been exposed to surrounding. Nevertheless, inadequate storage conditions may indeed have a detrimental effect on both the yield and the quality of extracted DNA, which in turn may influence the results from subsequent molecular biological analyses. A decrease in the DNA extraction yield and/or DNA quality can prevent the realization of planned experiments or result in inaccurate data.
2. Method
2.1 Portable blood analyzer mechanism

This review includes the detailed methods that involved in this research including the preparation and monitoring of liquid sample using Non-contact Infrared Temperature Sensor Module and KY-008 Laser Module and Laser Detector Module, study on characterizing the appropriate and non-appropriate liquid sample using syrup mixture as medium for replacing real human blood sample. This research flow is composed of a few main steps, which are the preparing of liquid sample in vacuum tube, sensors function and display value of temperature and level indication using LCD display. The overall process flow is shown in Figure 2.

Figure 2. Flowchart of portable blood analyzer principle.
2.2 Non-contact Infrared Temperature Sensor Module

Figure 3 shows a high precision non-contact temperature measurements that is using method where the circuit is controlled by an internal state machine, which controls the measurements and calculations of the liquid sample and ambient temperatures and does the post-processing of the temperatures to output them through the PWM output.

![Figure 3. Shows a block diagram of MLX90614ESF module sensor.](image)

2.3 KY-008 Laser Module and Laser Detector Module

Instead of practically using a blood sample to test out this type of paired sensor, a mixture of syrup liquid is use as the medium between both transmitter and receiver module (Figure 4) to determine whether this laser beam methods is convenient to indicates any trigger. Furthermore, a serial monitor on arduino software is use to read the indication for syrup mixture level whether it reach the specify level or not. When the result shows “Good condition” it means that the syrup mixture is adequate for next storage purpose but if result shows “Bad condition” it means that the syrup mixture is not enough which can’t use for real case blood sample examination. However, the real case for this paper is using a blood sample that fill up in a transparent vacuum tube container which the beam laser will test to penetrate through the tube and reach the receiver module sensor.

![Figure 4. Show figures between adequate and unadequate liquid sample.](image)

(a) Receiver module receive laser beam.  (b) Receiver module unable to receive laser beam.
3. Result and discussion

3.1 Temperature sense on different physical substance

In result, Figure 5 shows the capability of this infrared sensor to sense a hot and cold substances in a distance without touching any surface. Three types of substance is used for this experiment where a fire from a lighter, a few cube of ice and a syrup mixture. Thus, the temperature value is pointed out at the lcd display for monitoring purpose.

![Figure 5](image)

(a) Shows -2.39 °C on ice cube. (b) 175.83 °C on heat flame. (c) 28.19 °C on syrup mixture.

3.2 Liquid sample detection level

In result, Figure 6 shows when the laser beam able to reach receiver module, it will trigger “Good condition” whereas when the laser can’t penetrate through syrup mixture and reach receiver module it will trigger “Bad condition”.

![Figure 6](image)

(a) Output             (b) Internal wiring setup.

**Figure 6.** Output from serial monitor and complete wiring setup.
4. Conclusion

This study has shown that an overview of the background and related work in the area of blood sample monitoring. Thus, the majority of the blood sample monitoring methods based on objective quality measurements. The most obvious finding to emerge from this study is to study and explore the effectiveness of blood sample monitoring by its quantity perseverance and temperature value. From this experiment, it can be decide that those four types of methods for both requirements are compatible for obtaining a great quality of blood sample for further analysis. This study was done by obtained the blood sample in a vacuum tube and analyze them by different types of method. Experimental results show the variation of method that is used to monitor human blood sample temperature and adequate quantity in hospitals. In contrast, infrared temperature sensor and non-contact quantity level measurement improves the efficiency of blood perseverance which is reliable to monitor the quality of a blood sample in medical applications. It is recommended that in the following areas for further experimental research are needed to estimate the weakness in this method because the temperature value that are recorded are not accurate and still have affect from ambient temperature. So, there is a few research is needed to determine to get better result of temperature value by using infrared method. Otherwise, future study by investigating the many infrared sensors would be very interesting.

References

[1] Anon 2015 Implementation of Body Temperature and Pulseoximeter Sensors for Wireless Body Area Network Sensors Mater. 1
[2] Prakash R, Ganesh A B and Girish S V. 2016 Cooperative wireless network control based health and activity monitoring system J. Med. Syst. 40
[3] Li X, Ibrahim M H, Kumari S, Sangaiah A K, Gupta V and Choo K K R 2017 Anonymous mutual authentication and key agreement scheme for wearable sensors in wireless body area networks Comput. Networks 129 429–43
[4] Kim S C, Jalal U M, Im S B, Ko S and Shim J S 2017 A smartphone-based optical platform for colorimetric analysis of microfluidic device Sensors Actuators, B Chem.
[5] Kim M, Kim A, Kim S and Yang S 2012 Improvement of electrical blood hematocrit measurements under various plasma conditions using a novel hematocrit estimation parameter Biosens. Bioelectron. 35 416–20
[6] Khoigani M G, Goli S and Hasanzadeh A 2012 The relationship of hemoglobin and hematocrit in the first and second half of pregnancy with pregnancy outcome. Iran. J. Nurs. Midwifery Res. 17 S165–70
[7] Mozos I 2015 Mechanisms linking red blood cell disorders and cardiovascular diseases Biomed Res. Int. 2015
[8] He M, Li Z, Ge Y and Liu Z 2016 Portable Upconversion Nanoparticles-Based Paper Device for Field Testing of Drug Abuse Anal. Chem. 88 1530–4
[9] Zhang K, Wang K, Zhu X, Zhang J, Xu L, Huang B and Xie M 2014 Label-free and ultrasensitive fluorescence detection of cocaine based on a strategy that utilizes DNA-templated silver nanoclusters and the nicking endonuclease-assisted signal amplification method Chem. Commun. 50 180–2