e-ISSN:2582-5208
International Research Journal of Modernization in Engineering Technology and Science
Volume:03/Issue:06/June-2021 Impact Factor- 5.354 www.irjmets.com

PULSE TEMPERATURE OXYGEN MONITORING SYSTEM

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ABSTRACT

This remote patient monitoring framework is introduced and is used to track different health criteria of a remotely located patient in timely manner. The two factors measured and distributed via a network to a remote client are oxygen saturation and body temperature. The primary goal of this paper is to introduce a remote Pulse Oximetry System for health surveillance purposes. The system is based on the premise that critical health signs can be obtained from the patient and sent to a processer, where they can be collected, compared, and evaluated in order to alert critical staff in the event of an emergency. The biometric indicator tracked by this device is blood oxygen saturation. The procedure used in this study is known as "Photoplethysmography," and it is based on the difference in the strength of light reflected through tissue caused by an arterial blood pulse. This procedure transforms the strength of light into a voltage signal, which is then used to measure the patient's oxygen saturation. This is attributable to the fact that oxygenated blood varies from deoxygenated blood in its ability to capture red and infrared wavelengths. The difference between the two absorptions yields an estimate of the oxygen saturation in the patient's blood.

I. INTRODUCTION

It is significant to monitor the patient's essential health signs at home in order to save the patient's existence. The advent in technology has made it possible for patients with critical heart disorders and other critical health problems, as well as their corresponding physicians, to track vital health symptoms at home rather than being in the hospital. The blood oxygen saturation, or SpO2, is a significant health indicator for patients with such circumstances. The pulse oximeter measures the patient's oxygen saturation level in the blood. The data obtained by the pulse oximeter is then forwarded to the doctors' computers. Many experiments have been conducted and they have highlighted the benefits of using pulse oximetry to track blood saturation levels in patients with serious heart problems. For instance, Simon and Clark found that using pulse oximetry reduced the need for arterial blood gas analysis by 37%. They also stated that the use of pulse oximetry resulted in major improvements in the medical management of conditions in emergency departments.

II. LITERATURE REVIEW

In today's scenario, the maximum utilization of the resources is always appreciated. To meet the needs of remote control and monitoring, the use of wireless technology is being modified. Remote Patient Monitoring is a technology that helps patients to monitor their health even when they are at distant and not in the clinic or hospitals. RPM increases the reliability and the efficiency of health services by saving the time of both patient and doctor.

With arising remote methods like Bluetooth and wearable sensors are utilized for patient observing because of the benefits like versatility also, low power utilization by the framework. The benefits of the technology are treatment can be given in priority to the disease any patient have when compared with other patients, if in critical circumstances they can be hospitalized.

These modes of communication are only effective over small distances and for short periods of time. A research was conducted to assess the kinds of health status that a doctor regularly measures for a patient. Body temperature, heart rate, and fall detection are also vital signs. The mass-weighted average temperature of body tissues and skin temperature are calculated.

Peripheral tissue temperature calculation is more difficult than heart temperature measurement. Using zigbee, biomedical systems can detect critical patient health indicators.

The machine is two-tiered and is used to collect and process biomedical signals. First, a system with a variety of biosensors must be mounted on the body, and then the raw data transmitted by the cell device must be processed by a local base station.

Smart wearable remote health management devices are becoming more popular in order to provide high-quality health care at a low cost while preventing needless hospitalizations and ensuring urgent care.

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With a low-cost telemedicine network, the system helps to improve disease control. The network is approached for physiological parameter assessment in order to cope with patient welfare control and analysis. The network collects data from sensors and sends it to a server. The machine will process and automate physiological parameters, which are then reflected on the monitor.

2.1) Introduction Of The Platform

A Remote Health Monitoring System comprises of three fundamental segments, for example, information detecting module, information handling module and information correspondence module. The information detecting module comprises of temperature sensor and heart beat sensor which detects the progressions in the particular physiological boundaries. The data is passed on to the PIC microcontroller of information preparing module. The information handling module dissects the information signals. The correspondence module is utilized to move information among individual and gear. This has essential parts like the message, the sender, the recipient, the medium and the convention by which the message is shipped off the specialist through cell phones by data gateway for the treatment to be taken.

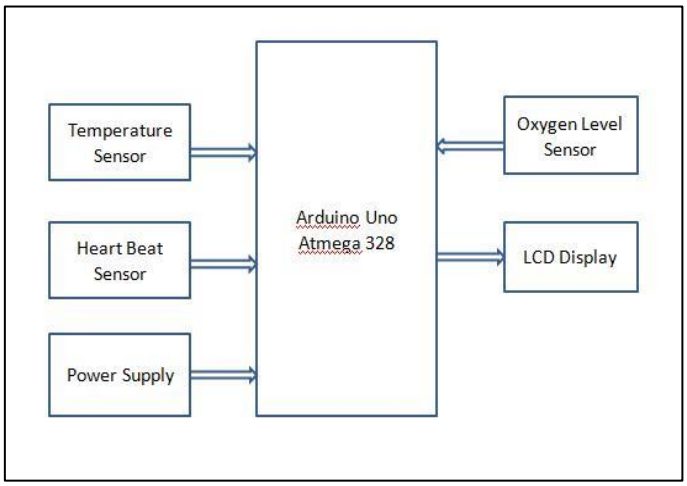

Figure 1 Block Diagram

III. WORKING

The point of this proposed approach is to plan a wireless programmed remote health monitoring framework. The goal is to screen the temperature and heartbeat of the patient's body which ought to be shown to the specialist utilizing NRF innovation. In clinics, the checking of the patients' wellbeing is finished by the staff individuals from the medical clinic. The temperature and pulse of the patient's body is checked and the data is recoreded. The required segments used in this framework are power supply, ATmega328 microcontroller, a temperature sensor, a RF TX, a RX module and a LCD show. The ATmega328 microcontroller is utilized as a CPU for checking the temperature of the patient's body. The working of this proposed wellbeing observing framework can be clarified with the assistance of a square graph. This square outline incorporates a force supply block that supply capacity to the entire circuit, and a temperature sensor is utilized to detect the temperature and heartbeat of a patient's body. The circuit graph of the programmed remote wellbeing observing framework primarily incorporates transmitter segment and beneficiary area. In the TX area, the temperature and heart beat sensor is utilized to distinguish the temperature and heartbeat of the patient's body and the information which are detected by the sensor is shipped off ATmega328. The sent data can be encoded into sequential information over the air through nRF module and the temperature of the patient's body esteems is shown on the LCD show utilizing a receiving wire organized toward the finish of a transmitter and the information from the transmitter is sent to the beneficiary end.

3.1) Features Of Design

Health Monitoring System is comprised with modules of information detecting, information handling and information correspondence. Three sensors are contained in information detecting module like temperature sensor, pulse sensor. Temperature sensor is utilized to gauge the internal heat level. Heartbeat sensor is utilized to gauge the capacity of heart by blood move through Finger. The yield of every sensor is interfaced

with Analogue to Digital circuit (ADC) pins of microcontroller. Information preparing module comprises of ATmega328, 28-pin 8-Bit microcontroller of Harvard engineering which is an elite nRF circuit used to tackle issues in change of RS232 signal voltage to TTL voltage and expected to convey the collector and sending SMS through data entryway, LCD is utilized as a presentation unit regarding microcontroller for showing the current subtleties of physiological boundaries.

Monitoring the patient is relevant in various circumstances when a patient is in the accompanying conditions:

- In flimsy physiological administrative frameworks – for example, on account of excess of sedation.
- In a dangerous condition – for example, when there means that respiratory failure in a patient.
- In a critical physiological state.

Single Parameter Monitoring System- To monitor ECG, measure the blood pressure of a human body, to monitor SPO_2, etc. this system is used.

Multi Parameter Monitoring System- This device is used to track a variety of vital physiological signals in patients by transmitting essential information such as ECG, respiration rate, and blood pressure, among other things. Because of these, Multi parameter patient management devices play an important role for a variety of purposes. In the world of medical devices, they play a major part.

IV. SYSTEM COMPONENT AND METHODOLOGIES

This system is divided into two major components which work simultaneously to acquire the desired outcomes.

4.1) Hardware Components

The central focus of the hardware component of this system is to collect, analyse and compare the outcomes of the data. The other part that is the software component enables the user of this system to connect with the logic that helps from the wavelengths of the light that are transmitted and received in measuring the oxygen saturation. The mode of transmission of the pulse oximetry is the central on which this system is based. In this mode, the transmitters which are place on two opposite side with one side of the receiver's the test side will be sandwiched between these two. This allows the simultaneous collection of two incidents of light by the sensors.

Further, in order to get the real SO_2 level, the data received is process by applying Equation for obtaining the oxygen saturation–

$$R/IR= I_{R\,MAX}/I_{R\,MIN} \;/\; I_{IR\,MAX}/I_{IR\,MIN} \qquad \text{Equation(1)}$$

This equation is a standardization condition that gives the real oxygen saturation inside the blood. The parameters of this equation address the AC and the DC current got from the infrared and the red LEDs individually. The hardware portion of this device is partitioned into two fundamental parts which are:

[1] Oximeter circuit.
[2] Arduino MEGA and GSM.

4.2) Software Components

This piece of the of the framework is capable of giving the rationale expected to figure and introduce the correspondence between the oximeter circuit and the Arduino board just as instating the correspondence between the Arduino and the GSM safeguard. The primary condition used to register the oxygen immersion introduced in Equation (1) was first presented by the Japanese researcher, Takuo Aoygi in 1970s. He had the option to arrive at this condition seeing that when he holds his breath, the proportion of the thickness of the red and the infrared frequencies changes. Utilizing this condition, the code required for setting up the calculation and the examination between the ingestion of the two frequencies had the option to be accomplished. It was composed utilizing the Arduino compiler that utilizes uncommon and changed guidance set worked to be viable with the Arduino. The compiler additionally upholds the majority of the C++ guidance set.

4.3) Outcomes

The pulse oximeter can gauge the SO2 saturation dependent on the way that the colour the blood changes to as the haemoglobin retains two range of light contingent upon its saturation with oxygen. The two frequencies utilized are red light with a frequency of 660nm and infrared light with a frequency of 940nm. The oxy-

haemoglobin retains more infrared light than it does with the red light. Notwithstanding, when the saturation diminishes, the ingestion of the red light increments accordingly to that the shade of the blood gets hazier.

The pulse oximeter consolidates two advancements in particular:

[1] **Spectrophotometry:** This innovation estimates the saturation inside the blood. The estimation of the oxygen saturation inside the blood depends on Beer-Lambet law which connects the power of the light sent through an offered answer for the centralization of the arrangement.

[2] **Optical Plethysmograph:** This innovation gauges the pulsatile changes in the blood vessel blood volume.

1. **The creating of the oximeter circuit-** Any pulse oximeter circuit is construct dependent on one of the two normal modes:

a) Mode of Transmission:

As recently clarified, in this mode the light producing diodes are place on one side of the test site while the sensors are kept on the opposite side for collecting the light passed through.

b) Reflectance mode:

In this method of the oximetry, both the light discharging diodes just as the sensors are put close by one another on one side of the test site. This strategy is proposed to be utilized in body areas where the conveyance mode can't be utilized, for example, on the check, legs, and the brow.

In this framework advancement, the sent method of oximetry was utilized because of accommodation and the benefits it gives. The benefits of utilizing this mode can be recorded as the accompanying:

1. The partition between the results of the two sent frequencies.
2. The subsequent sign from the two sensors will be less affected by the commotion that would happen on account of reflectance mode.
3. In this mode, the infrared ingestion can be utilized as the base at which the retention of the red light would be looked at.

In the wake of picking the oximetry mode, the circuit was created utilizing the segments. In the wake of building this circuit, the infrared sensor was appended to a channel that assists with decreasing the commotion impact and acquired a vastly improved sign structure. The channel has a cut off recurrence of practically 2Hz.

V. SOFTWARE DEVELOPMENT AND RESULTS

The product that upholds this framework was composed utilizing the Arduino C++ libraries. This product is mindful of registering the SpO2 inside the blood from the gathered sign from the two sensors. The product figures this outcome by utilizing the standardization condition introduced before. The result is then contrasted with the typical degree of oxygen saturation and the condition is set to recognize any degree of SpO2 which is underneath 95%. At the point when the worth of the oxygen saturation is underneath this condition, the product will start the GSM safeguard to send a SMS message to the doctor cell phone.

The framework was tried on couple of volunteers. A few examples were taken when the volunteers were approached to inhale ordinarily. The oximeter was put on the forefinger of the volunteers and the chronic screen order of the Arduino compiler was utilized to show the boundaries of the IR and red sensors just as the level of the oxygen saturation which is determined with the standardization condition. In the last example, the volunteer was approached to hold her breath for 45 seconds and a similar technique was followed. This example was expected to test the condition to guarantee that the GSM safeguard was working appropriately. The oximeter recorded an extreme degree of drop in the oxygen saturation which is in the scope of moderate hypoxia (86-90%). At the point when the product identified this condition, it started the GSM safeguard and sent instant message.

VI. CONCLUSION

We have examined the wireless patient health monitoring system of temperature and heartbeat of people utilizing nRF24L01. The heartbeat was estimated with the assistance of photodiode and bright LED while the temperature was estimated by utilizing accuracy incorporated temperature sensor LM35. Both the information were prepared in the arduinouno and shipped off the distant end remotely by utilizing nRF transmitter and got at the far off end by utilizing nRF recipient. The got information was handled in the arduinouno and the information estimated was shown effectively with the assistance of LCD at the far off end. The remote

correspondence was favored on the grounds that it gives more prominent portability to the sensor gear and lessens the expense wherein there are multi-sending segments.

The Arduino-based heartbeat oximeter was effectively assembled. The beat oximeter is a vital gadget that helps in the persistent checking of perhaps the main wellbeing boundaries in particular the oxygen immersion. The retention of light by the blood shows the meaning of the execution of this type of energy in checking the prosperity of the person. Subsequent to completing this task, the troubles confronted can be recorded as the accompanying:

1. The critical impact of the noise on the result waveforms got from the sensors due to the encompassing wellsprings of light.
2. The high affectability of the LEDs just as their sensors which may prompt the lasting harm of these gadgets.
3. The change of the simple sign structure into the advanced sign structure yields in some invalid results which can't be confirmed in light of the fact that the majority of the connected works are under copyright.
4. The advancement of the code to compute the SpO2 was somewhat convoluted.

FUTURE APPLICATIONS AND DEVELOPMENTS

The system may be attached to a computer by serial output, allowing the recorded heartbeat and temperature to be transmitted to the computer for further online or offline analysis. An alert about abnormalities in a person's wellbeing may be shown. Tone may be applied to the system such that it makes a sound each time a pulse is received and a warning is triggered in the event of an adverse health condition. The performance can be submitted to cell phones for further review using a GSM module or a Bluetooth module. Additional parameters (such as blood pressure) may be applied to the system. Furthermore, the device should have several numbers so that more than one person can receive an emergency call. More parameters can be sensed and monitored based on sensor availability or advancements in biomedical trends, which would significantly increase the performance of the wireless monitoring system in the biomedical field.

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