LOW-COST NON-INVASIVE SMART BED SYSTEM USING MEDICAL DEVICES EMBEDDED WITH IOT

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ABSTRACT

Now a days, advances in information and communication technology have prompted the rise of internet of things (IOT). In the modern era, the usage of IOT technologies brings the physician and doctor to monitor the health condition of the patient even in remote and rural areas can be examined and consulted by doctors worldwide where the database of the patient is uploaded in sub-server and sends to government website using android technology .In this paper, different kinds of sensor modules and controller are used to monitor the health parameter of patient includes heart rate, temperature, pulse rate respectively and the measured parameter can be transmitted to the microcontroller sequentially. From the measured value blood oxygen level, carbon dioxide level, hemoglobin, stress, and glucose level flow can be derived, the main aim of the project is to access the individual health condition of the patient by the doctor anywhere in the world. The death rate because of these kind of simple health problems will be reduced and the convenience for treatment time alert is invented, the remote health monitoring system with the help of internet of things (IOT) which has the portable features.

KEYWORDS

Sensors, Micro-Controller, Wi-Fi module, IOT, NON-Invasive method.

1. INTRODUCTION

Health monitoring plays a key role in our day-to-day life based on this criterion; it is technically called as tele-medicine. Which will clearly focus on the patients' health monitoring system by forming an instrument with various type of sensors and equipment's which will receive and sends the data to the database in the mode of wireless communication to the desired professional who wants to monitor the patient, the key idea is to concentrate on metabolic disorder called diabetes (Jin *et al.*, 2017). Where regular checking of blood glucose is needed keeping this concept, we have planned to design a device which can monitor the patient's health regularly to have a clear record on the patient's status of health. Based on the types of diabetes namely diabetes I and diabetes II where both are chronic diseases which affects the way your body regulate the blood sugar. The clinical records are studied as normal level (<100 mg/dl), prediabetes (100-125 mg/dl), diabetes (>126 mg/dl) and death (>700 mg/dl) so according to this data's this project is designed based on the above listed values as the triggering peaks when it is recorded. This project aims for design and authenticate the system that automatically informs the relative personnel about their healthiness of an elderly person, if the person's pulse rate, temperature and other related parameters drops below or rise beyond a threshold level. So, the main moto of this work is making wireless and to make that as remote access. These techniques are referred in the domain of bioinstrumentation, computer, and telecommunication (Quaiyum *et al.*, 2017).

2. MATERIALS AND METHODS

The main goal is to design an instrument which is fitted to the patient as a wearable which is also portable, technically it is named as tele-health care device this device is for mainly monitoring the health regularly based on the records doctors can discuss the patient's health and recommend them for further medication steps. If the patient is discharged after treatment and located in a remote location it is easy for them to monitor the health by their doctor without physical presence (Sakthimohan & Deny, 2021). Main sensors in this device constitutes near infra-red ray, which is used to attain the absorption co-efficient from the blood to achieve the glucose level. So that it becomes the non-invasive method of glucose monitoring system. Where near infra-red ray method plays a major role in it (Yu *et al.*, 2017). Optimum insulin dosage should be monitored because of the abrupt changes in

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blood glucose levels so for this kind of fluctuations are monitored by using this instrument. The calibrated values are of approximates the near and far recordings by mean square values, so that the design constitutes all the values by the physical attributes and processes the data's according to the user defines functions (Sakthimohan & Deny, 2020a). Therefore, the devices involved according to this proposed design is Arduino mega board, pulse sensor, temperature sensor, respiratory sensor and fingerprint sensor as an input device, Whereas the output devices are LCD, Wi-Fi module and some smart devices like computer or smart phones. The statistical analysis of this paper is to increase the benefit by 20% of the total population. In depth study about what sensors to be used for this non-invasive blood glucose monitoring system is carried out by evaluating the individual process taken by each sensor (Martinez, 2002). Pulse sensor which will find the bpm and stores the value, next the temperature sensor and the respiratory sensor will check the patients thermal and blood pressure rate indirectly by using mathematical model in code, whereas the fingerprint sensor calculates the absorption coefficient of blood glucose level, by cumulating all the obtained. Values the blood glucose level (Sakthimohan & Deny, 2020b).

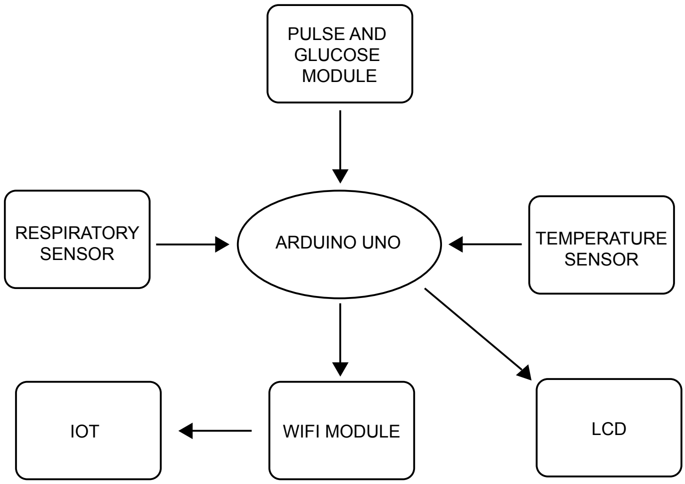

Figure 1. Block Diagram.
Source: own elaboration.

Figure 1 describes the last part in this system is IOT database implementation method which follows the data framing method to indicate the past and present inputs and the average values are determined by the slope which gives the parameter's Range of glucose and stress.

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2.1. INPUTS & OUTPUTS BY ANALYZING THE PHYSICAL PARAMETERS

The system design is framed by three sectors micro-controller, sensors and actuators and communication device. Micro-controller used here is Arduino mega board, where the input ports are connected with sensors and actuators like pulse sensor, temperature sensor, respiratory sensor and fingerprint sensor (Raikham *et al.*, 2018). The output ports are connected with Wi-Fi module, LCD display and smart phone.

2.2. NON-INVASIVE HEALTH MONITORING

Comparing to other health monitoring system our proposed Non-Invasive help us to monitor health with the help of sensor (Sakthimohan *et al.*, 2020). In existing system, we need to take blood of human beings after that measurement to be taken but our proposed system no need to take much more risk in humans. Our sensor predicts the health of human beings (Harbouche *et al.*, 2017).

3. DESIGN SPECIFICATION

The description of the block diagram consists of two major components. Heartbeat sensor and temperature sensor which constitutes a couple of parameters which incorporates the trigger values based on the modes classified as babies, children, and adults where the average values for these three categories are 72, 90 and 120 respectively. Whenever there is bradycardia (low heartbeat level) or tachycardia (higher heartbeat level) the system responds to it and calls the function which will alert (or) records the value as per the unit beats per minutes (bpm) similarly the system also responds to temperature level by getting the amount of body temperature corresponding to maximum peak le (36-37.8c).

Respiratory criteria are also concerned in this process.

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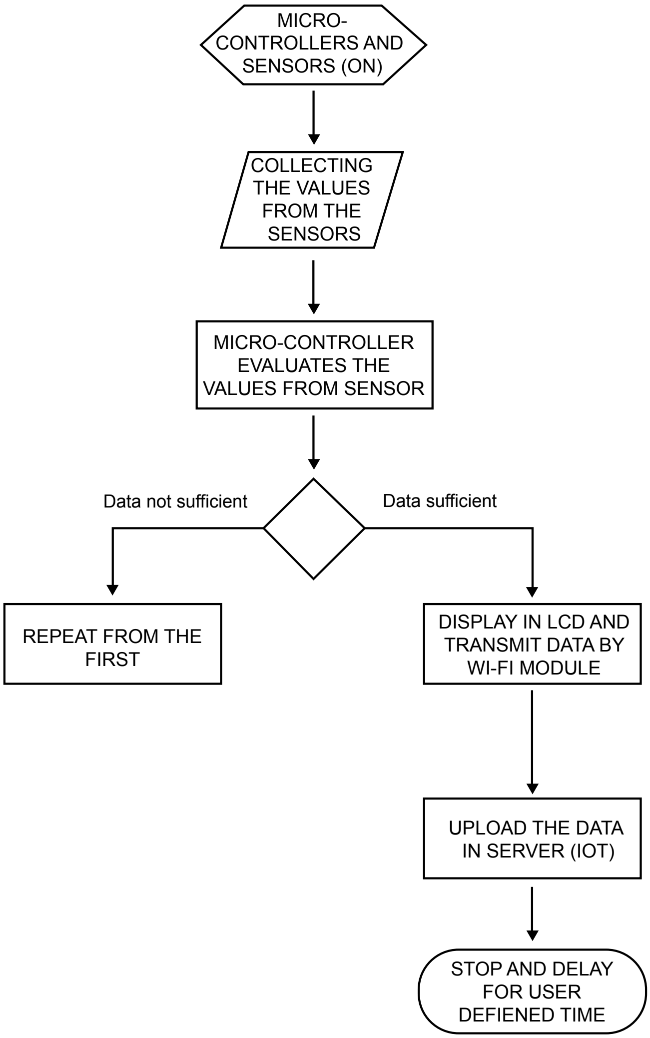

Figure 2. Flow Chart.
Source: own elaboration.

Figure 2 shows that Micro controller (Arduino mega board) is connected with sensors and other communication devices where pulse sensor, temperature sensor, respiratory sensor and fingerprint sensor are the input devices to the micro-controller the physical quantities like heat, pressure and radiation gets the values of each parameters and gives them to the Arduino mega board , which processes the given data and indicated the blood glucose level the final process after the inputs is to calibrate the level of inputs and display them in the output section where we use LCD (16*2) for on-board indication of results and for remote access using Wi-Fi module we integrate it with the IOT platform which sends the data's

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to the devices like smart phones (or) computers. So, this system works on the basis of data recording and analysis of peak values which gives the output data to the corresponding devices.

4. RESULTS AND DISCUSSION

Table 1 describes using the components which makes the combinational work of calculating the blood carbon dioxide, oxygen, stress level, infra-red ray absorption coefficient factor and temperature the calculation are made, and the results are uploaded to the database using the IOT platform, so that previously the range of values are made to be recorded, like low, medium and high. Whereas the monitoring system triggers output to be displayed in the interface by wireless data transfer using wi-fi module. Where various parameters like blood glucose level, blood oxygen level, and temperature and pulse rate are tabulated according to the various ranges attained from the patient. So, these values are uploaded to the processor in order to check the low, normal and high-risk level.

Table 1. Results.

Parameters	Case 1: (Low)	Case 2: (Normal)	Case 3: (High)
Blood Glucose Level	62mg/dl	120mg/dl	232mg/dl
Blood Oxygen Level	89% <O2	92% O2	100% >CO2
Temperature	92	98.4	102
Pulse Rate	72(bpm)	90(bpm)	120(bpm)

Source: own elaboration.

4.1. FUTURE SCOPE

Using these ideas from the project in the fore coming days further enhancement can be done by the following ideas.

- To implement remote viral fever recording system.
- To reduce size and optimize the code which will minimize the processing time.
- Also, to use this device for industrial and commercial purpose
- To introduce more parameters and alerting system.

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5. CONCLUSIONS

Our proposed work helps human beings in measuring health monitor systems. Using Respiratory and Temperature sensor by sensing the human's health was monitored. The components which make the combinational work of calculating the blood carbon dioxide, oxygen, stress level, infra-red ray absorption coefficient factor and temperature the calculations are made and the results are uploaded to the database using the IOT platform, so that previously the range of values are made to be recorded, like low, medium and high. Whereas the monitoring system triggers output to be displayed in the interface by wireless data transfer using Wi-Fi module. Without taking blood from human being can monitor glucose, blood oxygen level. Our proposed device helps human beings in multiple manner.

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