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NON INVASIVE HEALTH MONITORING SYSTEM FOR INFANTS USING IOT

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Abstract:- Monitoring of the health plays a crucial role in the medical industry; an application for monitoring the children from distances by their parents is developed. Different types of sensors are used like; a temperature sensor is a device typically is an RTD. Heartbeat senor works on the principle of the basic optoelectronics. The Raspberry Pi 3 B+ Model are presently the latest, faster, and easier to use. Massimo's acoustic respiration sensor the RAS-45 for Rainbow Acoustic Monitoring scored FDA clearance for infants and patients 10kg and under. We use an IOT board that is used for online applications with many advantages and authorize the embedded system. We use ADC to convert analog values to digital values as output.
Keywords— Internet of things, Heart Beat Sensor, Resistance Temperature Detectors (RTD).

INTRODUCTION

According to 2014, 2.2 million children aged below 1 month died which are 7000 deaths per day. From the Institute of Health Metrics and by evaluating them the results are explained. A method is used to monitor parameters such as temperature and the heart rate of a human body. A sensor is kept on the hand of a person who is to be monitored It discerns the condition and it insinuate an alarm (1). Health care is the most principal application of IOT. It generates many more applications like remote health monitoring (2).

Condenser microphone is attached to the system for detection of the baby crying and after detecting it gives a signal to the raspberry pi (3). The adhesive sensor RAS45 is applied on the baby's chest to measure a patient's respiration rate (4). The human health monitoring (HHM) involves some research questions as the contextual uncertainties and this kind of information is inherent in sensor technology (5). Raspberry Pi is accessible in different models with the different speeds from 700 MHz (6). ADC converter is used for converting the analog values received from raspberry pi to the digital values for the output (7). An intelligent system is introduced in here so that parents can monitor their infants at any moment and keep an eye on them (8).

SYSTEM ARCHITECTURE

Architecture of the infant health monitoring system consisting of Heart beat sensor, Humidity sensor, Temperature sensor, Respiratory sensor. By using these applications, the following parameters are obtained from premature stage. But by using this application we can monitor the baby position at any time. If parents are away from the baby, they can monitor their children's health and their condition by using this application easily.

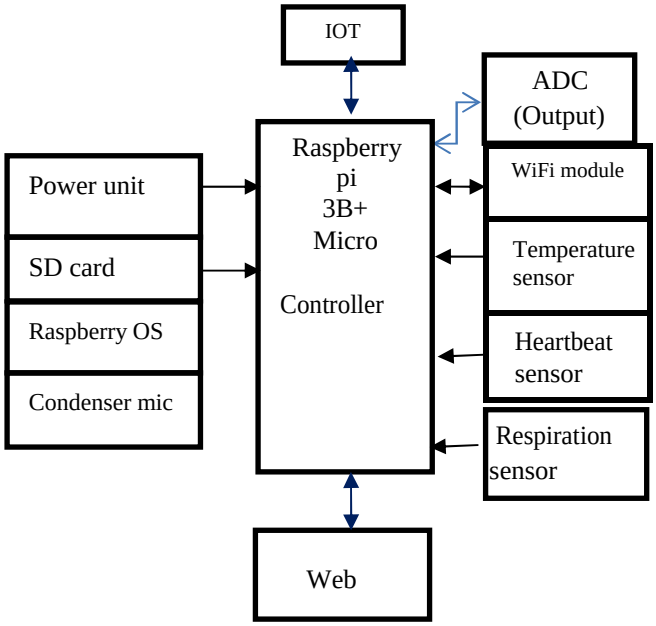

Fig.1 Health monitoring system for infants

We find temperature, heartbeat, pulse rate, respiration of the baby. It is difficult to view the infant in them. A heart rate sensor runs on the theory of optoelectronics. To measure heart rate, a couple of LEDs, LDR and microcontroller is used. This will give comfort to the parents working in long distances. If the condenser MIC detects any sound, it gives a signal to the Raspberry Pi. The human health monitoring involves some research questions as the contextual uncertainties.

Temperature Sensor

S.no	Typical Rate	Equations
1	Heart rate reserve	$HR_{reserve} = HR_{max} - HR_{min}$
2	Maximum heart rate	$HR_{max} = HR_{reserve} + HR_{rest}$
3	Resting heart rate	$HR_{rest} = HR_{max} - HR_{reserve}$

Table.1 Heart Rate Representations under different conditions

Wi-Fi module

The module has a successful load handling and capacity. It also has the ability that authorizes it to be in cooperation with sensors and the other applications particularly gadgets of its GPIOs with null improvement. It takes In this setup we use LM35 as a temperature sensor; the other name for the LM35 is a thermo couple. This LM35 sensor measures temperature through electrical signals. In this temperature and voltage is symmetric. Due to this when voltage increases the temperature increases automatically. The sensor circuitry is sealed as such it does not undergone through oxidation or any other processes. It calibrates the values directly in Celsius. The range is rated for full - 55°C to 150°C. It is most suitable for the remote applications; it has the better battery management compared to the other sensors

Heartbeat sensor

It uses the theorem of optoelectronics and it has a couple of LEDs and a microcontroller. The Infra-red LED ejects infra- red radiations which are reflected on the surface. The reflected rays create a reverse saturation current based on their intensity. Electron hole pair is also based on intensity of the radiation which is reflected. This reflected radiation causes reverse Saturation of current. This current is directed through a resistor to get the equivalent voltage. As the intensity of ray's incident on the reversed biased IR sensor varies, voltage by the resistor various respectively.

This is indicated by an LED; the direct output signal is obtained as it is directly a high profile on-chip joining into account of inconsequential outer hardware including the front-end module. It has a versatile quality of being compatible with sensors and other application-based gadgets with help of its processor with insignificant improvement beforehand and least amount of stacking in the midst of runtime. Due to its advanced on- chip joining it accounts for outer hardware including front end module.

Raspberry pi 3B+

A fourth generation Raspberry Pi is the latest one in the market. It replaced the old Raspberry Pi 3. The older Raspberry Pi 3 has a similar factor to the old raspberry pi 3B and has the certain amount of similarity with Raspberry pi second and third. The desirable part about this raspberry Pi 3B+ has the same shape, connections, and spot holes similar to the Pi 3. Quad Core, Audio Core software accelerated OpenVG and 1080p 30 H.264 high-profile decode. The new one has the inbuilt Bluetooth of low range and inbuilt RAM.

Respiration Sensor

The RAS-45 is a sensor that will be connected for an infant's chest and when information utilized inside the RAM

$$P = [\frac{E}{R + n2R}](2nR') \qquad (2)$$

framework, this can quantify non-intrusively and constantly an individual's breathe rate. On bigger patients more than 10 kilograms, sensor is set on the patients' neck. From the earliest starting point, we have concentrated our R&D on neonates and youngsters for some, reasons, including our conviction that helping kids will give extra gain to human.

IOT

The IoT (internet of things) is context in which objects, animals or people are implemented with unique identifiers and so it has ability to transfer data through a network without requiring human-to-human or human-to-computer interaction. IoT has derived from the concurrence of wireless technologies. IoT board is designed for multiple online applications with distinct advantages that authorize the embedded system designer easily, vastly and smoothly add internet connectivity to the applications. The module's update and the webpage make them accurate for variety of online applications like biomedical technology, environmental sector, and data from battery operated wireless sensor to the network devices.

Condenser Mic

Microphone is very sensitive. As the sound level surpasses the predetermined value the result is displayed. AO pin displays the analogue output. There are two module output. Analogue output and a real time output. As threshold level is reached an alert is sent. Potentiometer can manipulate the strong and weak output signals. Signal is sent from microphone to microcontroller and result is displayed via IOT. USB microphone is used because audio socket in raspberry-pi can produce output signals only. Sound card is controlled by the USB microphone.

Sensitivity of the micro phone is denoted as,

Power output is represented as,

S=Sensitivity of the microphone, P=Polarization in esu/cm^2, e= Piezo electric constant, R'= load resistance.

Blood Gas Sensor

It is actually used for children for monitoring the type 1 diabetes, it is tested at least 2 times for a day and by doing this the PH of the inner solution becomes linked to the partial pressure of PCO2. Outside the membrane by simple mathematical equation. The dispersion of CO2 in the solution, in the film and in the electrolyte to an extremely high degree controls of the active conduct of the sensor.

$$T = \frac{1}{2} + x\frac{E2}{De} + \frac{m2}{Dm} + \left[\frac{Se}{Sm}\right].e.m \qquad (3)$$

T=Exponential response time, D=Diffusion coefficient, S= Solubility of CO2, m=Thickness of electrolyte or membrane

METHODOLOGY

Our project consists of 4 sensors for monitoring children's health. These have the advantage like monitoring the children's health parameters by their parents from their location with the help of application in their phone or in the web browsers. In this we are using the wireless communication using Radio waves through Wi- Fi using the Wi-Fi module. This Wi-Fi will work similar to connecting our phone to a network using the internet but in this we will use Hotspot for connecting to the wireless network for checking the parameters of the baby. We have several types of sensors that work as follows. An Instant digital signal is given to the Microcontroller and the system will collect data from the sensors connected to their respective ports and send the information to the cloud using the internet protocol to a destination URL/IP. This controller in our project will collect data for intervals and repeats the process and store it in the cloud. For user interface we are using the HTML and PHP for processing language.

RESULTS

The system was tested carefully on an infant and the results are the same as they were measured by the standard instrument. During the execution of the system snapshots of the display was taken. The system being a complete hardware design and the data available on laptop and LCD display have been captured. Test results shows successful implementation of the system and the reading was matched to the readings taken by standard instrument. The webpage contains the heart rate, humidity and temperature of infant. Fig.1 has the sample values of the different parameters used in the system. An infant health monitoring system is proposed by using IOT with several sensors. There are several advantages in this system compared to the old methods. In this system there are several parameters and these parameters are connected to IOT board. Every sensor is connected to ADC convertor to get output in digital form. In this we use ADC convertor to convert analog values into digital values. Raspberry is connected to ADC convertor.

Parameters	Admissible	Infant 1	Infant 2	Infant 3
Temperature	37	39	35	28
Heart beat	58	52	55	57
Respiration	44	43	39	28
Blood-gas sensor	pH<7.35	6.5	5.5	6.0
Condenser mic	1000 Hz	900 Hz	800 Hz	600Hz

Table.2 Representation of results-parametric analysis of infant conditions (Data from private hospital).

CONCLUSIONS

We have proposed a non-invasive health monitoring system for infant using IoT technology with sensors. There are few Advantages in this system compared to the previous system. In this system we proposed more parameters that can be added. Each and every sensor used in this system is connected to IoT-board and this system we use the ADC convertor to convert the values into the digital values. Raspberry pi is the main part of the system and this we use fourth generation model of raspberry pi. This system baby condition is observed and status of the baby is sent to their parents in the form email. So this gives peace of mind to the parents when they are away from their baby.

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