MANAGEMENT OF DIABETES IN CHILDREN BASED INTERNET OF THINGS

Abstract: Health systems have a vital and continuing responsibility for people`s health throughout the lifespan. They are crucial to the healthy development of individuals, families and societies everywhere. In recent years, we have witnessed a rapid rise in e-healthcare technologies such as Electronic Health Records (EHR) and the importance of emergency detection and response. The paper introduces a method to design a system which monitors the health parameters of a patient and send the details through inbuilt Wi-Fi feature present in the Raspberry pi processor to an android phone and also alerts through buzzer if any of the parameters exceed the threshold value.

Keywords: Raspberry pi processor, Temperature sensor, BP, Spo2 sensor, Glucometer.

1. Introduction

The purpose of this project is Advances in information and communication technologies have led to the emergence of Internet of Things (IOT). In the modern health care environment, the usage of IOT technologies brings convenience of physicians and patients, since they are applied to various medical areas (such as real-time monitoring, patient information management, and healthcare management). The body sensor network technology is one of the core technologies of IOT developments in healthcare System, where a patient can be monitored using a collection of tiny-powered and light weight wireless sensor nodes. However, the development of this new technology in healthcare applications without considering security makes patient privacy vulnerable. In this paper, at first, we highlight the major security requirements in BSN-based modern healthcare system. Subsequently, we propose a secure IOT-based children diabetes detection system which can efficiently accomplish those requirements.

The device which is able to perform the task is a Raspberry Pi processor. The Temperature sensor, Glucometer, BP, Spo2 sensor and buzzer are interfaced to the raspberry Pi processor. The sensors data is sent to android phone through Wi-Fi. To perform this task, Raspberry Pi processor is programmed using embedded 'Linux'.

Wi-Fi is a wireless technology that uses radio frequency to transmit data through the air. Wi-Fi has initial speeds of 1mbps to 2mbps. Wi-Fi transmits data in the frequency band of 2.4 GHz. It implements the concept of frequency division multiplexing technology. Range of Wi-Fi technology is 40-300 feet.

2. LITERATURE SURVEY

[1] Project presents a review of the latest mobile health applications based on Internet of Things that are used for diabetes management. Diabetes is a group of metabolic diseases in which there are high blood sugar levels over a prolonged period. Long-term diabetes care requires involvement from patients as well as doctors and family caregivers. With rapid advancements in wireless and web technologies, a number of applications based on Internet of Things have been proposed for management of diabetes. Most of these applications focus on patient monitoring and technology-based decision making. We analyze the working and underlying architecture of these latest applications and discuss the major issues and challenges faced by them.

[2] Project presents a new eHealth platform incorporating humanoid robots to support an emerging multidimensional care approach for the treatment of diabetes. The architecture of the platform extends the Internet of Things to a Web-centric paradigm through utilizing existing Web standards to access and control objects of the physical layer. This incorporates capillary networks, each of which encompasses a set of medical sensors linked wirelessly to a humanoid robot linked (via the Internet) to a Web-centric disease management hub. This provides a set of services for both patients and their caregivers that support the full continuum of the multidimensional care approach of diabetes. The platform's software architecture pattern enables the development of various applications without knowing low-level details of the platform. This is achieved through unifying the access interface and mechanism of handling service requests through a layered approach based on object virtualization and automatic service delivery. A fully functional prototype is developed, and its end-to-end functionality and acceptability are tested successfully through a clinician-led pilot study, providing evidence that both patients and caregivers are receptive to the introduction of the proposed platform.

3. Implementation:

MANAGEMENT OF DIABETES IN CHILDREN BASED INTERNET OF THINGS
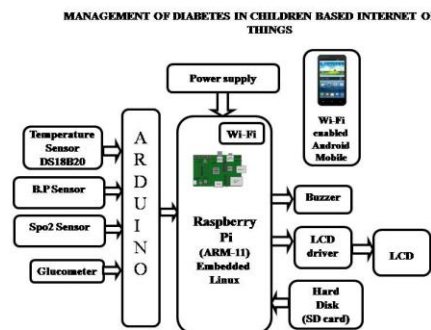
In this proposed system, the sensors are connected to ARM11BCM2837. The BP sensor provides the Systolic, Diastolic readings to the microprocessor. Spo2 sensor monitors the oxygen levels in the blood. Glucometer gives the glucose levels in the blood. Temperature sensor measures the body temperature. These values are displayed on the web page. If any of the above values exceed their threshold values an alert is given through mail and the buzzer beeps. The data collected by processor is placed on the cloud server by using inbuilt Wi-Fi present in the raspberry pi3 processor. The data placed in the web page can be accessed anywhere by the doctor and nurse.

4. Related Work:

The brief introduction of different modules used in this project is discussed below:

Raspberry Pi (ARM-11) PROCESSOR:

The Raspberry Pi 3 Model B is the latest single-board computer from the Raspberry Pi Foundation. In this version, they've upgraded to a 1.2 GHz 64-bit quad-core ARM processor and added 802.11n Wireless LAN, Bluetooth 4.1 and Bluetooth Low Energy.

Like the previous version (the Pi 2) it has 1 GB of RAM, 4 USB ports, and full HDMI support. The Raspberry Pi 3 also has the same form factor as the Pi 2 (and Pi 1 Model B+).

The Raspberry Pi runs Raspbian and/or NOOBS (both Linux-based operating systems) which boot from the removable SD card. A host of third-party operating systems are also supported, including Ubuntu Mate, Windows 10 IoT Core, and OSMC.

The Raspberry Pi 3 is a credit-card sized computer capable of doing just about anything a desktop PC does. From web surfing and word processing, to playing Mine craft or acting as a media player, the Raspberry Pi's capabilities are extensive. With plenty of graphics processing power, the Raspberry Pi 3 is capable of streaming BluRay-quality video. If you're looking to incorporate the Pi into your next embedded design, the 0.1" spaced 40-pin GPIO header gives you access to 27 GPIO, UART, I2C, SPI as well as both 3.3V and 5V power sources.

Raspberry Pi processor is programmed using embedded 'Linux'. Linux is the best-known and most-used open source operating system. As an operating system, Linux is software that sits underneath all of the other software on a computer, receiving requests from those programs and relaying these requests to the computer's hardware.

Temperature sensor:
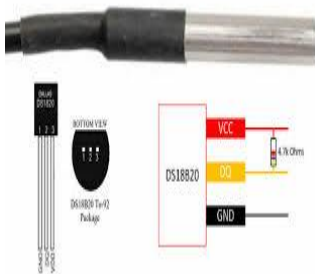
Description:

The DS18B20 digital thermometer provides 9-bit to 12-bit Celsius temperature measurements and has an alarm function with nonvolatile user-programmable upper and lower trigger points. The DS18B20 communicates over a 1-Wire bus that by definition requires only one data line (and ground) for communication with a central microprocessor. In addition, the DS18B20 can derive power directly from the data line ("parasite power"), eliminating the need for an external power supply.

Spo2 sensor:

SpO2 stands for tangential capillary oxygen dispersion, an estimate of the amount of oxygen in the blood. More specifically, it is the percentage of oxygenated hemoglobin (hemoglobin containing oxygen) compared to the total amount of hemoglobin in the blood

SpO2 is an estimate of arterial oxygen saturation, or SaO2, which refers to the amount of oxygenated hemoglobin in the blood.

Hemoglobin is a protein that carries oxygen in the blood. It is found inside red blood cells and gives them their red color.

SpO2 can be calculated by pulse oximetry, an indirect, non-invasive method (meaning it does not involve the overture of instruments into the body). It installation by emitting and then absorbing a light wave passing through blood vessels (or capillaries) in the fingertip. A variation of the light wave passing through the finger will give the value of the SpO2 capacity because the degree of oxygen saturation causes variations in the blood's color.

For a regular healthy person, the normal blood oxygen saturation level (SpO2) should be around 94% to 99%. For patients with mild respiratory diseases, the SpO2should be 90% or above.

Supplementary oxygen should be used if SpO2 level falls below 90%, which is unacceptable for a prolonged period of time.

Low O2 in it, notorious as hypoxemia, means that the level of O2 in the it has fallen below regular levels, due to one or more of many different causes. Under the chief part status, pant room air, normal readings range from 95% to 100 %

Blood Pressure sensor:

The metrology is the technology of transuding P into an electrical quantity. Normally, a diaphragm construction is used with strain gauges either bonded to or diffused into it, acting as resistive basics. Under the pressure-induced strain, the resistive values change.

In capacitive tech, the diaphragm is one plate of a C that changes its value under pres-induced displacement.

P sensing using diaphragm TECH dealings the difference in P of the two sides of this. Depending upon the relevant p, we use the terms unqualified, where the mention is vacuum (1st picture), gauge, where the allusion is atmospheric P(2nd pic), or discrepancy, where it has two ports for the compute of two different P.

The piezo resistive or silicon cell
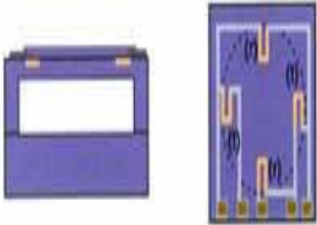
This type of consists of a micro-machined silicon with piezo resistive strain gauges subtle into it, combined with a silicon or glass back plate.

The resistors have a value of approx. 3.5 kOhm. P induced strain increases the value of the radial (r) and decreases the value of the resistors (t) transverse to the radius. This resistance change can be high as 30%.

Based on piezoelectric TECH various physical quantities can be unhurried; the most familiar are P and S. For this, a thin membrane and a massive base are used, ensuring that an applied P specifically loads the rudiments in one bearing. For this meter, a seismic mass is attached to the crystal elements. When it experiences a bid, the invariant seismic mass loads the essentials conferring to Newton's second law of action.

Glucometer:

A glucometer is a device that is designed to measure the level of glucose in the blood. It is also used for the diagnosis of carbohydrate metabolism in people who suffer from diabetes mellitus. The pathophysiology behind diabetes is based on a lack of insulin abundance which can be due to insufficient release of insulin from beta cells in the pancreas, or inactive insulin receptors that can no longer responds to insulin compounds. Diabetes type II is the most common type of diabetes and is prevalent among people whom are overweight or over middle age. The electrochemical method for testing blood glucose concentrations is driven by a current that is directly proportional to the level of blood glucose present in a blood sample. The blood is drawn between two electrodes and the testing strip. Alike to the reflectance photometry method, glucose oxidation still occurs transforming the glucose molecule from beta-D-glucose to D-glucagon-1,5-lactone and then hydrolyzed to D-gluconic acid. This reaction generates an electrical current that forces electrons to flow between the working electrodes and counter electrodes. With this method,

an impregnated enzyme is present so that, when in contact with glucose, a current is generated.

Wi-Fi:

Wi-Fi or WLAN as it is commonly known is fast becoming the preferred mode of connecting to the internet. Many people are not aware of the descriptions and explanations related to it. Wi-Fi gets its name from a certification called Wireless Fidelity given to networks operating under 802.11 standards. Wi-Fi allows computers, PDAs and other devices to connect to a broadband connection in a wireless mode. The 802.11 standard defines the wireless communication operating via electromagnetic waves. While reading the descriptions and explanations related to Wi-Fi, one should remember there are different modes for wireless networks like Infrastructure mode and Ad-Hoc mode that can be used for different criteria.

Buzzer:

A buzzer is a mechanical, electromechanical, magnetic, electromagnetic, electro-acoustic or piezoelectric audio signalling device. We are using electromagnetic buzzer in our project. The vibrating disk in a magnetic buzzer is attracted to the pole by the magnetic field. When an oscillating signal is moved through the coil, it produces a fluctuating magnetic field which vibrates the disk at a frequency equal to that of the drive signal.


4. CONCLUSION:

The existing model presents an Integrating feature of all the hardware components which has been used and developed in it with Arm-11 Raspberry pi processor. The Presence of each and every module has been reasoned out and placed very carefully. Hence the contributing to the best working unit for "MANAGEMENT OF DIABETES IN CHILDREN BASED INTERNET OF THINGS" has been designed perfectly. Secondly, using highly advanced IC's like Broadcom BCM2387 chipset, 1.2GHz Quad-Core ARM Cortex-A53 (64Bit) processor, Linux operating system technology with the help of growing technology. Thus, the project has been successfully designed and tested.
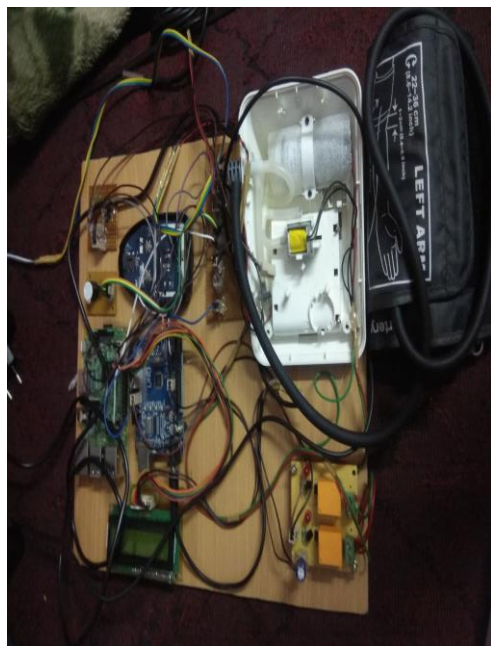
6. RESULTS

The entire equipment is as shown above.

All the sensors interfaced to the arduino and then to raspberry pi and then to WiFi module, LCD and buzzer.

The Spo2 sensor displays its value on the LCD

The above figure shows the results of glucometer and finally displays the sugar value in the blood sample.

The above figure shows the temperature value given by the temperature sensor.
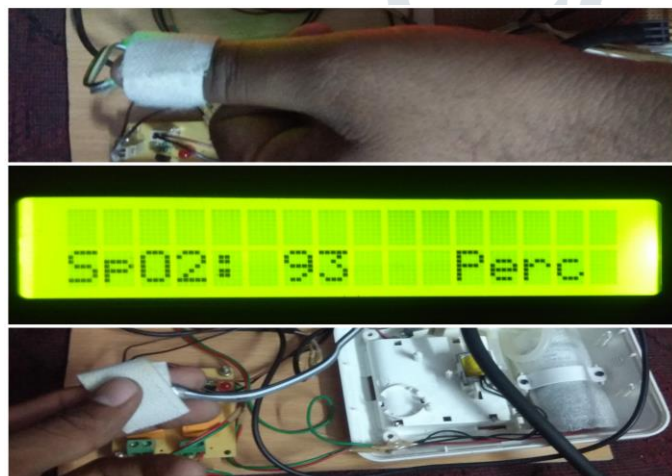
The BP sensor reading is shown on LCD.

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