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BSN-Care:IoT Based Human Health Care Using Body Sensors

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ABSTRACT

Human service is a standout amongst the most quickly growing application zones of the Internet of Things (IoT) innovation. IoT gadgets can be utilized to empower remote wellbeing checking of patients with perpetual infections, for example, cardiovascular diseases (CVD).Body sensor Network (BSN) innovation is one of the center advancements of IoT improvements in social insurance framework, where a patient can be observed utilizing an accumulation of minor controlled and lightweight remote sensor hubs. The fundamental goal of the proposed work is to transmitting the patient's wellbeing observing parameters through remote correspondence in a crisis circumstance utilizing distinctive sensors. Sensors are utilized to follow patient's wellbeing with the help of web. The wellbeing perception framework can monitor patient's heartbeat rate, weight level rate, temperature and so forth. In the event that framework identifies any sudden changes in understanding pulse or temperature, the framework mechanically cautions the client concerning the patients remaining over IOT and moreover demonstrates subtle elements of patient live finished the web.

Keywords: Internet of Things, Body sensor Network, Raspberry Pi, Temperature Sensor, ECG Sensor, Heartbeat Sensor

I. INTRODUCTION

The most recent couple of decades have seen an enduring increment in future in numerous parts of the world prompting a sharp ascent in the quantity of elderly individuals. A current report from United Nations [1] anticipated that there will be 2 billion (22% of the total populace) more established individuals by 2050. Likewise, look into demonstrates that around 89% of the matured individuals are probably going to live freely. Appropriately, giving an personal satisfaction for matured individuals has turn into a genuine social test right then and there. The quick multiplication of data and correspondence advancements is empowering inventive human services arrangements and devices that show guarantee in tending to the previously mentioned challenges. Presently, Internet of Things (IoT) has turned out to be a standout amongst the most capable correspondence standards of the 21th century. IoT expands the idea of the Internet and makes it more unavoidable. IoT permits consistent collaborations among diverse sorts of gadgets, for example, restorative sensor, observing cameras, home apparatuses so on. [2]. Since of that reason IoT has turned out to be more gainful in a few regions, for example, health insurance framework. In health insurance framework, IoT includes numerous sorts of shabby sensors (wearable, embedded, and condition) that empower matured individuals to appreciate current health insurance benefits anyplace, whenever. Moreover, it likewise incredibly enhances matured people groups nature of life. The body sensor network (BSN) innovation [2] is a standout amongst the most basic advances

utilized as a part of IoT-based present day medicinal services framework. It is essentially an accumulation of -power and lightweight remote sensor hubs that areutilized to screen the human body works and encompassing condition. Since BSN hubs are used to gather life-basic data and may work in threatening conditions, in like manner, they require strict security components to forestall vindictive collaboration with the framework.

II. RELATED WORK

Advances in information and communication technologies and embedded systems have given rise to a new disruptive technology, the Internet of Things (IoTs). Modern health care environment, the usage of IoT technologies which brings convince of physicians and patients and hence applied to various medical areas such as real time monitoring, patient information management and healthcare management. The body sensor network (BSN)is one of the core technologies of IoT developments in healthcare system, where a patient can be monitored using a collection of sensors nodes. Provide the information aboutIoT-based healthcare system using BSN-Care requirements [2].

Healthcare applications in the fields of wireless sensor networks, where patients can be monitored using wireless medical sensor networks. Current medical sensors healthcare research trends focus on patient reliable communication, patient mobility, and energy-efficient routing, as a few examples and mainly focused on different new technologies in healthcare applications without considering security makes patient privacy vulnerable. Therefore, security is a paramount requirement of healthcare applications, especially in the case of patient privacy, if the patient has an embarrassing disease.

Few critical issues in healthcare application depend directly on patient security and privacy.So privacy plays a major in health care monitoring systems [3].

Advance technologies in IoT-based health care reviews the state-of-the-art network architectures, applications, and industrial trends in health care solutions for that purpose proposed an intelligent collaborative security model to minimize security risk and discussed about how different innovations such as big data, ambient intelligence, and wearables can be leveraged in a health care context. Addresses various IoT and eHealth policies and regulations to provide some avenues for IoT-based health care based on a set of open issues and challenge [4].

Sensor networks a new class of devices, have the potential to revolutionize the capture, processing, and communication of critical data for use by first responders. Sensor networks consist of small, low-power and low-cost devices with limited computational and wireless communication capabilities. They represent the next step in communication's miniaturization, their power and size and make it feasible to embed them into wearable vital sign monitors, location-tracking tags in buildings, and first responder uniform gear[5].

III. METHODOLOGY

A. Architecture

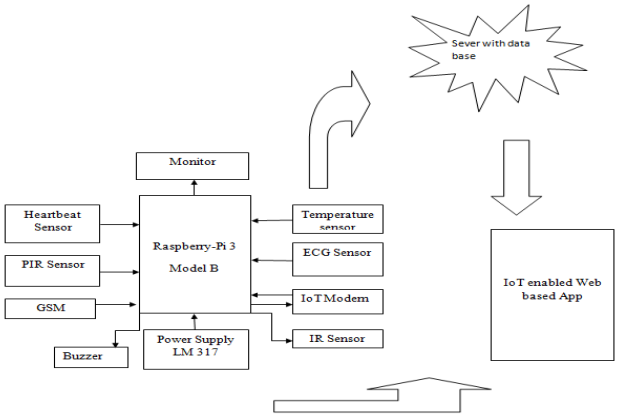

Figure 1: Block Diagram

Body Sensor Network (BSN) is the integration of intelligent, miniaturized low-power sensor nodes in, on or around human body to monitor body functions and the surrounding environment. Temperature sensor,Heart Beat sensor, ECG sensor,IR sensor are connected to Raspberry Pi through IC MCP3008. Heartbeat sensors arebased on the principle of photo phlethysmography. It measures the change in volume of blood through any organ of the body, which causes a change in light intensity through that organ. PIR sensor is a motion detection sensor, it detects whether the person is in movement or rest condition. IR sensor is used as obstacle sensor, which transmits an infrared signal, this infrared signal bounces from the surface of an object and the signal is received at the infrared receiver.

IR sensor can be used in ICU or for security purpose or if a person met with an accident and continuously if the data obtained is unconscious, the alert will be sent to doctors, family and emergency unit simultaneously.

B. Modules

a. RASPBERRY PI3 B

Raspberry Pi 3provides the same Pi features but with double the ram and 6x faster processor speed. It is credit-card sizedcomputer capable of performing the multitask at single time. It runs on several flavors of Linux based operating system.

It consists of Broadcom BCM2836, an ARMv11 Quad Core ProcessorSystem-on-Chip, running at 1Ghz, and a Videocore 4 GPU. The GPU provides Open GL ES 2.0, hardware-acceleratedOpenVG, and 1080p30 H.264 high-profile decode and is capable of 1Gpixel/s, 1.5Gtexel/s or 24 GFLOPs of generalpurpose compute. The biggestchange that has been enacted with the Raspberry Pi 3 isan upgrade to the main processor and an increase of ram from 512MB to 1GB.

b.Temperature Sensor

Temperature sensor is a gadget which detects varieties in temperature crosswise over it. LM35 is a fundamental temperature sensor that can be utilized for trial reason. It gives the readings in centigrade (degree Celsius). The LM35 series are exactness coordinated circuit temperature sensors, whose output voltage is proportional to the Celsius (Centigrade) temperature. It operates from 4 to 30 volts and has less than 60 Micro amperes current deplete.

c. ECG Sensor

ECG sensor is the pressure exerted by circulating blood upon the walls of blood vessels. When used without further specification, "blood pressure" usually refers to the arterial pressure in the systemic circulation. Blood pressure is usually expressed in terms of the systolic (maximum) pressure over diastolic (minimum) pressure and is measured in millimeters of mercury (mm Hg). Normal resting systolic (diastolic) blood pressure in an adult is approximately 120 mm Hg(80 mm Hg), abbreviated "120/80 mm Hg". Blood pressure varies depending on situation, activity, and disease states. It is regulated by the nervous and endocrine systems. Blood pressure that is low due to a disease state is called hypotension, and pressure that is consistently high is hypertension.

d. Heartbeat Sensor

Heart rate is the speed of the heartbeat measured by the number of contractions of the heart per minute (bpm). The heart rate can vary according to the body's physical needs, including the need to absorb oxygen and excrete carbon dioxide. It is usually equal or close to the pulse measured at any peripheral point. Activities that can provoke change include physical exercise, anxiety, sleep, stress, illness, and ingestion of drugs. Many texts cite the normal resting adult human heart rate range from 60 to 100 bpm. Tachycardia is a fast heart rate, defined as above 100 bpm at rest. Bradycardia is a slow heart rate, defined as below 60 bpm at rest. The normal resting adult heart rate is probably closer to a range between 50 to 90 bpm. During sleep a slow heartbeat with rates around 40 to 50 bpm is common and is considered normal. When the heart is not beating in a regular pattern, this is referred to as an arrhythmia. Abnormalities of heart rate sometimes indicate disease.

e. PIR Sensor

PIR sensors allows to sense motion, used to detect whether a human has moved in or out of the sensors range. They are small, inexpensive, low-power, easy to use and don't wear out. For that reason they are commonly found in appliances and gadgets used in homes or businesses. The PIR (Passive Infra-Red) Sensor is a pyroelectric device that detects motion by measuring changes in the infrared levels emitted by surrounding objects. This motion can be detected by checking for a high signal on a single I/O pin A PIR detector combined with a Fresnel lens are mounted on a compact size PCB together with an analog IC,SB0081, and limited components to form the module. High level output of variable width is provided. The PIR sensor has a detection range, ranging from 2-3meters. Supply voltage of 3-5v.Current drain is less than 50uA Temperature ranges from -15C to +70C.

f. GSM [Global System for Mobile Communication]

GSM module is used to establish communication between a computer and a GSM system. Global System for Mobile communication (GSM) is an architecture used for mobile communication for the users. GSM t enables higher data transmission rate for sending the alert messages when abnormalities occurs.

g. Buzzer

A buzzer or beeper is an audio signaling device, which may be mechanical, electromechanical, or piezoelectric. It is used for alerting when abnormalities occur to the patients.

C. Workflow

The Body sensor network architecture composed of wearable and implantable sensors. Each sensor node integrated with biosensors.These sensors collect the physiological parameters and forward them to a coordinator called Local Processing Unit (LPU), when the LPU detects any abnormalities then it provides immediate alert to the person.When the server receives data of a person from LPU, then it feeds the BSN data into its database and analyses those data. Subsequently, based on the degree of abnormalities, it may interact with the family members of the person, local physician, or emergency unit.

Algorithm Steps:

Step 1: Read the sensor yield esteem.
Step 2: Check the sensor yield an incentive with the typical esteem.
Step 3: if the sensor yields, esteem is typical nothing to do.
Step 4: if the sensor yields,esteem is abnormalbut not severe.
Step 4a: Inform to relatives and doctor.
Step 5: If the sensor yields, esteem is abnormal and severe.
Step 5a: Inform family members,doctor,and emergency unit at the same time.
Step 6: Send the information to all.

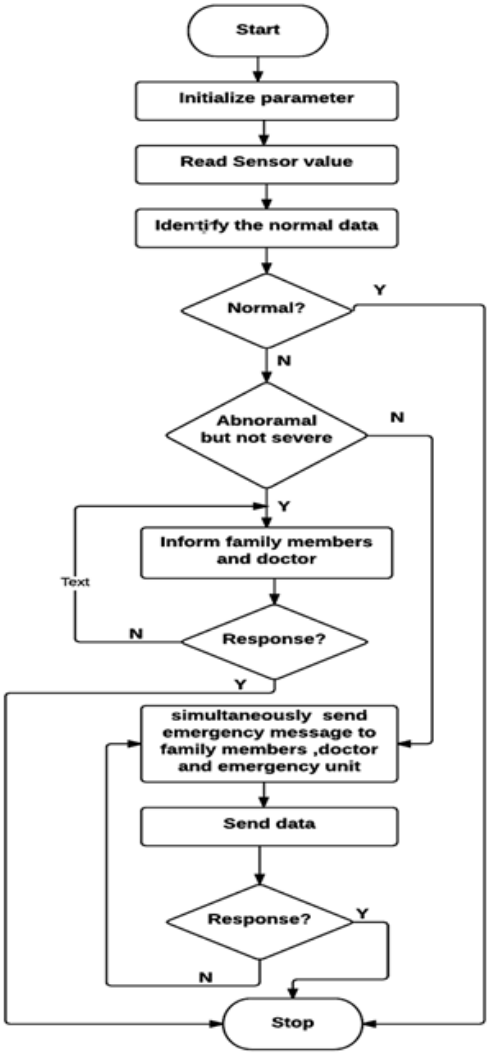

Figure 2: Workflow

IV. Result Discussion

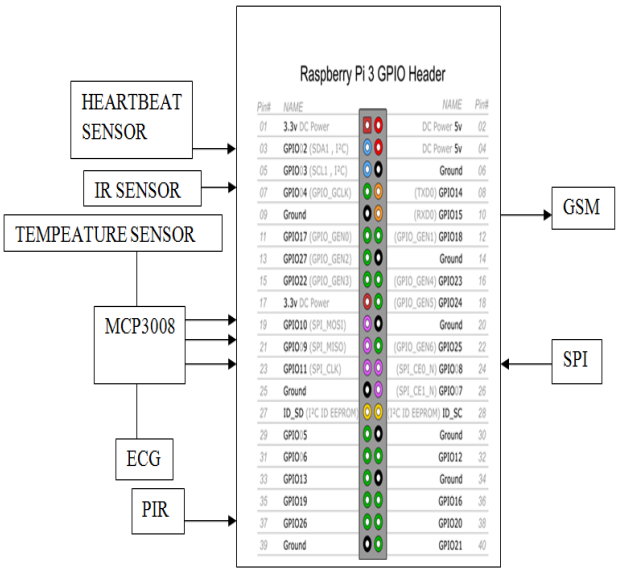

Figure 3: Pin Configuration of Raspberry Pi 3 with sensors

Fig 3 shows Raspberry Pi 3 pins configured with sensors respectively. Heartbeat sensor is connected to GPIO 2, pin 3 where SDAI is function. IR sensor is connected to GPIO 4, pin 7, where GCLK is the function; PIR sensor is connected to pin 37, GPIO 26; GSM is connected to pin 10, GPIO 15, where RXD0(UART) is its function. Temperature sensor and ECG sensor are connected to MCP3008 which is interfaced to SPI in Raspberry Pi 3 model B with pins 19,21,23, these pins are SPI pins functions as MOSI(SPI) for pin 19, MISO(SPI) for pin 21 and SCLK(SPI) for pin 23.SPI is Serial Peripheral Interface between IC MCP3008 and ADC respectively, the interface has to be done since analog values obtained must be converted to digital values. Temperature sensor and ECG sensor produces output in the form of analog values, to covert these values to digital, ADC is used which is interfaced with Raspberry Pi 3 through SPI pins in it respectively.

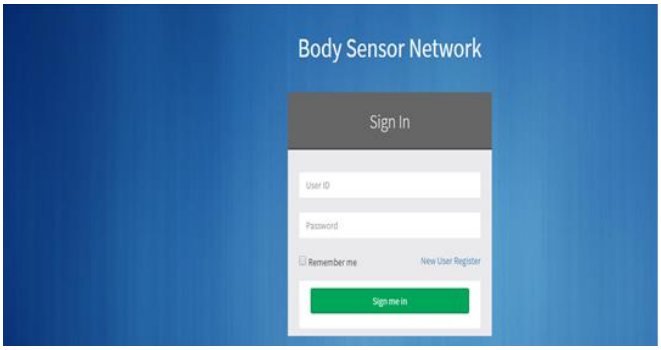

Figure 4: Sign in Page for BSN

Fig 4 shows sign-in using login ID and password in Body Sensor Network Web-app through internet in mobile or system which is convenient to the person respectively.

Figure 5: Current Patient Status

Fig 5 shows the current patient status were it contains the information of the different sensors values.

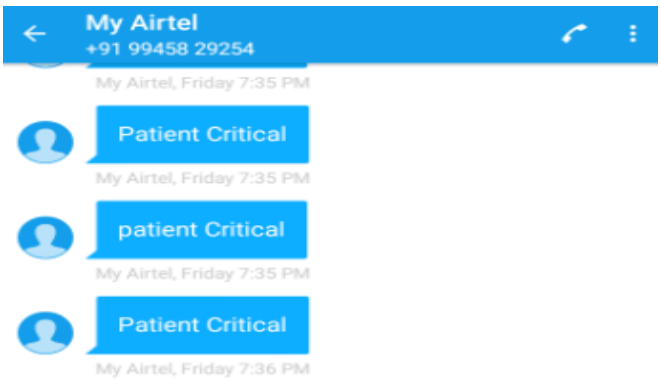

Figure 6: Alert Message

Fig 6 shows the alert message to the recipient when the abnormal conditions occurs.

V. CONCLUSION

Health care services plays an important role in the society, automating these services lessen the burden on humans and eases the measuring process andalso the transparency of this system helps patients to trust it. When threshold value is reached, the alarm system that consists of buzzer, alerts the doctors, relatives and emergency unit based on the severity. The goal of developing monitoring framework is to reduce health care costs by reducing physician office visits, hospitalizations, and diagnostic testing procedure.

The GSM technology helps the server to update the patient data on website. Many further improvements can be made in the system to make it better and easily adaptable such as adding more advanced sensors and by developing the android application, which helps the user to use the application more conveniently.

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