IoT Based Wearable Health Monitoring System

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ABSTRACT

Our health and well-being are the most important elements for longevity. Healthcare and health monitoring are important to the society because people get ill, accidents and emergencies do arise and the hospitals are needed to diagnose, treat and manage different types of ailments and diseases. A person who need treatment in emergency conditions has to be noticed to minimize the time delay. This intimation of a person getting sudden ill can be found with the help of electronic systems such as sensors and controllers. Now this data has to be transferred to the family members to monitor the patient's health condition. The present health monitoring systems works absolutely fine. But these activity trackers shifts data of the person from the device to the nearby mobile phone through short range communications like Bluetooth. The user can monitor or the data can now be transferred to the internet or family members from the local processing unit like mobile or pc. The current paper involves the latest technology of microcontroller from which the data of the patient can be transferred to the internet from the patient's wearable device itself. In this system we used pulse sensor to measure the heart beat rate of a person, and accelerometer to count number of steps, distance, speed, calories burned and a controller board Ti's CC3200 ,which has inbuilt Wi-Fi that works in both station mode and access point mode. The pulse sensor's data goes to controller, then the controller sends this data to the internet enabled mobile application by using available Wi-Fi network. The information can be viewed from mobile application with security credentials like login details.

Keywords: heart beat monitoring, activity tracking, Ti's cc3200, IoT clouds, security, weareable devices, android application.

I. INTRODUCTION

One of the challenges of medical care is the distribution of accurate and current information to patients. Healthcare also struggles with guidance given the complexity of following guidance. IoT devices not only improve facilities and professional practice, but also health in the daily lives of individuals. IoT devices give direct, 24/7 access to the patient in a less intrusive way than other options. They take healthcare out of facilities and into the home, office, or social space. They empower individuals in attending to their own health, and allow providers to deliver better and more granular care to patients. This results in fewer accidents from miscommunication, improved patient satisfaction, and better preventive care. The advanced automation and analytics of IoT allows more powerful emergency support services, which typically suffer from their limited resources and disconnect with the base facility. It provides a way to analyze an emergency in a more complete way from miles away. It also gives more providers access to the patient prior to their arrival. IoT gives providers critical information for delivering essential care on arrival. It also raises the level of care available to a patient received by emergency professionals. This reduces the associated losses, and improves emergency healthcare. Beyond safety or energy concerns, most people desire certain comforts from housing or commercial spaces like specific lighting and temperature. IoT enhances these comforts by allowing faster and easier customizing. Adjustments also apply to the area of productivity. They personalize spaces to create an optimized environment such as a smart office or kitchen prepared for a specific individual. Here the IoT involves in healthcare sector, where a patient is connected to the internet via a small system. This system build with controller and some other supporting components. The architecture and work flow of the system explained in detail below

II. FRAME WORK DESIGN

A. System architecture

The present health monitoring system consists of several components like controller, sensors, power supply unit. The controller cc3200, which has in-built Wi-Fi support and a temperature sensor to measure the object temperature. It also has on board accelerometer to measure the acceleration and orientation of the device and further the orientation of the patient.

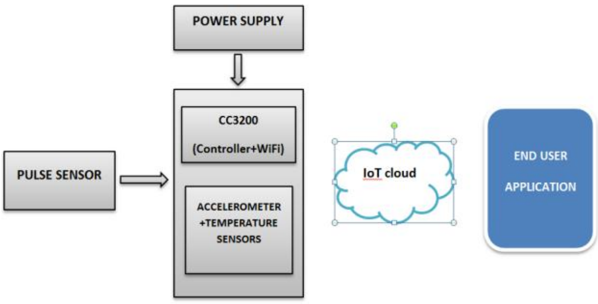

Fig1: Block diagram of the system

B. Work flow of the proccess

The overall process is divided into three parts. These three parts are the main functions of the system. The other minor elements are covered in next session.

The three main components are,

a) Data acquisition.

Here the data represents the heart rate, temperature and position of the patient. Pulse sensor, temperature sensor and accelerometer sensor are used to measure the physical signals respectively. The pulse sensor itself comprises of an infrared producer and identifier mounted one next to the other and squeezed nearly against the skin. At the point when the heart pumps, pulse rises forcefully, thus does the measure of infrared light from the transmitter that gets reflected back to the identifier. The detector passes more current when it gets all the more light, which thus causes a voltage drop to enter the amplifier hardware. This outline utilizes two successive operational amplifiers ("operation amps") to establish a steady baseline for the signal, emphasize the peaks, and filter out noise. Both op-amps are contained in a single integrated circuit (IC or “chip”), and hooking them up is really just a matter of interconnecting the pins correctly.

The measurement of the temperature sensor is about the hotness or coolness of an object. The working base of the sensors is the voltage that read over the diode. In the event that the voltage builds, at that point the temperature rises and there is a voltage drop between the transistor terminals of base and producer, they are recorded by the sensors. In the event that the distinction in voltage is increased, the simple flag is created by the gadget and it is straightforwardly corresponding to the temperature.

By utilizing the temperature sensor, the temperature can be measured by four estimation scales and they are isolated into various degree units. The metric Celsius scale is utilized by the estimation scale and they begin from zero. The Fahrenheit temperature detecting utilizes the Rankin scales and these scales are supreme scales. The Rankin scale measures indisputably the zero as the 492 degrees Rankin. The temperature sensor determines the absolute zero measurement as close to the minus 46 degrees Fahrenheit.

b) Processing information in cc3200

The system implementation and design procedure is discussed in this part. In the schematic block diagram, the working principle of IoT based wearable health monitoring system using CC3200 is explained. Block consists of temperature sensor, pulse sensor, accelerometer sensor and CC3200. The sensing part will sense the temperature, pulse rate and pressure of the patient and it sends analog signal to the microcontroller CC3200. The controller consists of in-built ADC and Wi-Fi module. Hence the analog input signal is converted into digital signal which is then transferred to cloud. Here we used Blynk cloud service to store the patient data. Then we can monitor the patient information such as heart rate, temperature and acceleration from a mobile application via internet.

c) End user mobile application

Mobile apps are as ubtiqouis as oxygen in today’s technology driven world. The statement is not an over exaggeration, but, completely defines the Omnipresence of the mobile apps. From redefining marketing strategies to organizing the future tech like IoT, AR, etc. mobile apps have immensely contributed in revolutionizing the technology world.

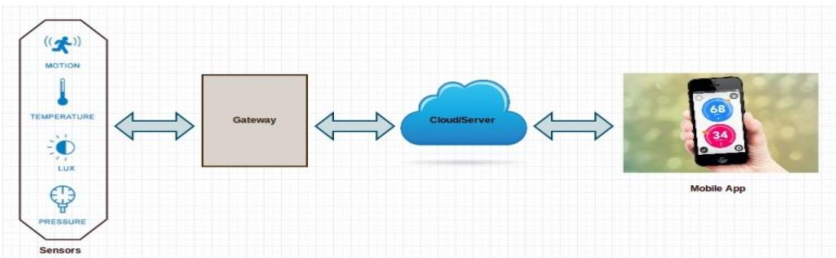

Fig2: IoT mobile application

The intuitive mobile apps will help end users to control & monitor their devices from remote locations. These apps push the important information on your hand-held devices & help to send commands to your Smart Devices.

III. PRESENT HEALTH MONITORING SYSTEMS

Medical problems of humankind is been expanding everyday in current days because of various reasons. In each perspective nearness of individual behind the patient could not be possible. As of present human services focuses are having short period of staff as of this conditions it was extremely hard to screen persistent so as to time, there by this astute medicinal services framework used to screen the patient without the nearness of the individual. There by it lessens cost of restorativeand labor cost

IV. SYSTEM COMPONENTS

The components used in this system are explained each individual.

pulse sensor

Heart rate data can be really useful whether you're designing an exercise routine, studying your activity or anxiety levels or just want your shirt to blink with your heart beat. The problem is that heart rate can be difficult to measure. Luckily, the Pulse Sensor Amped can solve that problem in real time.

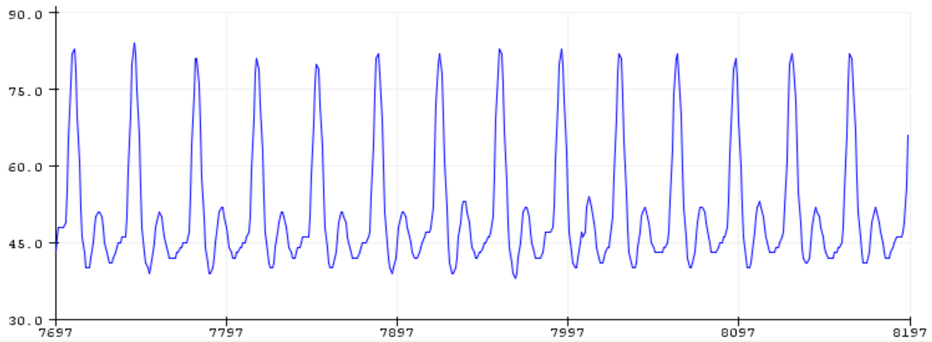

Fig3:ECG acquisition

The Pulse Sensor Amped is a plug-and-play heart-rate sensor for microcontrollers. It can be used by students, artists, athletes, makers, and game & mobile developers who want to easily incorporate live heart-rate data into their projects. It essentially combines a simple optical heart rate sensor with amplification and noise cancellation circuitry making it fast and easy to get reliable pulse readings. Also, it sips power with just 4mA current draw at 5V so it's great for mobile applications. Simply clip the Pulse Sensor to your earlobe or finger tip and plug it into your 3 *or* 5 Volts and you're ready to read heart rate! The cable on the Pulse Sensor is terminated with standard male headers so there's no soldering required.

Activity tracking

Activity tracking includes number of steps(steps count), distance travelled, speed of the person and calories burned. These activities can be measured with the help of accelerometer. The accelerometer measures the acceleration in three direction, x, y and z respectively. The person's or patient's activity can now be calculated with the acceleration values with some equations.

Step length=0.41*height;

calories burned per km=(0.57*weight*1.6)/0.453;

steps in a mile=160000.0/step length;

velocity=(step length*count)/(t*100);

here weight, height and step lengths are the predefined values, which may vary from person to person

CC3200 controller

The SimpleLink™ Wi-Fi® CC3200 LaunchPad™ development kit (with QFN-packaged device) is an evaluation development platform for the CC3200 wireless microcontroller (MCU), the industry's first single-chip programmable MCU with built-in Wi-Fi connectivity. The board features on-board emulation using FTDI and includes sensors for a full out-of-the-box experience. This board can be directly connected to a PC for use with development tools such as Code Composer Studio™ Cloud integrated development environment (IDE) and IAR Embedded Workbench. The controller has 32-bit ARM Cortex-M4 architecture optimized for small-footprint embedded applications. 80-MHz operation, Fast interrupt handling, Low-power consumption with multiple sleep modes, 3-stage pipeline Harvard architecture , Thumb-2 mixed 16-/32-bit instruction set delivers the high performance, 32-bit ARM core in a compact memory size usually associated with 8 and 16-bit devices, 16-bit SIMD vector processing unit, Deterministic, high-performance interrupt handling for time-critical applications.

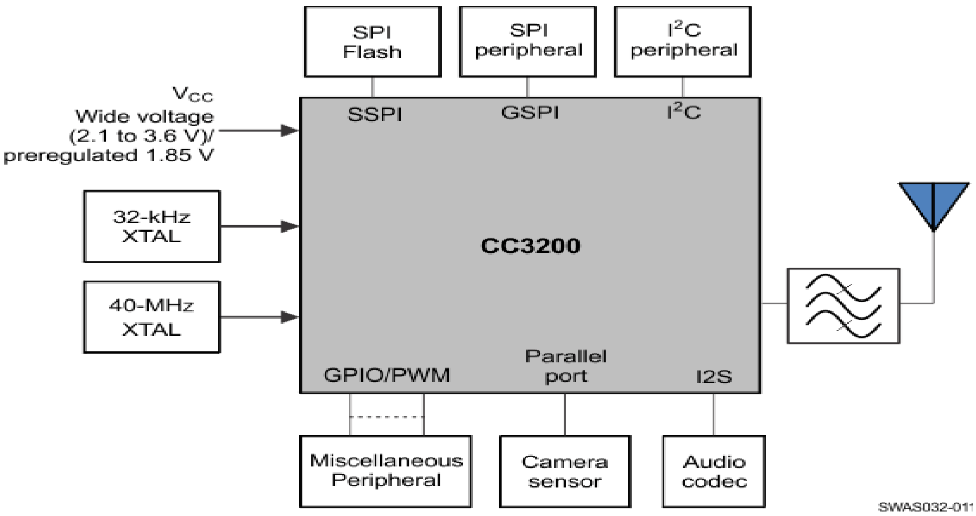

Fig4: CC3200 blocks

This LaunchPad comes with driver support and a software development kit (SDK) with 40 applications for Wi-Fi protocols, internet applications, and MCU peripheral examples.

weareable devices

The new age of wearables tap into the connected self – they're laden with smart sensors, and make use of a web connection, usually using Bluetooth to connect wirelessly to your smartphone. They use these sensors to connect to you as a person, and they help you to achieve goals such as staying fit, active, losing weight or being more organized. Most wearables are wrist worn, but an increasing number can be clipped to the body and hung around the neck. Wearables are quickly blending with jewelry, and are worn in the same way.

There are a few different categories of wearables at the moment. Some products manage to get their feet in more than one camp and a few others define new categories all of their own.

- Smart watches
- Fitness trackers

- Sport watches
- Head mounted displays
- Smart clothing
- Smart jewelry
- Implantables

IoT cloud

IoT Cloud can provide business users with much a much more comprehensive and integrated perspective on customers, without requiring technical expertise or the services of a data analyst. The platform can take in billions of events a day and users can build rules that specify events to act on and what actions to take. IoT cloud is data format- and product-agnostic.

V. PERFORMANCE

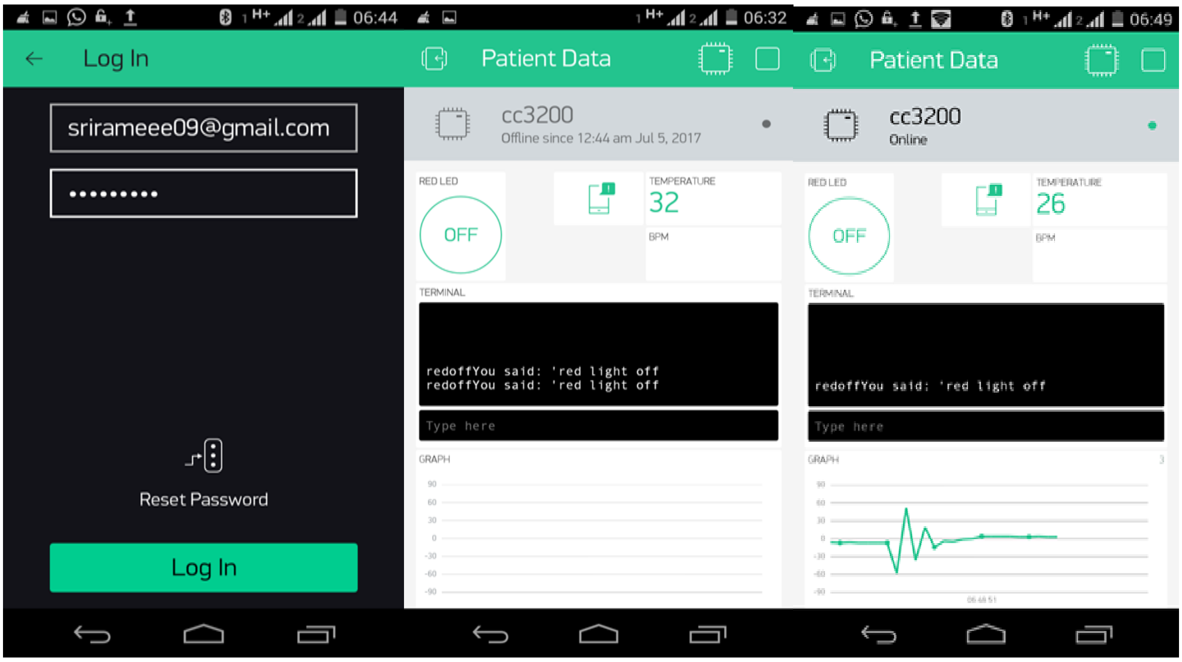

Fig5: authentication and data logging in application

VI. CONCLUSION

By using this kind of structures in social protection will cause effortlessness of watching senior person, by this system we easily handle odd conditions too. No need of pith of individual with patient. As by adding GPS, will be taken the paper to next level. As of making own healthcare server we can reduce the cost of maintenance. Data set in serve can be access from anywhere. This kind of system must be gotten logically for straightforwardness of getting to tolerant data, to easily keep up a vital separation from sporadic conditions.

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