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Smart (scalable medical alert response technique) Health Monitoring System Using Raspberry Pi

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Abstract - *An As saying a "Health is wealth" is exceptionally crucial to make utilization of innovation for better well being. Smart health monitoring systems using raspberry pi have been given more attention in recent research efforts as they are not only used for patients but also recommended for old age people, sports persons and home makers. Although smart health monitoring systems automate patient monitoring tasks and, thereby improve the patient workflow management, their efficiency in clinical settings is still debatable. The self health care monitoring system aims at monitoring the condition of the vital organs in patients continuously at home. In this project is used as a gateway to communicate to the various sensors such as temperature sensor and accelerometer sensor. In medicine and biotechnology, sensors are tools that detect specific biological, chemical or physical processes and then transmit or report this data monitoring vital signs.*

Keywords—Epilepsy; scalable medical Alert; Python shell, Respiration, pulse rate, temperature sensor

1. INTRODUCTION

The SMART (Scalable Medical Alert Response Technology) system using raspberry pi integrates patient monitoring (body temperature, Pulse rate,), geo-positioning, signal processing, targeted alerting, and a wireless interface for caregivers. Smartphone apps with self-monitoring and sensing capabilities can help in disease prevention; however, such context-aware applications are difficult to develop, due to the complexities of sensor data acquisition, context modeling, and data management .In this learning approaches to interpreting large quantities of continuously acquired, multivariate physiological data, using wearable patient monitors, where the goal is to provide early warning of serious physiological determination, such that a degree of predictive care may be provided.

The monitoring of vital physiological signals has proven to be one of the most efficient ways for continuous and remote tracking of the health status of patients. Wearable sensors monitors are often used to diagnose and monitor a person's health status by measuring their cardiac activity. Wearable sensor such as temperature sensors, accelerometer using raspberry pi is monitor, which can be utilized to evaluate the body temperature activity, epilepsy detection, Position of comma patient. This procedure is very useful for monitoring people with (or susceptible to) impairments in their cardiac activity. An increase in world population along with a significant aging portion is forcing rapid rises in healthcare costs. The healthcare system is going through a transformation in which continuous monitoring of inhabitants is possible even without hospitalization. The advancement of sensing technologies using raspberry pi, makes it possible to develop smart systems to monitor activities of human beings continuously. Wearable sensors detect abnormal and/or unforeseen situations by monitoring physiological parameters along with other symptoms. Therefore, necessary help can be provided in times of dire need.

This project will help the people that can monitor or check their health issue instead of going hospitals. People itself taking care with monitor their health and it is very simple method and very cost efficient .Fitness monitoring is a fundamental service in pervasive healthcare, but finding a balance between usability and privacy is a hard challenge. They demonstrate this idea with a fitness monitoring system for the healthy individuals in a workplace. The system maintains its original interface for users, in order to provide the same ease of usability. The system uses collected physiological information (body temperature, epilepsy detection and pulse rate) etc.

1.1 Literature review

Subhas Chandra Mukhopadhya et al.[1]The design and development of Zigbee smart non-invasive wearable physiological parameter monitoring device has been developed and reported in this paper. The system can be used to monitor physiological parameters, such as temperature and heart rate, of a human subject. P. Castillejo et al.[2] have developed application for uses in scenario where data collection is applied for smart spaces aiming at its uses in fire fighting and sports. A graphics user interface has been implemented to suggest a series of exercises to improve a sportsman/women's condition depending on the context and their profile. Aleksander Milenkovic et al.[3]This paper discusses implementation issue and describes the prototype sensor network for health monitoring that utilizes of the shelf 802.15.4 compliant network nodes and custom build motion and heart activity sensors. The paper present system architecture and hardware and software organization as well as the solution for time synchronization power management and on chip signal processing. J.Edwards[4] presented an idea to have very light basically disposable sensors that would be worn on the body to perform standard medical monitoring

1.2 S Background and basics

This project reviews the latest reported systems on activity monitoring of humans based on wearable sensors and issues to be addressed to tackle the challenges. In recent times there has been a surge of usages of wearable sensors, especially in the medical sciences, where there are a lot of different applications in monitoring physiological activities. In the medical field, it is possible to monitor patients' body temperature, Pulses rate, epilepsy detection using accelerometer sensor using raspberry pi. It is important to have very light sensors that could be worn on the body to perform standard medical monitoring. It is possible to measure the body activity using smart sensors through a raspberry pi. In the area using of temperature sensor easily detect the body The use of wearable sensors has made it possible to have the necessary treatment at home for patients after an attack of diseases such as epilepsy, fever. Patients after an operation usually go through the recovery/rehabilitation process where they follow a strict routine. All the physiological signals as well as physical activities of the patient are possible to be monitored with the help of smart sensors. During the rehabilitation stage the wearable sensors using raspberry pi may provide audio feedback, virtual reality images and other rehabilitative services.

The system can be tuned to the requirement of individual patient. The whole activity can be monitored remotely by patient itself, doctors, nurses or caregivers. It is now an everyday news that the wearable electronics devices and technologies, such as temperature sensor, accelerometer monitors etc.. Fitness devices are by far the most mature market, making up 97% of the projected value in 2013, though this will fall dramatically as smart watch and smart glasses categories develop and products with embedded sensors that track and analyses physical or other movements and activity. Future wearable technology reports that the wearable technologies will impact future medical technology.

2. PROJECT PLANNING

A.Raspberry pi

At the heart of the Raspberry Pi is the same processor you would have found in the iPhone 3G and the Kindle 2, so you can think of the capabilities of the Raspberry Pi as comparable to those powerful little devices. This chip is a 32 bit, 700 MHz System on a Chip, which is built on the ARM11 architecture. ARM chips come in a variety of architectures with different cores configured to provide different capabilities at different price points. The Model B has 512MB of RAM and the Model A has 256 MB. (The first batch of Model Bs had only 256MB of RAM) .The Secure Digital (SD) Card slot. You'll notice there's no hard drive on the Pi; everything is stored on an SD Card. One reason you'll want some sort of protective case sooner than later is that the solder joints on the SD socket may fail if the SD card is accidentally bent. C. The USB port. On the Model B there are two USB 2.0 ports, but only one on the Model A Some of the early Raspberry Pi boards were limited in the amount of current that they could provide. Some USB devices can draw up 500mA. The original Pi board supported 100mA or so, but the newer revisions are up to the full USB 2.0 spec. One way to check your board is to see if you have two polyfuses limiting the current In any case, it is probably not a good idea to charge your cell phone with the Pi. You can use a powered external hub if you have a peripheral that needs more power.

The Raspberry Pi 2 has an identical form factor to the previous (Pi 1) Model B+ and has complete compatibility with Raspberry Pi 1.We recommend the Raspberry Pi 2 Model B for use in schools: it offers more flexibility for learners than the leaner (Pi 1), which is more useful for embedded projects and projects which require very low power.

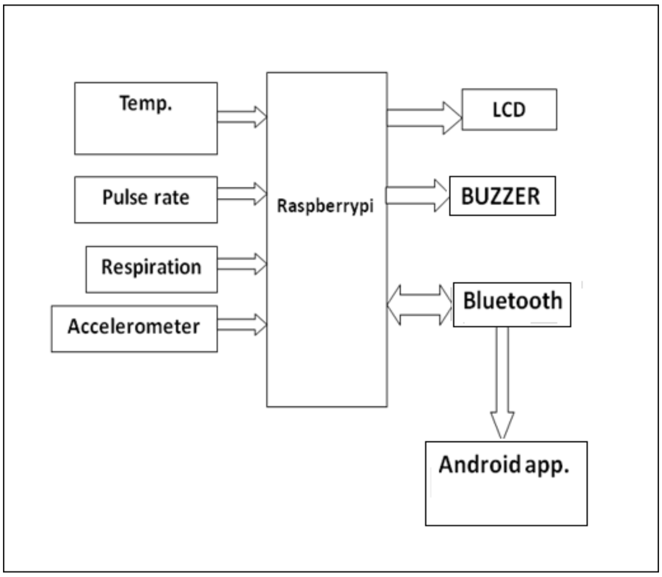

Figure 1 Block diagram of smart health monitoring system using raspberry pi

B.MCP3208 A to D convertor:

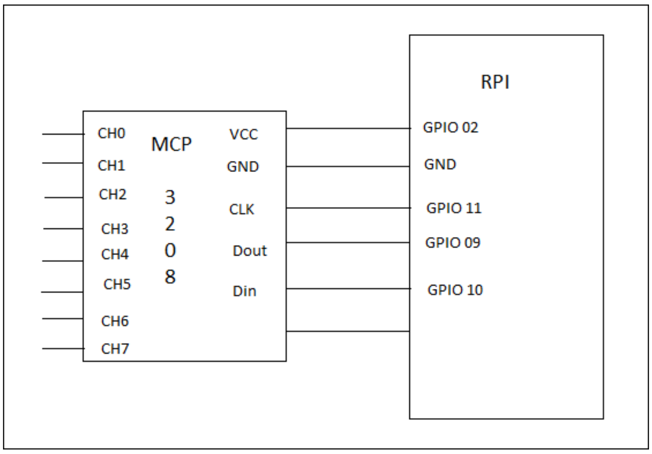

Fig. 2.MCP3208 interfacing with Raspberry Pi

MCP3202 12-bit Analog-to-Digital Converter (ADC) combines high performance and low power consumption in a small package, making it ideal for embedded control applications. The MCP3202 features 2 input channels, low power consumption (5nA typical standby, 550 µA max. active), and is available in 8-pin PDIP, SOIC and TSSOP packages. Applications for the MCP3204 include data acquisition, instrumentation and measurement, multi-channel data loggers, industrial PCs, motor control, robotics, industrial automation, smart sensors, portable instrumentation and home medical appliances. The Microchip Technology Inc. MCP3204/3208 devices are successive approximation 12-bit Analog to Digital (A/D) Converters with on-board sample and hold circuitry. The MCP3204/3208 devices operate over a broad voltage range (2.7V - 5.5V). Low current design permits operation with typical standby and active currents of only 500 nA and 320 µA, respectively.

C. Temperature Sensor

Temperature sensor is used to sense the temperature. We have used a Temperature sensor called LM35. This temperature sensor can sense the temperature of the atmosphere around it or the temperature of any machine to which it is connected or even can give the temperature of the human body in case if us0ed. So, irrespective of the application to which it is used, it gives the reading of the temperature. The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature.

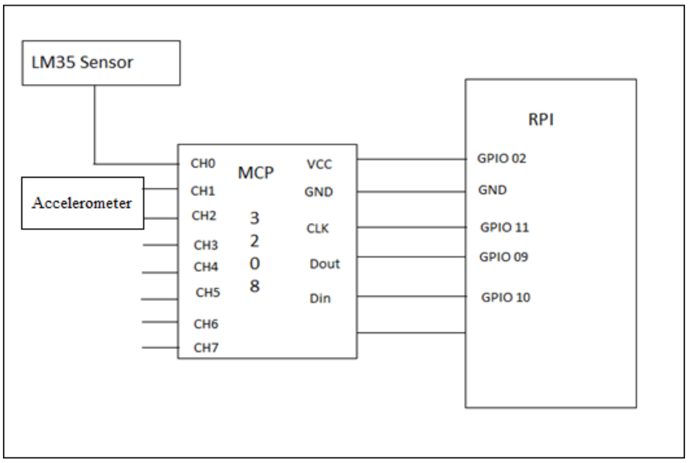

Figure4.Temperature and accelerometer sensors are interfacing with Raspberry Pi

Temperature sensor is an analog sensor and gives the output into form of analog signal. This signal is feed to ADC which will convert it into digital form. Once converted into analog form, the microcontroller can process the digital temperature signal as per the application. like the constant force of gravity pulling at your feet, or they could be dynamic caused by moving or vibrating the accelerometer. By measuring the amount of static acceleration due to gravity, you can find out the angle the device is tilted at with respect to the earth. By sensing the amount of dynamic acceleration, you can analyze the way the device is moving. Accelerometer will be used to locate the vip person on the x, y, and z axis parameters. The accelerometer will provide the location of the vip within the parliament location. Accelerometers use the piezoelectric effect - they contain microscopic crystal structures that get stressed by accelerative forces, which causes a voltage to be generated. Another way to do it is by sensing changes in capacitance. If you have two microstructures next to each other, they have a certain capacitance between them. If an accelerative force moves one of the structures, then the capacitance will change. Add some circuitry to convert from capacitance to voltage, and you will get an accelerometer. The three axis accelerometer are basically used to identify the movements across the three axis i.e. x-axis, y-axis, z-axis. Accelerometer is an electronic device which is interfaced using I2C protocol and provides the reading after every 1msec. According to the requirement of the application, the microcontroller will take the reading from the accelerometer within a fixed interval of time and do the necessary operation according to the requirement of the application using the template.

D. Respiration sensor:

Here we are using an Mask assembly which is linked to a test tube having a sponge ball which keeps moving in forward and reverse direction according to the breathing pattern. The ball movement is captured with the help of an IR transmitter and receiver assembly. As soon as the ball passes the IR pair pulse is generated at the output of IR sensor.

Here we are connecting a IR based obstacle sensor. The 50 ohm resistor is for current limiting. The current through the LED is 5v / 50 ohm = 100 mamp , which is high for an LED. But to increase the range of the obstacle sensor we are using a lower range resistor (50 ohm).On the receiver side we have connected the IR receiver in reverse bias. So as soon as the light falls in the IR receiver, the anode voltage increases and when the anode voltage is more than the cathode voltage then the LED is in forward bias mode and start conducting.

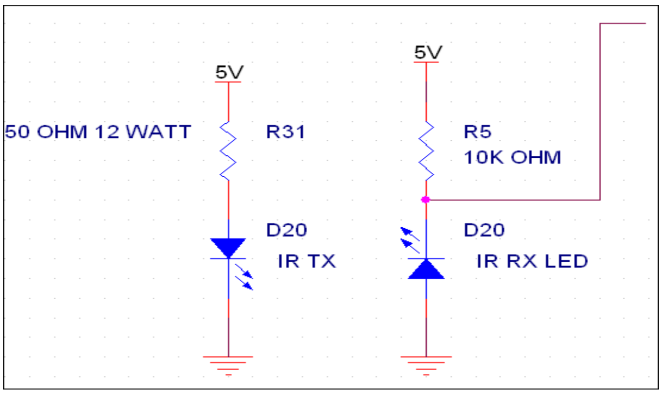

Figure 5.IR based obstacle sensor

F. Pulse rate sensor:

Here we are connecting a IR based obstacle sensor. The 100 ohm resistor is for current limiting .The current through the LED is 5v / 100 ohm = 50 mamp, which is high for an LED. But to increase the range of the obstacle sensor we are using a lower range resistor (100 ohm).

On the receiver side we have connected the IR receiver in reverse bias. So as soon as the light falls in the IR receiver, the anode voltage increases and when the anode voltage is more than the cathode voltage then the LED is in forward bias mode and start conducting.

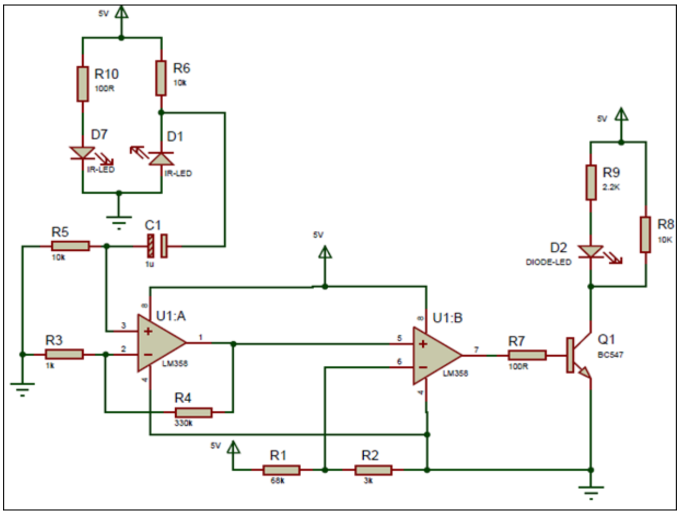

Figure 6.Pulse rate sensor

1st stage:

Here at the Non-inverting I/P we are giving the pulse rate signal..So according to the formula for Non inverting amplifier Voltage gain = 5v =R3 + R4 / R3 = 330K+1k / 1k = 331 Gain = 331

2nd stage:

2d stage is Non Inverting Amplifier

Voltage divider circuit

Vout = Vin * 65K / 65+3K = Vin * 65 / 68

The transistor:

There is a R7 (100 Ohm) resistor at the base of transistor it used to limit the current flowing to the base of transistor. The R8 (10 K ohm) resistor is the pull up for the collector pin of transistor. The BC547 is used in saturation mode, which means that it is used in On / OFF region and not for amplification.

Also as soon as the voltage across this resistor increases beyond 0.7V the transistor turns ON and at the output we get 0v and the LED D2 glows. The resistor R9 is current limiting for LED. If the output at the base of Q1 is below 0.7V the transistor turns OFF and at the output we get 5v and the LED D2 is off.

3. RESULT

The analog result of the simulation is as shown in figure5.In simulation result X and Y shows the accelerometer sensor result which monitors the patient direction such as epilepsy patient and comma patient and Temperature sensor gives result such as in voltage which monitors the body temperature. In the simulation result accelerometer and temperature sensor output is shown. Software used for simulation result is Python shell.

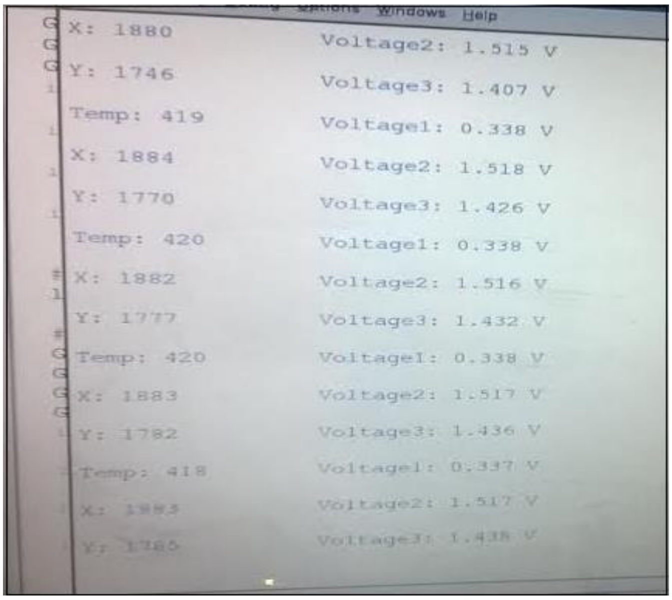

Figure7.Simulation Result

4. CONCLUSION

The data from the wearable sensors may be used for long-term health monitoring and may predict the future health condition. The development smart health monitoring system using raspberry pi devices to monitor different ranges of activities of inhabitants of light-weight physiological sensors will lead to comfortable .Advances in principled approaches to predictive patient monitoring have been limited by the difficulty of collecting physiological data from a mobile population of patients.

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