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Research Article

PATIENT MONITORING AND POSTURE RECOGNITION EMBEDDED WITH GSM FOR DISABLED PERSON

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ABSTRACT

The healthcare system is going through a transformation in which continuous monitoring of inhabitants is possible even without hospitalization. The advancement of sensing technologies, embedded systems, wireless communication technologies, and miniaturization makes it possible to develop smart systems to monitor activities of human beings continuously. Therefore, necessary help can be provided in times of their need. With the help of the present technology we are going to design a system which helps disabled person.

INTRODUCTION

The Purpose of this project is to implement a system for continuous monitoring of older people by using wearable sensors (N. K. Suryadevara, S. C. Mukhopadhyay, R. K. Rayudu* and Y.M.Huanng, 2012). The entire project can be implemented by dividing it into two parts. One part is responsible for implementing a critical system that is responsible to alert the caretaker whenever the patient needed rescue or help. Another part is noncritical part and is responsible to send an SMS to the care taker when the person is in risk.

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 heart-attacks and so on. 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 can be monitored with the help of wearable sensors. During the rehabilitation stage the wearable sensors may provide audio feedback, virtual reality images and other rehabilitative services . The system can be tuned to the requirement of the individual patient. The whole activity can be monitored remotely (Emmanuel- Kobina Payne, Dennis Joe Harmah, 2015) by doctors, nurses or care taker.

System Overview

Sensors

- Heartbeat sensor
- Temperature sensor
- Pressure sensor are used to measure the patient's health parameters

Mems accelerometer

MEMS accelerometer is used to determine the posture (Hristijan Gjoreski, Mitja Lustrek, matjazGams, 2011). of the person. It is a technology that can be defined as a combination of mechanical functions and Electrical functions on a same chip using micro fabrication Technology. The Mechanical Functions like Sensing, Moving and heating etc. The Electrical Functions like Switching and deciding System capability etc. The MEMS are made up of components size between 1 to 100 micrometer ranges. Generally, MEMS devices are in the range of 20 micrometers (20 millionths of a meter) to a millimeter (i.e. 0.02 to 1.0 mm) in size.

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GSM

Global System for Mobile communications (GSM) is the world's most widely used cell phone technology (*Chuo, Y., Marzencki, M., Hung, B., Jaggernauth, C., Tavakolian, K., Lin, P., & Kaminska, B. 2010).*. Cell phones use the cell phone service carriers of GSM network for searching cell phone towers in the nearby area. GSM is a globally accepted standard for digital cellular communication.

Block Diagram

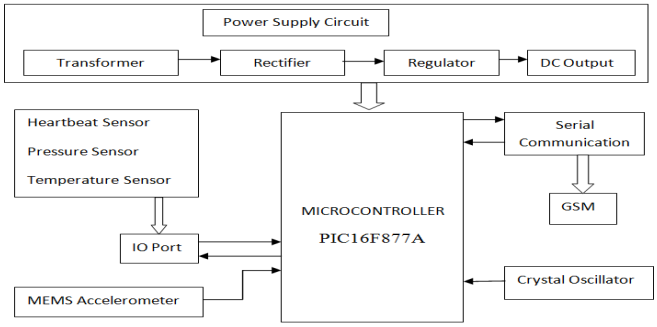

Figure 1 Block Diagram of the system

Specification of devices

Block diagram of the entire system is shown in the (Fig 1).

- PIC16F877A Microcontroller
- MEMS sensor,
- LCD Display Unit,
- Temperature sensor,
- Pulse Detector,
- GSM modem and
- Power supply

Microcontroller

PIC 16F877 is a 40-pin 8-Bit CMOS FLASH Microcontroller (V.Sai Satish, Sd.bibi.Ayesha, 2015). The core architecture is high-performance RISC CPU. Since it follows the RISC architecture, all single cycle instructions take only one instruction cycle except for program branches which take two cycles. 16F877 comes with 3 operating speeds with 4, 8, or 20 MHz clock input. Since each instruction cycle takes four operating clock cycles, each instruction takes 0.2 µs when 20MHz oscillator is used. It has two types of internal memories, one is program memory and the other is data memory. Program memory is provided by 8K words (or 8K*14 bits) of FLASH Memory, and data memory has two sources. One type of data memory is a 368-byte RAM (Random Access Memory) and the other is a 256-byte EEPROM (Electrically Erasable Programmable ROM). The core features include interrupt up to 14 sources, power saving SLEEP mode, a single 5V supply and In-Circuit Serial Programming (ICSP) capability. The sink/source current, which indicates a driving power from I/O port, is high with 25mA. Power consumption is less than 2 mA in 5V operating condition.

Heartbeat sensor

The sensor consists of an IR light emitting diode (the transmitter) and an IR photo detector (the receiver). The IR light passes through the tissues as shown in (Fig 2). Variations in the volume of blood within the finger modulate the amount of light incident on the IR detector. In this design, both the IR transmitter and receiver are placed on the same plane and the finger functions as a reflector of the incident light. The IR receiver monitors the reflected signal. The infrared LED and phototransistor are used as sensor device.

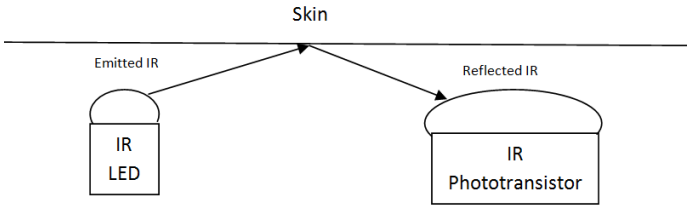

Figure 2 Illustration of the working of the heartbeat sensor

Mems accelerometer

MEMS accelerometer is based on the principle of differential capacitance technology. The capacitors are available in one, two or three axis versions. The first one represents X-axis, second one is Y-axis and another one is z-axis. It is used for accelerometer measurement .The sensing element of the accelerometer consists of two fixed plates as shown in Figure 3. One plate is attached to the substrate and the other one to a suspended plate. By sensing the motion of these two plates the value changes the position of the x, y and z-axis directions. The MEMS sensor ADXL735 is used.

The MEMS Sensor is responsible to convert the coordinates of the device position with respect to earth's coordinates and gives it in the form of electrical signals to the microcontroller. This MEMS device will give the coordinates in the form of electrical signals as X-axis coordinates, Y-axis coordinates and Z-axis coordinates as shown in (Fig 3). These coordinates are the 3 dimensional data of MEMS sensor as its position. This is attached to the patient's body. (*S K Saidulu , B Karunaiah , K V Murali Mohan, 2014)*. When the patient is about to fall down, the coordinates of the MEMS Sensor will be altered. These different values will be analysed and if the generated values indicates that person is about to fall down then it will be indicated by giving some alert to the caretaker.

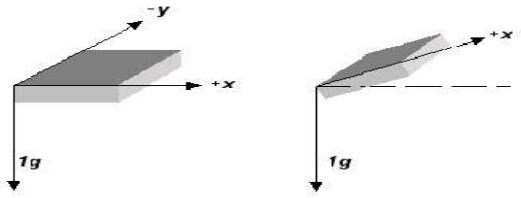

Figure 3 Device position with respect to Earths coordinates

GSM modem

GSM-SIM900 is used for the transmission of information. Information from the Microcontroller is transmitted to the mobile phone with the help of AT command used in Embedded C.

Power supply

The input can be given in the form of AC or DC. A rectifier is used to convert AC signal to DC signal. A regulator is used to

convert +12 V AC supply to +5 V DC signal. Since all the components used can withstand only +5V.

Pressure sensor

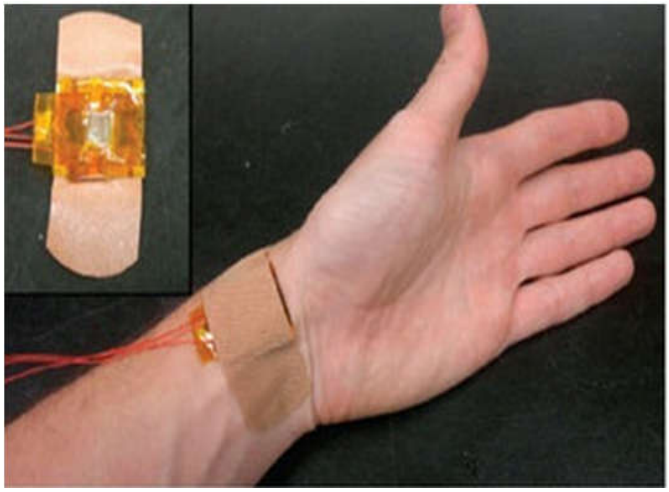

Figure 4 Measurement of the systolic and diastolic Pressure.

Pressure range between 70-110mm is considered to be normal. Pressure sensor is shown in (Fig 4).

Operation

The main aim of this project is to provide assistance to older people in emergency health condition. The sensors which are interfaced to the microcontroller will continuously monitor the Patients health condition. And in case of emergency situation, it gives an alerting message as SMS to the care taker.

The temperature sensor will measure the temperature of the patient's body. The pulse detector sensor is used to measure patient's heart rate. These sensors will be placed on the patient's body. This temperature sensor will continuously get the body temperature as electrical signals. These electrical signals will be processed by the microcontroller, if it is detected as emergency condition (The temperature of the body is more than the normal temperature) it will alert the caretaker by sending SMS to the caretaker. As well as, the patient's heart rate will be measured in digital form. This data will also be processed by the microcontroller and it checks with normal values of the patient's heart rate. And if the values are not in normal range, an emergency alert message is given to the care taker.

The modules used are PIC16F877A controller, GSM Modem, Pulse detector, MEMS Sensor and Temperature sensor will be connected with the power supply.

CONCLUSION

The development of light-weight physiological sensors will lead to the production of comfortable wearable devices that can monitor different range of activities of the inhabitant. Hence, disabled persons can be taken care without the personal assistance.

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