Abstract

Healthcare systems are a very important part of the economy of any country and for the public health. In this fast pace of life, it is difficult for people to be constantly available for their near ones who might need them while they are suffering from the difficult. Patient monitoring systems measure physiological characteristics either continuously or at regular intervals of time. The recent survey of world health organization estimated approximately 5.6 million people were paralyzed representing 1.9 percent of the population roughly 1 among 50. Health surveillance of the paralyzed in the hospitals reveals that, there are many exercises, stimulation and medicines to safeguard the paralyzed people. But there is not a particular monitoring system to monitor the health conditions of the paralyzed. To overcome these problems a monitoring system is introduced, which is used to check the patients’ health conditions. In this monitoring system, bio sensors are used to sense the vital framework of patients such as pulse rate, blood pressure, airflow sensor and these parameters are measured continuously and transmits the message to the caretaker by using GSM. This can be processed in Microcontroller(MSP430).

Keywords: Patient monitoring systems, Health surveillance, safeguard, bio sensors, vital framework.

I. INTRODUCTION

Paralysis is the inability to move muscles on your own and with purpose. It can be temporary or permanent. The most common causes are stroke, spinal cord injury, and multiple sclerosis. Paralysis can be a complete loss of movement known as plegia, or a significant weakness called paresis. Paralysis is most often caused by damage in the nervous system, especially the spinal cord. Other major causes are stroke, trauma with nerve injury, poliomyelitis, cerebral palsy, peripheral neuropathy, Parkinson’s disease, ALS, botulism, spina bifida, multiple sclerosis, and Guillain–Barré syndrome. For example, monoplegia/monoparesis is complete loss of movement or weakness of one limb. Hemiplegia/hemiparesis is complete loss of movement or weakness of arm and leg on same side of the body. Paraplegia/paraparesis is complete loss or weakening of both legs. Tetraplegia/tetraparesis or quadraplegia/quadraparesis is complete loss or weakness of both arms and both legs.
Paralysis is caused by injury or disease affecting the central nervous system (brain and spinal cord) which means that the nerve signals sent to the muscles is interrupted. Paralysis can also cause a number of associated secondary conditions, such as urinary incontinence and bowel incontinence.

Eventhough, there are innovative approaches for curing or treating paralysis patients, but the aim of treatment is to help a person adapt to life with paralysis by making them as independent as possible. Where we see a problem with these types of devices that are being developed is that they are very large and expensive machines. They seem to be only available in hospitals and not able to be used at the patientís home or at their convenience. Our goal is to make a device that will be able to retrain a patient’s motion but have them be able to use the device themselves and have it be cheap enough for them to afford without much debt.

**Block diagram**

![Block diagram of Paralyzed patient monitoring system](image)

**Fig: Paralyzed patient monitoring system**

**Methodology**

In this monitoring system, the implementation of the module is for the paralyzed patients. This module comprises of parameters include heart rate, respiration rate, temperature. The primary function of this system is to monitor the heart rate, breathing rate, temperature of the paralyzed and the data collected by the sensors are sent to the msp430 Launchpad. This Launchpad will process the sensed data using the embedded program for the required parameters using code composer studio complier.

The program is available for monitoring at the operational levels. The normal heart beat range of a paralyzed will be nearly 60-100 beats a minute. If the range reaches below 60, it leads to heart block, syncope and when the range exceeds 100, it leads to anxiety and tachycardia. So, when it increases or decreases the status of the patient pulse rate will be intimated. The normal temperature of a paralyzed patient shall be 98.6 F i.e. 37 C. If the range reaches above or below 98.6, it leads irrational thinking and health problems. This can be measured to know the rise in temperature. The normal respiratory rate of a paralysis can be nearly 12-20 breathes per minute. The rate is usually measured when a person is at rest and simply involves counting the number of breaths for one minute by counting how many times the chest rises. If the paralysis increases for the paralyzed patient,
then the respiration increases. This can be the basic parameter of the paralyzed. If the respiration rate increases or decreases 12-20 breathe per minute, it will be intimated.

All the basic parameters are monitored and if there is a dangerous change in paralyzed patient's status, then a message will be intimated to the doctor and caretaker about the condition of the paralyzed. This contribution of paralysis monitoring system is for better process management, superior flexibility and increased efficiency within hospitals is further underlining the appeal of wireless networking options for paralysis patient monitoring systems.

Hardware description

GSM Module

A GSM modem is a device which can be either a mobile phone or a modem device, can be used to make a computer or any other processor communicate over a network. A GSM modem requires a SIM card to be operated and operates over a network range subscribed by the network operator. It can be connected to a computer through serial, USB or Bluetooth connection.

This GSM Modem can accept any GSM network operator SIM card and act just like a mobile phone with its own unique phone number. Advantage of using this modem will be that you can use its RS232 port to communicate and develop embedded applications. Applications like SMS Control, data transfer, remote control and logging can be developed easily.

Features of GSM module

Compatibility that we can use the same mobile to make calls in several countries, Flexibility and increased capacity due to equipment is smaller in size, Improved spectrum efficiency, International roaming, Compatibility with integrated services digital network (ISDN), Support for new services, SIM phonebook management, Fixed dialling number (FDN), Real time clock with alarm management, High-quality speech, Uses encryption to make phone calls more secure and Short message service (SMS).

MSP430

MSP430 is a family of ultra-low-power microcontrollers consist of several devices featuring different sets of peripherals targeted for various applications. The architecture, combined with five low-power modes, is optimized to achieve extended battery life in portable measurement applications. The device features a powerful 16-bit RISC CPU, 16-bit registers, and constant generators that
contribute to maximum code efficiency. The digitally controlled oscillator (DCO) allows wake-up from low-power modes to active mode in less than 1 µs.

The MSP430x21x1 series is an ultra-low-power mixed signal microcontroller with a built-in 16-bit timer, versatile analog comparator, and sixteen I/O pins. Typical applications include sensor systems that capture analog signals, convert them to digital values, and then process the data for display or for transmission to a host system. Stand-alone RF sensor front end is another area of application. The analog comparator provides slope A/D conversion capability.

**Features of MSP430**

![MSP430 Image]

- Low Supply-Voltage Range: 1.8 V to 3.6 V, Ultra-Low Power Consumption,
- Active Mode: 230 µA at 1 MHz, 2.2 V
- Standby Mode: 0.5 µA
- Off Mode (RAM Retention): 0.1 µA
- Five Power-Saving Modes
- Ultra-Fast Wake-Up From Standby Mode in Less than 1 µs
- 16-Bit RISC Architecture, 62.5-ns Instruction

**Heart rate sensor(SEN-11574):**

Heart rate data can be really useful for designing an exercise routine, studying our activity or anxiety levels with our heart beat. The problem is that heart rate can be difficult to measure but the Pulse Sensor Amped can solve this problem. The Pulse Sensor Amped is a plug-and-play heart-rate sensor for microcontroller. 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 is great for mobile applications. The pulse sensor is simply clipped to the earlobe or fingertip of the victim and plug it into microcontroller with 3 or 5 Volt to read heart rate. The 24" cable on the Pulse Sensor is terminated with standard male headers so there is no soldering required.

**Dimensions:**

- 0.625" Diameter
- 0.125" Thickness
Kit Includes:

- Pulse Sensor Board
- Velcro Finger Strap
- Transparent Stickers to Protect Sensor
- Ear Clip for Earlobe Heart Rate Measurement
- 24-inch Color-Coded Cable with Standard Male Headers

Temperature sensor (LM35):

The LM35 series are precision integrated-circuit temperature sensors, whose output voltage is linearly proportional to the Celsius (Centigrade) temperature. The LM35 has an advantage over linear temperature sensors calibrated in ° Kelvin, as the user is not required to subtract a large constant voltage from its output to obtain convenient Centigrade scaling. The LM35 does not require any external calibration or trimming to provide typical accuracies of ±1/4°C at room temperature and ±3/4°C over a full −55° to +150°C temperature range. Low cost is assured by trimming and calibration at the wafer level. The LM35’s low output impedance, linear output, and precise inherent calibration make interfacing to readout or control circuitry especially easy. It can be used with single power supplies, or with plus and minus supplies. As it draws only 60 µA from its supply, it has very low self-heating, less than 0.1°C in still air. The LM35 is rated to operate over a −55° to +150°C temperature range, while the LM35C is rated for a −40° to +110°C range (−10° with improved accuracy). The LM35 series is available packaged in hermetic TO-46 transistor packages, while the LM35C, LM35CA, and LM35D are also available in the plastic TO-92 transistor package. The LM35D is also available in an 8-lead surface mount small outline package and a plastic TO-220 package. Features:

- Calibrated directly in ° Celsius (Centigrade)
- Linear + 10.0 mV/°C scale factor
- 0.5°C accuracy guaranteeable (at +25°C)
- Rated for full −55° to +150°C range
- Suitable for remote applications
- Low cost due to wafer-level trimming
- Operates from 4 to 30 volts
- Less than 60 µA current drain
- Low self-heating, 0.08°C in still air
- Nonlinearity only ±1/4°C typical
- Low impedance output, 0.1 Ω for 1 mA load
LM35 is a precision IC temperature sensor with its output proportional to the temperature (in °C). The sensor circuitry is sealed and therefore it is not subjected to oxidation and other processes. With LM35, temperature can be measured more accurately than with a thermistor. It also possess low self heating and does not cause more than 0.1 °C temperature rise in still air.

The operating temperature range is from -55°C to 150°C. The output voltage varies by 10mV in response to every °C rise/fall in ambient temperature, i.e., its scale factor is 0.01V/°C.

Pin Description:

<table>
<thead>
<tr>
<th>Pin No</th>
<th>Function</th>
<th>Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Supply voltage: 5V (+35V to -2V)</td>
<td>Vcc</td>
</tr>
<tr>
<td>2</td>
<td>Output voltage (+6V to -1V)</td>
<td>Output</td>
</tr>
<tr>
<td>3</td>
<td>Ground (0V)</td>
<td>Ground</td>
</tr>
</tbody>
</table>

Software description

Proteus is a simulation and design software tool developed by Labcenter Electronics for Electrical and Electronic circuit design. It also possess 2D CAD drawing feature. It deserves to bear the tagline “From concept to completion”.

About Proteus

It is a software suite containing schematic, simulation as well as PCB designing.

- **ISIS** is the software used to draw schematics and simulate the circuits in real time. The simulation allows human access during run time, thus providing real time simulation.
- **ARES** is used for PCB designing. It has the feature of viewing output in 3D view of the designed PCB along with components. The designer can also develop 2D drawings for the product.

Features

ISIS has wide range of components in its library. It has sources, signal generators, measurement and analysis tools like oscilloscope, voltmeter, ammeter etc., probes for real time monitoring of the parameters of the circuit, switches, displays, loads
like motors and lamps, discrete components like resistors, capacitors, inductors, transformers, digital and analog Integrated circuits, semi-conductor switches, relays, microcontrollers, processors, sensors etc.

ARES offers PCB designing up to 14 inner layers, with surface mount and through hole packages. It is embedded with the footprints of different category of components like ICs, transistors, headers, connectors and other discrete components. It offers Auto routing and manual routing options to the PCB Designer. The schematic drawn in the ISIS can be directly transferred ARES.

Simulation Results

Intimation during increase in Heartbeat:
Intimation during increase in Temperature:

Intimation during increase in Respiration Rate:

CONCLUSION

By taking a overall survey, it can be found that there are many problems existing for the paralyzed people such as paralysis in their leg, hand, vocal tract and also in other body parts. There are systems existing for their comforts individually. But, this system will help to monitor all the factors that cause paralysis and intimate that to the caretakers so that treatment can be given before the paralysis reaches hike.

REFERENCE
