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Posture Monitor-(Makes you sit smart)

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***Abstract*— Embedded systems have become very popular in recent years, and that field is rapidly advancing especially in health monitoring technology. Therefore, we present in this paper an application for posture correction and stress management. As computer adoption increases we can expect a corresponding increase in the occurrence of health problems (like back pain, neck pain etc.), if appropriate countermeasures are not employed. Our system is designed specifically for computer users to prevent them from leaning too close to their computers' monitors. This device continuously monitors our pose by utilizing LPC2148 Controller, accelerometer and alerts the user by notifying through a vibrator or LEDs or a voice module. If he/she leans below a threshold level for some predefined time. Additionally it suggests some refreshing activities to reduce the stress that build up due to bad posture, like walking or simple exercises etc. along with playing of some pleasant music.**

***Index Terms*— Accelerometer, LPC2148, LED's, Stress management, Vibrator or a voice module.**

I. Introduction

Research shows as computer adoption increases we can expect a corresponding increase in the occurrence of health problems (like back pain, neck pain etc.), if appropriate countermeasures are not employed. A lot of research has been done in the field of posture monitor. Our system is designed specifically for computer users to prevent them from leaning too close to their computers' monitors. When a bad posture is detected, the user is notified using a voice module. The detection is done by utilizing LPC2148 and accelerometer.

If the user is in bad posture for a long time, indicates that the person is under stress, then voice module alerts saying him/her to get relax. This is done by initializing 2nd channel of the voice module where a recorded voice says "get relax". If back pain occurs it provides treatment to cure .it reduces the stress management also.

There are many existed systems in pose estimation, but have their own disadvantages like they may need accurate piezoelectric sensors, or costly pressure sensors or it may not be portable.

In this paper we propose a system, To overcome these limitations we are designing a pose monitor that detects the bad posture using an accelerometer with - low cost, high performance and less power consumption. Sensor designed is attached to users body(on the spine),thus it is portable.

When a bad posture is detected, the user is notified using a vibrator or LEDs or a voice module. The detection is done by utilizing ARM 7 Processor and accelerometer.

To reduce the stress that build up due to bad posture, it suggests some refreshing activities like walking or simple exercises etc. along with some pleasant music. Thus manages the users stress.

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II. BLOCK DIAGRAM & DESCRIPTION OF COMPONENTS

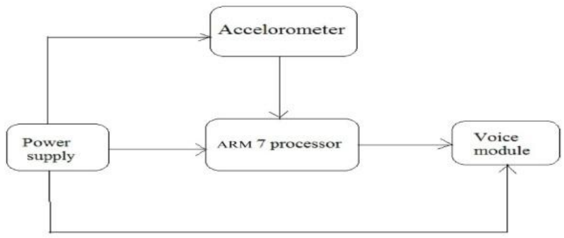

Figure 1

a) *Hardware components:*

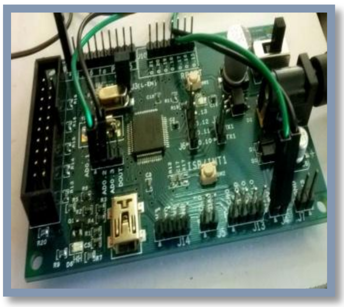

Figure 2

The LPC2141/2/4/6/8 microcontrollers are based on a 32/16 bit ARM7TDMI-S CPU with real-time emulation and embedded trace support, that combines the microcontroller with embedded high speed flash memory ranging from 32 kB to 512 kB. A 128-bit wide memory interface and a unique accelerator architecture enable 32-bit code execution at the maximum clock rate. For critical code size applications, the alternative 16-bit Thumb mode reduces code by more than 30 % with minimal performance penalty.

Due to their tiny size and low power consumption, LPC2141/2/4/6/8 are ideal for applications where miniaturization is a key requirement, such as access control and point-of-sale. A blend of serial communications interfaces ranging from a USB 2.0 Full Speed device, multiple UARTs, SPI, SSP to I^2Cs, and on-chip SRAM of 8 kB up to 40 kB, make these devices very well suited for communication gateways and protocol converters, soft modems, voice recognition and low end imaging, providing both large buffer size and high processing power. Various 32-bit timers, single or dual 10-bit ADC(s), 10-bit DAC, PWM channels and 45 fast GPIO lines with up to nine edge or level sensitive external interrupt pins make these microcontrollers particularly suitable for industrial control and medical systems.

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b) ARM7 processor:

The ARM7TDMI-S is a general purpose 32-bit microprocessor, which offers high performance and very low power consumption. The ARM architecture is based on Reduced Instruction Set Computer (RISC) principles, and the instruction set and related decode mechanism are much simpler than those of micro programmed Complex Instruction Set Computers. This simplicity results in a high instruction throughput and impressive real-time interrupt response from a small and cost-effective processor core.Pipeline techniques are employed so that all parts of the processing and memory systems can operate continuously. Typically, while one instruction is being executed, its successor is being decoded, and a third instruction is being fetched from memory.The ARM7TDMI-S processor also employs a unique architectural strategy known as THUMB, which makes it ideally suited to high-volume applications with memory restrictions, or applications where code density is an issue.The key idea behind THUMB is that of a super-reduced instruction set.

c) Power supply:

The power supplies are designed to convert high voltage AC mains electricity to a suitable low voltage supply for electronic circuits and other devices. A power supply can by broken down into a series of blocks, each of which performs a particular function. A d.c power supply which maintains the output voltage constant irrespective of a.c mains fluctuations or load variations is known as "Regulated D.C Power Supply"

d) accelerometer:

Figure 3

An accelerometer is a sensing element that measures acceleration; acceleration is the rate of change of velocity with respect to time. It is a vector that has magnitude and direction. Accelerometers measure in units of g – a g is the acceleration measurement for gravity which is equal to $9.81 m/s^2$. Accelerometers have developed from a simple water tube with an air bubble that showed the direction of the acceleration to an integrated circuit that can be placed on a circuit board. Accelerometers can measure: vibrations, shocks, tilt, impacts and motion of an object.

e) Voice module:

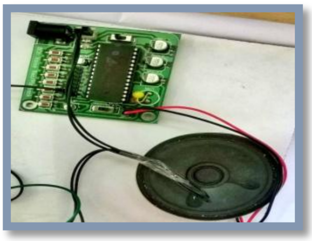

Figure 3

This Voice Recognition Module is a compact and easy-control speaking recognition board. Stress and excitement alters ones voice. This affects the accuracy of the circuit's recognition. For instance assume you are sitting at your workbench and you program the target words like fire, left, right, forward, etc., into the circuit. Then you use the circuit to control a flight simulator game, Doom or Duke Nukem. Well, when you're playing the game you'll likely be yelling "FIRE! …Fire! ...FIRE!! ...LEFT …go RIGHT!". In the heat of the action you're voice will sound much different than when you were sitting down relaxed and programming the circuit. To achieve a higher accuracy word recognition one needs to mimic the excitement in ones voice when programming the circuit. These factors should be kept in mind to achieve the high accuracy possible from the circuit. This becomes increasingly important when the speech recognition circuit is taken out of the lab and put to work in the outside world.

III. INTERFACING THE COMPONENTS

A. Software interfacing:

Connect all the components as per block diagram as shown in above figure.

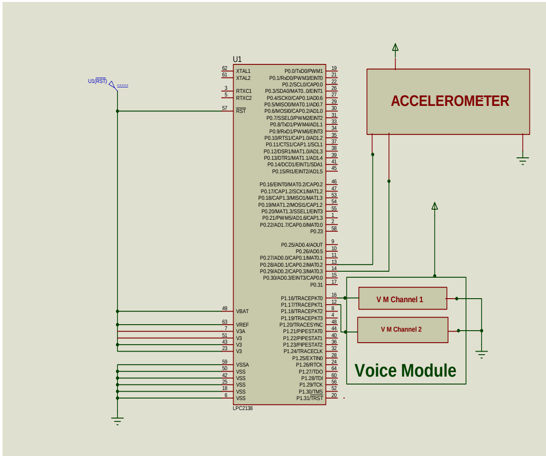

Figure 5

B. Hardware interfacing:

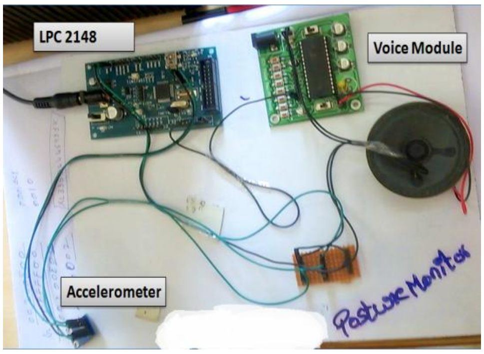

Figure 4

Connect all the components as per our requirements and write the program in keil software and interfacing these

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hardware kits into that keil software code by using usb cable and we have to observe the blinking of leds as well as gpio interfacing

C. *Description of interfacing :*

Switch on the power supply. This supplies LPC 2148 with 3.3 DC voltage. Select the channel where required alert voice is present When accelerometer is vertically straight in position then voice module is in idle state When there is a bend in user's position then accelerometer senses and alerts through the speaker present with the voice module. Speech recognition will become the method of choice for controlling appliances, toys, tools and computers. At its most basic level, speech controlled appliances and tools allow the user to perform parallel tasks (i.e. hands and eyes are busy elsewhere) while working with the tool or appliance.

This board allows you to experiment with many facets of speech recognition technology. It has 8 bit data out which can be interfaced with any microcontroller for further development.
The keypad is made up of 12 normally open momentary contact switches. When the circuit is turned on, "00" is on the digital display, the red LED (READY) is lit and the circuit waits for a command. Press "1" (display will show "01" and the LED will turn off) on the keypad, then press the TRAIN key (the LED will turn on) to place circuit in training mode, for word one. Say the target word into the onboard microphone (near LED) clearly. The circuit signals acceptance of the voice input by blinking the LED off then on. The word (or utterance) is now identified as the "01" word. If the LED did not flash, start over by pressing "1" and then "TRAIN" key. Press "2" then TRN to train the second word and so on. The circuit will accept and recognize up to 20 words (numbers 1 through 20). It is not necessary to train all word spaces.

D. *GPIO interfacing:*

Every physical GPIO port is accessible via either the group of registers providing an enhanced features and accelerated port access or the legacy group of register.

Accelerated GPIO functions:

- GPIO registers are relocated to the ARM local bus so that the fastest possible I/O timing can be achieved
- Mask registers allow treating sets of port bits as a group,leaving other bits unchanged
- All registers are byte and half-word addressable
- Entire port value can be written in one instruction

Bit-level set and clear registers allow a single instruction set or clear of any number of bits in one port

Direction control of individual bits.All I/O default to inputs after reset ,it is Backward compatibility with other earlier devices is maintained with legacy registers appearing at the original addresses on the APB bus

Applications:

- General purpose I/O
- Driving LEDs, or other indicators
- Controlling off-chip devices
- Sensing digital inputs

E. *ADC function:*

The basic function of this ADC is Basic clocking for the A/D converters is provided by the APB clock. A programmable divider is included in each converter, to scale this clock to the 4.5 MHz (max) clock needed by the successive approximation process. A fully accurate conversion requires 11 of these clocks.

The main features of ADC is

- 10 bit successive approximation analog to digital converter (one in LPC2141/2 and two in LPC2144/6/8).
- Input multiplexing among 6 or 8 pins (ADC0 and ADC1).
- Power-down mode.
- Measurements range 0 V to V_{REF} (typically 3 V; not to exceed V_{DDA} voltage level).
- 10 bit conversion time >= 2.44 us.
- Burst conversion mode for single or multiple inputs.
- Optional conversion on transition on input pin or Timer Match signal.
- Global Start command for both converters (LPC2144/6/8 only).

IV. ALGORITHM (FLOW OF CODING CONDITIONS):

A. *Algorithm:*

Step1: Read the sensor values using multiple ADC's,
Step2: Send the same data to controller.
Step3: We need to write a code such that we get an alert using buzzer based on some threshold values of the sensor data.
Step4: Provide some stress bursting activities through a voice module when bad posture detected continuously for a pre defined time.

B. *Functions:*

- Monitors our health in real time by thresh-holding of sensor values.
- Gives alerts if necessary.
- Provides stress relieving activities

C. *Flowchart:*

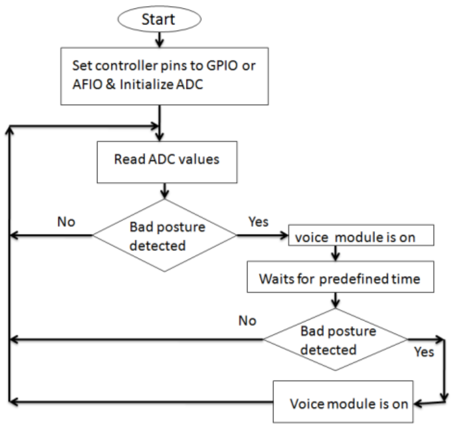

Figure 5

V. OUTPUTS

In this output diagram after completion of successful interfacing all the components in the software the LED is blinking with the use of accelerometer and voice modules

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below diagrams are both hardware and software simulation results:

A. Switch on the power supply it will give The power supplies of LPC 2148 with 3.3 DC voltage:

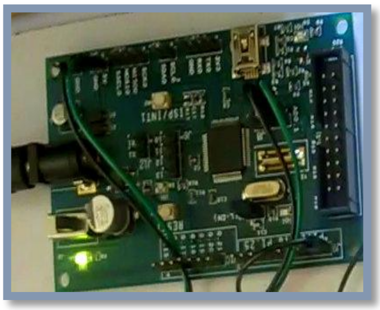

Figure 7

B. Select the channel where ever we are required alert voice is present:

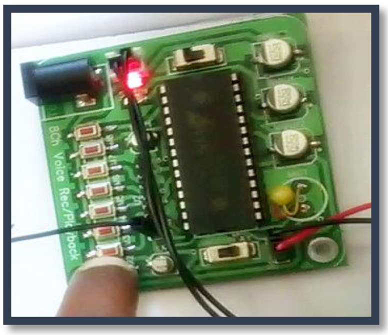

Figure 8

C. Interfacing in keil u –vision software:

Interfacing the components with the GPIO's and observe the pins those are on/off condition as well as their register addresses.

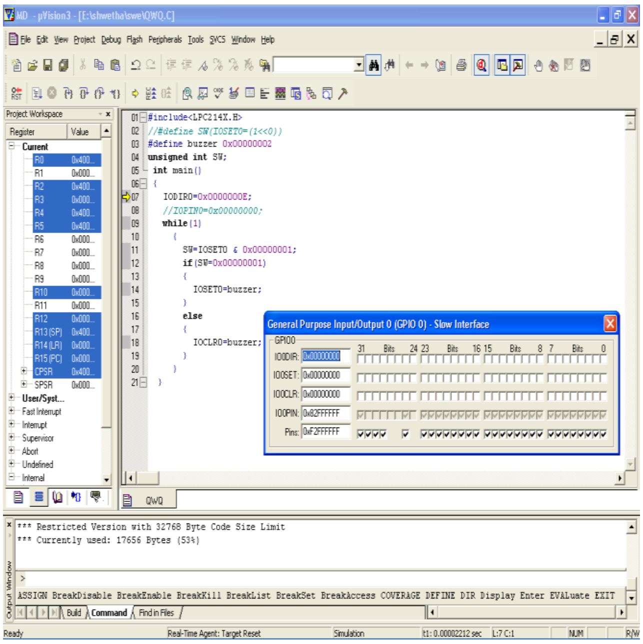

Figure 9

D. Keep the Accelerometer is vertically straight in position then voice module is in idle state shown in the diagram

Figure 10

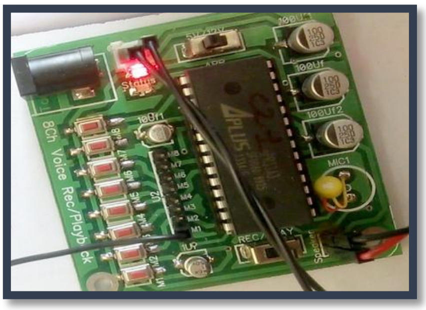

Figure11

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E. A bend in user's position then accelerometer senses and alerts through the speaker present with the voice module

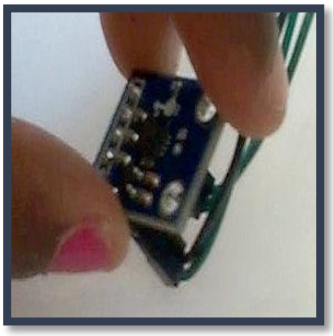

Figure 12

Figure 13

VI. FUTURE WORK

This paper is used to improve the posture technology using LPC 2148 controller . in the future, voice recognition systems may have the ability to distinguish nuances of speech and meanings of words, to "Do what I mean, not what I say!".In stress management ,If back pain occurs it provides treatment to cure

VII. CONCLUSION

In conclusion it Maintain an upright posture .it will be Adopt healthy and as well as sitting habits Manages the stress management .it is good procure adoptive technology to move the stress as well as back pain .

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