

MICROCONTROLLER BASED SCOLIOSIS PREVENTION EQUIPMENT USING FLEX SENSOR

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ABSTRACT

Our device is being designed to help people who are suffering with scoliosis by preventing their spinal deformity from further destruction using flex sensor. This Device will alert the user whenever the curvature of the bend of spinal cord has reached the threshold value of spinal curve angle on comparing with predetermined value. Continuous use of device will ultimately train the user to maintain good posture for their entire life.

Keywords: Flux sensor, PIC16F877,Scoliosis,

1.INTRODUCTION

In recent days nearly 80% of the people suffer from spinal cord problems. Bad posture can cause various health problems ranging from fatigue to persistent back pain and if not corrected immediately could result in long-term health problems. However, if you have poor posture, the pressure on the spine increases and also the pressure gets disturbed unevenly. So if not able to get the support it needs to stay balanced. Sudden movements and bad posture causes musculoskeletal disorders that affect the spinal cord leading pain from the neck to lower back. In our proposed model, Smart jacket can be designed which use flex sensor. As the posture changes, resistance of the flex sensor vary accordingly. The output of these flex sensor is fed to pre-amplifier. The preamplifier stage converts resistance variations in the flex sensor to voltage with suitable gain. The output of the preamplifier is feed to ADC of the microcontroller. The data is sent to PC through UART for analysis of spinal curve angle collected from flex sensor for analysing the condition of the spinal cord. Specific algorithm will be designed to detect any abnormal/incorrect spinal angle or posture. Whenever bad posture detected, microcontroller will send a control signal to speaker.

1.1SPINE

The spine is very delicate structure of the human body. The spinal cord is located inside the spine. Vertebrae are small bone forming the spinal column. These curves round our shoulders and make our lower back curve slightly inward. When viewed from the back, the spine should run

straight down the middle of the back. When abnormalities of the spine occur, the natural curvatures of the spine are misaligned in certain areas.

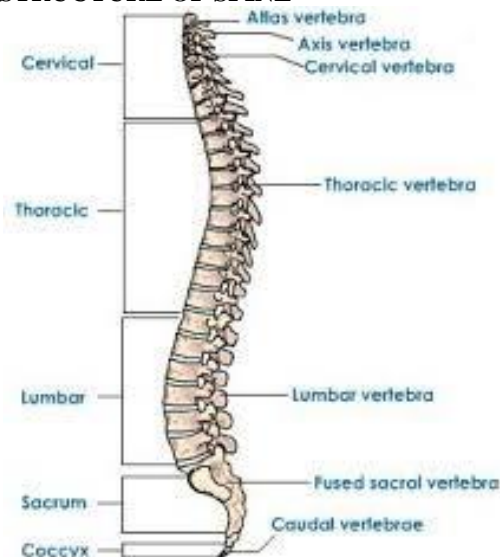
1.12 FUNCTIONS OF SPINE

Support mass of the body/head and withstand external forces.

Allows for mobility and flexibility to absorb energy and protect against impact.

Protects the spinal cord, nerves and the vertebral artery in the cervical area.

STRUCTURE OF SPINE



1.13 SPINAL CURVATURE DISORDERS

In poor posture, the spinal cord will be bent on sides. They are three types of spinal curvature disorders,

1. **Kyphosis**-is a curve seen from the side in which the spine is bent backward.
2. **Lordosis**-is a curve seen from the side in which the spine is bent forward
3. **Scoliosis**-develop additional curves to either side or the bones of the spine twist on each other like a corkscrew.

1.14 SCOLIOSIS

Scoliosis is about two times more common in girls than boys.

Scoliosis is hereditary in that people with scoliosis are more likely to have children with scoliosis.

In most cases, the cause of scoliosis is unknown (idiopathic).If the person is less than 3years old .it is called infantile idiopathic scoliosis,. Scoliosis that develops between 3 and 10 years of age is called juvenile idiopathic scoliosis, and people that are over 10 years old have adolescent idiopathic scoliosis.

More than 80% of people with scoliosis, and the majority of those are adolescent girls.

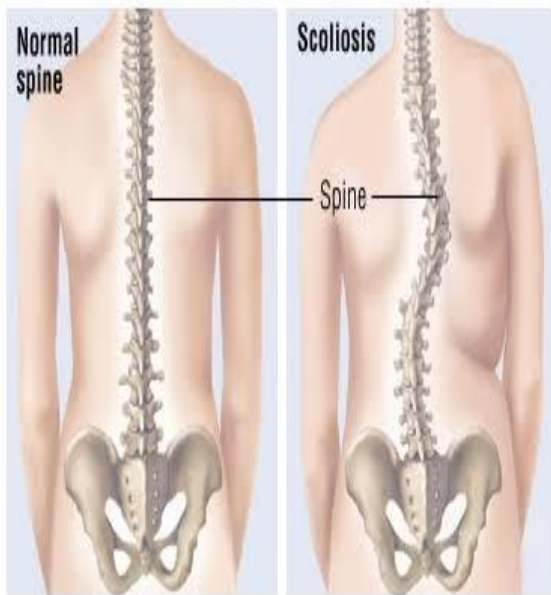


Fig 1.2

There are three other main types of scoliosis:

Functional: In this type of scoliosis, the spine is normal, but an abnormal curve develops because of a problem somewhere else in the body. This could be caused by one leg being shorter than the other or by muscle spasms in the back.

Neuromuscular: In this type of scoliosis, there is a problem when the bones of the spine are formed.This type of scoliosis develops in people with other disorders, including birth defects,muscular dystrophy, cerebral palsy, or Marfan’s disease .People with these conditions often develop a long C-shaped curve and have weak muscles that are unable to hold them up straight. This type of scoliosis is

often much more severe and needs more aggressive treatment than other forms of scoliosis.

Degenerative: Unlike the other forms of scoliosis that are found in children and teens, degenerative scoliosis occurs in older adults. It is caused by changes in the spine due to arthritis known as spondylosis. Weakening of the normal ligaments and other soft tissues of the spine combined with abnormal bone spurs can lead to an abnormal curvature of the spine. The spine can also to be affected by osteoporosis, vertebral compression fractures, and disc degeneration. There are other potential causes for scoliosis, including spine tumors such as osteoid osteoma .This is a benign tumor that can occur in the spine Cause pain.

2.RELATED WORKS

The possibility of using learned physiological responses in control of progressive adolescent idiopathic scoliosis (AIS) was investigated. Sixteen AIS patients with progressive or high risk curves were fitted with a device with tone alarm for poor posture. In the first 19 months of application,3 patients defaulted and 4 showed curve progression>10 degrees[2].Another work related to scoliosis were explained with the title “An intelligent info-structure for composing and pushing personalized healthcare information over the Internet” by the authors Abide ,S.S.R .Chong Yong Han; SaminaRazaAbidi. It provides a technology-enriched solution to Web-mediated patient empowerment initiatives via the implementation of an intelligent information structure that features(1) the dynamic composition information(PHI)conforming to an individual’s EMR(electronic medical record)based health profile; and (2)proactive Internet-based delivery of PHI[10].Recently developed technique is explained with the title “Evaluating informatics applications-clinical decision support systems literature review” by the author Bonnie Kaplan. That paper reviews clinical decision support systems (CDSS) literature, with a focus on evaluation. The literature indicates a general consensus that clinical decision support systems are thought to have the potential to improve care. Evidence is more equivocal for guidelines and for systems to aid physicians with diagnosis. There also is general consensus that a variety of systems are little used despite demonstrated or potential beets .In the evaluation literature, the main emphasis is on how clinical performance changes. Most studies use an experimental or randomized controlled clinical trails design (RCT) to assess system performance or to focus on changes in clinical performance that could affect patient care. Few studies involve held tests of CDDS and almost none use a naturalistic design in routine clinical settings with real patients. In addition, there is little theoretical discussion ,although papers are permeated by a rationalist perspective that excludes contextual issues related to how and why systems are used. The studies mostly concern physicians rather than other clinicians. Further, studies appear to be insulated from evaluations of other informatics applications [9].

3. PROPOSED SYSTEM

In our proposed system we are using a flex sensor based equipment to prevent the spinal bending and correct the posture. In this system we use flex sensors, microcontroller, voice indicator and LCD. This method is compatible for all age group of people. It is a user friendly device.

3.1 BLOCK DIAGRAM

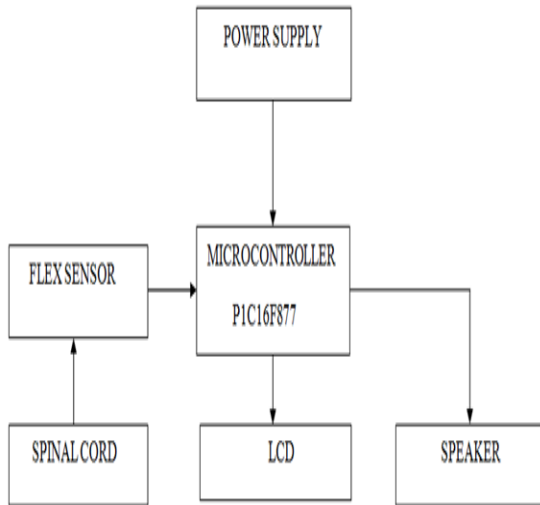


Fig 1.3

3.12 BLOCK DIAGRAM DESCRIPTION

3.121 POWER SUPPLY

FILTER:

The circuit used for removing the ripples is called Filter circuit. The simple capacitor filter is the most basic type of power supply filter. This system uses a bridge rectifier. A bridge rectifier makes use of four diodes. In a bridge arrangement to achieve full-wave rectification.

REGULATOR:

The output voltage is maintained irrespective of the fluctuations in the input AC voltage. As and then the AC voltage changes, the DC voltage also changes. Thus to avoid this Regulators are used. Also when the internal resistance of the power supply is greater than 30 ohms, the output gets affected. Thus this can be successfully reduced here. The regulators are mainly classified for low voltage and for high voltage. Here we used 7805 positive regulator. It reduces the 12V DC voltage to 5V DC.

3.122 MICROCONTROLLER

Microcontroller, as the name suggests, are small controllers. These are like single chip computers that are often embedded into systems to function as processing controllers unit. For example, the remote control you are using probably has microcontrollers inside that do decoding and other controlling functions. They are also used in automobiles, washing machines, microwave ovens,

toys...etc, where automation is needed. The key features of microcontrollers include:

HIGH INTEGRATION OF FUNCTIONALITY

Microcontrollers sometimes are called single chip computers because they have on-chip memory and i/o circuitry and other circuitries that enable them to function as small standalone computers without other supporting circuitry.

FIELD PROGRAMMABILITY AND FLEXIBILITY

Microcontrollers often use EEPROM or EPROM as their storage device to allow field programmability so they are flexible to use. Once the program is tested to be correct then large quantities of microcontrollers can be programmed to be used in embedded systems.

EASY TO USE

Assembly language is often used in microcontrollers and since they usually follow RISC architecture, the instruction set is small. The development package of microcontrollers often includes an assembler, a simulator, a programmer to 'burn' the chip and a demonstration board. Some packages include a high level language compiler such as a C compiler and more sophisticated libraries.

3.13 FLEX SENSOR

Flex sensors are sensors that change in resistance depending upon the amount of bend on the sensor. They are usually in the form of a thin strip from 1-5 inch long that vary in resistance. They can be made unidirectional and bidirectional.

FEATURES:

- Angle displacement measurement.
- Bends and flexes physically with motion device.
- Possible uses:
 - Robotics
 - Gaming (virtual motion)
 - Medical instruments
 - Computer peripherals
 - Physical therapy
 - Medical devices.

The Flex sensor used in this system is from Spectra Symbol manufacturer and is based on resistive carbon elements. The flex sensor achieves great form-factor on a thin flexible substrate. When the substrate is bent, the sensor produces a resistance output correlated to the bend radius.

3.134 LIQUID CRYSTAL DISPLAY (LCD)

Liquid crystal display (LCD) has material which combines the properties of both liquid and crystals. They have a temperature range within which the molecules are almost as mobile as they would be in a liquid, but are grouped together in an order form similar to a crystal. More microcontrollers devices are using 'smart LCD' displays to output visual information. LCD displays designed around Hitachi's LCD HD44780 module, are inexpensive, easy to use and it is even possible to produce a readout using the 8x80 pixels of the display.

To make an LCD, you need to take two polarized glass pieces. The glass which does not have a polarized film on it must be rubbed with a special polymer which creates microscopic grooves in the surface. It must also be noted that the grooves are on the same direction as the polarizing film. Then, all you need to do is to add a coating of nematic liquid crystals to one of the filters. The grooves will cause the first layer of molecules to align with the filter's orientation. At right angle to the first piece, you must then add a second piece of glass along with the polarizing film. Till the uppermost layer is at a 90-degree angle to the bottom, each successive layer of TN molecules will keep on twisting. The first filter will naturally be polarised as the light strikes it at the beginning. Thus the light passes through each layer and is guided on to the next with the help of molecules. When this happens, the molecule tend to change the plane of vibration of the light to match their own angle. When the light reaches the far side of the liquid crystal substance, it vibrates at the same angle as the final layer of molecules. The light is only allowed an entrance if the second polarized glass filter is same as the final layer. The main principle behind liquid crystal molecules is that when an electric current is applied to them, they tends to untwist. This causes a change in the light angle passing through them. This causes a change in the angle of the top polarizing filter with respect to it. So little allowed topass through that particular area of LCD. Thus that area becomes darker comparing to others. For making an LCD screen, a reflective mirror has to be setup in the back. An electrode plane made of indium tin oxide is kept on the top and a glass with polarising film is also added on the bottom side. The entire area of the LCD has to be covered by a common electrode and above it should be the liquid crystal substances. Thus the entire rectangular area appears blank.

3.135 SPEAKERS

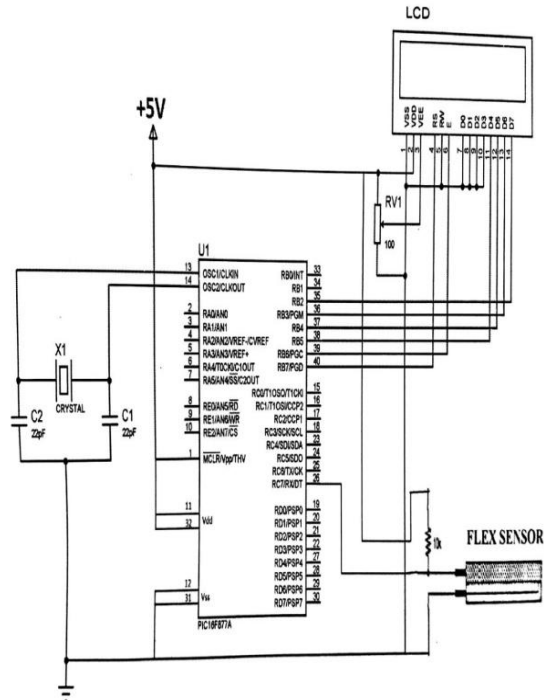
Speakers come in all shapes and sizes, enabling you to listen to music on your ipad, enjoy a film at the cinema or hear a friend's voice over the phone. Inorder to translate an electrical signal into an audible sound, speakers contain an electromagnet: a metal coil which creates a magnetic field when an electric current flows through it. This coil behaves much like a normal magnet, with one particularly handy property: reversing the direction of the current in the coil flips the poles of the magnet.

Inside a speaker, an electromagnet is placed in front of a permanent magnet. The permanent magnet is fixed firmly into position whereas the electromagnet is mobile. The electromagnet is attached to a cone made of a flexible material such as paper or plastic which amplifies these vibrations, pumping sound waves into the surrounding air and towards your ears.

The frequency of the vibrations governs the pitch of the sound produced, and their amplitude affects the volume-turn your stereo up high enough and you might even be able to see the diaphragm covering the cone move.

To reproduce all the different frequencies of sound in a pieces of music faithfully, top quality speakers typically use different sized cones dedicated to high, medium and low frequencies. A microphone uses the same mechanism as a speaker in reverse to convert sound into an electrical signal. Infact, you can even use a pair of headphones as a microphone.

4.CIRCUIT DIAGRAM



5.RESULT ANALYSIS

Smart jacket can be designed which use flex sensor. As the posture changes, resistance of flex sensor vary accordingly. The output of these flex sensor is fed to preamplifier. The preamplifier stage converts resistance variations in the flex sensor to voltage with suitable gain. The output of the preamplifier is feed to ADC of Microcontroller.

The data is sent to PC through UART for analysis of spinal cord. Specific algorithms will be designed to detected any abnormalities/incorrect spinal angle or posture. Whenever bad posture detected, microcontroller will send a control signal to speaker.

As per the analysis, the system is easy to wear and is very comfort for children. It is a user friendly device. Even though it has this much of advantages its cost is low.

Before the bending of spinal cord, the output is NORMAL.



After the bending of spinal cord, the output is BROKED that is it alert the person to correct the spinal posture.



6. CONCLUSION AND FUTURE WORK

The aim of the project is finally achieved with the use of microcontroller. The ultimate aim is to save the human life from scoliosis disorder. The flex sensor used to sense the bend in the spinal cord and it indicates to the microcontroller then gives an alarm if the value goes beyond the threshold value.

Thus our project Microcontroller Based Scoliosis Prevention Equipment Using Flex sensor is very helpful to prevent the spinal deformity from further destruction but it is not to cure the scoliosis. It is cost effective and the implementation is done here in this proposed system.

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