# POSTURE ENHANCEMENT JACKET BASED ON ACCELEROMETER SENSOR AND MAGNETIC THERAPY

**K.I. Janani, Dr.G. Manonmani**

**Research scholar, Assistant professor**

**Mother Teresa Women's university**

## Abstract

*The project covers various factors with in smart textile and clothing, with a certain focus on sewing machine operators. In this project there has been a focus on smart and technical applications and application concentrated on enabling technologies. Smart textiles are possible thanks to the three following developments. The first is the introduction of new type of textile fibers and structures for example conductive materials. The second is the miniaturization of electronics, which makes it possible to integrate electronics into textile structures and products. The third is different kind of wireless technologies enabling the technology to be wearable technology in general.*

*The basic concept of smart textile consists of a textile structure that sense and react to different stimuli from its environment. In its simplest from the textile sense and reacts automatically without a controlling unit, and in a more complex from, smart textiles sense, react and activate a specific function through a processing unit. The main parts include in a smart textile system are the sensor, the actuator and the controlling unit. The sewing operators usually sits in backless stools/ certain position for a long period of time this leads to the problem. This project is mainly concentrated on accelerometer sensor to sense the posture and alerts the user and magnetic therapy is given to reduce and relieve pain. Magnetic therapy is painless way of treatment. This study helps in the development of sewing operators' well-being and health.*

***Key words:*** *Smart Textile, Accelerometer sensor, Magnetic therapy, Arduino.*

---

**INTRODUCTION:**

Back pain is a common problem in people who are used to sit for long time. The people working in sewing field are experiencing long term back and shoulder pain this is due to the continuous pressure on certain part of the body and prolonged sitting. This prolonged pain and carelessness leads to severe spine, disk problems and decrease in bone density. Poor posture or slouching can lead to tension and pain in your neck, upper back, lower back, and shoulders. Be careful that you don't over correct on your own wrongly by pulling your shoulder back too far as this could cause muscle tension and stiffness.If you sit for hours, especially if it's daily, in a chair with poor posture, you're putting yourself at risk of developing or worsening circulation problems. By sitting with poor posture all day, you're keeping your body from obtaining the necessary circulation it requires. Poor posture can also make you vulnerable to varicose veins.

The long-term impact of poor posture can cause your spine and other bones to shift their position. This is because your skeletal system starts coming into contact with your surrounding nerves, "pinching" them. The "pinched" nerves can not only lead to back and neck pain, but could also cause pain in other parts of the body. Misaligned spine is caused due to bad posture. Bad posture can negatively impact your spine's position. When you have proper alignment, you can easily feel posture throughout your musculoskeletal system. But, when if you perform most of your everyday activities with bad body mechanics or are stressed or injured in any way, you could end up with spinal misalignment and muscle spasm. Bad posture can distort these natural curves of your spine, affecting your whole body and causing an array of issues. Technical textile is one of the oldest in India and is intrinsically linked to a range of traditions and cultures that is a reflection of the diversity that prevails in our country.

## MATERIALS AND METHODOLOGY

Materials and methodology chapter includes the materials used and the method of construction and the working process of accelerometer sensor and magnets for magnetic therapy and posture correction and tools holding.

## MATERIAL SPECIFICATION

Woven fabric
Cotton-Polyester blend
Sensor

Accelerometer sensor Arduino board Buzzer

LCD display

Magnets

Color: Grey

## METHODOLOGY

Study on Accelerometer Sensor and Magnetic Therapy
Selection of fabric as per specification
Assembling Accelerometer sensor with Arduino
Pattern Making
Cutting
Sewing
Fastening magnet and sensor with the jacket.

**Components required**

Arduino
ADXL355 accelerometer
Connecting wires
USB cable for connecting Arduino with your laptop
Circuit
Buzzer
16*2 green and white display

**Pattern Making:**

The poly-cotton fabric is layed on a table. The length and chest measurements are marked according to the size. Then neck, armhole measurements are marked for the back part of the jacket. For the front part the back part is traced on the fabric then the required neckline and depth is made. The front side consist of two parts which is one over other.

**Cutting:**

The cutting is made using scissors or rotary cutter or any other cutting equipment's on the marks on the fabric according to the pattern and measurements.

**Sewing:**

The cutted front and back part is taken. The neck and armhole are finished with bias piece.

Then bottom hem is made.

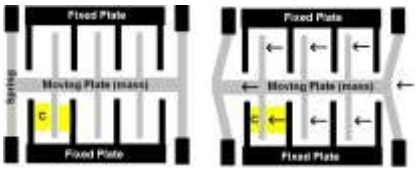
Shoulders of front and back part is attached together. Then the sides are attached.

A strip of cloth is stitched and attached to the sides of the jacket for adjusting the fit.

**Fastening magnet and sensor with the jacket:**

The magnets and accelerometer sensor are attached to the back part of the jacket from inside the jacket

**Accelerometer sensor**
**Working Mechanism**

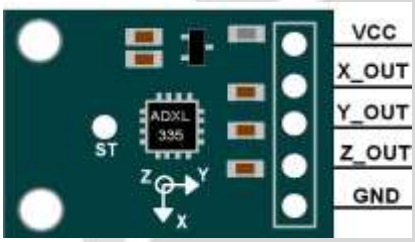



As we can see from the above figure, basic structure of accelerometer consists fixing plates and moving plates (mass)

Acceleration deflects the moving mass and unbalance the differential capacitor which results in a sensor output voltage amplitude which is proportional to the acceleration.
Phase-sensitive demodulation techniques are then used to determine the magnitude and direction of the acceleration.

**Acceleration ADXL335 Module**

VCC: Power supply pin i.e., connect 5v here X_OUT: X axis




analog output.
Y_OUT: Y axis analog output. Z_OUT: Z axis analog output.
GND: Ground pin i.e., connect ground here.

ADXL335 accelerometer provides analog voltage at the output X, Y, Z pins which is proportional to the acceleration in respective direction i.e., X, Y, Z.

**Angles using ADXL335**

We can calculate angle of inclination or tilt by using X, Y, Z's value. Also, we can calculate roll, pitch and yaw angles with respect to X, Y and Z axis. So first we need to convert 10-bit ADC values into g unit

As per ADXL335 data sheet maximum voltage level at 0g is 1.65V and sensitivity scale factor of 330mV/g.

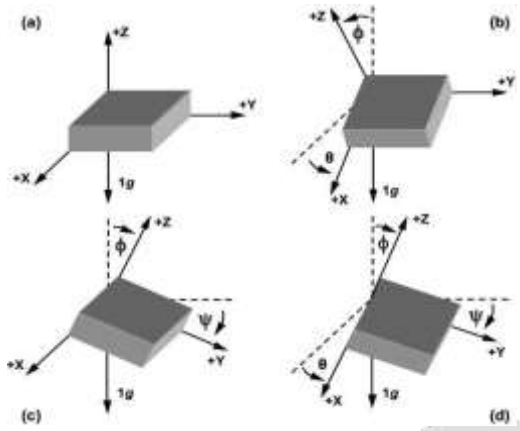
$$\text{Aout} = \frac{\frac{\text{ADC value} * \text{Vref}}{1024} - \text{Voltage Level at 0g}}{\text{Sensitivity Scale Factor}}$$

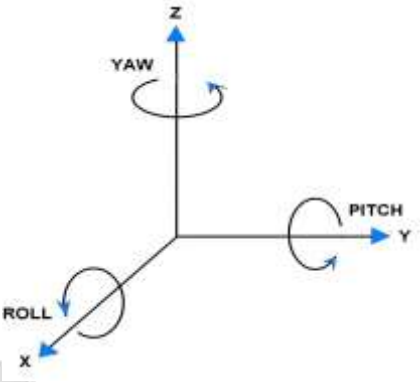
Above formula gives us acceleration values in g unit for X,Y and Z axis as, Axout=(((X axis ADC value*vref)/1024)-1.65)/0.330
Ayout=(((Y axis ADC value*vref)/1024)-1.65)/0.330 Azout=(((Z axix ADC value*vref)/1024)-1.65)/0.330
Note that, practically we get slightly different voltage at 0g. So, put the practical value of voltage at 0g.

**Angle of Inclination**

Angle of inclination means by how much angle the device is tilted from its plane of surface.

Angle of inclination are shown in below figure.



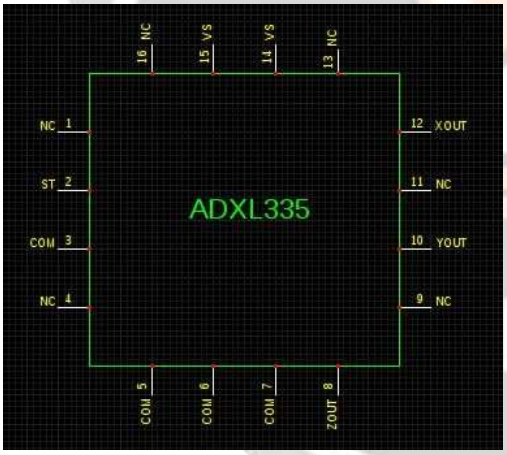




**Angle of Rotation**

A complete angle of rotation (0*to360*) around X, Y, Z axis, which we can also call as,

- Roll-Angle of rotation along the X axis
- Pitch-Angle of rotation along the Y axis
- Yaw-Angle of rotation along the Z axis

All of them are shown in below conceptual diagram

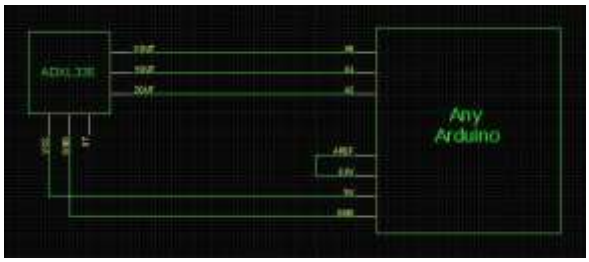



Step 1: Connecting the pins

The three output pins of accelerometer give analog output and should therefore be connected to the analog input pins of your Arduino. Let's take A0, A1 and A2. Now, look at the power pins. Connect the VCC pin of the accelerometer to the 5V pin of the Arduino. Connect GND of the accelerometer to the GND of Arduino. Set the reference voltage of ADCas 3.3v by connecting the AREF pin to 3.3v so as to match the output of ADXL335.

Step 2: Writing the program

Programming Arduino is very simple and straightforward. Our program will take shape in three steps. First, we shall initialize variables. Next, we call any function that initializes any process. They will be executed only once. Finally, we all the functions that perform the tasks in our project. They are given inside an infinite loop so that they are executed again and again.




Step 3: Initializing the variables

First, we need three input variables. Let us name them “xout”, “yout”, and “zout”. We will assign the values at the analog input pins of arduino to these pins.

Step 4: Uploading the code

**Coding**

Sketch #include<math.h>

```
const int x_out = A0; /*connect x_out of module to A0 of UNO board*/ const int y_out =
A1; /*connect y_out of module to A1 of UNO board*/ const int z_out = A2; /*connect
z_out of module to A2 of UNO board*/
  void setup() { Serial.begin(9600) ;
} void loop() {


  int x_adc_value, y_adc_value, z_adc_value; double
  x_g_value, y_g_value, z_g_value; double roll, pitch, yaw;
  x_adc_value = analogRead(x_out); /*Digital value of voltage on x_out pin*/ y_adc_value =
  analogRead(y_out);/*Digital value of voltage on y_out pin*/ z_adc_value =
  analogReady(z_out);/*Digital value of voltage on z_out pin*/ Serial . print(“x=”);
    Serial . print(x_adc_value);  Serial  .
    print(“\t\t”);
    Serial . print(“y=”);

    Serisl . print(y_adc_value);  Serial  .
    print(“\t\t”);
    Serial . print(“z=”);

    Serial . print(z_adc_value);  Serial  .
    print(“\t\t”);
    //delay(100);
    x_g_value = ( ( ( (double)(x_adc_value*5)/1024) - 1.65) / 0.330 ); /*Acceleration in x-direction in g
units*/

    y_g_value = ( ( ( (double)(y_adc_value*5)/1024) - 1.65) / 0.330 ); /*Acceleration in y-direction in g
units*/

    z_g_value = ( ( ( (double)(z_adc_value*5)/1024) - 1.65) / 0.330 ); /* Acceleration in z_direction in g
units*/


    roll = ( ( (atan2(y_g_value, z_g_value) * 180)  / 3.14 ) + 180 ); /*Formula for roll*/ Pitch = ( (
    (atan2(z_g_value, x_g_value) * 180) / 3.14 ) + 180 ); /*Formula for

    pitch*/

    //yaw = ( ( (atan2(x_g_value,y_g_value) * 180) / 3.14 ) + 180 ); /*Formula for yaw*/

    /*Not possible to measure yaw using accelerometer. Gyroscope must be used if yaw is also required*/
```

```
Serial . print("Roll="); Serial .
print(roll); Serial . print("\t");
Serial . print("Pitch="); Serial .
print(pitch); Serial .
print("\n\n"); Delay (1000) ;}
```

The code connects your Arduino to your PC using the USB connector and click the upload button on the top of the Arduino IDE window

**WORKING:**

When the system is powered on, the Arduino waits for the Accelerometer Sensor to be calibrated. Sensor will be ready to detect any movement when the object leads or lag by 90 degrees. If the object leads by 90-degree, Sensor will be ready to send a signal to Aurdino and its Digital Out pin, which is connected to Pin 8 of Arduino will become HIGH. Arduino will detect this HIGH Signal and activates the Emergency buzzer and send a signal to LCD display. LCD will display as "Emergency buzzer on". If the object lag by 90-degree, Sensor will be ready to send a signal to Aurdino and its Digital Out pin, which is connected to Pin 8 of Arduino will become HIGH. Arduino will detect this HIGH Signal and activates the Emergency buzzer and send a signal to LCD display.LCD will dispaly as "Emergency buzzer On".If the object equals to 90 degree, Sensor will be ready to send a signal to Aurdino and its Digital Out pin, which is connected to Pin 8 of Arduino will become LOW. Arduino will detect this LOW Signal and deactivates the Emergency buzzer and send a signal to LCD display.LCD will dispaly as "Emergency buzzer Off".

**DATA ANALYSIS AND INTERPRETATION:**

| **S.no** | **Age** | **No. Of Res** | **Percentage** | **COMFORTNESS WHILE WEARING** | **NO OF RESPONSE** | **PERCENTAGE** | **FEEL SKIN IRRITATION** | **NO OF RESPONCE** | **PERCENTAGE** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 18-30 | 4 | 40 | yes | 3 | 30 | yes | 1 | 10 |
| 2 | 31-40 | 4 | 40 | no | 2 | 20 | no | 7 | 70 |
| 3 | Above 40 | 2 | 20 | Yes, to some extend | 5 | 50 | Yes, to some extend | 2 | 20 |
| | Total | 10 | 100 | Total | 10 | 100 | Total | 10 | 100 |

**INTERPRETATION:**

From the above table we should understood that 40% of the respondents are in the age group 18-30, 40% of the respondents are in the age group 31-40 and 20% of the respondents are in the age group of above

40. we should understand that 30% of the respondents are feeling comfortless while wearing the jacket, 20% of the respondents are not feeling comfort while wearing the jacket and 50% of the respondents are yes to some extend while wearing the jacket. we should understand that 10% of the respondents are reporting as yes, 70% of the respondents are reporting as no and 20% of the respondents are reporting as yes to some extent.

**RESULT AND DISCUSSION:**

The current analysation is aimed to develop a jacket for working women to correct posture and relieve pain using accelerometer sensor and magnetic therapy. The jacket is made from poly-cotton woven fabric for various properties. The magnets and accelerometer sensor are attached to the back of jacket from inside. Thus, from my findings it is concluded that the posture can be corrected by using this accelerometer sensor attached jacket at early stage of the process. Then the back and shoulder pain can to reduced and relieved through magnetic therapy which is an alternative way of reducing pain. Magnetic therapy is a medicine less way of reducing pain with no side effects. Currently there is no prevention for this. The carelessness in this leads to various serious problems which may result in surgery and lifelong medicinal intake and treatments. This study also gives the new source for wearable textiles in smart way. In future studies I would like to develop the project in simplified way with self-charging reusable batteries with circuit induced fabrics to reduce posture problems.

**BIBLIOGRAPHY:**

1. The body Magnetic and Getting started in Magnetic Healing, by Buryl Payne Ph.D.

2. Magnetic Healing Advance Techniques for the Application of Magnetic Forces, by Buryl Payne Ph.D.

3. Eliminating pain with Magnet Therapy, by Robert Dehn

4. The pain relief break through: The power of Magnets to relieve Backaches,

Arthritis, Menstrual cramps, carpal Tunnel Syndrome, Sports Injuries and more by Julian Whitaker M.D

5. Healing with magnets, by Gary Null Ph.D.

6. 2007 Study published by the european spine journal, 2016 Annals of physical rehabilitation medicine journal.

7. Discovery of Magnetic Health by George J Washins

8. Magnet Therapy:The pain cure alternative, by Ron Lawrence M.D and Paul J Rosch M.D

9. Biomagnetic Handbook by William H Philpott M. D 10.
Handbook of Smart textiles by Xiaoming Tao PP (357-379)

11. Hand book of Modern sensors by Fraden, Jacob Ph.D
12.Researchgate

13. Academia.edu

**Website Reference**

www.backfithealth.com

www.instructables.com

www.mepits.com

www.britannica.com

www.osha.gov

www.techterms.com

www.sciencedirect.com