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Novel Design for Fabrication of Low Cost Flex Sensor for Wheel Chair of Handicapped Humans

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ABSTRACT: The objective of this project is to design and fabrication of a low cost flex sensor withpenta comparator for handicapped human wheel chair. Depending upon the movement of the finger, the required object is moved. This method ensures effective communication. The goal of the project is to design useful and fully functional real-world systems that efficiently translate the hand gesture into movement of the object. This project is based on this technology to help the deaf community. This could be also further enhanced in various applications such as robotics, automation systems, etc. We have design an object which moves forward, backward, right, left and stops based on the gesture of the user. In addition to this, we have used LCD to indicate an object moving position. The movements of the object are done using DC motors.

KEYWORDS: Flex sensor, Lithium/Polyethylene Terephthalate Sheet, Microcontroller, Wheel Chair.

I. INTRODUCTION

Due to rapid growth of modern communication system, the demand of consumer changes day by day. New technical innovation is required to overcome the challenged faced by the designer and scientists to meet the requirement of consumer. Resistive flex sensors have been increasingly used in different areas for their interesting property to change their resistance when bent.Among sensors, flex sensor is very attractive for automatic control of different application (robotic arm, robotic car etc.).[1][3] Robotic application demand sensor with high degree of repeatability and reliability. Flex sensor is such a device which accomplishes their task with great degree of great accuracy. In this paper a novel design of low cost flex sensor with daily used materials such as, aluminium/copper foil, cleaning pad, banded tape, lithium powder/Polyethylene Terephthalate Sheet etc. is represented for automatic controlling of handicapped human wheel chair. These sensors consist of two conductive layer of thin copper plates or aluminium foil with some lithium powder (work as a variable resistor). The proposed flex sensor is novel in comparison to because it uses low cost daily used materials. The proposed flex sensor is also precised and accurate. The proposed flex sensor is simple and it can be easily used for automation controlling of different 89c51 based human purpose appliance. [2][4]

II. SYSTEM DEVELOPMENT

Description: -

The microcontroller 89c51 is the basic operator of this whole system which is interfaced with all the modules acquired of technologies like comparator, LCD, sensors, as well as motor driving circuits. The procedure of working of this chair is as soon as the sensor signal is received by the comparator, the comparator will get activated and start comparing the voltagecomparator will check and thereafter taking correct decision will move further.The comparator will check for flexing (if any) on the hand of it than if there will be any it will move its direction than it will check the directions i.e. weather it is backward and forward and then if the path observed will be right and left it will go ahead in it by changing its directions. Now it will check for any bendingfinger the premise and if any one of sensor will be sensed it will perform pre-defined action coded by the developer. The action as pre-defined in it is if bending is

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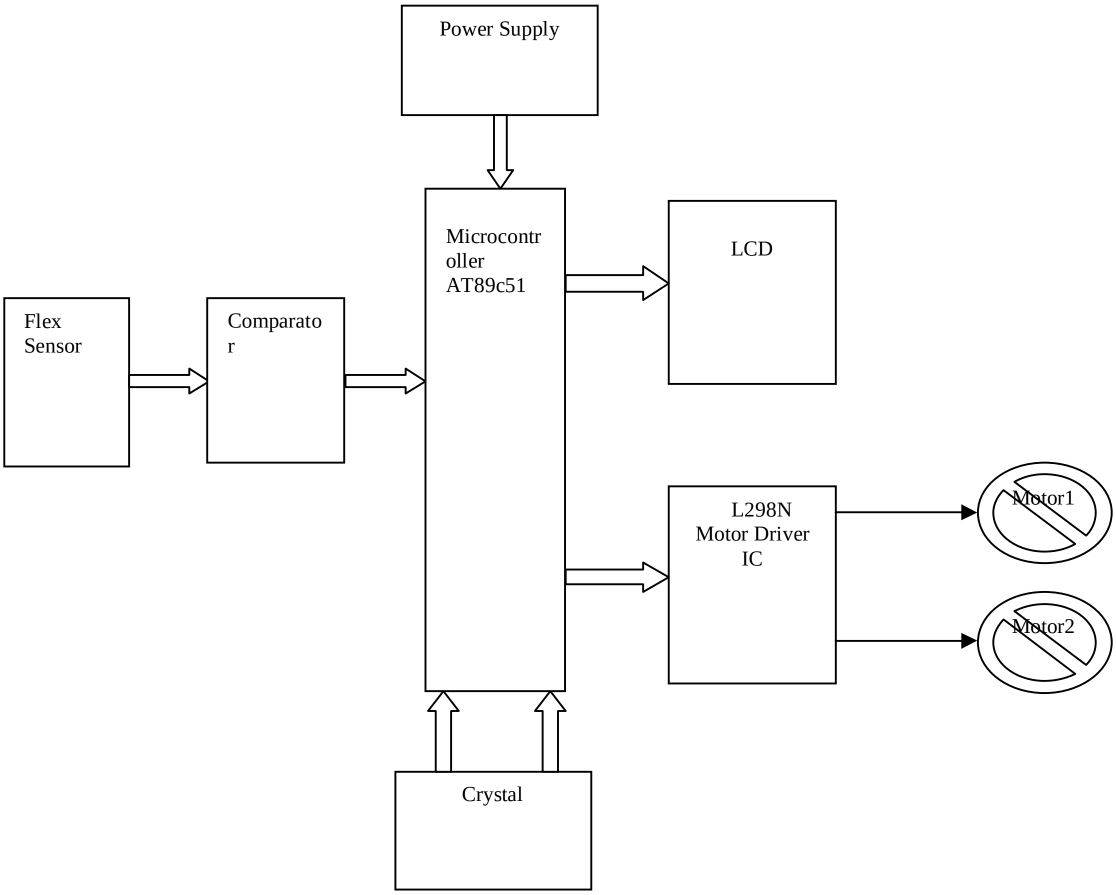
observed a message will be generated and displayed on LCD. All of this activity are processed by microcontroller and comes to conclusion. The system development block diagram representing the project structure is shown (in fig.)



III. MECHANISM

The mechanism of the designed flex sensor is shown in Figure 1. The flex sensor consists of two conductive layer of copper plate or Aluminium (Al) foil (food wrapping film) soldered with 10cm long wire at either end of each plate and in middle of this Polyethylene Terephthalate Sheet is used as resistive material or Lithium powder is attached in the middle of the aluminium/copper foil and medical/cello tape is used to attach both the upper & lower Cu/Al plate and it is covered with plastic tape that can help for flexibility. This works on +5 volt supply. The structural block diagram of the designed flex sensor using Lithium is shown in Figure 2(a) & same as for the sensor using ITO coated PET in Figure 2(b).

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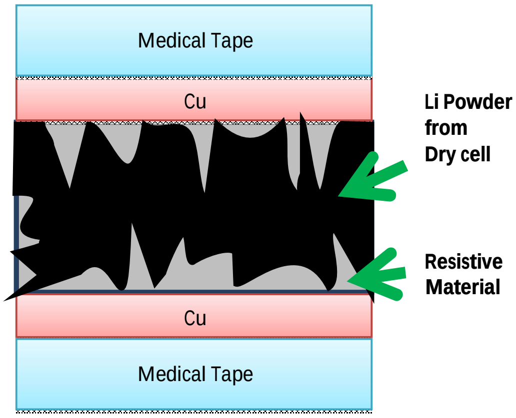

Figure: 1 Mechanism of the designed flex sensor

IV. CONSTRUCTION

In this paper a novel design of low cost flex sensor with daily used materials such as, aluminium/copper foil, cleaning pad, banded tape, lithium powder (Fig. (a) Structural layout of the designed flex sensor using lithium powder), Polyethylene Terephthalate Sheet (Fig. (b) Structural layout of the designed flex sensor using Polyethylene Terephthalate Sheet), medical tape etc. is represented for automatic controlling of handicapped human wheel chair. These sensors consist of two conductive layer of thin copper plates or aluminium foil with some lithium powder (work as a variable resistor). The proposed flex sensor is novel in comparison to because it uses low cost daily used materials. The proposed flex sensor is also precised and accurate. The proposed flex sensor is simple and it can be easily used for automation controlling of different 89c51 based human purpose appliance. [2][4]

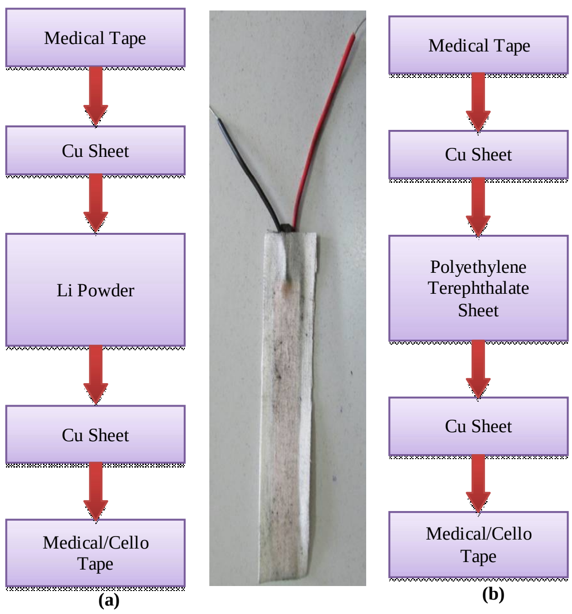

Figure: 2:
(a) Structural layout of the designed flex sensor using lithium powder.
(b) Structural layout of the designed flex sensor using Polyethylene Terephthalate Sheet.

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V. WORKING PRINCIPLE

The working principle of proposed flex sensor depends upon bending phenomenon. When it is in normal condition i.e. 180°, resistance offered maximum. When the sensor is bent to 90°, their resistances will decreases. The resistance value decreases with further decrease in bend position. This phenomenon is validated with some numerical values. Figure 3 (a) indicates the graphical plot of bent position versus resistance value. It is clearly that as the bending position decreases the corresponding resistance also decreases hence conductivity increases. And The current versus voltage characteristics for accuracy as shown in below Figure.3 (b).

The most significant component in this design is the flex sensor, because it requires negligible force to bend the sensor, which in turn causes the bending of fingers. Five flexible bend sensors embedded into the Data gloves,[5] whereas each finger having a different function. The basic function of the Data Glove system is, when the index finger is bent and then the signal will be sent to the both DC motors to rotate clockwise to go forward a chair. When the middle finger is bent, then the signal will be sent to the both DC motors to rotate anti-clockwise to go reverse a chair. When the ring finger is bent, then the signal will be sent to the RIGHT DC motor to rotate, LEFT DC motor in "OFF" condition. Meanwhile, when the little finger is tend to bend, the LEFT DC motor starts rotating and the RIGHT DC motor in "OFF" condition. However, when thumb finger is bent, then the both motors speed can be controlled. Finally, the DC motor will stop.

VI. DESIGN PENTA COMPARATOR USING IC 741

The impedance buffer is a single sided operational amplifier, used with these sensors because the low bias current of the op amp reduces error due to source impedance of the flex sensor as voltage divider.

These comparators are designed for use in level detection, low–level sensing and memory applications in consumer automotive and industrial electronic applications.

- Single or Split Supply Operation
- Low Input Bias Current: 25 nA (Typ)
- Low Input Offset Current: ±5.0 nA (Typ)
- Low Input Offset Voltage: ±1.0 mV (Typ)
- Input Common Mode Voltage Range to Gnd
- Low Output Saturation Voltage: 130 mV (Typ) @ 4.0 mA
- TTL and CMOS Compatible
- ESD Clamps on the Inputs Increase Reliability without Affecting Device Operation

VII. RESULTS AND DISCUSSION

I-V characteristic of the device shows linear characteristics in -1V to +1V range. It indicates good metallic characteristics of the device which obeying ohm's law. The resistive nature of the Lithium powder is directly given by this graph Figure 3 (b). The effect of bending for 0^0,45^0,90^0& 135^0 angle had studied and from this study it is clear that as we increase the angle of bending the slope of I-V curve decreases due to increase in resistance Figure 3(a).

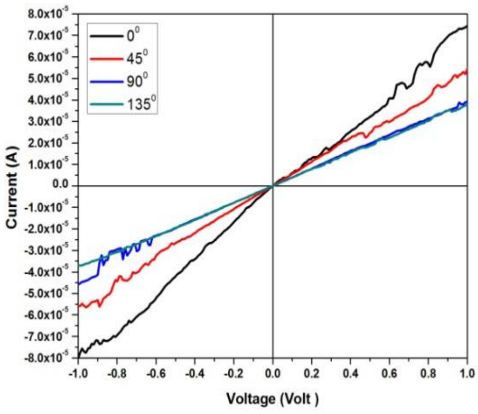

Figure: 3 (a) Plotting of Current vs. voltage of multiple sensors

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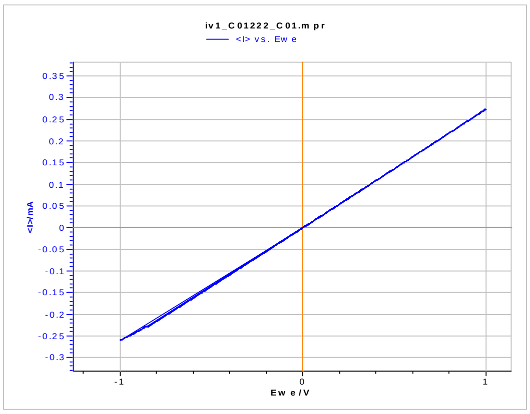

Figure: 3 (b) Plotting of Current vs. voltage for accuracy

VIII. FLEX SENSOR OUTPUT VARIATION

Below Figure shows the variation of resistance with respect to variation in deflection of flex sensor. Initially the flex sensor is at default position, a constant value of 0 degree. The value increases as we start bending the flex sensor. This particular change in flex sensor value is used to control the voltage of servo motors.

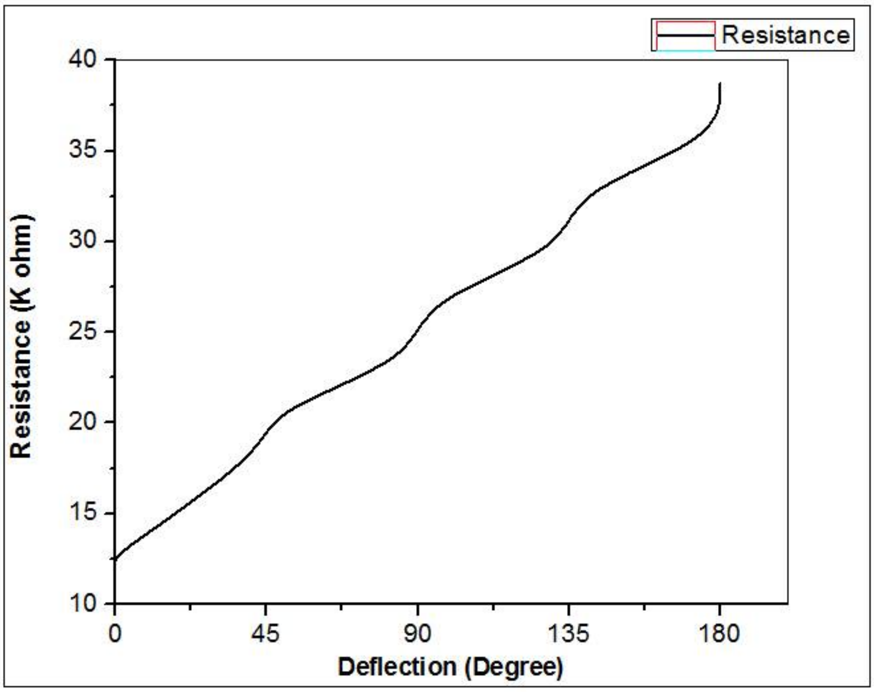

Figure 4: Deflection vs. Resistance of flex sensor

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IX. SENSORS REPEATABILITY

Repeatability testing began with the evaluation of the sensors and final sensor selection, and continues by considering the performance of the entire glove. The sensor glove repeatability testing has been performed with my colleagues, who are the first in a study that will include repeatability testing for 6 healthy controls. [6]

Test A: Repeatability Testing of Flat Sensor Glove

Repeatability testing of sensor glove for the flat hand test (Test A).Means and standard deviations are shown. Mean values aresimilar because all fingers are straight.

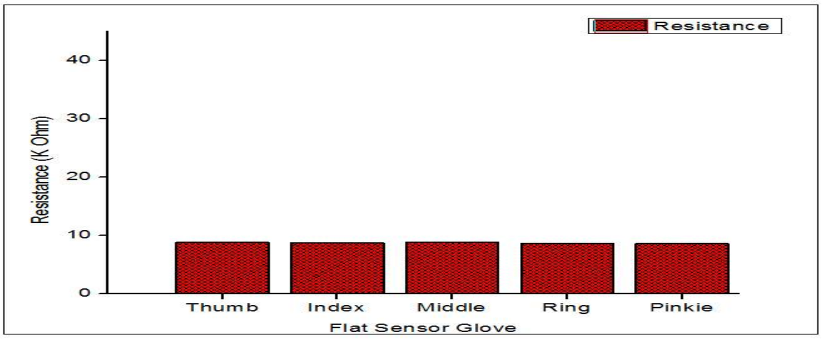

Figure 5: Repeatability testing of flat sensor glove

Test B: Repeatability Testing of Bending Sensor Glove

Repeatability testing of bend sensor glove for the bending test (Test B). Means and standard deviations are shown. Mean values differ because each finger is in a bending position when bending the sensor glove. Repeatability information is contained in the variation around the mean.

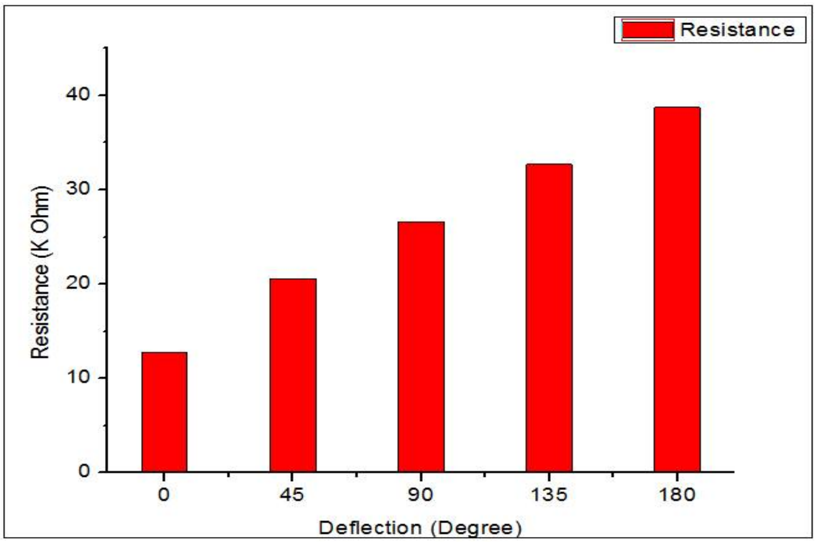

Figure 6: Repeatability testing of bending sensor glove

X. APPLICATION

Angle Displacement Measurement, Bends and flexes physically with motion device, Robotics, Gaming (Virtual motion, Virtual Reality Gaming Gloves), Medical Devices, Computer peripherals, Musical Instruments, Physical Therapy, Antenna Positioning System, Hand Talk Glove/ Wired Glove, Solar Cell Tracking, Door lock, Bio-metrics, Automotive & Industrial Controls, Computer Peripherals, Joysticks, Fitness Products, Musical Instruments and Assistive technology for modern vehicles.

XI. CONCLUSION

The project discussed a novel technique to design a low cost flex sensor using daily used materials for controlling of handicapped human wheel chair. The proposed sensor can also be used in industrial purpose, gaming devices and measuring devices. The proposed sensor is much more cost effective and less complex in structure. This sensor is greatly advantageous due to its bidirectional motion control capability. All difficulties can be overcome by using penta comparator. And other difficulties in flex sensor can be overcome by using different materials.

Future directions include completion of the current study to establish and to identify calibration methods at nanotechnology level.

XII. FUTURE ASPIRATION

Gesture recognition technology can also be used to make the robot understand the human gesture and make them work accordingly. We extend our topic further such that, we could produce voice information or display the information on LCD based on the hand gesture of the user. This is more useful for specially challenged people to communicate their thoughts exactly as normal humans do. I will work to improve our idea "gesture controlling" to control any devices by any part of body not just by hand. Also I will use our project to become helpful for people with special needs

REFERENCES

1. M.Priyadharsini1, S.Jagan2, M.Hari prasath2, G.Gopi2, Microcontroller Based Robotic Arm Control Using Hall Effect Sensors, National Conference on RecentTrends inElectronics and InstrumentationEngineering (NCRTE 2K16), IJAREEIE, 2016.
2. RAPID Toolkit - Tools for Knowledge and Learning: A guide for development and humanitarian organizations, Ben Ramalingam, July 2006.
3. JagdishLalRaheja, RadheyShyam, Umesh Kumar, Bhanu Prasad, Real-Time Robotic Hand Control using Hand Gestures, Second International Conference on Machine Learning and Computing, 2010.
4. Mr. Chetan A. Burande, Prof. Raju M. Tugnayat, Prof.Dr. Nitin K. Choudhary, Advanced Recognition Techniques for Human Computer Interaction, 2nd International Conference on Computer and Automation Engineering (ICCAE), 2010, Singapore.
5. AmbikaGujrati1, Kartigya Singh2, Khushboo3, Lovika Soral4, Mrs. Ambikapathy5, Hand-talk Gloves with Flex Sensor: A Review, International Journal of Engineering Science Invention, 2013.
6. Lisa K Simone*1 and Derek G Kamper2, Design considerations for a wearable monitor to measure fingerposture, Journal of NeuroEngineering and Rehabilitation 2005.

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BIOGRAPHY

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Originally from Maharashtra, India, I post graduated with first rank from the North Maharashtra University,Jalgaon with degree in M. Sc. Electronics.

While there, I working onmy project, a flex sensor and dedicated to the handicapped human.

My scholarly interests generally revolve around the electronics and communication areas such as digital signal/image processing, microcontroller and embedded system (Keil, Proteus, Quartus, Altera, Pinnacle, MASM), VLSI technology, fabrication, analog circuits and simulation techniques (MATLAB,DSCH, Microwind, TCAD(Silvaco&Sentaurus), PSPICE, etc.).