DEVELOPMENT OF A SKIN-LIKE TACTILE SENSOR ARRAY FOR CURVED SURFACE

ABSTRACT

Embedded Technology is now in its prime and the wealth of knowledge available is mind-blowing. However, most embedded systems engineers have a common complaint. There are no comprehensive resources available over the internet which deals with the various design and implementation issues of this technology. Intellectual property regulations of many corporations are partly to blame for this and also the tendency to keep technical know-how within a restricted group of researchers.

The uses of embedded systems are virtually limitless, because every day new products are introduced to the market that utilizes embedded computers in novel ways. In recent years, hardware such as microprocessors, microcontrollers, and FPGA chips have become much cheaper. So when implementing a new form of control, it's wiser to just buy the generic chip and write your own custom software for it. Producing a custom-made chip to handle a particular task or set of tasks costs far more time and money. Many embedded computers even come with extensive libraries, so that "writing your own software" becomes a very trivial task indeed.

In this paper, we develop a skin-like tactile sensor array to measure the contact pressure of curved surfaces. The sensor array is laminated into a thin film 3 mm in thickness and can easily be wrapped around a pencil without damaging its skin-like structure. So far, we have achieved the array containing 8 × 16 sensor elements.

Its spatial resolution is 1 element per 9 mm^2 area and it can measure the pressure up to 360 kPa. The sensor-array patch contains three layers. The upper and lower layers are

polydimethylsiloxane (PDMS) thin films embedded with the conductor strips formed by PDMS-based silver nanowires (AgNWs) networks. The middle layer is formed by the mixing of nickel powder with liquid PDMS for contact force measurement.

Experimental tests have demonstrated that conductor strips on the upper layer can maintain their resistances ~ 23 Ω with increase when the tensile strain is up to 50%. Noted is the conductor made with carbon nanotubes can keep its conductivity unchanged for up to only 40% tensile strain. Through fatigue tests, it is observed that the measured AgNWs/PDMS conductor strip exhibits low and stable resistances. This is one of the most desired behaviors of the stretchable interconnects for signal transmission.

The integrated sensor system can successfully measure the contact pressure induced by objects of different shapes. It can be applied on curved or non-planar surfaces in robots or medical devices for force detection and feedback.

PROPOSED SYSTEM

In this project we develop a skin-like tactile sensor array of 8x16 sensor elements to measure the contact pressure of curved surfaces. Skin-like tactile sensor has been widely applied to the robotics and medical devices. Intelligent tactile sensor array which acquires information such as shape, texture, softness, temperature and force can be used as artificial skin for robotics and medical devices to sense the physical contact with human/environment.

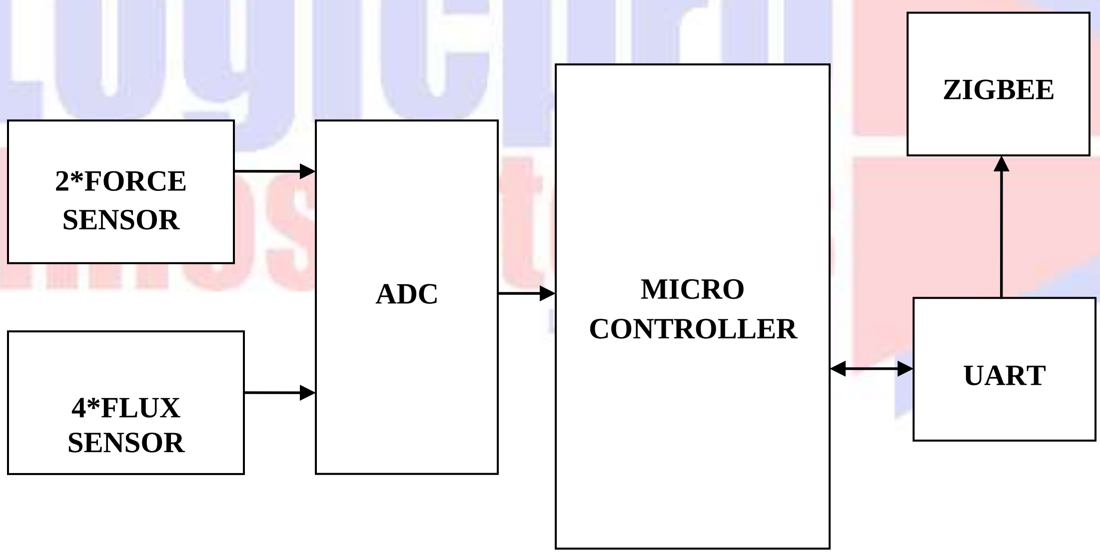
The two layers of conductive strips are placed in a way that the strips in one layer is orthogonal to the strips in another layer, thus form a matrix of sensing elements, where the sensitive area corresponds to the portion of the piezo resistive film under the crossing of each pair of upper and lower conductive strips.

ADVANTAGES

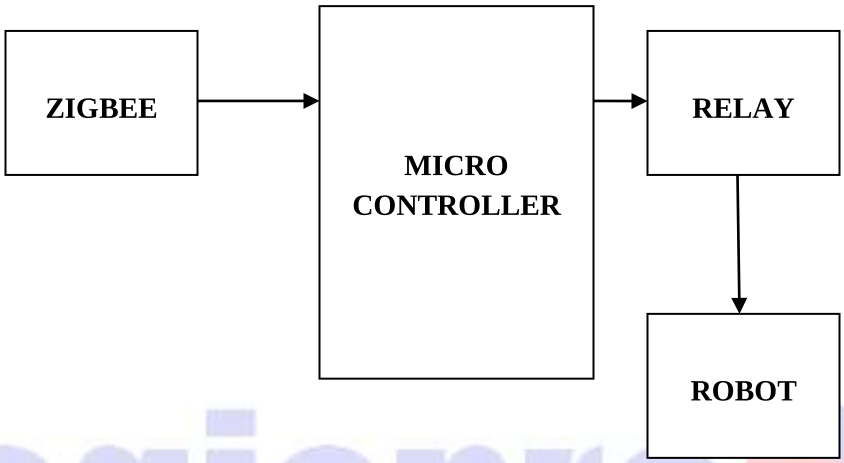
- Force sensors size is less than 0.5mm
- They are good shock resistance
- Flexible and conformable powder-based conductive elastomer was used as the piezoresistive material for pressure sensing

BLOCK DIAGRAM

TRANSMITTING SIDE:



RECEIVING SIDE:



HARDWARE REQUIREMENTS

- MICROCONTROLLER
- ADC
- FORCE SENSOR
- FLUX SENSOR
- ROBOT
- UART
- ZIGBEE
- ROBOT

SOFTWARE REQUIREMENTS

- MCU COMPLIERS
- PROTEUS SOFTWARE

MICROCONTROLLER may ATMEGA,8051,PIC OR Arduino

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