TACTILE SENSOR DESIGN FOR ELECTRONIC SKIN APPLICATIONS

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INTRODUCTION

The human sense of touch is the main inspiration to tactile sensing. Tactile sensors are widely applied in the artificial e-skin to mimic the structure of human skin.

The aim of this study is to design and manufacture flexible and wearable, capacitive tactile sensors which can achieve an artificial sense of touch by using MEMS fabrication techniques.

METHODOLOGY

Capacitive tactile sensors utilize a pair of parallel electrodes to perceive force, pressure and achieve the multi-touch ability.

In mechanism of capacitive sensing, the applied force upon the tactile sensor results capacitance changes in the displacement and overlapped areas among two electrodes.

Capacitive sensors have good frequency response, high sensitivity and resolution, thus they are efficient for wide range applications.

SENSOR DESIGN

In this work, capacitive sensing sensor system is built with a Carbon Nanotube based conductive ink which was produced by research team, and a silicon based organic polymer PDMS (Polydimethylsiloxane) as an insulator layer. The top and bottom electrodes were formed by using conductive elastomeric Multi Walled Carbon Nanotube ink, and vertically aligned to each other. The dielectric layers were formed by microstructured PDMS which provides precise measurements by enhancing the array's sensitivity. The sensor consists of 16 individual sensing units to detect the external tactile stimuli data in a 4x4 array matrices. The dielectric/conductive layers were formed by using spin-coater which has been developed by research team as it's a high priced nanotechnological device. Additionally, in order to transfer the conductive ink into the substrate, a 3D printer was manufactured by the project group. One of the most important performances of the proposed design of capacitive sensor is its sensitivity, because it can detect even slightly capacitance changes down to femtoFarad levels, which is 50 times smaller than the recent capacitive touch screen sensor systems.