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Abstract

Development of a Flexible Pressure Sensor Array with Only 2 I/O Ports to Distinguish Object Hardness †

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Abstract: Flexible pressure sensor array can be as tactile sensor array to detect loading pressures and locations in lots of applications, including wearable devices, electronic skins, robotics, and machine learning. Many studies have been proposed high performance flexible tactile sensor array. However, when the sensing points and spatial resolution increase, signal wiring issue arises, but the cumbersome I/O wirings between sensors and readers will greatly affect the user's mobility and comfort. Recently, several methods have been proposed to simplify the signal line. Some common approaches utilize orthogonal electrodes to reduce I/O ports from $2n^2$ to $2n$ in an $n \times n$ array. Some innovative methods can reduce I/O ports to 2 in an $n \times n$ array, but they are unable to perform multi-touch measurement and maintain high spatial resolution at the same time. To achieve multi-touch and high spatial resolution, this research proposes a flexible pressure sensor array is based on parallel RLC resonance circuit and made by PDMS/Graphene mixture as piezoresistive sensor on FPC (Flexible Printed Circuit). In this research, Single pressure sensor can measure the pressure from 37.5 to 250 kPa. Loading multi-points force on the pressure sensor array, it can distinguish different pressure with different loading force on sensor array. The results of the hardness experiment show pressure distribution of hard ball on pressure sensor array is one to two pixels, and soft ball is three to nine pixels by loading force 1.5, 2.7, and 3.9 N. This design successfully distinguishes different hardness, and it is potential to be applied in electronic skin and wearable device.

Keywords: pressure sensor; tactile sensor; flexible sensor; hardness