Electronic Supplementary Material (ESI) for Nanoscale.

Supporting Information

Effect of the CNT sheet width on generating voltage

The effect of the CNT sheet width on generating voltage is investigated as shown in Figure S1. When the sheet width is increased, the output voltage ratio (Vpp*/Vpp), which is an output voltage (Vpp*) relative to the voltage for a 1.0 cm wide sheet (Vpp), decreases as shown in Figure S1(a). At the same time, the resistance of the CNT sheet decreases as the sheet width increases. The output power is linearly proportional to the voltage squared and inversely proportional to the resistance. Therefore, the output power ratio (P*/P), which is an output power (P*) relative to the power for a 1.0 cm wide sheet (P), remains constant regardless of the sheet width.

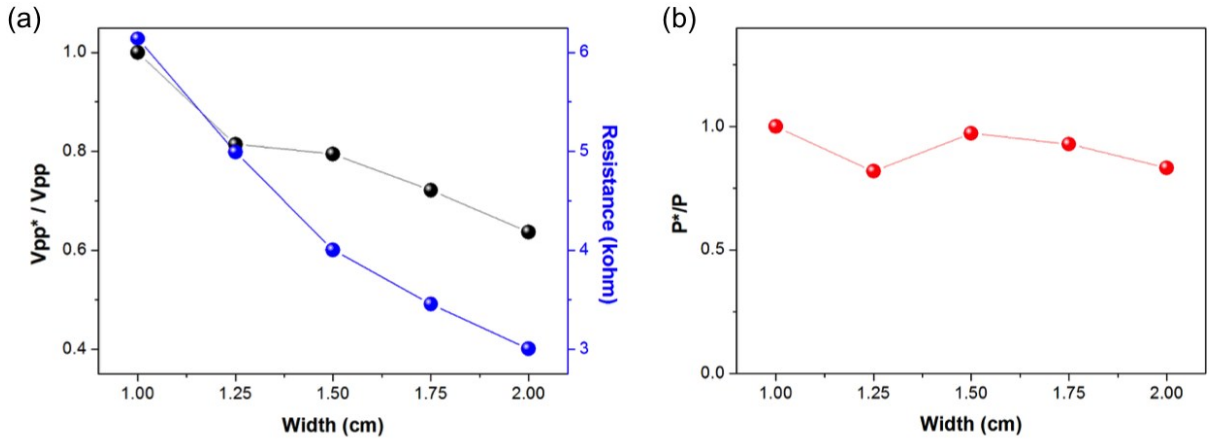

Figure S1. Effect of CNT sheet width on (a) output voltage ratio, resistance, and (b) output power ratio.

Measurement of sheet resistance of CNT devices

A resistance of CNT sheet suspended between a pair of rigid copper wire electrodes was measured by a multimeter connected between the two electrodes. The sheet resistance then is calculated by normalizing the square area of the sheet. The sheet area is fixed as 6 cm^2 (6 cm in sheet length and 1 cm in width).

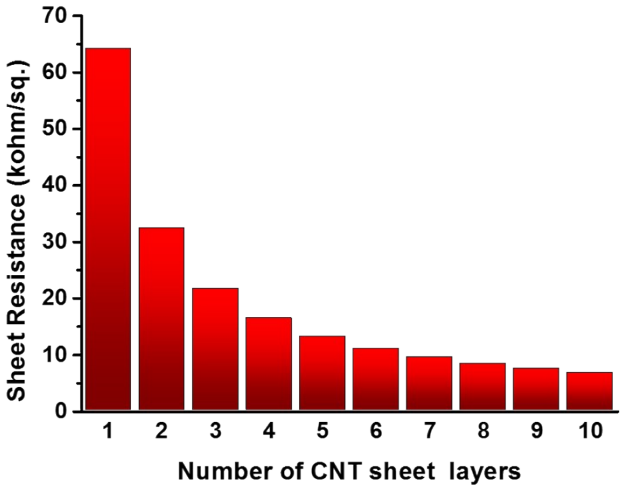

Figure S2. A sheet resistance of CNT sheet device as the number of sheet layer increases.

Discharge behavior of CNT sheet device

The discharge behavior of CNT sheet device was investigated by connecting external electrical loads. Figure S2 shows the discharge behavior of CNT sheet device where a linear voltage-current behavior is clearly observed. The experimental conditions were as follows: surface charge of -5.0 kV, sweeping speed of 67 rpm, and closest inter-distance between PTFE rod and CNT sheet of 2 cm.

An electrical output power is commonly expressed as the maximum value which occurs when the external load resistance is set equal to the internal resistance of the device. In which such voltage-current curve is linear, the maximum power is given by the rectangle of greatest area under the voltage-current curve. As shown in the figure, the slope of graph (i.e., the internal resistance of the device) is measured as ~2.45 kohm, which is consistent with the resistance of the CNT sheet (~2.5 kohm) used in here. Therefore, the output power generated from the device can be calculated from the square of measured voltage divided by the 4 times multiplied resistance of the CNT sheet.

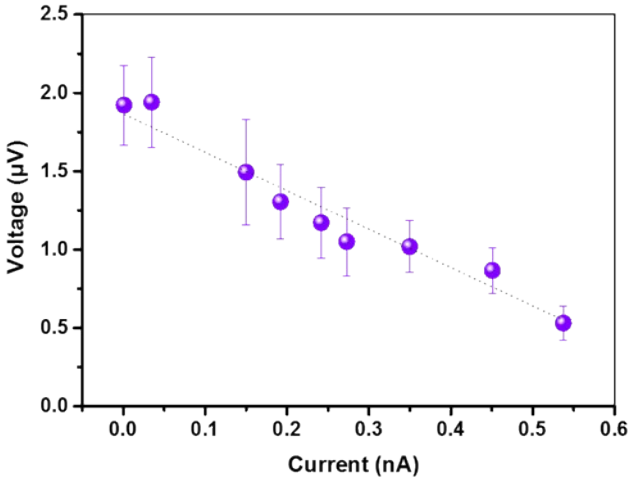

Figure S3. Voltage-current curve of CNT sheet device

CNT sheet array

Figure S4 shows a CNT sheet array for motion sensor. Each CNT sheet array on the PET has area of $1\ cm^2$, and electrodes were formed using silver paste.

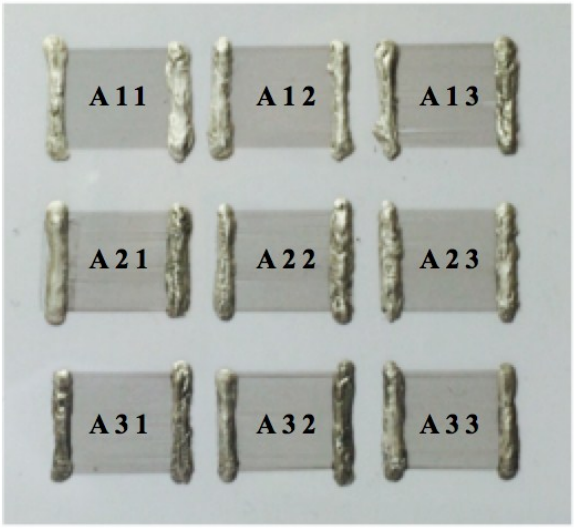

Figure S4. 3×3 CNT sheet array for motion sensor