

Supporting Information for

Highly sensitive, stretchable and wearable strain sensors using fragmented conductive cotton fabrics

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This file includes:

Figures S1-S8

Table S1

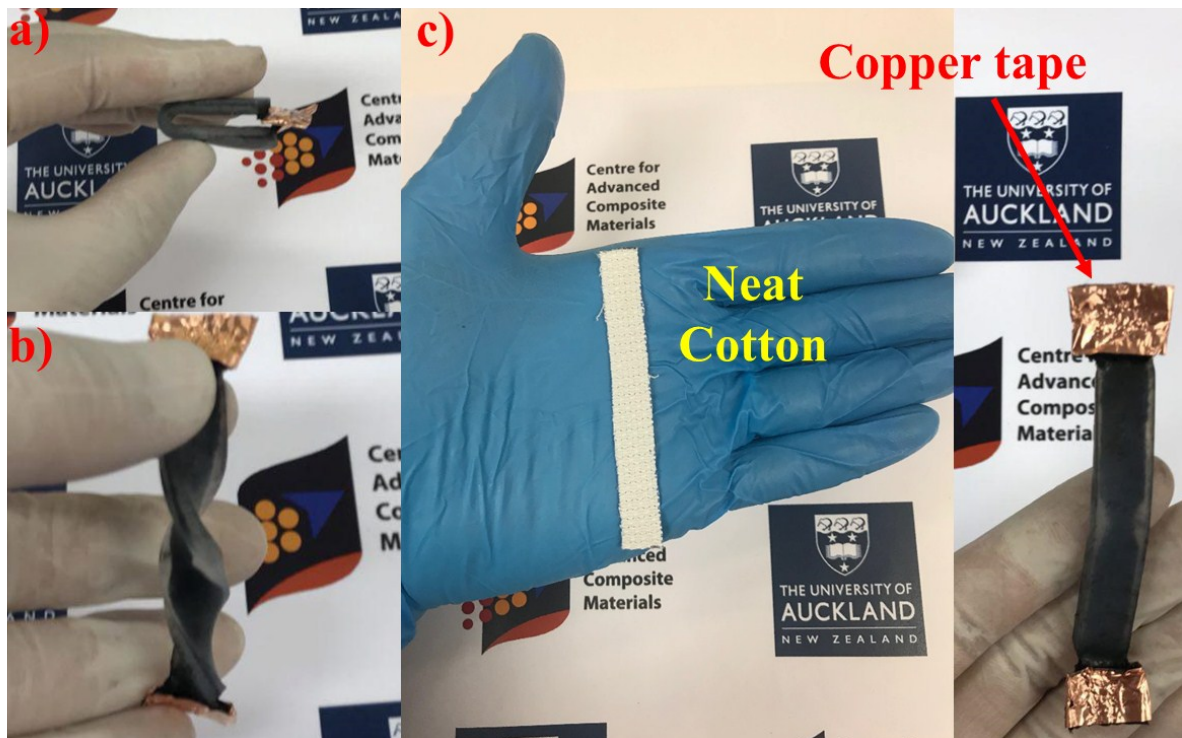


Figure S1. Photograph of our strain sensors; a & b) view of our flexible strain sensor, and c) view of a piece of cotton fabric and our strain sensor made of CC fabric.

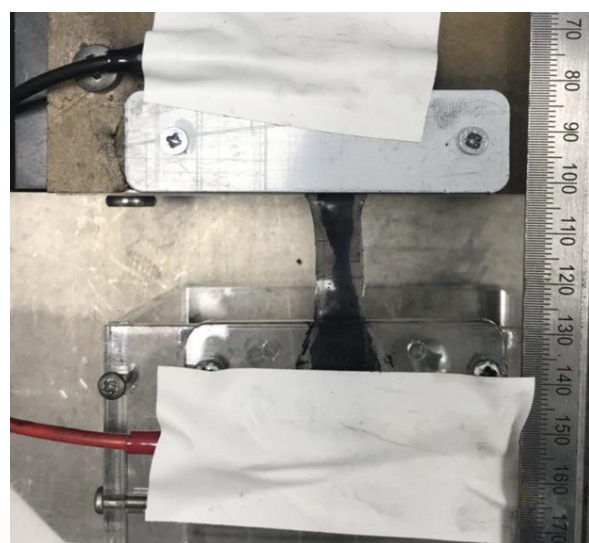


Figure S2. Our strain sensor gripped with the motorized moving stage.

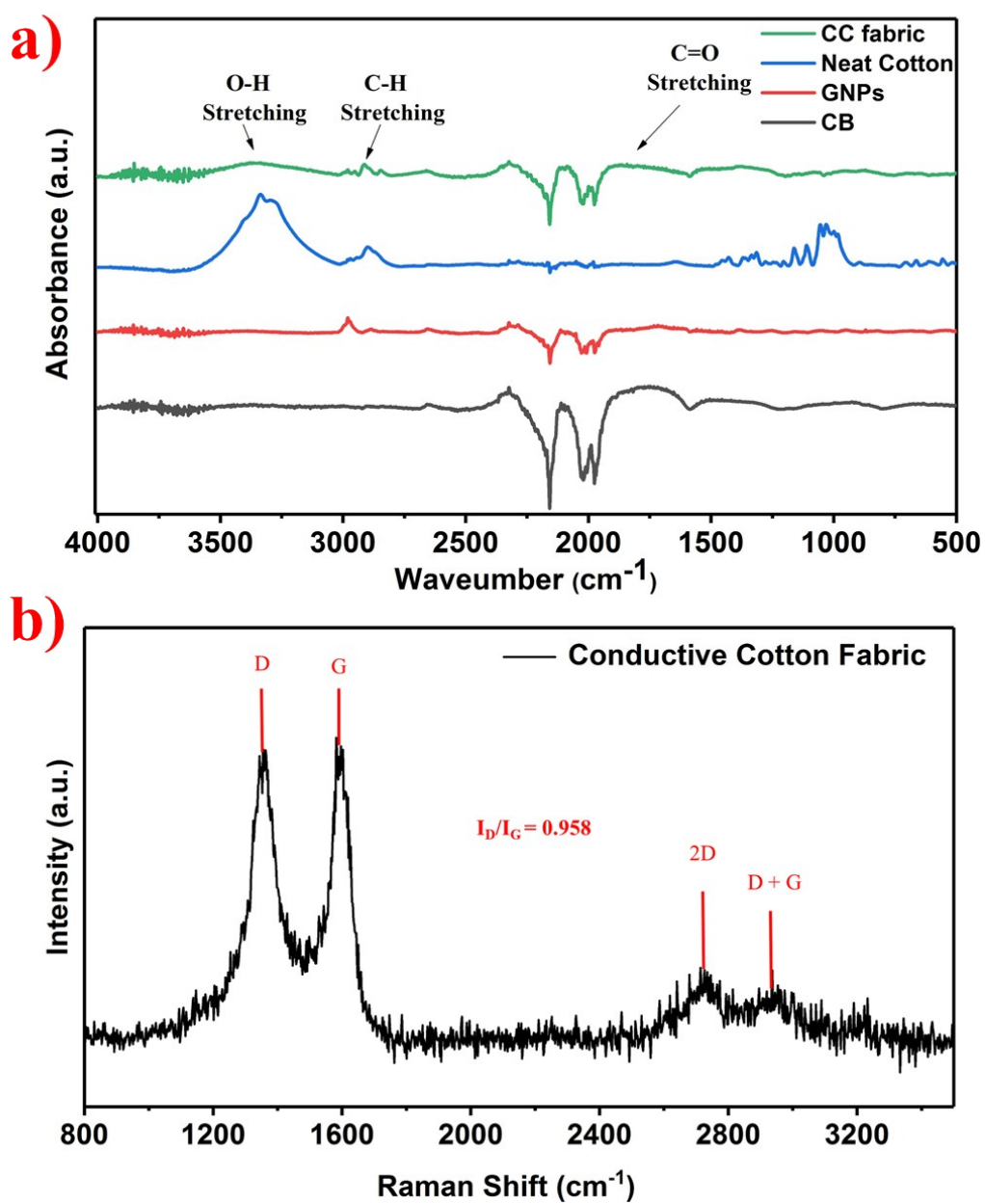


Figure S3. Characterization of conductive cotton fabric; a) ATR-FT-IR and b) Raman spectra of conductive cotton fabric.

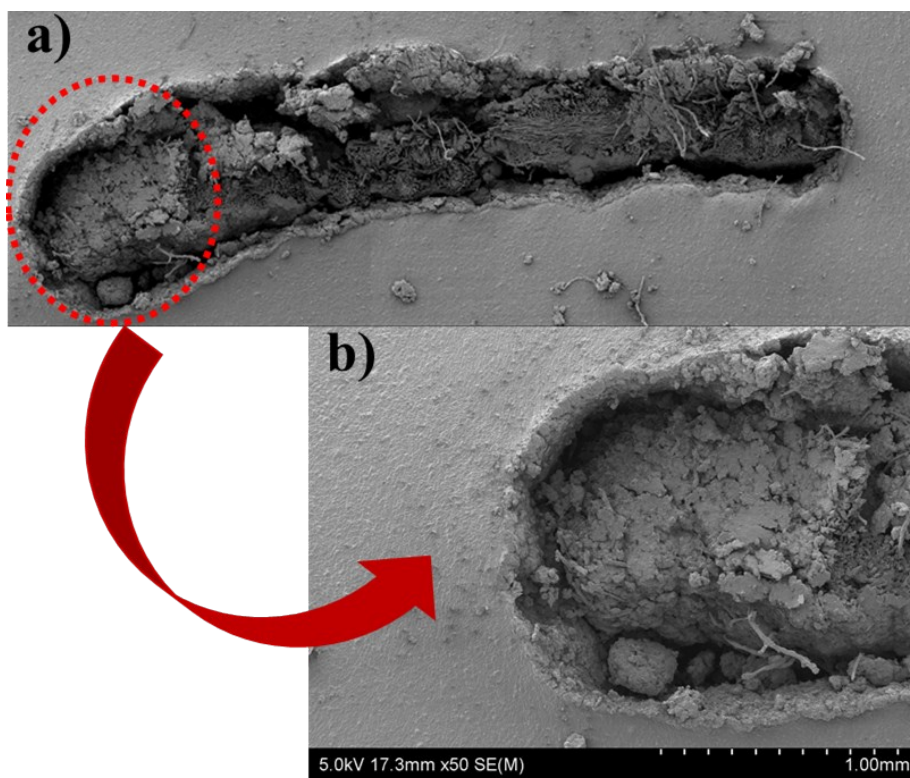


Figure S4. Cross-sectional SEM images of our strain sensors a) and b) protection of the coating from flowing the elastomer within the fibers.

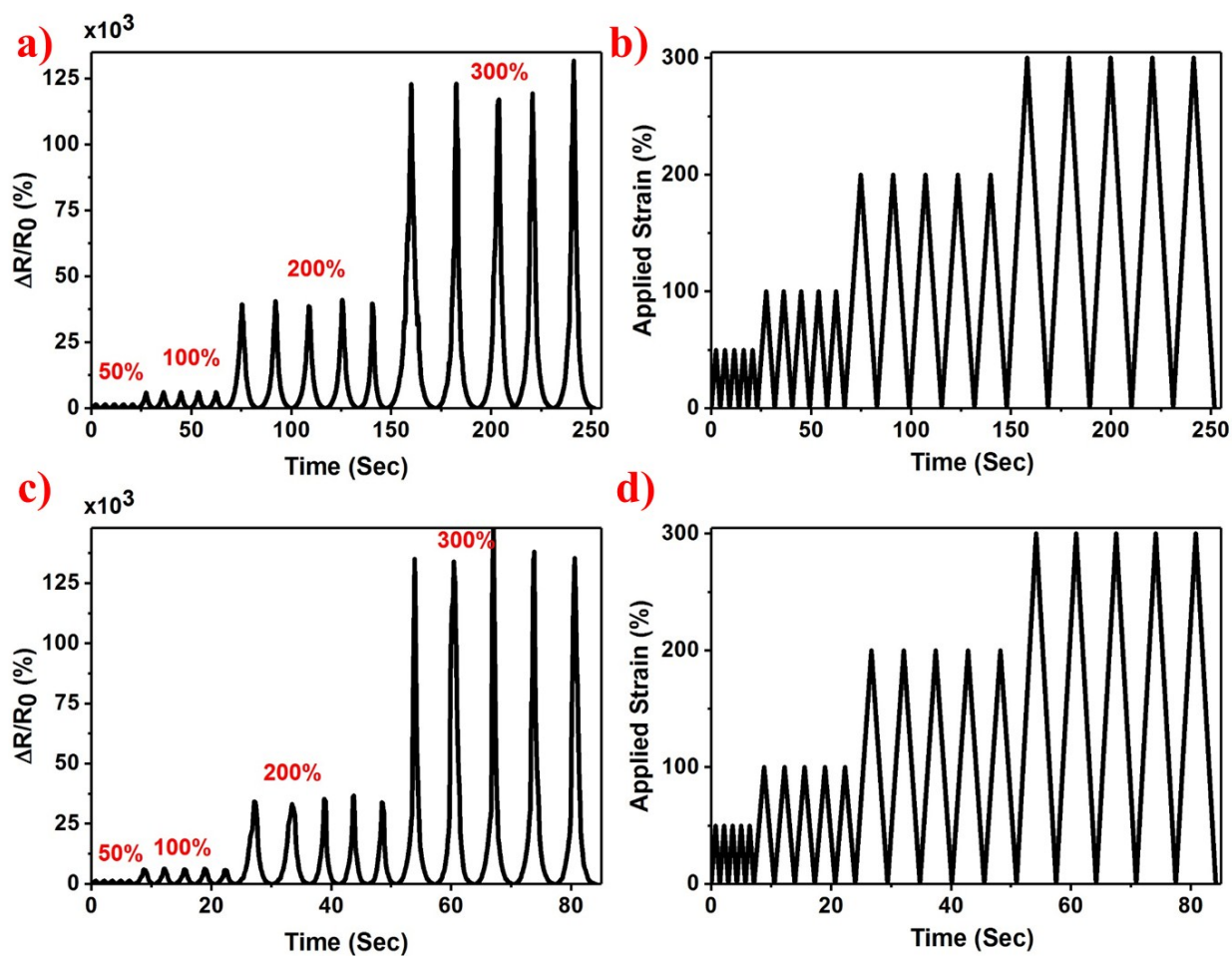


Figure S5. Electromechanical performance of our strain sensors; a) Relative change of resistance versus strain under cyclic stretching–releasing at displacement rate of 5 mm.s⁻¹ for a CC strain sensor and b) the applied tensile strain profile; c) the relative change of resistance versus strain under cyclic stretching–releasing at displacement rate of 15 mm.s⁻¹ for a CC strain sensor and d) the applied tensile strain profile.

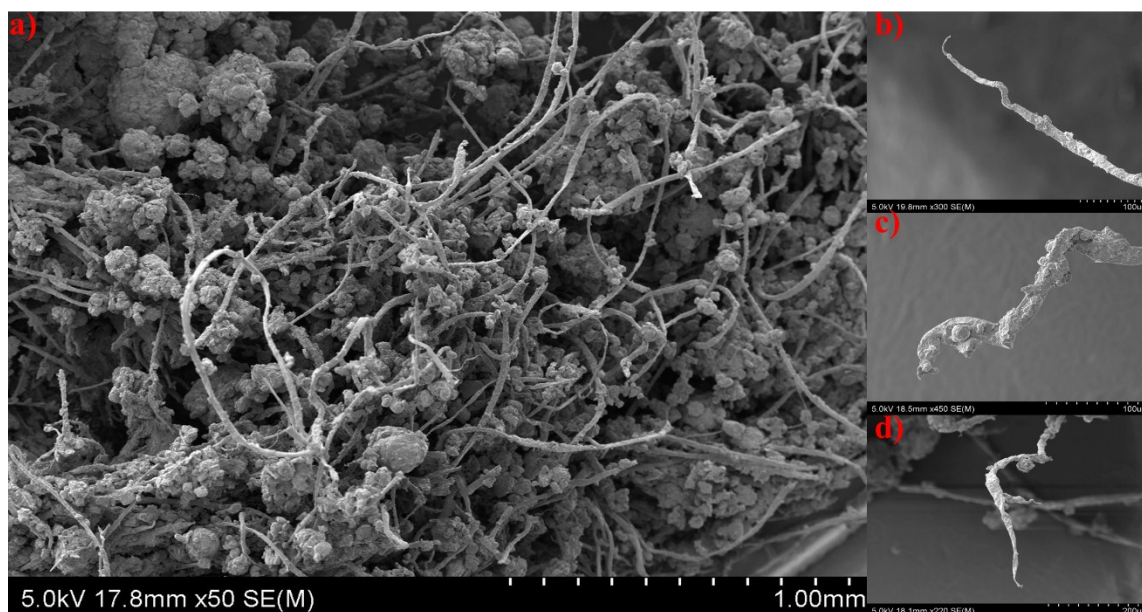


Figure S6. SEM images from the fractured area of CC fabric a), and b, c, and d) showing the fractured tentacle-like single fiber at the fractured area.

Table S1. Comparison of main performance of our strain sensors and recently reported strain sensors with large strain range sensing.

<i>Strain sensors</i>	<i>Maximal strain range</i>	<i>Maximum Gauge factor</i>	<i>Durability</i>	<i>Response time</i>
Our work (graphene nanoplatelets and carbon black coated cotton/Ecoflex)	400%	102351	1000 cycles at 75%	42 ms $T_{90\%} \cong 97$ ms
Carbonized silk/Ecoflex ¹	500%	37.5	10,000 cycles at 300%	70 ms
Graphene/rubber ²	800%	35	1000 cycles at 100%	Not shown
Carbon nanotube fiber/Ecoflex ³	960%	64	10,000 cycles at 300%	10 ms
Carbon nanotube film/PDMS ⁴	280%	0.82	10,000 cycles at 200%	14 ms
Carbon black/Elastomer ⁵	80%	20	3600 cycles at 80%	Not shown
Graphite thin films/Ecoflex ⁶	150%	11344	2000 cycles at 25%	Not shown
Metallic film/Polyurethane Acrylate ⁷	2%	2000	5000 cycles at 2%	100 ms
SWCNTs/PDMS ⁸	150%	160	100,000 cycles at 60%	Not shown

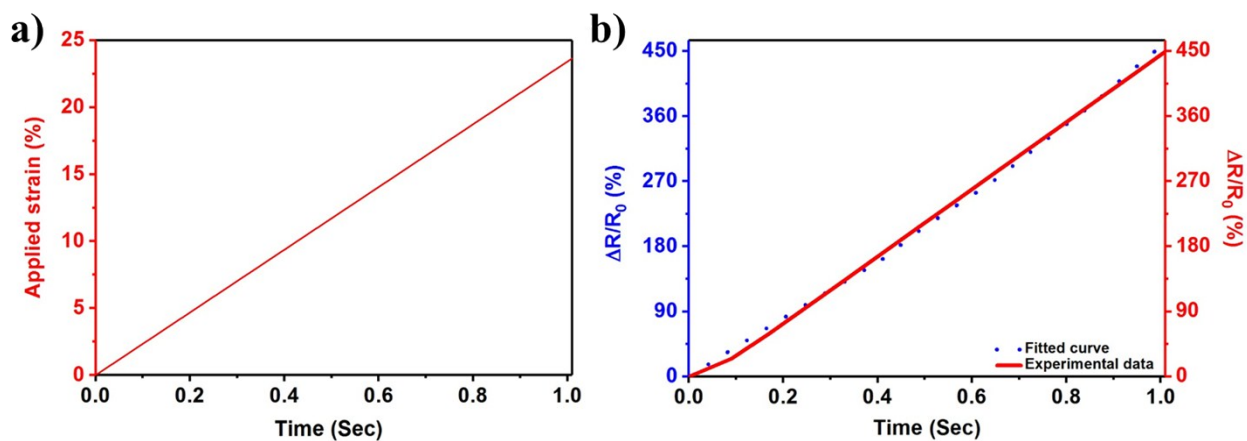


Figure S7. Plots related to the calculation of response time for our strain sensors; a) Ramp strain applied to the strain sensor; b) experimental data from our strain sensor at the displacement rate of $5 \text{ mm}\cdot\text{s}^{-1}$ and best fitted curve.

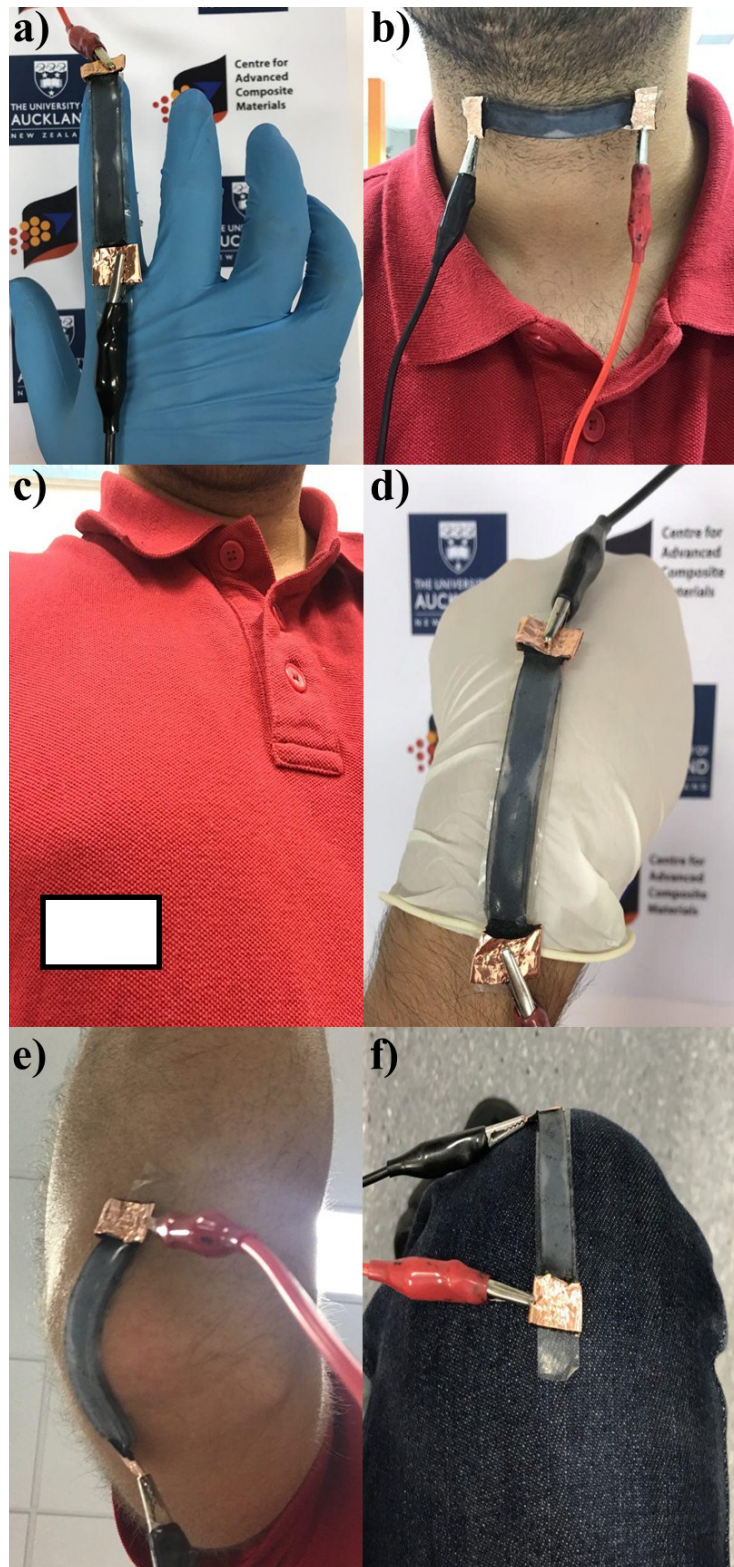


Figure S8. Photographs exhibiting the attachment of our strain sensor on various parts of a volunteer's body for human motions detection a) finger joints movements, b) phonation, c) respiration (strain sensor attached on the skin under the white box), d, e, and f) wrist, elbow, and knee joints movements.

References:

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