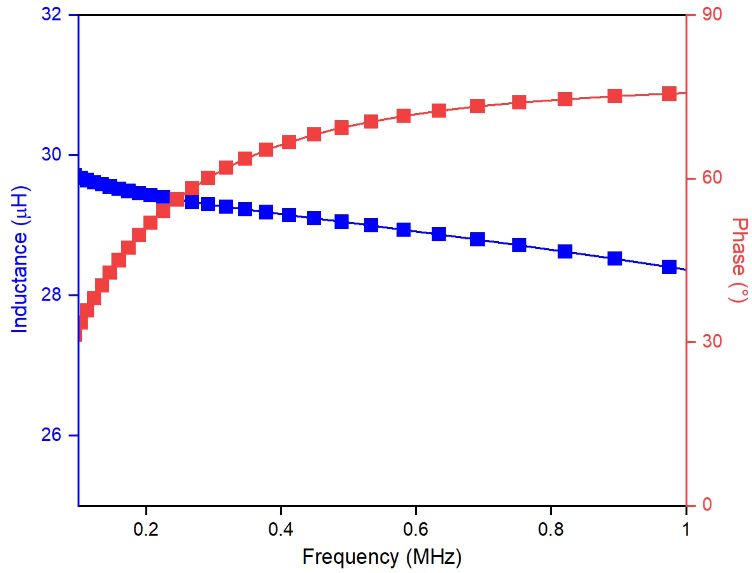
A Wireless Reader for Detecting Frequency Shift of Passive Sensors

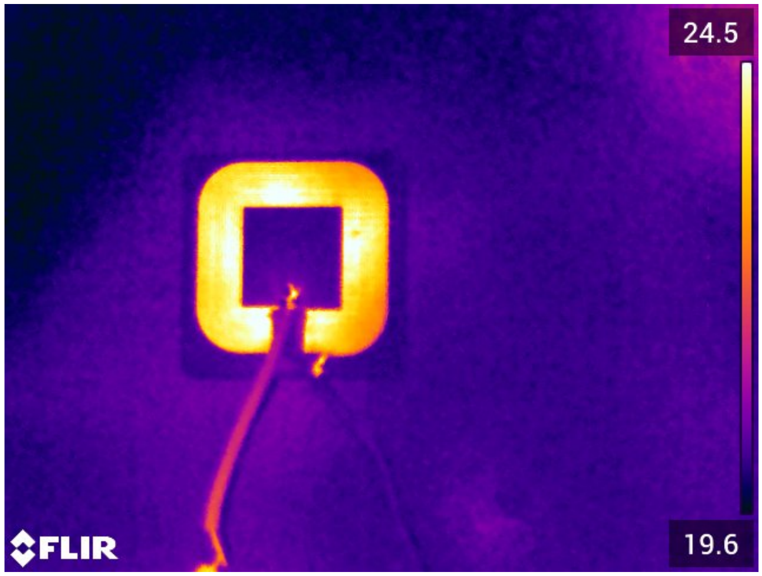
Supplementary Information

Fariborz Mirlou, Emine Bardakci, Taher Abbasiasl, Levent Beker

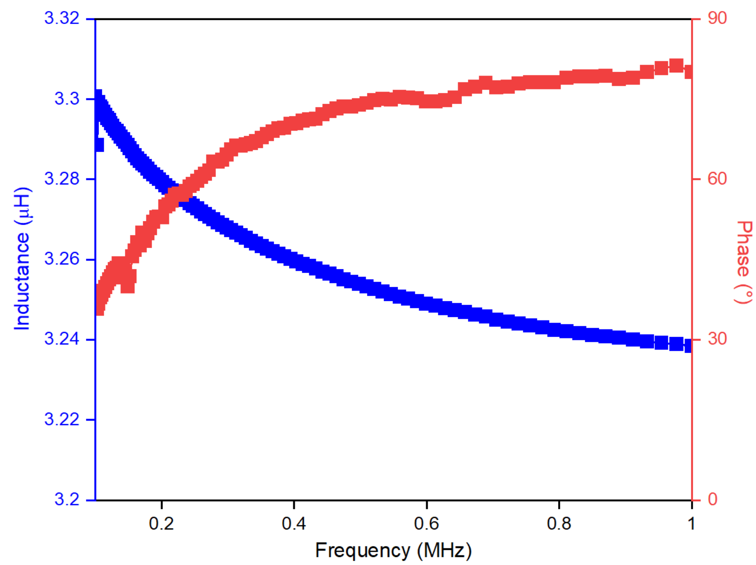
Table of contents:



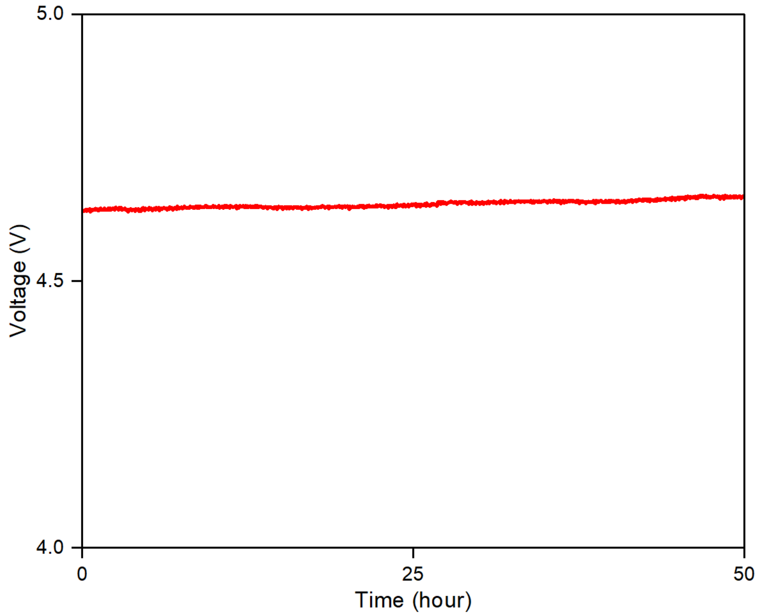
Supplementary Figure 2. Inductance and phase measurements of the reader coil on the WiRe. The measurements show an inductance value of ~29 µH at 1 MHz.



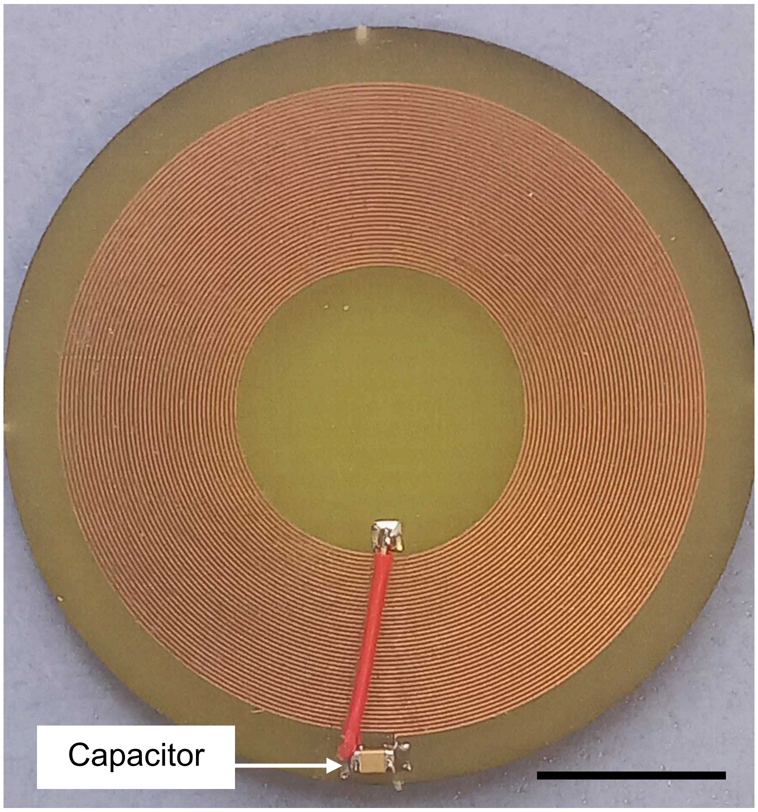
Supplementary Figure 2. The thermal image of the reader coil shows a maximum temperature of ~24.5 °C, which is in the human tolerance range.



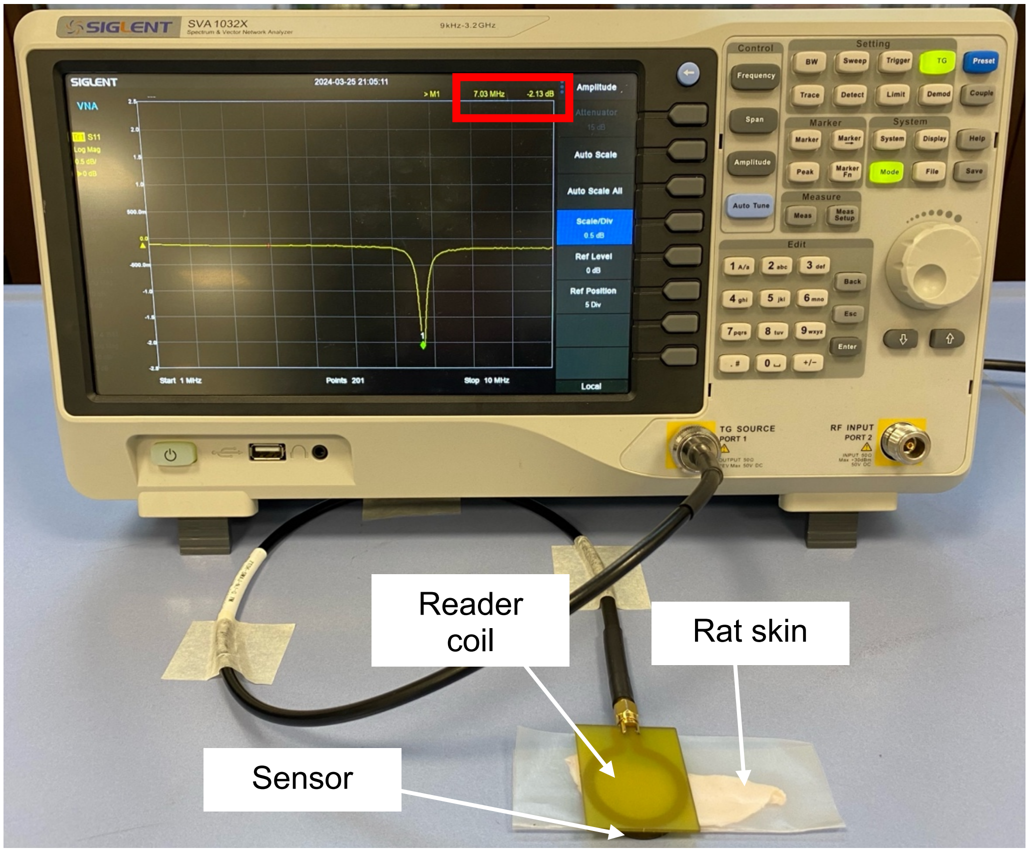
Supplementary Figure 3. Inductance and phase measurements of the NFC antenna used for power harvesting from external power sources with a frequency of 13.56 MHz. The measurements show an inductance value of ~3.25 µH at 1 MHz.



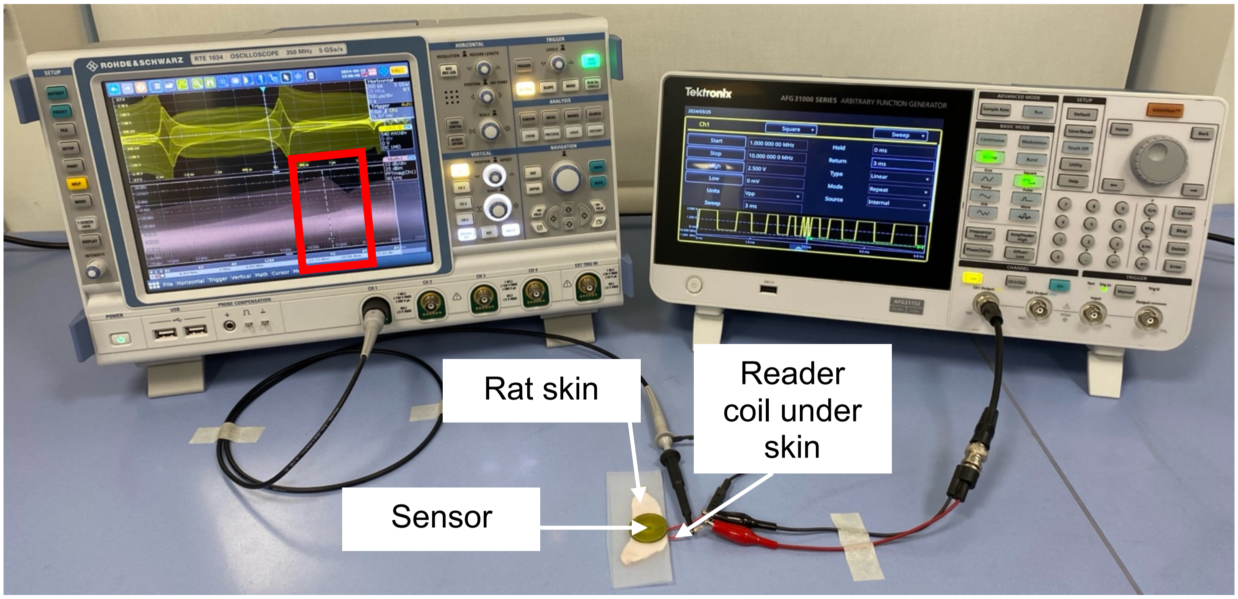
Supplementary Figure 4. A long-term study of the power harvesting for the WiRe shows the stability of the harvested power over 50 hours.



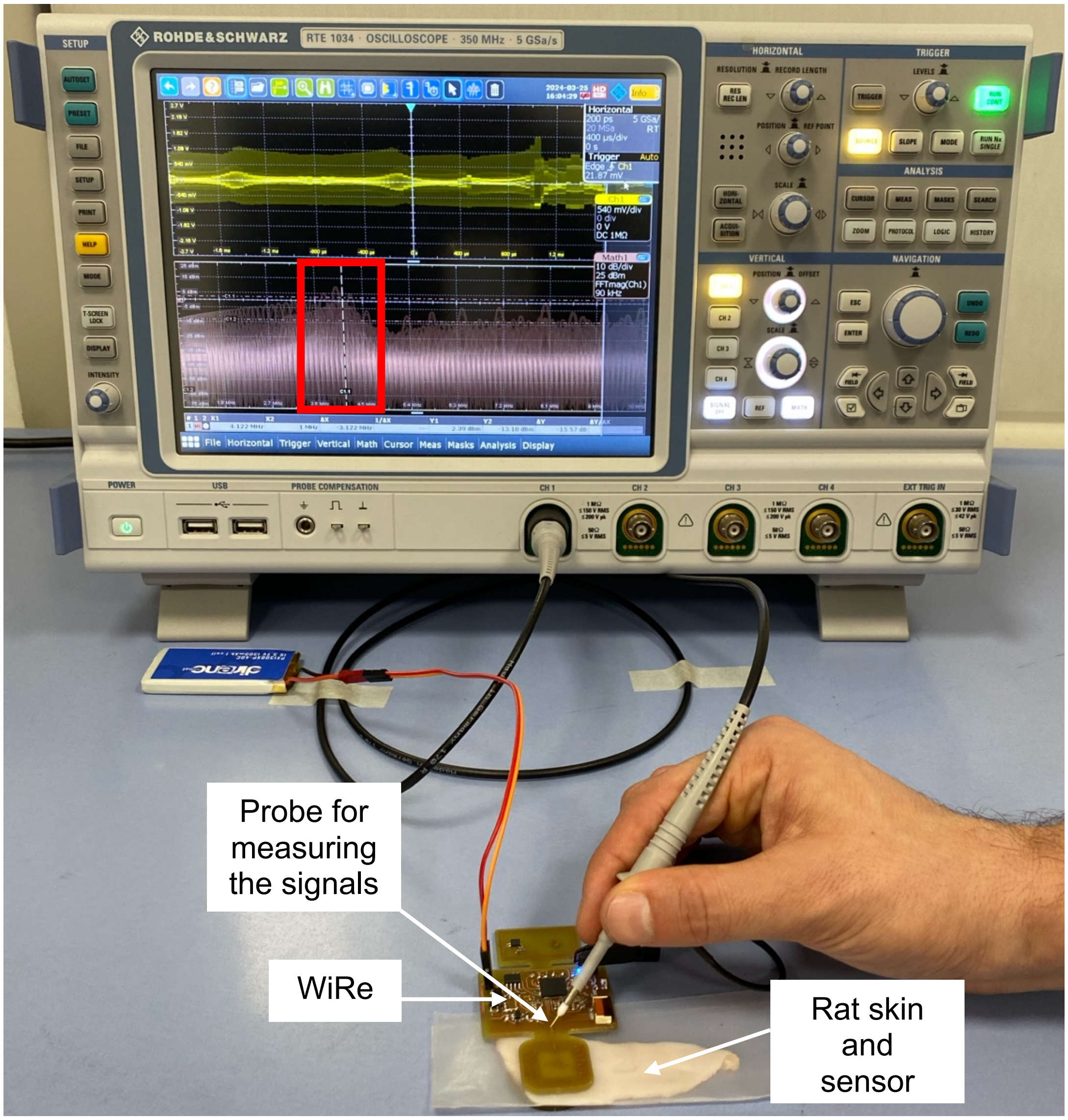
Supplementary Figure 5. Image of the fabricated passive sensors for WiRe characterizations. The sensors were fabricated using the laser cutter machine with tracks and a gap width of 75 µm. The SMD capacitors with different values were soldered on the coil to achieve different resonance frequencies with each sensor. Scale bar, 5 mm.



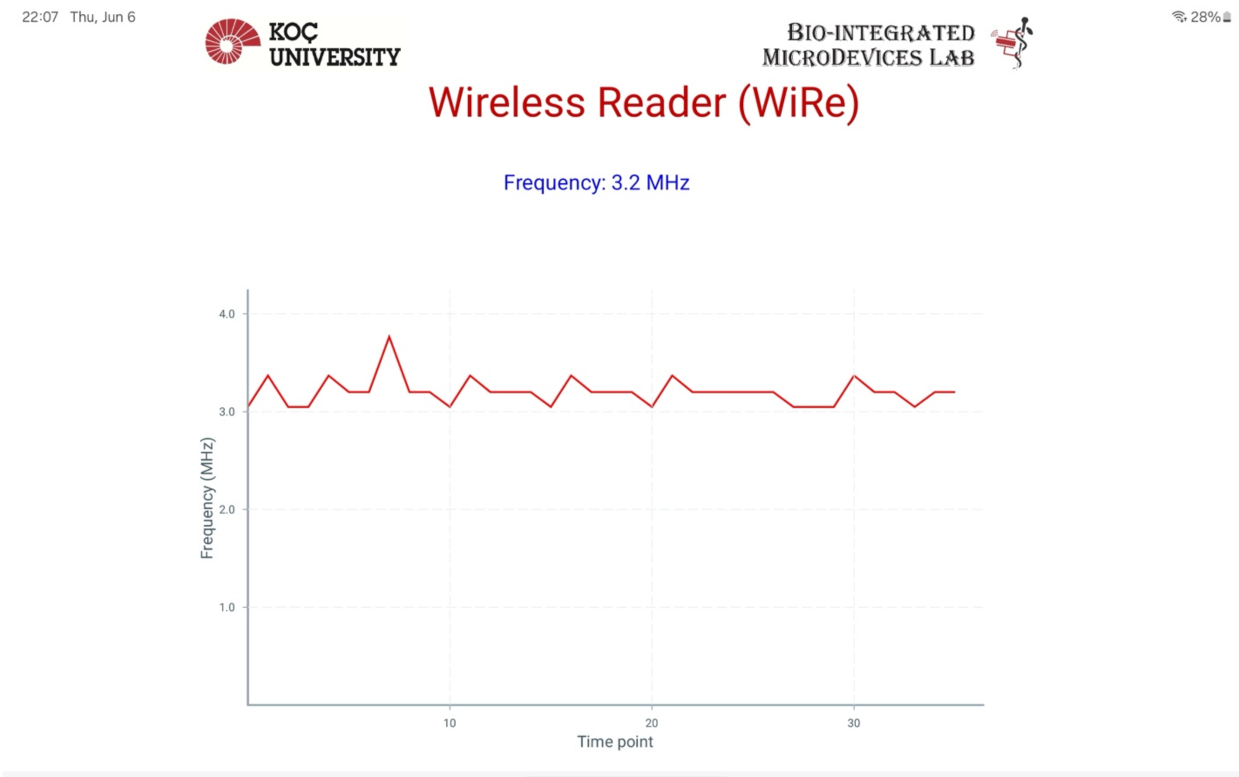
Supplementary Figure 6. Reading the resonance frequency of the coils placed under the rat skin using the VNA.



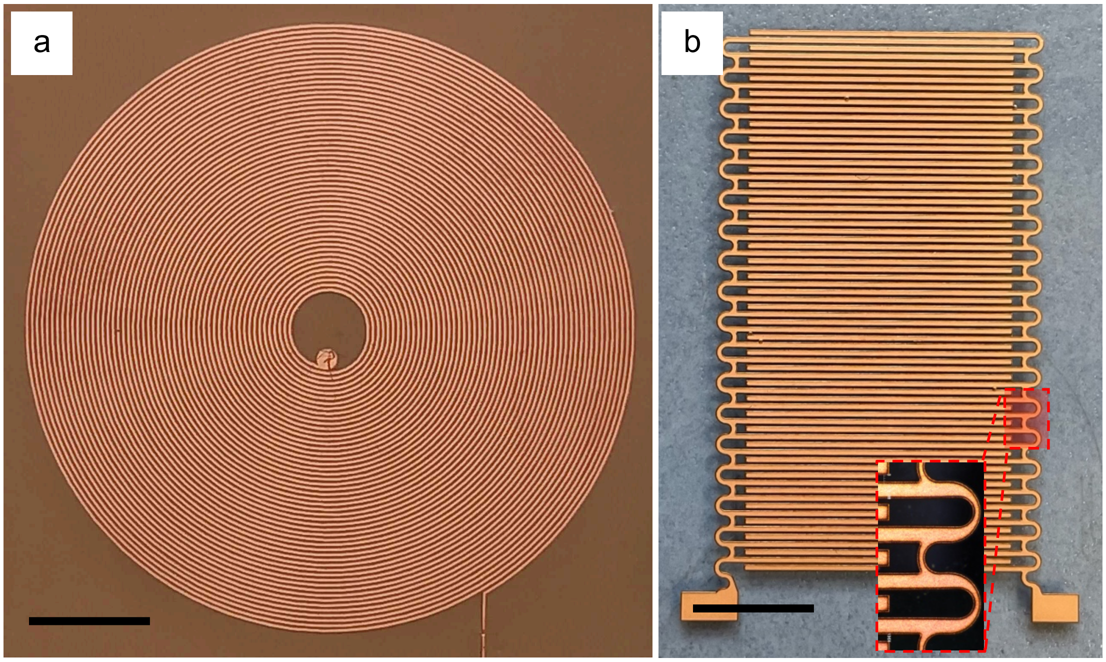
Supplementary Figure 7. Reading the resonance frequency of the coils placed under the rat skin using a function generator to sweep a voltage over the frequency range of 1 to 10 MHz and recording the signals with an oscilloscope. The real-time FFT of the signals was calculated and recorded with the oscilloscope.



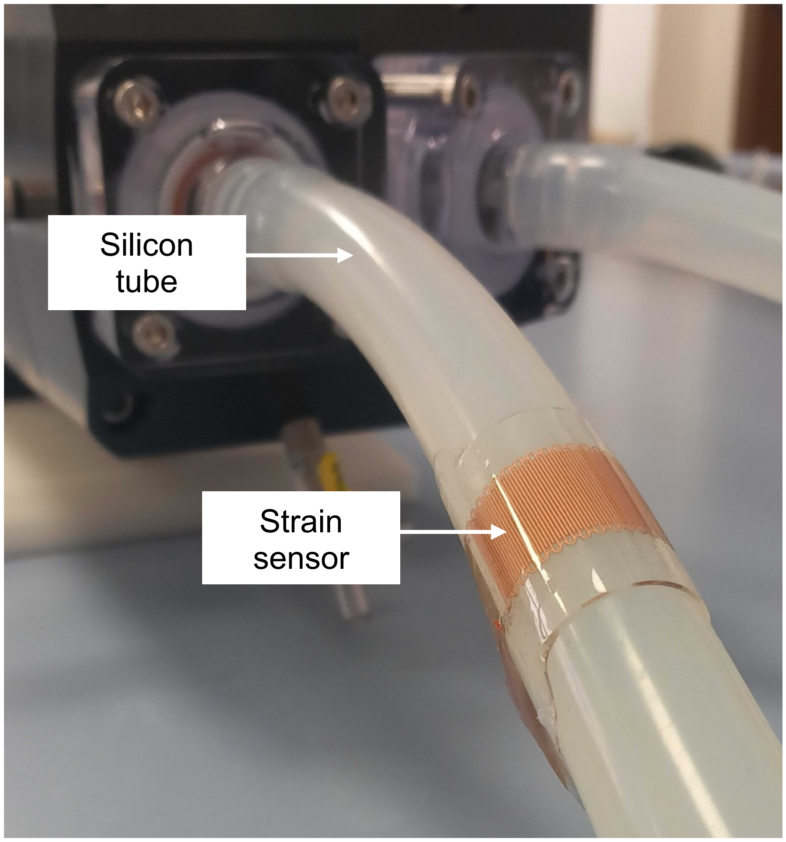
Supplementary Figure 8. Reading the resonance frequency of the coils placed under the rat skin using the WiRe. The real-time FFT of the signals was calculated and recorded with the oscilloscope.



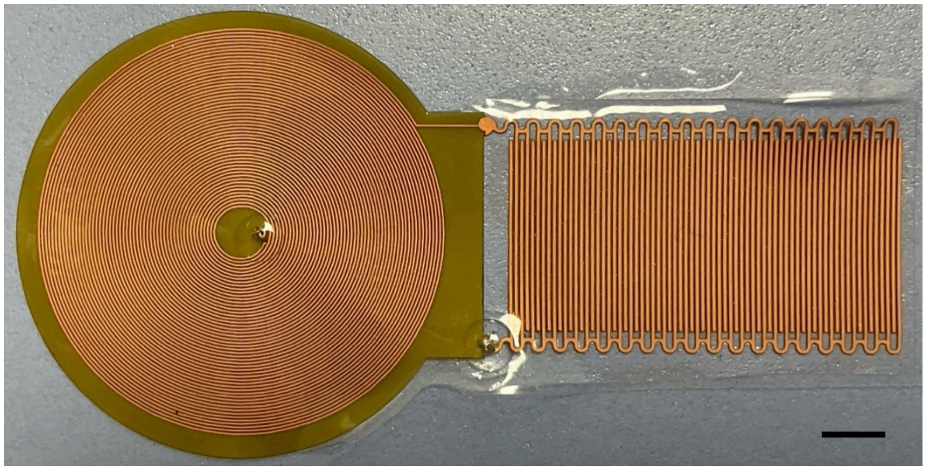
Supplementary Figure 9. The custom-developed mobile and cloud application for the WiRe device. The application can log the data and plot it simultaneously.



Supplementary Figure 10. Images of the fabricated a) inductor and b) interdigitated capacitor (with a zoomed-in view) for making a stretchable capacitive strain sensor. Scale bars, 5 mm.



Supplementary Figure 11. A flexible strain sensor wrapped around the silicon tube in a setup demonstrating the heart rate measurements using the WiRe.



Supplementary Figure 12. Image of the developed strain sensor for measuring the heart rates from a setup mimicking the heartbeats. Scale bar, 1 cm.