Description of Additional Supplementary Files:

Supplementary Movie 1. Assembly and working principle of the water extraction system.

Supplementary Movie 2. Real-time demonstration of the stretchability of high and low modulus hydrogels.

Supplementary Movie 3. Real-time demonstration of the hydrogels harvesting water from atmosphere at extremely low humidity.

Supplementary Movie 4. Stitched image reconstruction of the actuating out-of-plane porous membrane at 89, 110, and 115 kHz (longitudinal mode) using PICOSCALE vibrometer.

Supplementary Movie 5. Stitched image reconstruction of the actuating out-of-plane (thickness mode) PZT piezoelectric polycrystal at 89, 110, and 115 kHz (thickness/longitudinal mode) using PICOSCALE vibrometer.

Supplementary Movie 6. Real-time wireless ultrasound energy transfer through the atmospheric water harvesting hydrogels from the actuator.

Supplementary Movie 7. Real-time demonstration of water extraction from the atmospheric water harvesting hydrogels using our system.