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All-Fabric Triboelectric Nanogenerator (AF-TENG) smart face mask: remote long-rate breathing monitoring and apnea alarm

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Abstract-

Since the beginning of the COVID-19 pandemic, the use of face masks has become not only mandatory in several countries but also an acceptable approach for combating the pandemic. In the quest for designing an effective and useful face mask, triboelectric nanogenerators (TENGs) have been recently proposed. Novel functionalities are provided with the use of TENGs in face masks due to the induced triboelectrification generated by the exhaled and inhaled breath, allowing their use as an energy sensor. Nonetheless, within the face mask, the presence of nontextile plastics or other common triboelectric (TE) materials can be undesired. Herein, we propose the use of an all-fabric TENG (AF-TENG) with the use of high molecular weight polyethylene (UHMWPE) and cotton fabric as negative and positive triboelectric layers, respectively. With these materials, it is possible to detect the breathing of the patient, which in the case of not detecting a signal over a few minutes can trigger an alarm locally, providing valuable time. Also, in this article, we have sent breathing signals locally and remotely to distances up to 20 km via Wi-Fi and LoRa, the same as warning signals in the case of detecting anomalies. This work reveals the use of TENGs in smart face masks as an important tool to be used in difficult epidemiological periods to the general public, bringing much more comfort and relaxation to patients and elderly in today’s society, and based on pristine eco-friendly materials.

Index Terms- triboelectric TENG nanogenerator face mask LoRa

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