

Novel Wireless Thermal Convection Angular Accelerometer Integrated with Radio Frequency Identification Tag

Jium-Ming Lin*, Cheng-Hung Lin¹ and Hung-Han Lu²

Department of Communication Engineering, Chung-Hua University, Hsin-Chu 30012, Taiwan

¹Engineering Science, Chung-Hua University, Hsin-Chu 30012, Taiwan

²Department of Electrical Engineering, Chung-Hua University, Hsin-Chu 30012, Taiwan

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Five novel ideas are proposed to integrate a radio frequency identification (RFID) tag with a thermal convection angular accelerometer on a flexible substrate. The first idea is that this device has no movable parts; therefore, it is very reliable. The second idea is that the thermal conductivity of flexible substrates, such as plastic or polyimide, is much lower than that of silicon, and thus, it can save more power and is very useful for mobile operations. The third new idea is to apply xenon gas to the chamber to conduct heat instead of CO₂ conventionally used, which can oxidize the heater and thermal sensors, while the inert gas xenon cannot. The fourth new idea is the use of a hemispherical chamber; it is more streamlined with less drag to yield quicker responses. The fifth new idea is to integrate an angular accelerometer with the RFID tag on the same flexible substrate; thus, the device becomes a more useful wireless sensor. Compared with a device fabricated using a rectangular chamber filled with CO₂, we noted that the linearity, sensitivity, and response time of step-input angular acceleration are better for the proposed device. The sensitivity is 71.4 °C/(rad/s²) and the response time is 60 μs.

*Corresponding author: e-mail: jmlin@chu.edu.tw