A MEMS-based Weather Station

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ABSTRACT

This study proposes a wireless remote weather monitoring system based on Micro-Electro-Mechanical Systems (MEMS) and Wireless Sensor Network (WSN) technologies comprising sensors for the measurement of temperature, humidity, pressure, wind speed and direction. The sensing signals are transmitted between the Octopus II-A sensor nodes using WSN technology, following amplification and analog/digital conversion (ADC). Experimental results show that the resistance of the micro temperature sensor increases linearly with input temperature, with an average TCR (temperature coefficient of resistance) value of 8.2 x 10?4 (?C?1). The resistance of the pressure sensor also increased linearly with air pressure, with an average sensitivity value of 4.7 × 10?3 (Ω/mmHg). The sensitivity to humidity increased with ambient temperature due to the effect of temperature on the dielectric constant, which was determined to be 1.11, 1.12, 1.27, and 2.01 (nF/%RH) for 27 ?C, 30 ?C, 40 ?C, and 50 ?C, respectively. The velocity of airflow was obtained by summing the variations in resistor response as airflow passed over the sensors providing sensitivity of 4.2 x 10?2, 9.2 x 10?2, 9.7 x 10?2 (Ω/ms?1) with power consumption by the heating resistor of 0.2, 0.3, and 0.5 W, respectively. The passage of air across the surface of the flow sensors prompted variations in temperature among each of the sensing resistors. Evaluating these variations in resistance caused by the temperature change enabled the measurement of wind direction.

Keywords : Micro-Electro-Mechanical Systems (MEMS)、Wireless Sensor Network (WSN)、weather monitoring system

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