

Low Cost Passive Chipless UHF RFID Tags and RFID Based Sensors

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Abstract

Radio Frequency Identification (RFID) tags are poised to offer a wide range of applications ranging from supply chain management solutions, real time inventory control, remotely operable smart gadgets and devices to different sensing application by sensors included on the RFIDs known as RFID based sensors. Cost of the tag is the main factor in wide application of these devices. Silicon costs and assembly costs present main obstacle in lowering the price of silicon chip based RFID tags. We at our Wireless Sensor System lab, at Institute for Micromanufacturing (IfM), Louisiana Tech University are developing low cost alternative designs, techniques and processes for the RFID fabrication. The RFID tag proposed by our research team has no silicon based IC's, can be mass manufactured using low-cost fabrication processes. Our RFID based sensor version accommodates a sensor switch in series with the antenna and the ID generation circuit and the generic layout allows the change of sensing element to suit the specific sensing needs, and can be adapter for any frequency. A chipless ID generation circuit based on LC delay concept, a simple on-off sensor switch and low-cost fabrication processes are significant in our approach. A maximum of 32 bits have been generated using simulations. Piezoelectric materials and Quantum Tunneling Composites (QTC) are among the materials considered for the sensor switch. Desktop fabrication techniques such as xerographic patterning, electroless copper and polymer printing are some of the low cost fabrication techniques used in the fabrication of these gadgets. Our 915MHz (UHF) tag prototype includes transmitting and receiving antennas, a QTC based sensor switch and a 4 bit ID generation circuit. This tag will be read by custom built Reader which is in fabrication stage at IfM. While photolithography is used as an optional patterning technique in some of our present experiments, low-cost processing techniques mentioned earlier are being optimized in parallel. Our presentation outlines efforts put forth by our research team in the design, modeling and simulations, and experiments toward the fabrication of 915MHz prototypes. Results outlined include characteristics of low-cost fabricated devices such as resistors, capacitors, and interconnects, components such as sensor switch and antennas and the complete Tags including RFIDs and RFID based sensors.