Self-powered RFID Sensing Technology for Monitoring of Complex Product Supply-Chain

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1. Research Project & MRIVCC Theme

- Complexity of modern product supply-chain
  Encompasses off-shore manufacturing, multi-site storage and the use of third-party shipping channels - practically impossible to completely isolate and optimize.

- Leveraging advances in radio-frequency identification (RFID) technology
  Integrate sensors directly onto an RFID tag to convey either the source of contamination, product status or contamination within the supply-chain.

2. Value Created

- Size of RFID market anticipated to reach $23.4 billion by the year 2020.
  The majority of the RFID market share has been projected for passive RFID tags which are mainly designed for product tracking and product bar-coding. If the passive RFID tagging technology were enhanced with the proposed self-powered sensing technology, the integrated technology could be used for product quality monitoring.

- Monitoring of perishable product supply-chain
  Monitoring of food-product supply chain could be important towards preventing food-borne outbreaks and product recalls which account for approximately $6.9 billion in losses annually.

- Monitoring tampering and contamination.
  Applicable to other tamper-sensitive and contamination-sensitive products like cosmetics, medicines and construction materials.

3. Results and Future Directions

- Modify the reflectance of a commercial RFID tag using antenna self-assembly or modulation techniques.

- Future direction 1: Investigate self-powered sensors that can directly modulate the electrical impedance of the RFID antenna.

- Future direction 2: Integrate sensors, taggants and antenna with the packaging material - piezoelectric fibers or fouling substrates.

4. Project Plan

Milestone 1: Standardization of the RFID sensing platform to support multiple types of self-powered sensors. Investigation the integration of RFID with different packaging materials and substrates. Completion Date: 1 year from the start of the project.

Milestone 2: Proof-of-concept integration of three types of self-powered sensors on the RFID platform (piezoelectric, electrochemical and biological) Completion Date: 2 years from the start of the project.

Milestone 3: Top-down analysis and sensing optimization based on risk assessment and mitigation strategies on an existing product supply chain. Completion Date: 3 years from the start of the project.