Wireless and Batteryless RFID Sensors

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References / REIT7881 / EECS

Introduction

Batteryless, self-rechargeable RFID sensor tags harvest RF energy and return measurements via UHF backscatter (EPC Gen2). This project develops such tags for maintenance-free sensing in constrained or hard-to-service environments.

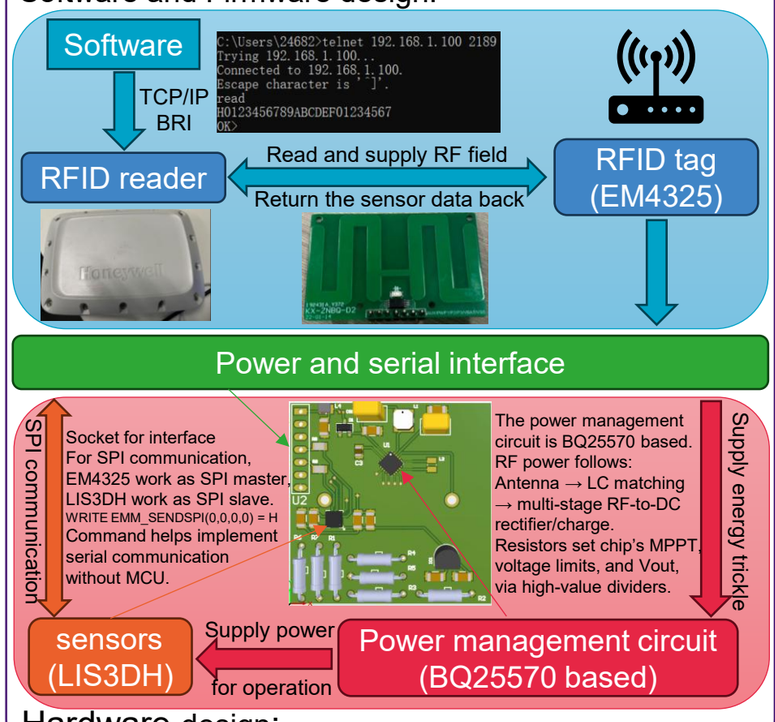
- *Significance:*
  Enables large-scale, maintenance-free IoT deployments in hard-to-reach or sealed environments, cutting installation and servicing costs.
- *Applications:*
  Small agriculture, asset tracking and human health monitoring.

Aims

- Read the attached sensor data via EM4325 without MCU integration.
- Design associated software(GUI or Web) to read and plot the sensor data smartly.
- Build a power management circuit, harvest RF energy and charge device's battery.

Method

Software and Firmware design:



Hardware design:

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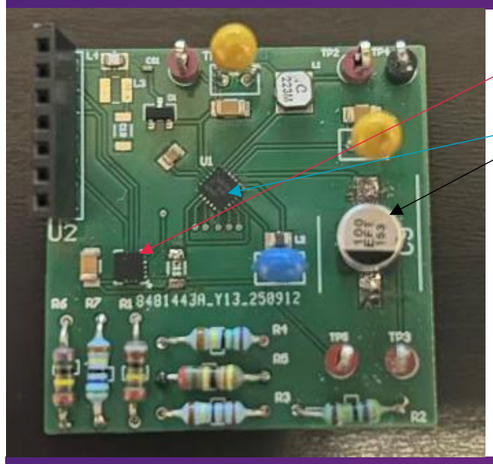
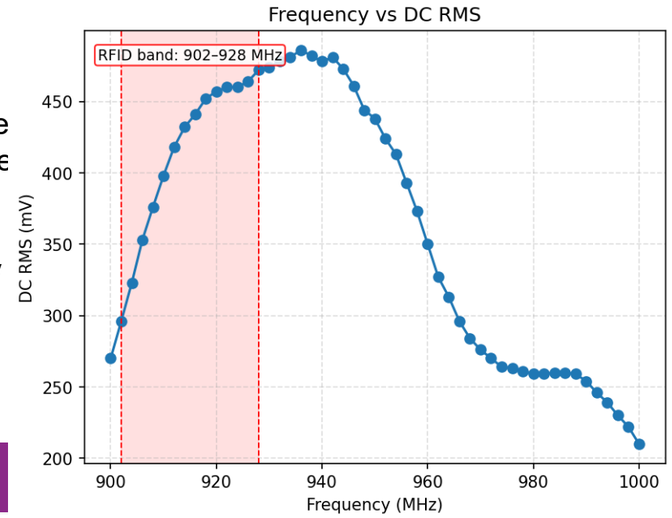
Results

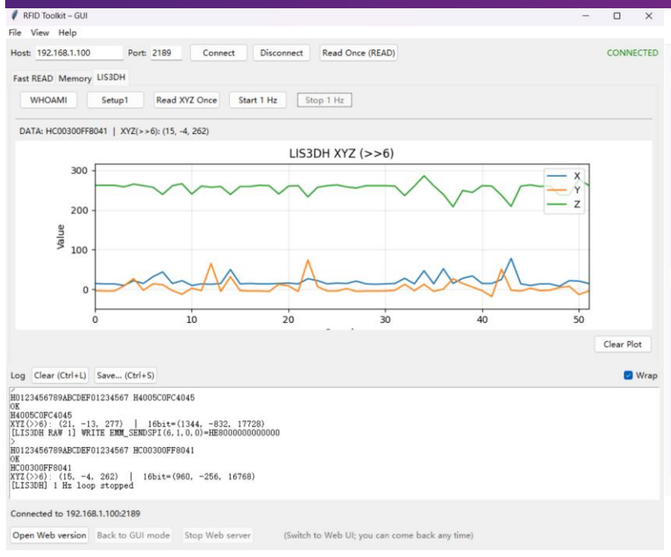
Hardware result: Antenna power measurement tool



Left: LIS3DH is placed mid-left; other components(BQ25570) implement power management. Supercapacitor is used to store the power harvested. So, with software capacitor's voltage will rise.
Right: With a 0 dBm transmission source, the DC-RMS vs frequency (MHz) measured from PCB, indicating the usable band (920 - 955MHz), compared to AU RFID band: (902 – 928 MHz)



Software overview and sensor function results



•GUI (left): One-click connect, set up LIS3DH, single-read or 1 Hz streaming, with real-time X/Y/Z plots and other functions shown above.
•Web UI (right): Browser interface mirroring the GUI; WebSocket live link for remote read/stream, responsive chart and live log.

Conclusions and future work

The device can successfully read and plot sensor data wirelessly;
In charging mode of software, the voltage of capacitor will rise.

In the future, we'll do further integration to make whole device much smaller, and also other optimization, more types of sensing…

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