DEPARTMENT OF ELECTRICAL AND COMPUTER ENGINEERING
COLLEGE OF ENGINEERING AND APPLIED SCIENCE

RESEARCH OPPORTUNITIES FOR UNDERGRADUATE students

APPLICATION DEADLINE: February 8, 2026

PROJECT TITLE: Secure Sensing Electronics for Precision Agriculture

Physical Requirement :
Light lab work at an electronics bench (optional soldering), 2–3-hour sessions, light lifting (less than 15 lb), and occasional short outdoor sensor setups

Project's Technical Skills Requirement :
Student should be comfortable with Arduino-style microcontroller programming, basic analog electronics, Python/MATLAB plotting, MCU toolchains and lab instruments (scope/DMM/power monitor); LoRa radio and simple packet-security concepts are a plus.

Project's Available Positions : 2

Ankit Mittal
College of Engineering and Applied Sciences
833 Rhodes Hall
Cincinnati, OH 45221
ankit.mittal@uc.edu

Project Description

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Why this matters.
On an agricultural farm, every reading and every byte costs battery life. Sensing takes power. Processing takes power. Wireless takes the most. If we want months of life from a tiny node, we have to send less, send smarter, and make sure fake or replayed packets don’t waste energy or corrupt the data.
What is the project about:
A small, low-power farm sensor that:
1) Measure soil conditions (moisture/EC, temperature/humidity; optional: a simple pest trigger)
2) Shrinks the data before sending it (so we use less energy).
3) Defend against simple wireless attacks
4) Send wirelessly to a base station using a long-range, low-power radio
Key Deliverables:
1) A working prototype that measures, shrinks, sends, and (re)builds data.
2) Basic wireless security in software, show that eavesdropped compressed data is not easily reconstructable without the key
3) One-button plotting script (from a 24-hour run) that shows:
a) Energy per message (before vs. after shrinking)

b) Reconstruction quality (how close to the original)
c) Security tests: acceptance rate for valid packets vs. spoofed/replayed packets
d) Time to reconstruct one data chunk
4) A short write-up (?4 pages) explaining what we built, how we tested, and the results.
5) A clean report with firmware, simple PC scripts, circuit diagram, and a parts list.
Note (living document).
Consider this as a living plan: the instructor may adjust scope, milestones, or deliverables to keep the work feasible, safe, and aligned with learning goals, and will share any changes in writing with reasonable notice.