

# Sonu Kanagala — Electrical & Embedded Portfolio

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## Overview

Microcontrollers and embedded firmware in C/C++, Python test scripts, bench bring-up with oscilloscopes and logic analyzers, Linux tooling, IoT telemetry. Focused on clear SOPs, reproducible tests, and measurable outcomes for product teams.

## Project 1 — ESP8266 Vitals Telemetry Pipeline (Healthcare)

**Role:** firmware + provisioning + test    **Tech:** C, Python, ESP8266, MQTT/HTTP, Linux, Wireshark

- Sensor interfaces for SpO<sub>2</sub>, ECG, BP with C firmware and Python tools
- < 2 s telemetry refresh and > 90% agreement across 10+ validation runs with saved logs
- Provisioning scripts with retries, health checks, timestamps; SOP for team handoff
- Verified links via Wireshark and logic analyzer; pass/fail tables for regression

## Project 2 — Smart Crop Monitoring (IoT + Embedded)

**Role:** embedded integration + calibration + cloud telemetry    **Tech:** ESP8266, HTTP, Python, Linux, Grafana/InfluxDB

- Deployed nodes over 100 m<sup>2</sup> with calibrated moisture/temperature/humidity sensors
- < 5 s end-to-cloud latency and 90% accuracy across 200+ samples
- Duty cycling to achieve 48+ hours uptime; bounds checking to reject outliers
- Setup and calibration SOP with acceptance checks; zero rework over 3 builds

## Project 3 — Wireless Sensor Network Simulation (ns-3 + Wireshark)

**Role:** C++ metrics + validation    **Tech:** C++, ns-3, Python, Wireshark, Linux

- C++ counters for retries/backoff/aggregation; exported CSV and PCAP artifacts across 40+ runs
- RTS/CTS under load: ~ 30–35% fewer retransmissions and ~ 20–25% lower 95p latency
- > 95% field alignment in Wireshark; figure-ready plots and tables

## Project 4 — Autonomous Vehicle Interaction (Sensor Fusion Simulation)

**Role:** sensing + filtering    **Tech:** MATLAB, ultrasonic, short-range RF

- Temporal filtering and threshold gating with confusion matrices and latency histograms
- 95% detection across 10+ scenarios and < 2 s alerting

## Bench & Validation Artifacts

- Oscilloscope captures: UART timing, sensor read windows, noise checks
- Logic analyzer traces: SPI/I<sup>2</sup>C transactions with decoded fields
- Wireshark: MQTT/HTTP payloads with timestamps and sequence alignment
- SOP excerpts: wiring, provisioning, calibration, acceptance checks

## Links

**Web Portfolio:** add URL once GitHub Pages is live

**Resume (PDF):** attach to application