Ankit Kumar

Software Engineer - Lab Automation & Instrument Integration
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Summary

Software engineer with 5+ years at a biotechnology startup, building and operating software that connects lab robots, liquid handlers, instruments, and scientific data workflows. Experience includes Python/Flask orchestration, equipment drivers, scientist-facing protocol tools, OpenCV inspection, and production lab applications on AWS and Linux. **Project descriptions, photos, and videos at ankit.one.**

Professional Experience

Hememics Biotechnologies, Inc. Gaithersburg, MD, USA
Data Analyst / Bioinformatics Scientist Jun 2021 – Present

Lab automation & robotics (Python, Flask, SPEL+)

- Integrated an Epson 6-axis robot, Seyonic electronic pipettor, and in-house biosensor reader into a workcell that runs complete assays without manual pipetting or instrument operation.
- Built a Python/Flask orchestration server with job queuing, per-device locks, and exclusive operator access to prevent conflicting hardware operations.
- Designed a JSON protocol format supporting sequential steps, parallel branches, and signal handlers so bench scientists can create, debug, and run multi-instrument workflows without writing code.
- Developed a Python equipment driver using pythonnet and vendor .NET libraries for pipettor control, pressure and vacuum settings, pipetting-curve readout, and liquid-level detection.
- Implemented configurable liquid-level detection modes and software descent limits for automated pipetting.
- Set up and operate two Opentrons robots for board imaging, graphene-chip functionalization, and reagent mixing alongside the six-axis workcell.
- Built an automated imaging station with OpenCV alignment, plate raster scans, and focus stacking at 1-micron commanded increments, replacing manual optical inspection for visual QC.
- Modeled the deck, labware, and tip inventory to reject invalid pickup requests before motion, preventing wasted consumables and mid-run stops.
- Generated SPEL+ dispatch code from annotated robot routines to keep hardware programs and server commands synchronized; maintained robot-server API tests to catch regressions during hardware and protocol changes.

Instrument control & data software (Electron, TypeScript, C++)

- Shipped HemWare, a cross-platform desktop application for serial control of HemBox readers, with live measurement streaming, native C++ curve fitting through Ceres, and TensorFlow.js classification in worker pools.
- Developed an Electron/SQLite experiment editor that scientists use to create and debug multi-step protocols executed by the automation workcell.
- Built a reporting pipeline that converts experiment-run files into Excel-ready reports and applies the trained curve classifier to check measurement quality before results are reported.

Lab systems & cloud infrastructure (AWS, Docker, Linux)

- Built and deployed HemTracker, a QR-based lab inventory system with a Flask API, JWT authentication, and revision history, on AWS EC2 behind Caddy TLS with scheduled S3 backups.
- Hardened the public deployment with CrowdSec and an application firewall; ran Locust load tests and fixed path-traversal and dependency issues.
- Deployed and operate the lab's production eLabFTW electronic lab notebook on AWS using Docker, S3 object storage, and EBS snapshots for backup and disaster recovery.

Analysis & data tooling (Python, Electron)

- Built DiracWhere, a self-hosted analysis web app and CLI with analyzer and filter plugins that record how results were produced; fits 3,312 curves in approximately 11 seconds with a cold cache and 3.3 seconds with a warm cache.
- Standardized .exp and .exprun JSON formats across the instrument app, robot server, and analysis tools, eliminating manual file conversion between systems.

Biosensor signal classification (Python, Keras, TensorFlow.js)

- Built a neural-network classifier for six biosensor curve-quality and fault classes using 71,000+ labeled curves; achieved 95% accuracy and 0.93 macro-F1 on a 24,042-curve holdout.
- Built a labeling interface with live model predictions and deployed the classifier in desktop-app worker threads for real-time measurement QC.

Embedded firmware (C, PSoC Creator)

- Led firmware bring-up for the dual-core PSoC 6 HemBox Gen7 reader, expanding acquisition to 96 circuits across six multiplexers, updating DMA descriptors, fixing ADC interrupt timing, and adding impedance monitoring.
- Diagnosed and fixed QSPI flash corruption caused by writes crossing page boundaries; built digital and SPI control state machines for the analog front end.

Education

New York University - Tandon School of Engineering — M.S.
Computer Engineering — Brooklyn, NY, USA • Sep 2018 – May 2020

Indian Institute of Technology (ISM) Dhanbad — B.Tech
Electronics and Communication Engineering — Dhanbad, India • Jul 2014 – May 2018

Technical Skills

Languages
Python, C/C++, TypeScript, JavaScript, SPEL+ (Epson robot)

Machine Learning
Keras, TensorFlow, TensorFlow.js, scikit-learn, NumPy / SciPy

Embedded Systems
PSoC 6, Embedded C, ADC / DMA, SPI, Serial / UART, QSPI NOR flash

Applications & Backend
Flask / REST APIs, Electron, React, SQLite, Node native addons, Ceres Solver, Git

Lab Automation
Epson 6-axis robots, Opentrons, Seyonic pipettes, pythonnet / .NET interop, liquid-level detection, OpenCV, multi-instrument orchestration, protocol execution, labware and tip tracking

Cloud & Infrastructure
AWS (EC2, S3, EBS, Secrets Manager), Docker, Linux, Caddy, gunicorn, CrowdSec / WAF, Locust

Self-Hosted Infrastructure (Homelab)

Personal systems in daily use - Debian Linux, Proxmox VE, TrueNAS, AWS

- Serve NVFP4-quantized open-weight LLMs with vLLM and LiteLLM on a GB10 DGX Spark, tuning memory allocation and inference parameters.
- Operate private services using Pangolin/Traefik, WireGuard tunnels, and Cloudflare DNS-01 certificates; host Headscale on AWS EC2 for overlay networking.
- Maintain multiple Proxmox VE hosts to support service availability during maintenance.