

# JACK SHKIFATI

## Embedded Systems Engineer

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### SUMMARY

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**Embedded Systems Engineer with a filed patent and 3+ years authoring production firmware.** At PepsiCo, led firmware and hardware integration for smart vending across France, Australia, India, and Poland (100+ units per market), including custom NIC firmware on Qualcomm Android SoCs, depth-vision sensor systems that replaced legacy RF sensors and cut hardware BOM cost by 20%, and offline-resilient payment subsystems integrating Nayax, Pax, and UPI. Work spans bare-metal MCUs (ATmega, STM32, ESP32) through embedded Linux. C/C++ specialist; B.S. Computer Engineering, NYU Tandon, Cum Laude.

### SKILLS

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**Programming Languages:** C/C++, Python, Java

**Operating Systems:** Bare-Metal, Embedded Linux, FreeRTOS

**Communication Protocols:** Ethernet, TCP, UDP, I2C, MQTT, SPI, UART, RS-232, RS-485, Tuya

**Microcontrollers & SoCs:** ATmega, Arduino, ESP32, Raspberry Pi, STM32, Qualcomm Kyro 670 SoC (Android)

**Machine Learning:** PyTorch, TensorFlow, Keras, Scikit-learn, NumPy, Pandas, YOLO, OpenCV

**Tools & Debugging:** ADB Automation, GDB, Log Analysis, Logic Analyzers, Oscilloscope

### WORK EXPERIENCE

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#### PepsiCo

Valhalla, NY

*R&D Systems & AI Engineer*

*Jul 2023 – Jan 2026*

- **Software & Computer Vision Lead:** Led end-to-end software and computer vision development for IoT smart vending across France, Australia, India, and Poland — owning the full lifecycle from design and implementation through testing, deployment, and production monitoring with continuous improvement loops — scaling to 100+ units per market.
- **Patented Invention:** Invented a Dynamic Product Label device (patent filed): engineered the hardware and firmware coupling YOLO classification with an independent tracking model to project a digital grid mapping products to segmented LCDs.
- **Edge Network Routing:** Designed a resilient LAN topology utilizing an unmanaged switch to mitigate 4G connectivity dropouts; engineered a custom NIC update on the Android SoC to automatically assign subnet-aligned IPs to headless Nayax processors and UI tablets, eliminating the need for manual ADB configuration and portal provisioning while preserving the WAN port for hardwired internet failover.
- **Hardware-Software Co-Design:** Architected a depth-based stereo vision algorithm in OpenCV and C++ to infer door states, replacing error-prone RF sensors; eliminated field service calls, relaxed OEM assembly tolerances, and reduced hardware BOM cost by 20%.
- **Payment Systems Integration:** Structured a unified payment subsystem integrating global processors (Nayax, Pax, UPI); developed a fault-tolerant pre-authorization and pre-authorization and incremental/decremental settlement flow for secure, unattended vending transactions under intermittent edge connectivity.
- **IoT Telemetry Architecture:** Engineered a low-latency NAMA Vending Data Interchange (VDI) telemetry pipeline; developed custom firmware extracting data directly from the vending machine edge device to parse and transmit bidirectional hardware states over MQTT, ensuring fault-tolerant cloud synchronization and sustaining 99.2% subsystem uptime across 100+ international units.
- **Automated Testing Infrastructure:** Developed a black-box and performance testing pipeline (system, integration, load/stress) in Python and ADB, increasing test coverage by 30% across firmware, cloud, and peripheral subsystems.

#### Student Impact Innovation Lab (SkiCad)

Brooklyn, NY

*Undergraduate Researcher*

*Sep 2022 – Jun 2023*

- **Firmware & Sensor Integration:** Built ESP8266 firmware (Arduino/C++) driving an AD5933 impedance analyzer over I2C — configured and calibrated a 40-point frequency sweep against a reference resistor and computed complex impedance ( $|Z|$  from real/imaginary registers) in real time, including an interrupt-driven acquisition path.
- **Touchscreen UI & Cloud Pipeline:** Developed an ILI9341 TFT touchscreen UI (SPI) and streamed measurements over WiFi/HTTP to a Flask + Firebase backend that rendered real-time impedance/phase Bode plots for non-invasive skin-impedance characterization.

#### NYU Smart Wearable Bio-Tracker

Brooklyn, NY

Undergraduate Researcher

Jun 2022 – Aug 2022

- **Signal Processing:** Applied surface mechanomyography (sMMG) using differential accelerometer readings to capture muscle signals for real-time hand-movement prediction and increased wireless transmission rate 40× (50 Hz → 2 kHz) by migrating to UDP, enabling responsive prosthetic control.

## PROJECTS

### Smart Shades (ESP32+TB6612ZFNG + IoT )

Jan 2026

- **Firmware & Motor Control:** Developed custom firmware to automate residential shades on an ESP32; implemented H-Bridge PWM control for high-torque worm gear motors with sub-100 ms response latency.
- **IoT Integration:** Integrated the Tuya IoT ecosystem for remote telemetry and cloud-based control, including manual overrides and scheduled state transitions via a mobile interface.

### Embedded Sentry (STM32 + Mbed OS + SPI) [Link](#)

May 2023

- **RTOS & Concurrency:** Engineered a multi-threaded, event-driven biometric authentication system on an STM32 utilizing the mbed framework. Implemented concurrent task scheduling with a dedicated worker thread for asynchronous button interrupts and utilized Mutexes to prevent race conditions across shared system flags and 3D sensor data structures.
- **Hardware Integration & DSP:** Architected an interrupt-driven SPI pipeline running at 1MHz to capture raw gyroscope telemetry, utilizing EventFlags for non-blocking data readiness callbacks. Applied a complementary filter to stabilize angular velocity, and engineered a Dynamic Time Warping (DTW) algorithm with Euclidean distance calculations to perform robust, variable-speed gesture sequence matching.

### Blood Pressure Monitor (ATmega32U4+Arduino+I2C) [Link](#)

May 2022

- **Firmware Architecture:** Engineered a 5-stage bare-metal state machine on an ATmega32U4 (Adafruit Circuit Playground) to interface with a Honeywell MPRLS pressure sensor over the I2C protocol. Authored custom driver logic to verify hardware status bytes and bit-shift 24-bit raw telemetry to compute real-time physical pressure readings.
- **DSP & Signal Extraction:** Developed a continuous peak-detection algorithm utilizing a 20-sample circular buffer to compute real-time pressure derivatives. Dynamically extracted systolic and diastolic metrics, alongside heart rate, by evaluating waveform slopes and identifying maximum amplitude differentials across the cardiac cycle.

### E20 Assembler, CPU Simulator & Cache (C++) [Link](#)

Jan 2022

- **Assembler & Simulator:** Built a two-pass E20 assembler (regex parsing, label resolution, bit-field machine-code encoding) and an object-oriented instruction-set simulator implementing the full ISA with sign extension, 16-bit register/memory masking, and validated against 40+ test scenarios.
- **Cache Simulation:** Implemented a configurable two-level (L1/L2) cache simulator supporting direct-mapped, n-way set-associative, and fully-associative modes with an LRU eviction policy, emitting per-access hit/miss logs.

## EDUCATION

### New York University, Tandon School of Engineering

Brooklyn, NY

B.S. in Computer Engineering, Minor in Science & Technology Studies

GPA: 3.8

Achievements: Cum Laude, 2× Dean's List