Alibek Nakhimov

Hardware & Embedded Engineer

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Skills and Interests

Programming Languages: C, C++, Python, JavaScript, Bash

Embedded Systems & Electronics: STM32, Raspberry Pi 4/5, ESP32, NVIDIA Jetson Orin NX, hardware–software co-design, power distribution, ADC/DAC integration, I2C, SPI, UART, CAN, PWM motor control, sensor fusion, real-time data acquisition

PCB Design & Hardware Development: Altium Designer, schematic capture and PCB routing, EMC and signal integrity considerations, embedded power systems, custom controller board design, hardware debugging and validation

IoT & Automation: Node-RED, Firebase, HTTP/REST APIs, MQTT, edge computing, cloud-based control systems, remote firmware deployment and monitoring

Software & Tools: Linux, Git/GitHub, Visual Studio Code, PlatformIO, STM32CubeIDE, serial analyzers, network configuration, system-level optimization

Experience

Robotics & Embedded Systems Engineer, Alma Valley — Jan 2023 - Present

- Led the development of Smart Parking Access, an integrated IoT and AI-driven parking control system deployed for university staff parking automation.
- Designed and fabricated a custom ESP32 PCB to control gate mechanisms securely via HTTPS, featuring relay isolation, onboard power regulation, and retrofit compatibility with existing hardware.
- Built a cross-platform mobile app (Flutter) integrated with Firebase Authentication and Realtime Database, providing geolocation-based access control and multi-user management.
- Implemented a computer vision module (Python + YOLOv3) to detect vehicles, analyze motion direction, and automatically log entry/exit events with 90
- Applied full-stack IoT design principles — from PCB design and embedded firmware to cloud backend and user interfaces — resulting in a reliable and scalable smart infrastructure solution.

Embedded Systems Engineer, Jaqsy IT — Sept 2021 – Dec 2023

- Designed and developed a commercial IoT payment and control module enabling laundry machines to operate only after verified customer payment via Kaspi Bank mobile app, deployed across multiple laundromats in Kazakhstan.
- Engineered a custom PCB with ESP8266 (ESP-12F) as the core controller, featuring three optocouplers for 230 V line isolation, and integrated AMS1117-3.3 V regulation for stable low-voltage operation.
- Created the firmware architecture in C++ (Arduino framework), implementing a state machine for payment verification, HTTP-based backend polling, and secure activation control logic.
- Supervised the hardware manufacturing process, including schematic design, PCB layout, CNC fabrication, and assembly validation.

Projects

Autonomous Warehouse Mobile Robot Integration Using TurtleBot3 and OPC U
(Publication)

- Collaborated on developing a LIDAR-based navigation and grid-positioning algorithm for the TurtleBot3 Waffle Pi to enable autonomous warehouse operation. Integrated a 3D-printed lifting mechanism and OPC UA connectivity with Wiren Board 7 and Honeywell Experion PKS for seamless industrial communication.

- Tools Used: Python, ROS1 Noetic, Wiren Board, Honeywell Experion PSK, Fusion360

Qt–STM32 Ethernet Control System

- Developed a full-stack embedded system enabling a Qt5-based GUI on Raspberry Pi 5 to control a bare-metal STM32F103 microcontroller over Ethernet via CH9121 bridge.
- Implemented a custom TCP protocol for real-time relay control, with STM32 firmware written in pure C using direct register access (no HAL or CMSIS).
- Tools Used: C, C++, Qt5, STM32F103, CH9121, Raspberry Pi 5, CubeIDE, Fusion 360

Naiza Boxer – Commercial Arcade Strength Tester Machine

- Developed a full-scale arcade boxing machine integrating impact sensing, multi-channel payment (coin, bill, QR), and synchronized LED/audio feedback.
- Designed custom EMI-resistant control and display PCBs and implemented modular C++ firmware for ESP8266 with interrupt-based event handling.
- Tools Used: C++, ESP8266, Altium Designer, DFPlayer Mini, WS2812B, Fusion 360

Smart Laundry Payment Module – IoT Payment Controller

- Created a production-ready ESP8266-based control board enabling washing machines after verified mobile payment via Kaspi Bank app.
- Implemented hardware isolation with PC817 optocouplers and developed secure HTTP-based firmware for backend payment validation.
- Tools Used: C++, ESP8266, Altium Designer, Fusion 360

Smart Parking Access – Automated Gate Control System

- Designed an IoT-powered parking barrier system with ESP32 custom PCB with relay drivers, Firebase integration, and AI-based vehicle recognition.
- Tools Used: C++, Python, ESP32, Altium Designer, YOLOv3, Qt, Flutter, Firebase

Smart Media Distribution System for Digital Signage

- Implemented a cloud-connected system managing and updating multimedia content across 18 Raspberry Pi-based TV units.
- Automated content synchronization via Firebase triggers and Node-RED backend with local playback resilience.
- Tools Used: Python, Firebase, Raspberry Pi, Node-RED, Qt

Activities and Achievements

KazEnergy Winner: Developed a VTOL Tricopter system for autonomous medical supply delivery in remote and hard-to-reach areas.

University Representative at Robotics Competitions: Evaluated projects and determined full scholarship recipients as an official university representative.

Education

Kazakh-British Technical University, BS in Engineering and Technology — Sept 2020 – May 2024

- **Coursework:** Foundations of Electrical Engineering, Theory of Linear and Non-linear Control Systems, Internet of Things and Embedded Systems, Digital electronics systems design, PLC Programming, Automation Components and Devices, Robotics in Manufacturing

Portfolio

Feel free to check my specific Portfolio entry for more details!
Portfolio: https://alibeknakhimov.github.io/portfolio.github.io