

Muhammad Ayaz Akhtar

Embedded Systems Engineer

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Summary

Embedded systems engineer with nearly 4 years building firmware and Linux systems on STM32, ESP32, and Xilinx Zynq/Versal. Strong in bare-metal MCU firmware, sensor integration, HMI/display interfaces, serial protocols (UART/SPI/I2C), plus Linux driver and FPGA work, hardware bring-up, and end-to-end integration.

Technical Skills

- **Languages:** C (advanced), C++, Python (scripting, automation)
- **Microcontrollers / Firmware:** STM32, ESP32, bare-metal firmware, state-machine architectures, inter-MCU comms
- **Protocols & Interfaces:** UART, SPI, I2C, PCIe, Ethernet (1G / 10G SFP+)
- **Sensors & HMI:** ADC sensor interfacing, BME280, 9DOF IMU; Nextion HMI, Linux GUI applications, web UI
- **Embedded Linux:** Kernel character drivers, device tree, U-Boot, PetaLinux, Yocto, Buildroot, OpenWrt
- **FPGA / SoC:** Zynq-7000, Zynq UltraScale+, Versal; Vivado, Vitis, AXI DMA/MCDMA (SG, MM2S/S2MM)
- **Debug & Tools:** dmesg, JTAG, kernel debugging, Git; hardware-software co-design

Experience

Embedded Linux Developer

EmbedINN Pvt. Ltd

Oct 2022 – Present

Islamabad, Pakistan

- Ported the Analog Devices IIO Oscilloscope flow from a ZedBoard PetaLinux build to a custom ZynqBC board, validating real-time waveform capture over a custom link.
- Built a Versal PetaLinux platform with a custom kernel driver, generated boot files, and a GUI hardware-control application.
- Developed a Linux character driver for Xilinx AXI DMA (Scatter-Gather) enabling high-throughput PS-PL data streaming.
- Enabled PCIe on Zynq UltraScale+ and stabilized a 10G SFP+ Ethernet link for reliable high-bandwidth host transfer.
- Designed PetaLinux BSPs and device trees for custom hardware; performed kernel debugging, driver validation, and system bring-up.

Embedded Hardware / Firmware Developer

EmbedINN Pvt. Ltd

Sep 2021 – Oct 2022

Islamabad, Pakistan

- Developed bare-metal firmware on STM32 and Zynq (Eclipse Z7) using state-machine-based architectures.
- Implemented UART and SPI sensor integration and inter-MCU communication (UART-UART, SPI-SPI) for reliable data exchange.
- Integrated a Nextion display over UART to deliver a real-time HMI / user interface.
- Streamed 256K ADC samples from Zynq to ESP32 over UART with SD-card logging for offline analysis.
- Built bare-metal firmware and Vivado FPGA designs for sensors (BME280, 9DOF IMU) over SPI.

Selected Projects

- **Linux on Versal** — Custom kernel driver + GUI hardware-control app on Versal PetaLinux.
- **Custom OpenWrt Board** — End-to-end firmware: U-Boot, Linux drivers, C services, custom web UI.
- **ANTSDR E200 SDR Firmware** — Adapted Buildroot UHD firmware for a client ADRV9364 board.

Education

BS in Electrical / Electronics Engineering

International Islamic University, Islamabad

2016 – 2020