Ravi Prakash
Role: Firmware Engineer (Embedded Systems) **Email:** ravisw82@yahoo.com
Exp: 8 yrs (Relevant), 13 Yrs (Total) **Present Location:** Ahmedabad, Gujarat, India

Preferred Locations: Pune, Delhi/NCR, Hyderabad
Purpose: Looking for a job closely related to embedded firmware development,

I. Company Type: Preferably in a small-mid sized - Embedded/Semiconductor Product Company
II. Role: Embedded Firmware Development or Embedded Application Firmware Support
III. Opportunities: Porting/upgrading firmware or maintenance of existing product f/w, if:

- Porting firmware from older MCU to ARM Cortex Mx based MCU
- Upgrading/adopting new SDK or new version for f/w development environment
- Adapt to changes in board design &/or interfaced components
- Adapt to changes in firmware architecture/data flow
- Implementing firmware for variants from the existing code base

Involved in the following firmware development projects:

- **Data Logger (Wind Turbine)** (Renesas ARM CM4 (with new SDK (SSP)), Porting from old solar variant (developed with older SDK (FSP) version), Layered Architecture (bsp/low-level drivers → application), Data Structures, RTOS (ThreadX: Threads, Events, Semaphores, Message Queues, Callbacks), HTTP Web Server (TCP Server, HTML/JavaScript), FTP Client (TCP Client), Multi Processor System with Analog, Digital, Serial Sensor Cards interfaced with main card communicating over SPI with UART (RS-232, RS-485), Timers, NVM (eeprom & flash partition), File System, SD Card, Ethernet, Wifi, SPI, RTC, GPIO Interfaces) – 0.6 Years (2023 – 2024)
- **IoT Enabled Smart Water Purifier** (ESP32, WiFi (AP+STA) based Device Provisioning, HTTP Rest APIs (for new device registration & certificate gathering/validation), AWS IoT (Sensor Data Update (MQTT - Publish & Subscribe), IoT Jobs for OTA), Flash partition to save configuration, Ported from Arduino to ESP32, RTOS (FreeRTOS: Threads, Events, Message Queues, Semaphores, Callback)) – 1 Year (2022 - 2023)
- **Flame Sensors** (Digital, Single & Dual Channel MWIR, Flame Data acquisition (from Korea Fire Institute) in different weather conditions to configure flame sensor calibration bench tool, in-house flame sensor testing & tuning flame sensor algorithm parameters accordingly for least false triggers with range limitations, STM32-F3 (ARM CM4), RTOS (Keil RTX), UART, I2C Interface with Sensor ASIC, DAC to see reconstructed signal output, Flash to save sensor module settings) – 3 years. (2017 - 2020)
- **Home Automation Processor** (LPC ARM CM3, RTOS (Keil RTX: Tasks, Mailbox (Message Queue), Events, Semaphore, Mutex), Layered Architecture (CMSIS → bsp/low-level drivers → Application), Data Structures, Ported from LPC ARM7, UART (RS-232, RS-485), I2C, SPI, Timers (GP, PWM, IR Burst Capture), RTC, TCP (Server & Client), UDP (Client), SMTP, Ethernet, WiFi Modules, Web Server, FRAM, EEPROM, GSM (SIM300, AT Command based), GPIO) – 2 years. (2014 – 2016)
- **Lighting Automation Processor** (LPC ARM CM3, RTOS (Keil RTX), Layered Architecture (CMSIS → bsp/low-level drivers → Application), UART (RS-232, RS-485), I2C, SPI, Timers (GP & PWM), RTC, FRAM, EEPROM, Ethernet, GPIO) – 1 Year (2013 – 2014)
- **Embedded Applications Support** (MCU & FPGA/CPLD prototyping kits) – 1.5 years. (2004 – 2005): UART, SPI, I2C, Switches. Leds, Segment Display, PROM, RTC, DC & Stepper Motor (LVDC).

Education: B.E - Electronics Engg. (1999 - 2003), PG Diploma - VLSI & Embedded (2003-2004)

Skill Summary

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Development & debugging of Firmware of embedded systems with microcontrollers based on 32 Bit ARM Cortex M0/3/4, ARM7, Arduino, ESP8266/ESP32 (Node MCU) & 8051 with Embedded C.

• Can interpret requirements into firmware code using dev/eval boards & lab tools.
• Familiar with flow charts, schematics, diagrams, manuals of MCU/processors, board peripherals, 3rd party devices & API/protocols/data structures/examples to collect info. to develop/customize firmware/device drivers.
• Understands hardware-software Interface & firmware abstraction layers (CMSIS/HAL/BSP, Low-Level Drivers, RTOS APIs, High-Level Drivers, Applications).
• Develop/customize/debug common device drivers for on/off-chip peripherals, integration of f/w modules & layers with/out RTOS.
• Familiar with RTOS (Multithreading): tasks/threads & their synchronization/operation sequencing, critical section, IPC/ITC (message queue, events), priorities of tasks & interrupts (h/w & s/w).
• Embedded C (basics, data structures & pointers)
• Systematic debugging skills (understanding problem behavior, re-creation, observation, tracing & solving) using logic analyzer, scope, peripheral simulator, terminal, sniffers, debugger & debugging techniques as per problems/issues.
• Familiar with tools used in Agile (collaborative development, change management, code integration, bug tracking, version control, task tracking).
• Very basic understanding of BLE Stack & worked with nRF52 for a very brief duration.
• Basic know-how of LabView (to create data monitoring screens, basic test automation/test bench (to test device communication & data transfers, device control over standard bus protocols))
• Basic familiarity with Makefile, and customization of scripts (python, shell, bash, javascript/html).

Peripherals: GPIO, SCI (UART, I2C, SSP/SPI), PWM, Timers, ADC, DAC, PGA, DMA, CAN, Flash, FRAM, E²PROM, NOR, WDT, RTC, SDI,...etc
RTOS: AWS FreeRTOS, Azure RTOS/ThreadX & ARM Keil RTX.
Protocol Stacks: SPI, I2C, UART, Ethernet, Modbus, TCP, UDP, HTTP, DHCP, SMTP, FTP, MQTT Cloud, BLE.
SDK: ESP-IDF, AWS IoT, MDK-ARM, nRF52, Renesas SSP/FSP
Framework Modules: File Systems, SD Card Interface
ToolChains: VS Code (with Platform IO & ESP-IDF extensions), Keil uVision, Segger ES, Renesas e2 Studio, ST CubeMx, Eclipse, Espressif, Arduino, GCC. (VS Code is my preferred IDE even for resolving merge conflicts)
Embedded F/W-H/W Tools: Arduino boards, Debuggers (Ulink/STLink), Development/Eval Boards, ST CubeMX, Analog/Digital Discovery (DSO), Digilents' EExplorer, NI LabVIEW, Logic Analyzers, Terminals, Packet Sniffers (like Wireshark),...etc.
Agile Tools: Git (CLI/GUI based), Jira, BitBucket/Gitlab, Github, Confluence, Tortoise Git.
Workspace Env: Windows & Ubuntu.

Experience Summary (Only Relevant, non-relevant jobs not mentioned)

Volansys (An ACL Digital Company),
Location: Ahmedabad, Gujarat, India
Firmware Engineer (Embedded Systems)
Job Tenure: Nov 2022 - Present (1 year 5 months)
Industry of Employer: IT/ITES Services (IoT Product Development Services)
Industry of Clients: 1. Renewable Energy (Solar & Wind) 2. Consumer Electronics

Project 1: Implementation of a Smart IoT Product F/W (Ported from Arduino to ESP-IDF-based firmware)
Product: IoT Enabled Smart Water Purifier

Work:
1. Understanding old firmware (leveraging knowledge from two old product firmware code bases).
2. Porting ESP8266 (NodeMCU, Arduino-based) product firmware to ESP32 (ESP-IDF SDK-based).

Functional Changes:
* Replacement of mobile app provisioning method from BLE to WIFI (AP+STA mode), by working with Android & iOS app developers for co-debug sessions & troubleshooting bugs.
* HTTP-based Rest API Calls to AWS MQTT Cloud for device registration & to get key & device certificate and validate rootCA certificate stored in flash.
* MQTT for regular sensor data updates (in JSON format). (The older variant on Arduino used Rest APIs for regular sensor data updates which cost a lot as AWS is expensive after a limit & may not be suitable for small products for retail customers)
* AWS IoT Jobs (MQTT) based OTA (to update device firmware Over The Air).

Tools:
MicroController: Xtensa ESP32
IDE/Toolchain: VS Code, Espressif
Testing Tools: Postman, AWS MQTT Console & Serial Terminal.
SDK: AWS IoT & ESP-IDF SDK.
Libraries: AWS MQTT library.
Build Environment: VS Code in Ubuntu mounted on VM (on Windows)

Project 2: Wind Turbine Data Logger (Present): Multi-Processor Sensor Data Acquisition Cards (for Analog & Digital, Serial Sensor (over Modbus-485 & Modbus-TCP, RS-232 (P2P), SDI-12 (P2P))), Web Server (for sensor configuration & status monitoring), FTP, HTTP, TCP, Ethernet, DHCP, SDMMC, Wifi, File System. (by leveraging knowledge from solar variant product f/w)

Tools: Renesas E2 Studio, j-link debugger, serial terminal, FTP server (Wing FTP/FileZilla).
RTOS: Azure RTOS (ThreadX).
MCU: Renesas Synergy (ARM Cortex M4)
Build Environment: Windows

Language: Embedded C
Project Tracking & Version Control: Jira, Git & Gitlab.

Trueyes Inc.
Firmware Engineer (Embedded Systems – Flame Sensor)
Job Tenure: February 2017 – January 2020 (3 Years)
Location: Seoul, South Korea.
Domain: Embedded Systems (Device Drivers & Firmware).
Industry: Fire Safety (Flame Detectors) & Wireless Transmitters (ESP8266 NodeMCU based).

Role: Firmware Development for MWIR Flame Sensors in Embedded C on ARM Cortex-M MCU targets.

- Understanding Product Specifications, End Customers, and Environmental challenges that may alter sensor performance/outputs
- Understanding documents, examples, use cases (from sensor asic vendor) & code base related to product & development resources.
- Understanding algorithms for sensor signal processing from SME & sensor application from application engineer of sensor chip vendor & trial with examples/application notes. Test algorithm with real sensor interfacing.
- Implementation of firmware modules/blocks & unit testing on the development board.
- Firmware integration, debugging & testing against specs
- Firmware migration from development board to custom product PCBA.
- Implementation of product concept & features, flow, command libraries, protocols & libraries, sensor API (function library to access sensor chip registers over I2C bus), and serial/IP interfaces.
- Test/Calibration: DAC to output processed digital sampled signal data acquired over I2C from sensor ASIC as to monitor continuous average data on DSO, calibration (flame sensor calibration bench) & test of flame sensors with real flames in govt. fire facility (in Korea Fire Institute).

Products involve Sensor chip configuration (sampling rate, internal circuit parameters such as gain, trans-conductance, lpf & hpf settings tuned for optimum data gathering & reduced noise), Data acquisition (analog or digital multi-frame data) & generic signal processing (implementation of algorithms sensor data processing (mainly to reduce noise, output signal offset due to temperature variations, trade-offs between response time & false triggers) & decision making). However, it is not using DSP filters & techniques.

Products worked on:
1. **Flame Sensors:**
a) **Single Channel (Flame 4.48 um) - IR1 (already released).** (non-OS based)
b) **Dual Channel (Flame (4.48 um) & Reference (3.9 um)) - IR2** (under final testing, samples are available for evaluation). (OS-based)
-> ASIC type (analog & digital section with i2c interface, multi-frame protocol, internal circuit parameters (gain, transconductance, sampling rate,..etc).
-> Signal processing algorithm to synchronize the data acquisition cycle, signal analysis (cross-correlation of data samples from 2 channels) & two pass decision-making criteria.
-> Human rejection is s/w based (doesn't have a physical channel, to reduce the product cost & size), it is a trade-off between false trigger & response time.

2. **Sensor IoT:** Wifi AP to receive sensor data from station device, connection & TCP socket handling, protocol implementation, send sensor data to user device, led updates & push button for config, auto-connect feature.
-> Using ESP8266 (Node MCU based).
-> Develop & implement data format to ensure reliable data transactions between all endpoints.

MCU: STM 32-bit ARM Cortex M4, Arduino.
Language: Embedded C.
RTOS: Keil RTX
Tools: Keil uV5, ARM Compiler 5, ST-Link, ST CubeMx, Digilent EExplorer, NI DAQmx, Logic Analyzers, DSO (Digital Oscilloscope), Simplicity Studio, Source Insight, LabVIEW, Prog. Power Supply,...etc
Build Environment: Windows

Raylogic Control Systems Pvt. Ltd., Mumbai
R&D Engineer - Embedded Firmware Development
Job Tenure: October 2013 - October 2016 (3 years),
Location: Mumbai, India
Domain: Embedded Systems (Device Drivers & Firmware).
Industry: Consumer Electronics (Lighting & Home Automation Processors).

Role: Firmware Development in Embedded C on ARM Cortex M MCU targets.

1. Understanding System/Module Specs, studying associated Reference Documents/ Manuals, Board Schematics, Processor/Peripherals Manuals, Code Examples...etc to filter out the necessary information to write device drivers.
2. Writing/Customizing existing driver codes, interrupt handlers & firmware modules, Simulation, and Debugging.
3. Development & Integration of various firmware abstraction layers, involving writing OS tasks, task scheduling, inter-task communication, memory management, data structures, interrupt & task priorities, interrupt handlers, writing networking callbacks (TCP & UDP sockets, SMTP server, HTTP server...)...etc.
4. Porting firmware to different processors &/or boards, bare metal to OS-based (and vice-versa).
5. Product testing as a user at all levels of firmware from drivers to product features in a networked environment connected with various types of equipment that this product is going to control.

Bus Peripherals: UART, I2C, SPI, RTC, Timers, WDT, EMC, DMA, Flash/EEPROM.
Board Peripherals: LAN, CapSense, Port Expander, NOR, FRAM, EEPROM, IR Remote, LCD (Char./mini O-LED/G-LCD), Relays, Wifi Module.
Libraries/Stacks: MDK-ARM, RL-ARM (Networking Stacks - Ethernet, TCP/UDP/DHCP/ HTTP/SMTP/DNS...etc).
RTOS: Keil RTX.
MCU Targets: ARM Cortex M.
Tools: Keil, Terminal, Logic Analyzer, Network Analyzer, JTAG Debugger(Ulink), TCP/UDP Emulators, MAC/IP Scanners, Multimeter.
Build Environment: Windows

Coders & Developers
Embedded Engineer (Intern) - Device Drivers
Job Tenure: November 2012 - September 2013 (11 months).
Location: Thane, Maharashtra, India
Domain: Embedded Systems (Device Drivers & Firmware).

Role: Embedded - Device Driver Development: 8051 (PIC/Philips) & ARM7 (NXP).
Bus Interfaces: RS 232/485, UART, I2C, SPI, CAN.

1. Device Driver Development for following peripherals for 8051 & ARM7 microcontrollers in Embedded C & 8051 Assembly Language.
2. Drivers for peripherals like ADC, DAC, Port Expander, RTC, and E2PROM.
3. UART Applications: Wireless with RF/GSM/GPS Modules, Serial Terminals,
4. ADC/DAC Applications: Analog Signal Acquisition & Digital Data Processing, Ex: for Channel inputs from sensors/analog outputs.
5. Motor Controllers for (DC, Servo, Stepper - low voltage motors) – Timer/PWM based.

6. GPIO Applications: LEDs, Seven Segments, Char LCD, Motor Controllers, Switches, Matrix Keypad,...etc.

Tools: Keil uVision 4, MPLAB, EDK, Flash Magic, Serial Terminal, Multimeter, FunctionGenerator, Oscilloscope.
Build Environment: Windows

---------- Jobs in between are not relevant to my present job search ----------

ni logic (ni2designs)
Applications Engineer (FPGA dev. boards)
June 2004 - January 2006 (1 year 8 months), Pune
Domain: Embedded Systems/VLSI.
Industry: Electronics Design Automation (Educational Sector)

Role: Maintenance of FAE demo kits, firmware development using Verilog (for FPGAs/CPLDs), embedded C/Assembly Language (for 8051 MCUs), coding & debugging.

1. Device driver development for LEDs, Seven Segment, ADC/DAC, UART, E2PROM, RTC, Keypad, Character LCD in embedded C & assembly language on 8051 MCU targets.
2. Basic Gate level digital logic designs (through boolean equations, truth tables, k-map, SOP/POS, state reduction) & logic design coding in Verilog(Gate level & Structural).
3. Verilog HDL coding, validation using logic simulation (Verilog stimulus) & test routines in C, in microcontrollers, functional testing using CRO, FG, and Multimeter.
4. My job was to develop device drivers for microcontrollers & digital designs for FPGAs sitting together on the company's development/proto boards. These kits were developed for FAEs, ready for demo.

EDA Tools: ModelSim, Xilinx ISE, XST & Altera - Quartus II/III, Keil, MPLAB, Flash Magic.
FPGAs & MCUs: MCU (8-bit & 16-bit PIC), FPGA (Xilinx - Spartan II/III, Altera Max Series).
Development Boards: Matrix, USDP, EDK (Embedded Development Kit), ADK(Altera Development Kits).

Education

PICT School Of Technology & Management, Pune (Autonomous)
PG Diploma, VLSI Design Technology · (2003 - 2004)
Kavi Kulguru Institute of Technology and Science, Ramtek (RTMNU, Formerly Nagpur University)
Bachelor of Engineering - BE, Electronics Engineering · (1999 - 2003)
Kendriya Vidyalaya (C.B.S.E Board)
12 years of schooling. (1987 – 1999)

Miscellaneous

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