Vamsi Kiran Mekala

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Linkdein | Github

Summary/Profile

Embedded Systems Engineer with strong expertise in C/C++, Linux kernel/user space programming, and low-level driver development. Proven track record in designing communication protocol stacks (CAN) and optimizing hardware software interfaces. Passionate about networking, algorithms, and bare-metal programming, seeking to leverage skills in register-level coding and system architecture.

EDUCATION

Master's in engineering & Electronics and Computer Engineering | Dublin City University

Bachelor's in science & Electronics and Communication Engineering | National Institute of Technology Kurukshetra

RELEVANT EXPERIENCE

Embedded Firmware Engineer **07/23 - 12/24**
Novus Hi-Tech Robotics Systemz | Gurugram,Haryana,India

1. **Protocol Stack Development:** Architected and implemented a custom **CAN protocol stack** from scratch in C/C++ for the Gen X product line. Engineered the Data Link Layer logic, handling frame transmission, error detection, and arbitration.
2. **Low-Level Implementation:** Engineered an ISO 11898-compliant 11-bit identifier system, optimizing bit-wise operations to reduce memory usage by **[e.g., 15%]** on resource-constrained hardware.
3. **Driver State Monitoring (DSM):** Enhanced the DSM firmware, reducing latency in sensor data processing. Created detailed timing diagrams to map signal propagation, ensuring synchronization between the sensor array and the main ECU.
4. **Benchmarking and Optimization:** Conducted comparative analysis of competitor DSM products, reverse-engineering feature sets to drive internal roadmap decisions.

KEY PROJECTS

1. **Real-Time Multi-Tasking Telemetry System (FreeRTOS & Linux)** | [Github Link]
   - **Kernel & Task Management:** Architected a preemptive multi-tasking system using the **FreeRTOS** kernel on a Raspberry Pi (BCM2711), managing three concurrent tasks with fixed-priority scheduling to ensure deterministic execution.

- **Concurrency & Synchronization:** Integrated **Mutex Semaphores** to arbitrate shared access to the I2C bus, successfully preventing race conditions between high-frequency **ADXL345 accelerometer** sampling (100ms) and **DS3231 RTC** time-tracking.
- **Asynchronous Event Handling (ISR):** Developed a high-priority hardware listener using **libgpiod** to monitor GPIO interrupts; engineered a "Signal-to-Task" synchronization pattern via **Binary Semaphores** to trigger an immediate, graceful system shutdown upon button detection.
- **Robust Resource Management:** Optimized system reliability by implementing a centralized cleanup routine that performs task deletion, memory deallocation, and safe closure of Linux file descriptors (I2C/GPIO) before process termination.
- **Deterministic Timing:** Leveraged **vTaskGetTickCoun**t and **vTaskDelayUntil** to eliminate cumulative drift, achieving precise timing for sensor data acquisition and real-time terminal visualization.

2. **Bare-Metal Linux Driver Development (Raspberry Pi)** | [Github Link]
   - Constructed a functional device drivers for the BCM2835 SoC without reliance on standard libraries, interacting directly with **Physical Memory** via memory mapping (/dev/mem).
   - **GPIO Driver:** Wrote C++ code to manipulate **hardware registers** directly (Select, Set, Clear registers), achieving sub-microsecond pin toggling speeds.
   - **UART Implementation:** Implemented a Universal Asynchronous Receiver-Transmitter driver by configuring baud rate divisors and FIFO control registers, enabling serial communication from the bare metal environment.
   - **I2C:** Managed Master Control logic, clock stretching, and acknowledgement handling to interface with external sensors.
   - **SPI:** Configured Serial Peripheral Interface registers to handle full-duplex communication, managing chip select (CS) logic and clock polarity/phase (CPOL/CPHA) for high-speed peripheral synchronization.

3. **Smart Asset Tracker & Vibration Logger | [Github Link]**
   - **IoT Cloud Integration:** Engineered a secure telemetry pipeline using **MQTT (Paho C)** to sync high-G impact data from a Raspberry Pi edge device to **HiveMQ Cloud**, implementing **SSL/TLS encryption** via port 8883 for secure data transmission.
   - **Custom Qt Dashboard:** Developed a real-time visualization dashboard in **C++ (Qt 6.4.2)**, architecting a multi-threaded system to parse asynchronous **JSON** payloads and visualize 3-axis vibration data on a live-scrolling **Qt Charts** interface.
   - **Systems Engineering & Optimization:** Compiled the **Qt MQTT** module from source to ensure binary compatibility with the Linux development environment, manually configuring transport layers and signal-slot mechanisms for low-latency UI updates.
   - **Asynchronous Event Handling:** Architected an interrupt-driven system using **libgpiod** to monitor GPIO triggers from an **ADXL345** accelerometer, eliminating CPU polling overhead and ensuring immediate capture of mechanical shock events.
   - **Hardware Interface & Register Logic:** Developed custom I2C drivers to manage the ADXL345 and DS3231 RTC, implementing **Two's Complement** sign-extension for raw data processing and managing Oscillator Stop Flags (OSF) for temporal integrity.
   - **Edge Reliability & Logging:** Built a robust logging routine with atomic write operations to non-volatile storage (CSV) and integrated state-machine logic to prevent log-flooding during sustained oscillations.

TECHNICAL SKILLS

1. **Languages:** C, C++, C++ (Qt 6),Python, Rust, Embedded C, Assembly, SQL, JavaScript.
2. **Embedded Systems:** Linux Kernel Modules, Bare-metal Programming, Device Drivers (Char/Block), RTOS, Bootloaders.
3. **Protocols & Interfaces:** I2C, SPI, UART, GPIO, CAN / CAN-FD, TCP/IP, UDP.
4. **Communication Protocols:** MQTT & HiveMQ Cloud, SSL/TLS Security, JSON Parsing
5. **Hardware:** Raspberry Pi (BCM2835/2711), ARM Cortex-M, FPGA basics,Proteus, QEMU, Simulink
6. **Tools & Web:** Git, CMake, GDB, Docker,Cross Compilation, OpenOCD, JTAG/SWD**,** Oscilloscope,Logic Analyzer, Django, HTML/CSS (for embedded dashboards).

LANGUAGES

1. **Telugu:** Native Speaker
2. **Hindi:** Full Professional Proficiency
3. **English:** Full Professional Proficiency (Duolingo Score: 135)

HOBBIES AND INTERESTS

1. Technical Blogging & Website Development
2. Cricket & Badminton
3. Video Games.
4. Reading Sci-Fi Novels & Manga.