Job Title: C Programming Engineer (Embedded Systems / Firmware)

Location: [City, State]

Department: [e.g., Engineering, R&D, Software Development]

Reports To: [e.g., Engineering Manager, Lead Software Engineer]

Company Overview:

"Join our innovative team at ABC Inc, a leader in developing cutting-edge SoC solutions for large-scale embedded products. We are seeking a talented C Programming Engineer to contribute to the core firmware development of our next-generation devices, impacting industries from automotive to IoT."

**Job Summary:**

We are seeking a highly skilled and passionate C Programming Engineer to join our dynamic software development team. In this role, you will be instrumental in designing, developing, testing, and maintaining robust, efficient, and reliable low-level software and firmware for our complex embedded products. The ideal candidate will possess deep expertise in C programming, a strong understanding of embedded systems principles, and a commitment to producing high-quality, performant code in resource-constrained environments.

**Key Responsibilities:**

* **Design & Development:**
  + Develop, implement, and optimize C code for microcontrollers (e.g., ARM Cortex-M/A, RISC-V), microprocessors, and DSPs.
  + Design and implement firmware modules, device drivers (e.g., SPI, I2C, UART, CAN, USB, Ethernet), and Hardware Abstraction Layers (HAL).
  + Contribute to the architectural design of embedded software solutions, ensuring scalability, modularity, and maintainability.
  + Develop and integrate bootloaders, firmware update mechanisms (FOTA/OTA), and power management routines.
* **Low-Level & System Programming:**
  + Work extensively with pointers, memory management (static, stack, heap), bit manipulation, and data structures to ensure efficient resource utilization.
  + Implement and debug multi-threaded applications, understanding concepts like mutexes, semaphores, inter-process communication (IPC), and race conditions.
  + Develop and optimize interrupt service routines (ISRs) and understand interrupt latency and prioritization.
  + Configure and interact directly with hardware registers and peripherals.
* **Real-Time Operating Systems (RTOS):**
  + Develop and integrate software components on various RTOS platforms (e.g., FreeRTOS, VxWorks, QNX, RT-Thread), understanding task scheduling, context switching, and real-time constraints.
  + Debug RTOS-related issues such as deadlocks, priority inversions, and resource contention.
* **Testing & Debugging:**
  + Perform comprehensive unit, integration, and system testing of C code on target hardware.
  + Utilize hardware debugging tools such as JTAG/SWD debuggers, oscilloscopes, logic analyzers, and protocol analyzers.
  + Employ advanced C debugging techniques (e.g., memory leak detection, stack analysis, profiling).
  + Conduct thorough code reviews to ensure adherence to coding standards, best practices, and functional requirements.
* **Collaboration & Documentation:**
  + Collaborate closely with hardware engineers, QA teams, and other software developers throughout the product lifecycle.
  + Create and maintain detailed technical documentation, including design specifications, API documentation, and test plans.
  + Participate in agile development methodologies, including sprint planning, daily stand-ups, and retrospectives.

**Required Technical Skills & Expertise in C Programming:**

* **Core C Language Mastery:**
  + Exceptional proficiency in C (C99, C11 standards) with a deep understanding of its syntax, semantics, and standard libraries.
  + Expertise in **pointer arithmetic and dereferencing**, including complex pointer types and function pointers.
  + Solid understanding of **memory management** (malloc, calloc, realloc, free), stack vs. heap allocation, and preventing memory leaks/buffer overflows.
  + Advanced knowledge of **data structures** (arrays, linked lists, trees, hash tables, queues, stacks) and their efficient implementation in C.
  + Proficiency in **bit manipulation** operations (AND, OR, XOR, shifts) for low-level hardware control and optimized data packing.
  + Strong grasp of **preprocessor directives** (#define, #ifdef, #ifndef, #include) and their impact on compilation.
  + Experience with volatile **keyword** for memory-mapped registers and multi-threaded contexts.
  + Understanding of const **correctness** and its application in robust C code.
* **Embedded Specific C Skills:**
  + Direct interaction with **hardware registers** and understanding of memory-mapped I/O.
  + Experience with **cross-compilation** toolchains (e.g., GCC for ARM, Keil, IAR).
  + Knowledge of **linker scripts** and memory layout on embedded targets.
  + Familiarity with **startup code** and boot process of microcontrollers.
* **Debugging & Tools:**
  + Proficiency with **GDB** or similar debuggers for embedded systems (e.g., Lauterbach TRACE32, IAR C-SPY).
  + Experience with version control systems, particularly **Git**.
  + Familiarity with build automation tools like **Make** or **CMake**.

**Qualifications:**

* Bachelor's or Master's degree in Computer Science, Computer Engineering, Electronics Engineering, or a related field.
* 10+ years of professional experience in C programming, specifically in embedded systems or low-level software development.
* Proven ability to work independently and as part of a collaborative team.
* Excellent problem-solving, analytical, and communication skills.

**Preferred Qualifications (Nice to Have):**

* Experience with specific microcontroller families (e.g., STM32, ESP32, NXP, Microchip, Renesas).
* Knowledge of other programming languages like C++, Python, or Assembly.
* Familiarity with communication protocols such as Ethernet (TCP/IP stack), BLE, Zigbee.
* Experience with Hardware-in-the-Loop (HIL) or Software-in-the-Loop (SIL) testing.
* Understanding of industry standards (e.g., MISRA C, ISO 26262, IEC 61508) for safety-critical systems.

**What We Offer:**

* [List benefits like competitive salary, health insurance, paid time off, professional development opportunities, flexible work arrangements, a collaborative work environment, etc.]
* Opportunity to work on challenging and impactful projects with cutting-edge technology.
* A culture that fosters innovation, learning, and growth.

**ABC Inc is an Equal Opportunity Employer.**