KHUSHBOO SINGH

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SUMMARY

An enthusiastic and experienced embedded software engineer with 2.5+ years of experience and a bachelor's degree in electronics and communication engineering. Skilled in C programming, RTOS, Embedded Linux, manual testing, and Agile methodologies. Hands-on experience with Renesas, STM32, and ESP32 microcontrollers. Proven ability to collaborate with cross-functional teams to deliver high-quality embedded software solutions.

EDUCATION

B.Tech. in EC Engineering, L.d college of Engineering (Cpi : 8.6) 2019 - 2023

TECHNICAL SKILLS

- **Programming Languages**: embedded C, C++, DS, Basic Python
- **Operating Systems & RTOS** : Linux OS, FREERTOS, Shell scripting.
- **Protocols**: UART, SPI, I2C, MODBUS(RTU),RS-485,TCP,UDP,HTTP/HTTPS,WebSocket,
- **Microcontrollers:** ESP32, Renesas RA6M2 ,Stm32
- **Wireless & RF :** Wi-Fi, Bluetooth (BLE),GSM,RFID
- **Version Control**: Git, SVN
- **Inter-Process Communication (IPC)**: Mutexes, Semaphores, Task Scheduling, Synchronization, Queues, Shared Memory
- **Development Tools:** e² studio, STM32CubeIDE, JIRA, Confluence
- **Debugging & Testing Tools:** Mbpoll, Mbslave, Logic Analyzer, USB to RS485 Converter

PROFESSIONAL EXPERIENCE

Engineer - Software Development Feb 2025 – Present
Bacancy Systems Pvt. Ltd. *Ahmedabad, Gujarat*

- Worked on an ESP32-based EV AC Charger, implementing load balancing across R/Y/B phases for efficient current distribution.
- Designed and enhance a **PLB commissioning page** for configuring up to **15 Modbus RTU slave devices**, assigning phase and current per slave for reliable master-slave communication.
- Improved an **offline transaction system** for an EV AC Charger using **ESP32**, enabling real-time logging and transmission of energy parameters (voltage, current, duration, mode, and EV state) to a **Nouvton chip** via **Modbus RTU**. Implemented logic to receive ON/OFF commands from a master by reading Modbus register values, enabling automated control of the EV power supply.

Engineer - Software Development Feb 2023 – Sep 2024
Matrix Comsec Pvt Ltd. *Vadodara, Gujarat*

- Developed and maintained software for **Access Control and Time-Attendance Devices**, including products like Argo-Face, Argo, Vega, Panellite, and various readers.
- Executed UART-based communication between processor and **PTZ camera controller** for reliable data transfer.
- Integrated a **bootloader** with separate memory allocation for smooth bootloader-application interaction.
- Collaborated in testing and debugging, actively identifying and resolving defects to improve product performance.
- Optimizing embedded code for stable and secure device performance.

KEY PROJECTS

AC charger Project

- Designed and Created a **commissioning interface** to configure slave devices with meter details (register address, baud rate, MAC, etc.).
- Executed backend logic to **detect active slaves and PLB readiness** using Modbus RTU by reading slave register responses.
- Developed a dynamic algorithm to **assign R/Y/B phase** to each slave based on available capacity and current demand.
- Enabled **real-time load balancing** by distributing current equally among active slaves connected to each phase and also redistribution of current to slaves.
- Integrated a **mobile application** with the AC charger using **WebSocket** communication with JSON and msgId-based messaging.
- Implemented remote control features (ON/OFF and charging mode selection) and enabled real-time monitoring of all charging parameters through the app.
- Added charger history storage, allowing **users** to view up to 30 past charging logs.
- Developed energy-consumption history storage for 7-day, 30-day, and 1-year periods, and enabled data sharing with the connected mobile app for graphical (bar chart) display.
- Implemented custom **Modbus** framing over I^2C to communicate with the Nuvoton controller, transmitting charging parameters (voltage, current, power, mode, duration, fault status) and handling slave commands (e.g., start/stop charging).
- Resolved multiple issues and delivered stable **firmware** releases as per client requirements.
- Conducted runtime **debugging** of both hardware and software components and **resolved** encountered issues.
- Developed flowcharts and complete end-to-end documentation, implemented and validated **test cases** for development, collaborated with clients and cross-functional hardware teams, and helped ensure a stable and reliable firmware release.

Access Control and Time-Attendance Project

- Enforced a feature to **reset configuration parameters** when switching between door types (e.g., smart card, face recognition) to prevent invalid settings.
- Applied conditional **tempuser activation logic** on Argo/Argo-Face devices, bypassing tempuser flow when both keypad and face recognition are used, and triggering enrollment only when no PIN is entered on Reader Pin-Pad.
- Created an **automated script** to validate configuration values against predefined ranges, reducing manual errors and streamlining testing.
- Enhanced Basic Access Control by resolving issues related to multicredential verification, ensuring that Advanced Access Control features are selectively disabled, and fixing credential denial errors when Smart Identification and Additional Security settings are enabled.

PTZ Camera Project

- Configured **Renesas RA6M2 microcontroller** to control motor movements for PTZ (Pan 360° / Tilt 90°) based on UART commands from the main processor.
- Applied a **custom communication protocol** with headers, length, sequence numbers, msgId, and data, transmitted over UART with message queue handling.
- Developed and integrated a **bootloader** with smooth transition logic for firmware upgrades and application jumps.
- Configured key peripherals like **UART and Watchdog Timers** using **e² studio**, utilizing stack configuration tabs under a **single-thread** environment.
- Implemented **magic number-based version control** to detect firmware updates and manage conditional boot or upgrade flow.