Parth Sanepara

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Embedded Firmware Engineer,
PG-Diploma in Embedded System Design
B.E (Power Electronics)

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PROFILE SUMMARY –

- Rich 5 year's domain expertise in embedded system programming for 16/32 bit and ARM core devices. Good experience in wired and wireless Communication Technologies like Wi-Fi, BLE, Ethernet.
- Good exposure to work with different IOT Devices, Gateways, Motion Detection, and other sensor applications used in smart devices.
- Involved in porting and merging of codes on various platforms, integration testing of Ethernet Stack, Lightweight TCP/IP (lwIP) Stack, Simple Service Discovery Protocol (SSDP) Network Protocol and other communication protocol based over 802.11 /b/g.
- Expert in C / Embedded C programming languages including multi-threading, multiprocessing using RTOS.
- Experienced in wireless communication technologies like BLE / Wi-Fi, Cellular and implementing different Low Power Modes for Smart IOT devices.
- Experienced in unit testing, Debugging, Analyzing and Bug fixing for the issue reported from field.
- Good understanding of Firmware architecture designing, coding rules, algorithm analysis, compilation, and device driver development
- Experienced with multiple wireless CPU's like NRF52, NRF51, nRF91, ESP32, STM32 ST-BlueNRG BLE Modules.
- Experience in 802.11 /b/g, TCP/IP Protocol, and other wireless communication Protocols
- Capable of analyzing the Embedded Software Requirement, Design, Development, Prototyping, and testing.
- Capable of understanding schematic designs and testing the Embedded HW using Oscilloscope / Multi-meters.

SKILL MATRIX :-

RTOS	Zephyr RTOS and Free RTOS
Programming Languages	Embedded C, Data Structures
Open CPU platforms	NRF52, NRF51, NRF91, ESP32, STM32, ST-BlueNRG BLE Modules.

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Compilers and tools	Visual Studio, Eclipse base IDE, Seeger Embedded Studio and MATLAB
Peripherals	SPI, I2C, RS-232/485, ADC, PWM
Software Version Control	GitHub, Bitbucket, Tortoise SVN, SourceTree
Embedded Tools	Wireshark, SonarQube, DMX Workshop

PROJECT HANDLED -

Wireless Smart Lights

Project is to design and develop the BLE + Wi-Fi communication-based driver for 45W LED Lights which can be easily operated via Android and iOS based Mobile App. Device use Generic Profile services to communicate the information with mobile App and BLE OTA service to provide remote firmware upgrades (OTA Upgrades). Device is also having Internal RTC to operate the LED Lights based on preconfigured Schedules and profiles.

Roles & responsibilities:

- Firmware design and development for the Smart Lights with BLE enablement
- BLE SDK configuration and compilation for the wireless MCU
- Device discovery, commissioning, and registration process
- Communication protocol development using BLE Generic Profiles
- Board Bring-Up, testing and interface with Android Mobile App
- Packet testing using BLE Scanner app via notification services.
- Sleep/Wakeup Mode Implemented Virtual timers RTC and Wakeup Interrupt.
- CONSOL Debugging, functional testing, and Bug fixing.
- Unit Testing, performance testing and Technical Document preparation.

IoT Enabled Smart Lights

Project is to design and develop Smart LED Driver to control, monitor, and manage Commercial Lighting Products over the Cloud. The Lights are connected to the cloud through ethernet Communications via the facility's network. WIZnet TCP/IP Stack integration with Free-RTOS and AWS IoT Core Stack integration done to facilitate AWS Connectivity. MQTT Protocol is enabled for communication between AWS IoT Core and device; Just In-time Provisioning library is used for device Installation; OTA Jobs used for FOTA; and Device management library integrated to achieve globally enabled IoT Smart Light features.

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Roles & responsibilities:

- Firmware design and development for Smart Lights control over Cloud.
- AWS IoT Core Library Integration and Testing (Integrate DHCP, MbedTLS, MQTT Lib, JSON Lib).
- Fleet Provisioning Library Integration for Device Installation and provisioning.
- AWS OTA Jobs used for Device FOTA
- Device management

HVAC Zone/ Central Controller for smart building

The scope of this project was to design the BLE Communication-based Smart Central AC controller system and the zone controller sensing modules. The Zone Controller Sensor was Developed for zone-wise control of the central HVAC System by collecting thermostat data of different Zones. In this system one Central Zone Controller can be connected with up-to 16 Zone Sensors to collect Realtime data. All Zonal sensors communicate with the Wall Touch Screen Controller and send Humidity, Temperature data and control parameters for setting particular zone AC modes and Temperatures. For both the Zonal and Central controllers, Nordic Low Power MCU with NRF Connect SDK (Zephyr RTOS base SDK) was used for BLE Connectivity.

Roles & responsibilities:

- Firmware Design and Development for Production Test Automation
- Communication Protocol development using BLE client and BLE central multi-client send/receive data management.
- IPC communication for controlling other IC as well IPC Firmware Update.
- Interface the HVAC Controller with the BLE module via MODBUS RTU
- Support OTA updates from Central BLE to multiple BLE Client.
- EINK Display Screens development and integration with real-time events.
- Si Lab Touch IC driver development and controlling
- Console base Command creation for each unit functionality and modules.
- Power Optimization to achieve Battery life up to 5 years with 3xAAA Battery.
- Scheduling multiple zone control points with single Central zone controller
- BLE Range test for Data communication as well as OTA Time analysis.

Location Tracking Wearable Device

Firmware Design and development for the location tracking devices used for the position tracking of user. Used low power Bluetooth Low Energy (BLE) system-on-chip module to communicate with Mobile App. Developed Motion MEMS Sensor, Motion algorithm, TWI for Sensor communication, ADC for battery percentage calculations and other peripherals programming's like driver development for the NOR Flash.

Roles & responsibilities:

- Firmware design and Development for the NRF52 wireless Controller
- BLE Communication enablement using NRF5 SDK

- Custom and Standard Profile development or use for data transfer with Application.
- Enabling WAN cellular Communication using an open CPU architecture
- OTA DFU develop for Firmware Update
- Product testing and Validation support
- Support for fixing production issues and problems

BLE + Cellular (NB-IOT enabled) GNSS Global Tracking device.

This Project is based on NB-IoT enabled global location tracing (GNSS) device development for wearable market.

Roles & responsibilities:

- Design and Develop firmware for the NRF52 Device and nRF91 using NRF Connect SDK
- Firmware development for GNSS, NB-IoT, and BLE application
- Power Management IC integration nPM1300 to achieve low power performance.
- OTA Support for both MCU.

Smart Cricket Bat

This project is based on BLE + Motion Sensor based Battery operated device collect motion data and Realtime 6 Axis Motion data send to Application via Custom BLE Service. Data sending Rate 200 Hz achieve by BLE Stack Fine and tuning. Power Optimized for 6 Hour Playtime with 800 Mah Battery.

Roles & responsibilities:

- Design and Develop firmware for the NRF52 Device using NRF5 SDK
- OTA DFU Development and Standard Device Information BLE Service develop
- Support in DFU and firmware in end user production release
- Provide post release firmware upgradation (OTA) for fixing different field related issues

Datalogger for Fitness Devices

Firmware Design and Wearable platform developed for sports activity detection like a trampoline, cycling, smart helmet, Gym activity detection, etc. in this platform One master device collect real-time motion data from other motion sensor nodes Up to 3 devices. All these devices are connected to the Master device, which collects the data and stores it its internal flash and simultaneously send the information to the android platform.

In this project I contribute and support Display Driver Development, DFU OTA Development and support in production. AFE Heart Rate sensor and algorithm Integration. MEMS Motion, Temperature, Pressure and GPS Integration and Testing. Also contributed to develop the algorithm for Motion Detection for trampoline, smart helmet for cycling.

Roles & responsibilities:

- Design and Develop firmware for the NRF52 Device using NRF5 SDK
- MEMS Motion, Pressure, GPS, AFE (Heart Rate) Sensor driver development and Integration.
- OTA DFU Development and Standard Device Information BLE Service develop.

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- FTMS Service communication profile develops for Fitness data transfer over BLE Application.
- Power analysis and Support in component selection and hardware development.
- Firmware Testing in SonarQube tool.
- Support in DFU and firmware in end user production release
- Provide post release firmware upgradation (OTA) for fixing different field related issues.

Toy Gun Bullet Speed Measurement Device

The device is used to measure the speed of bullet fired from a play gun which is necessary for the manufacturer to adhere with the country specific standards and strictly measure the speed of the fired bullet in testing. The device is developed in Arduino Platform and uses IR Sensors for speed measurement. The device is also capable of displaying the measured speed on 7 segment display.

- Platform: Arduino Platform
- Language: Embedded C
- Full Product design and firmware develop and test for production by own.
- Support in Hardware and enclosure development for POC.
- Product Testing and support in production and End users.

Work Experiences –

- **Embedded Software Engineer**
  Thingularity Consulting Pvt. Ltd. Bangalore — May 2022 – Present
- **Embedded Software Engineer**
  GT Silicon Pvt. Ltd. Bangalore — Nov 2019 – May 2022

Education Qualifications –

1. PG Diploma in Embedded Systems Design in 2019
2. Bachelor of Engineering in Power Electronics in 2018

Cirtification –

1. Certification in **Software architecture for the Internet** of Things from Coursera.
2. Certification in **Internet of things** from Standford University Online University.
3. Certification in **nRF Connect SDK Fundamentals** from Nordic Semiconductor. Credential
4. Certification in **nRF Connect SDK Intermediate** from Nordic Semiconductor. Credential
5. Certification in **Bluetooth Low Energy Fundamentals** from Nordic Semiconductor. Credential
6. Certification in **Wi-Fi Fundamentals** from Nordic Semiconductor. Credential
7. Certification in **Cellular IoT Fundamentals** from Nordic Semiconductor. Credential