Gadgeon's Expertize & Embedded Case studies - An Overview

GadgEon
Engineering Smartness

About Gadgeon

- **Started Operation in Aug 2011 from Kochi, India with 150+ years of overall product engineering experience**

- **Gadgeon Smart System**
  - ✓ **An Embedded System Company with special focus on outsourced product development in the area of Internet of Things.**
  - ✓ **Gadgeon has 120 member team – 20 member Hardware + 100 member firmware/software teams.**
  - ✓ **Started US subsidiary in Mar 2014.**

- **Vision**
  - ✓ **Most Reliable Embedded Systems Services company for productizing Ideas**

About Gadgeon

➢ Gadgeon specializes in:

- ✓ **Product realization from Specifications to Prototypes**
- ✓ **Hardware design/ Firmware/ Embedded Application development based on processor families from ARM and TI's MSP430, Stellaris, Piccolo and PIC**
- ✓ **Wireless firmware development for low power devices using WiFi, BLE, ZigBee and Simpliciti protocols**
- ✓ **Embedded OS - Linux, Android, VxWorks, freeRTOS, CoOS, etc.**
- ✓ **Embedded Application Development using C/C++**
- ✓ **Outsourced Testing Services**

➢ Types of Services:

- ✓ **Proof of Concept development, Hands free R&D collaboration, Manual/ Automated Testing, Test automation with productivity focus, Program management based on Agile process.**

Domain Focus

➢ Medical Device

- ✓ **Working as software partner for a Healthcare fabless chip company in California for 2 years – ARM Cortex M0; WiFi MAC; API, SDK & Eclipse based IDE development for their SoC, CoOS**
- ✓ **Working as software partner with an independent product design consultant in Boston, MA – ARM Cortex M4, TI MSP430, BLE, Simpliciti, freeRTOS**

➢ Industrial Automation

- ✓ **Redesigning the management software platform for an industrial automation company in California – Beaglebone black, Linux, Object Oriented Design, Modbus & BACNet protocols, mySQL database**

➢ Internet of Things

- ✓ **Sensors evaluation and selection, embedded device design & prototype, embedded firmware/ application development, connectivity using various Wireless technologies, data storage at cloud server with corresponding application along with Android/ IOS App**

Technology Offerings

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- **Hardware Offerings**
  - ✓ ***High speed digital design - Schematics, Layout***
  - ✓ ***Working with manufacturers for prototypes and production***
- **Linux, Networking & Telecom**
  - ✓ ***Linux Kernel hacking, Device driver development & development of Systems level applications.***
  - ✓ ***Wireless connectivity to Access points or Gateways using BT/BLE, ZigBee, WiFi, Z-wave, etc.***
  - ✓ ***SONET/SDH, OTN, NMS, SIP, VOIP, L2/L3 protocols.***
  - ✓ ***Expertize in realizing Network Systems based on Open source Software platforms like***
  - ✓ ***OpenWRT, Elastix, Asterisk, LuCI etc.***
- **Microcontroller Offerings**
  - ✓ ***Expertize on various micro controllers based systems using TI-MSP430, TI Piccolo, ARM Cortex M0, M3, M4, PIC, Atmel etc.***
  - ✓ ***Expertise in firmware development on RTOS like freeRTOS, Sys/bios, CoOS, etc. on these systems.***
  - ✓ ***WiFi, BLE, NFC, ZigBee, Z-Wave, Simpliciti, GSM/GPRS/3G***
- **Application development**
  - ✓ ***Cloud based application development: Google, Amazon, Azure, Thingsworx etc.***
  - ✓ ***Mobile App development- iOS/Android***
- **Testing Offerings**
  - ✓ ***Continuous Integration Test framework using Robot framework***
  - ✓ ***Automation of test cases using scripting languages like Perl, Python, Tcl/Tk etc.***

Gadgeon's Microcontroller Expertize & Embedded Case studies

Gadgeon's Microcontroller Expertize

- **Gadgeon has extensive expertize on various micro controllers based systems using TI-MSP430, TI Piccolo, ARM Cortex M0, M3, M4, PIC, Atmel etc. We have expertise in firmware development on RTOS like freeRTOS, Sys/bios, CoOS, etc. on these systems.**

- **Software features/ activities done on various Microcontrollers:**
  - ✓ **Ported boot loaders and RTOS like freeRTOS, Sys/bios, CoOS, etc. on these microcontrollers**
  - ✓ **Driver for UART, ADC, DAC, 2G/3G Module, RTC, Flash & LED driver using I2C interface**
  - ✓ **Realized many applications on these micro controllers using interrupt driver design**
  - ✓ **Designed and Implemented I2S to Ethernet bridging on Freescale Kinetis K60**
  - ✓ **Architecture, Design and Implementation of ZigBee nodes with MSP430 and Xbee**
  - ✓ **Wireless data transfer using TI CC1101 radio and Simpliciti protocol stack**
  - ✓ **Used RS232 interface and AT commands for interfacing and integrating**
    - a. **WiFi, 2G/ 3G, ZigBee and BLE modules**

Gadgeon's Microcontroller Expertize

- ✓ **Firmware architecture including component selection, hardware architecture and optimal firmware design**
- ✓ **Power optimization for battery powered devices like smart watches**
- ✓ **GUI driven firmware for embedded devices**
- ✓ **Implementation of data processing algorithms on embedded microcontrollers**
- ✓ **Porting MATLAB algorithm to resource constrained MCU like MSP430**
- ✓ **Throughput optimization for wireless communication (BLE, WiFi)**
- ✓ **Implementation of custom protocol for communication between devices**
- ✓ **Test firmware development for validating Hardware designs**
- ✓ **Interfacing with IOS and Android apps**
- ✓ **Interfacing with FPGA and CPLDs**

Microcontrollers, Peripherals

- **MCU'S:**

  - ✓ **TI MSP430**
  - ✓ **TI PICCOLO**
  - ✓ **TI STELLARIS**
  - ✓ **ST STM32F0**
  - ✓ **ST STM32F2**
  - ✓ **ST STM32 F4**
  - ✓ **Freescale Kinetis K60**
  - ✓ **Freescale Kinetis K70**
  - ✓ **ATMEL ATMEGA328**
  - ✓ **Microchip PIC16F**
  - ✓ **Microchip PIC24F**
  - ✓ **Microchip PIC32F**
  - ✓ **NORDIC NRF51822**
  - ✓ **Rabbitcore RCM3000**
  - ✓ **NXP LPC cortex M0**
  - ✓ **TI CC2538 ZigBee SoC**

- **Peripherals:**

  - ✓ **UART**
  - ✓ **SPI**
  - ✓ **I2C**
  - ✓ **ADC**
  - ✓ **I2S**
  - ✓ **DAC**
  - ✓ **SDIO**
  - ✓ **USB**
  - ✓ **Flash**

RTOS, Toolchains, BT/BLE

- **OS:**
  - ✓ **TI sys/bios**
  - ✓ **FreeRTOS**
  - ✓ **Freescale MQX (K60/K70)**
  - ✓ **CooCox CoOS**
- **Toolchains**
  - ✓ **TI Code Composer Studio**
  - ✓ **Freescale Code Warrior**
  - ✓ **Keil uVision**
  - ✓ **IAR embedded workbench**
  - ✓ **Wiced SDK (WiFi) for broadcom chipsets**
  - ✓ **MPLAB X for PIC**
  - ✓ **Atmel Studio**
  - ✓ **Coocox IDE**
  - ✓ **Eclipse**
  - ✓ **Dynamic C (RCM3000)**
- **BT/BLE**
  - ✓ **Nordic NRF 51822**
  - ✓ **TI CC2540**
  - ✓ **iDevices module bcm20732i**
  - ✓ **RN42/41**
  - ✓ **Laird BTM511**
  - ✓ **CSR 1012**

WiFi, GSM, Wireless

- **WiFi**
  - ✓ **Gainspan GS1101**
  - ✓ **Xpico wifi**
  - ✓ **TI CC3000**
  - ✓ **TI CC3200**
  - ✓ **Broadcom Wiced (Murata SN8205)**
- **GSM/3G/LTE**
  - ✓ **SIM900**
  - ✓ **SIM908**
  - ✓ **Telit HE910/LE910 (3G/LTE)**
  - ✓ **U-blox SARA G350**
- **Other Wireless**
  - ✓ **TI TRF7970 NFC**
  - ✓ **Xbee Zigbee**
  - ✓ **CC1101 TI Sub GHz RF @ 433MHz**
  - ✓ **Xbee Digimesh**

Drivers, Protocols

- **Drivers:**

  - ✓ **Sharp memory LCDs/OLED**
  - ✓ **SPI Flash**
  - ✓ **Accelerometers**
  - ✓ **Magnetometers**
  - ✓ **GPS**
  - ✓ **Haptic**
  - ✓ **Fuel gauge**
  - ✓ **RTC**
  - ✓ **CAN**
  - ✓ **RS485**
  - ✓ **Temperature sensor**
  - ✓ **Humidity Sensor**
  - ✓ **Light Level Sensor**
  - ✓ **Soil moisture sensor**
  - ✓ **IR**

- **Protocols:**

  - ✓ **TCP/IP**
  - ✓ **http REST**
  - ✓ **MQTT**
  - ✓ **JSON**
  - ✓ **DDS (Distributed Data Sharing)**
  - ✓ **Modbus**
  - ✓ **NTP**
  - ✓ **TI Simpliciti protocol**
  - ✓ **LLDP (PoE)**

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Micro-controller Based Embedded Case Studies

CS1: Growers water optimizer

Client profile: Startup in agricultural and commercial applications

Technology: WiFi CC3200, MQTT, Cloud application

Business Need

- Under NDA

What did Gadgeon do?

- Architecture, Design and Implementation of Embedded Firmware
- Setting up various Wi-Fi modes on CC3200
- Reading raw data from sensors.
- Sending and receiving data using MQTT protocol.
- Periodic updation of data and device status to the cloud server.
- Commands to device to initiate specific operations on the device from server using MQTT services
- Internal HTTP page for device configuration (cloud URL, AP mode settings etc).

CS2: Wifi enabling Consumer Appliance

Client profile: Startup in Consumer Appliances

Technology: WiFi CC3000, PIC32, REST, Cloud application, Android App

Business Need

- Under NDA

What did Gadgeon do?

- Architecture, Design and Implementation of Firmware
  - Porting of CC3000 drivers to PIC32
  - CC3000 smart configuration support
  - Periodic status updates to the cloud server regarding device status
  - Commands to device to initiate specific operations on the device from server (controlled from Android APP) using REST services
  - Field firmware upgrade demo with firmware stored in cloud server
- Android application development
  - CC3000 Smart configuration support to configure wireless network parameters
  - Control commands initiation for specific device via internet
  - Current status of device available on UI.

CS3: Consumer Device

Client profile: Consumer Equipment Manufacturer

Technology: Freescale Kinetis, Code Warrior IDE, MQX RTOS, BT, USB, LCD Display, Compass, ADC, GPIO, GPS TC6000

Business Need

- Under NDA

What did Gadgeon do?

- Architecture, Design and Implementation of Firmware
  - MQX RTOS
  - SD card via SHDC for high speed data transfer with FAT FS
  - Display driver and graphics library for menu and graph display
  - GPS location and graphical icons for lock status
  - Bluetooth using RB42 for data transfer
  - Tilt compensated compass
  - Highspeed ADC acquisition and for pressure , distance, temperature
  - USB interface for data communication
  - GPIOs for navigation buttons
  - Implementation of data processing algorithms
  - Porting to custom hardware and test firmware
- Hardware schematics review and support

CS4: Wearable Smart Watch

Client profile: A start-up with focus on Smart wearable technology

Technology: BLE on nRF51822, MSP430, IOS App, GPS. ARM Cortex M0, LCD Display, Tap on Input.

Business Need

- Not to be disclosed

What did Gadgeon do?

- Developed firmware for wearable smart watch.
- Firmware driver development for GPS and other peripheral sensors like accelerometer, magnetometer, Haptic, fuel gauge, RTC
- Watch GUI screens which responds to taps and messages from smartphone via BLE. Implemented top and side tap patterns as the inputs to the watch and response for the text messages from phone.
- Time synchronization from phone and GPS
- Design and implementation of various icons and fonts for display
- Power optimization for long term operations on coin-cell battery with automatic sleep & wakeup feature by monitoring the accelerometer & fuel gauge readings.
- BLE pairing using “Just Works”
- Implemented feature to locate phone on the watch display with arrow and distance displays with respect to the heading information from phone.
- Unique vibratory and beep patterns for incoming Notifications, alerts, text messages etc.
- iOS application development
    - Map screen which locates Watch and the phone.
    - Options to send text messages and notifications to watch.
    - Popup and alerts for specific features.
    - Implemented Heading and distance calculating algorithm.

CS5: NFC Tag Emulator with BLE

Client profile: A startup company

Technology: BLE on nRF51822, NFC TRF7970A, Android BLE App, Tag Emulation, Peer to Peer mode, Reader mode.

Business Need

- Under NDA

What did Gadgeon do?

- Architecture, Design and Implementation of Firmware
  - Porting of NFC drivers to nRF51822.
  - Receive tag information to be emulated from Android phone and store data in nRF51822 flash memory.
  - Present the data to reader in tag emulation mode when NFC detects presence of a reading device.
  - LED indication for reading operation.
- Android BLE application development
  - User interface to input the NFC tag data to be emulated.
  - Communicate the data to Firmware via BLE.

CS6: ZigBee Industrial Automation

Client profile: Home and Building Automation OEM

Technology: Zigbee, CAN, Beaglebone black, MSP430 based Zigbee Nodes,

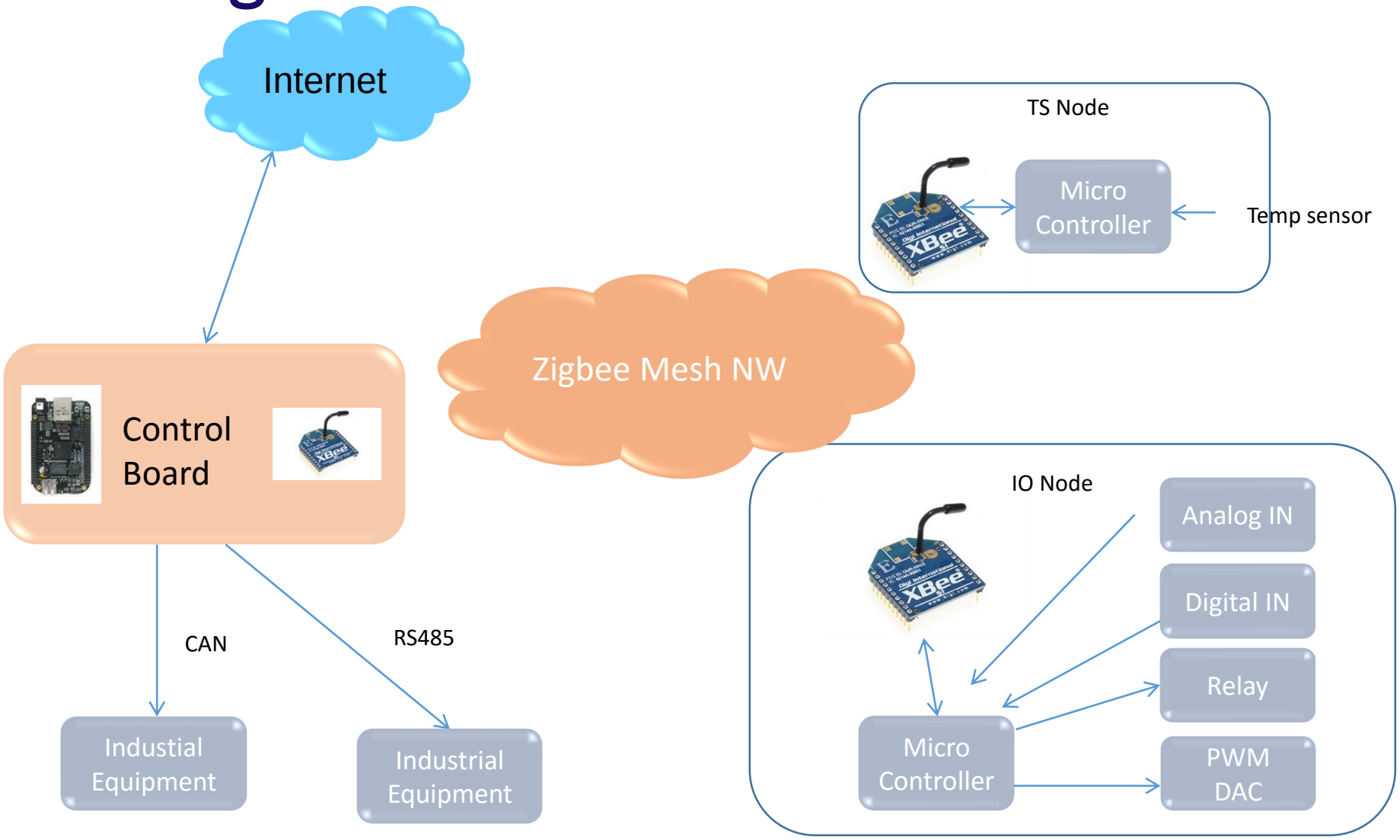
Business Need

- Not to be disclosed

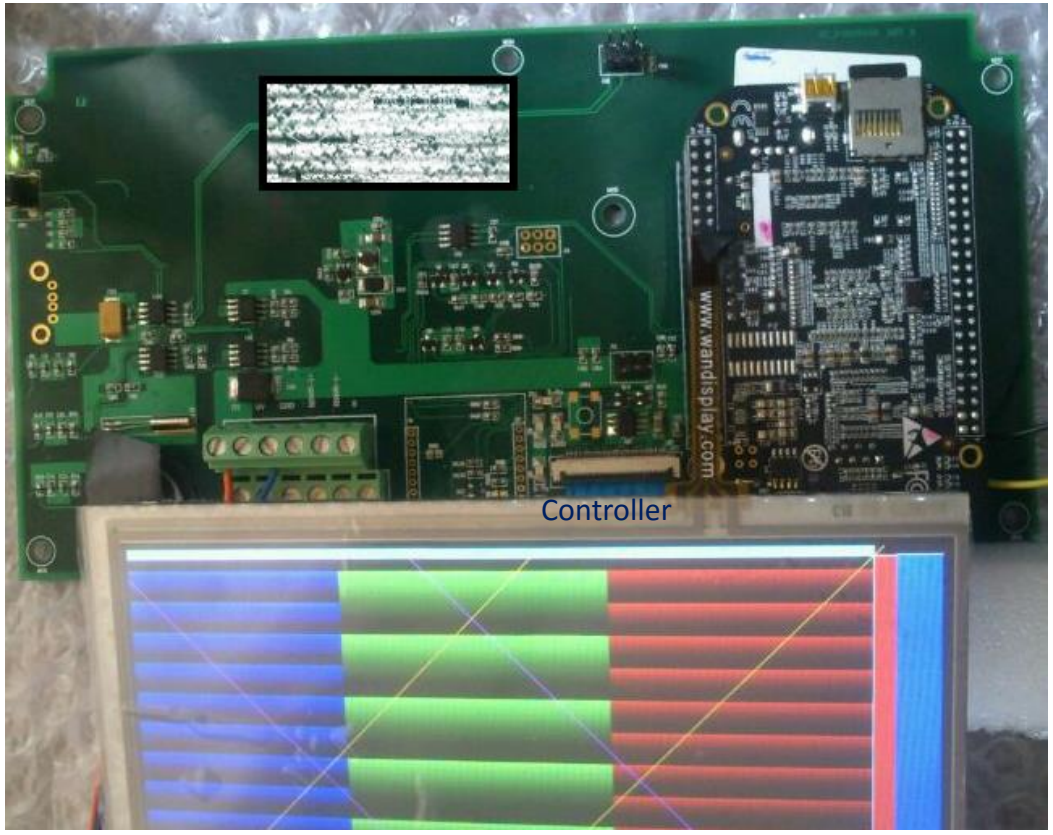
What did Gadgeon do?

- Architecture, Design and Implementation of
  - Controller HW with Beaglebone black and base board with CAN, RS485, Xbee, WiFi, 3G, Ethernet, LCD and Touch Screen.
  - Controller Board Test Software
  - Node firmware for Temperature sensor Node and IO Node
    - Implementation of custom protocol over Zigbee
    - Sending status messages to controller on power up
    - Respond to query messages from Controller according to protocol
    - Reset to factory defaults
    - Settings changed to flash memory
    - Implementing low power mode for End device (Temp Sensor Node)
    - Test RF button
    - LED emulation for RF RSSI indication
    - Force wake for End device for specific time period
    - Software debounce of push buttons
    - Decoding ADC values to temperature as per algorithm
    - Generating DAC outputs, Relay control on IO Node

System diagram

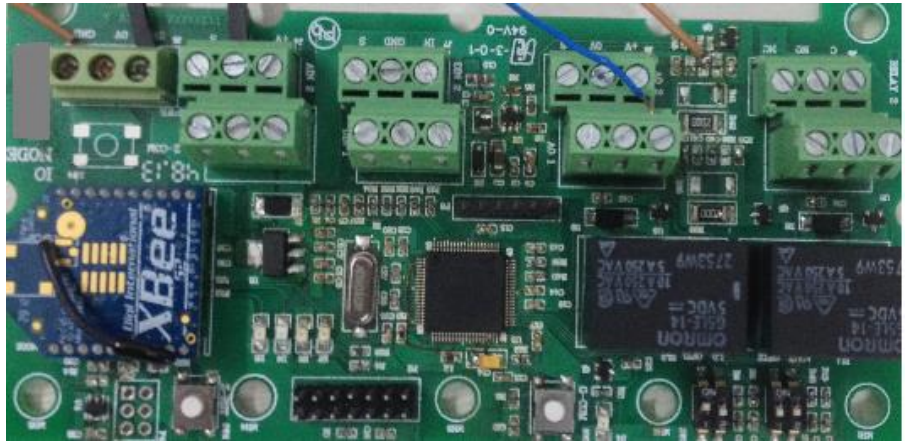


Hardware



Controller

TS Node



IO Node

CS7: BLE based Motes

Client profile: A startup company focuses on BLE based Motes

Technology: BLE, ARM Cortex M0, Nordic nRF51822 based boards, Nordic BLE emulator, and different sensors, Android 4.3

Business Need	What did Gadgeon do?
Not to be disclosed	Architecture, Design and Implementation of • Firmware driver development for different sensors for temperature, humidity, light level, soil moisture, accelerometer, etc. interfaced using I2C, Analog and Digital IOs on ARM Cortex M0. • BLE Custom profiles for Climate, Growth, Data storage etc. • BLE pairing using “Just Works” method. • Notification framework for handling different alarm conditions on Mote. • Power optimization for long term operations on coin-cell battery. • Sample Android 4.3 application to configure the Mote and get the alarm notification.

CS8:BLE Wearable Device for iOS

Client profile: A startup with focus on Bluetooth Smart wearable technology

Technology: BLE, Nordic nRF51822, ARM Cortex M0, iOS, ANCS, SSD1306 OLED Display Controller.

Business Need	What did Gadgeon do?
Under NDA	Developed firmware for a wearable Bluetooth Smart accessory for iOS devices that display messages and vibrates upon receiving notifications from Apple devices. Using ANCS(Apple Notification Center Service) to access notifications generated on iOS devices. Firmware driver development for dot matrix OLED controller using I2C. Design and implementation of various icons and fonts for display. BLE pairing using “Just Works”. Unique vibratory patterns for incoming call, text messages, emails, tweets etc. Power optimization for long term operations on coin-cell battery. Using Nordic nRF51822 evaluation board and Soft Device.

CS9: Bridge Device

Client profile: Design and Consulting Services Company for RFID and EAS

Technology: Freescale Kinetis, Code Warrior IDE, MQX RTOS, I2S, Bridge, PoE+, LLDP, Shell support, CLI

Business Need

- Under NDA

What did Gadgeon do?

- Architecture, Design and Implementation of Firmware
    - Customizing the I2S interface to transfer IP frames to another device. Customization done on MQXRTOS with generation and validation of CRC.
    - Provides bridging functionality between Ethernet and I2S interface.
    - Development of testing application on MSVC2010 to send test packets to bridge via TCP sockets and display test results.
    - Integration of LLDP support to MQX RTOS to request for PoE+ power levels from switch.
    - Shell support for command line interface.
    - DSP code download via UART and receive from PC through Ethernet.

CS10: Laser Tag Pro

Client profile: Commercial quality laser tag equipment for outdoor and indoor play

Technology: STM32 – ARM Cortex M3, IR sensors, WiFi, Bluetooth, freeRTOS,

Business Need

- Under NDA

What did Gadgeon do?

- Architecture, Design and Implementation of Firmware
  - Customized freeRTOS on the target board for running different tasks to realize the functionality.
  - Implemented a state machine representing different states of the gun.
  - Displays different menu options in the LCD display for the user.
  - Configures the keys through which the user can navigate through the options and set the options.
  - Creates data packets for gun shots and admin messages that are send via IR LEDs to other guns.
  - Creates a task for receiving gun shots from other guns.
  - Connects the gun to the WiFi access points and bluetooth devices and accepts data from PC or phones in a standard format to manage the gun.

CS11: Simpliciti based ePill

Client profile: Medical device consulting company

Technology: MSP430 (F5529), CC1101, Simpliciti, Sensors, C, Code Composer Studio

Business Need

- Not to be disclosed

What did Gadgeon do?

- Architecture, Design and Implementation of Firmware
  - State machine code
  - Acquiring sensor data using I2C, analog and digital IO
  - Data analysis and vital parameter extraction
  - Entering Low power mode when not active
  - Wireless data transfer using TI CC1101 radio and Simpliciti protocol stack
  - Buffering data to the flash memory when the ePill is out of coverage area of Access Point
  - Ability to roam among different Access Points
  - Supports configuration and status extraction from Access Point using the Simpliciti interface

CS12: Simpliciti based Access Point

Client profile: Medical device consulting company

Technology: MSP430 (F5529), CC1101, Simpliciti, Sensors, C, Code Composer Studio

Business Need

- Not to be disclosed

What did Gadgeon do?

- Architecture, Design and Implementation of Firmware
  - Receive data from the ePill, which is implanted in the cattle, using Simpliciti wireless interface.
  - Transmit the received data using RS-232 interface to the Base Station.
  - Wireless data transfer using TI CC1101 radio and Simpliciti protocol stack.
  - The design is highly scalable supports up to 500 ePills at the same time.
  - Basic status displays based on link availability, heartbeat mechanisms.

CS13: Wireless sensor network

Client profile: A start-up with focus on Industrial automation

Technology: Digimesh, Sensor, Sensor nodes, Concentrator node, Linux, MQTT

Business Need

- Not to be disclosed

What did Gadgeon do?

- Overall system architecture for the wireless sensor network
- Firmware for sensor nodes with MSP430 and Xbee Digimesh modules
- Interfacing with various sensors via ADC, GPIO, 1 wire and i2c
- Definition of communication protocol over Digi mesh for sensor data and alarms with very small payloads
- Implementation of image transfer over Digimesh with limited payload
- Implementation of software on concentrator node running Linux
- Web interface for system bring up and configuration
- Data backup to DB in case of connectivity loss
- Uploading data to server using http/MQTT
- Performance optimization of Digimesh for image transfer
- Hardware design for the sensor nodes, Board bring up, integration.

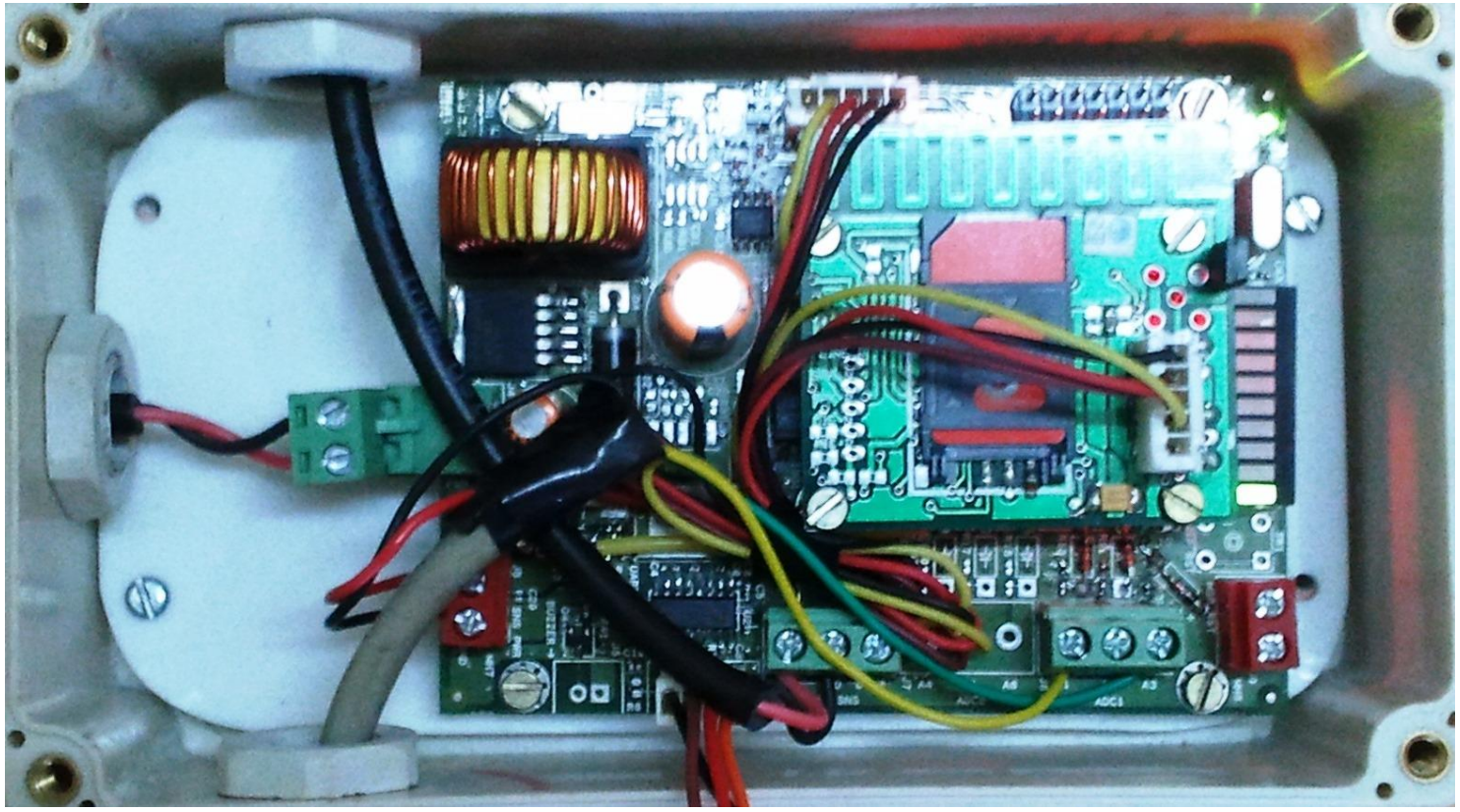
CS14: Fuel Monitoring System

Client profile: Industrial automation OEM

Technology: MSP430 (F5418), Sensors, Wireless (GSM/GPRS), freeRTOS, C, Code Composer Studio

Business Need	What did Gadgeon do?	Business Benefits
Fuel level monitoring of diesel generators in the field from a central server which can be accessed from internet	Design of MSP430 based hardware Architecture, Design and Implementation of Wireless Mote software • Porting Free RTOS on the MSP430 MCU • Driver for UART, ADC, GSM Module, RTC, Flash • Save sensor data to flash and periodic reporting to server via GPRS (SIM 900) • Automatic sync with network time using AT commands • State machine for sending data using GPRS modem using AT commands • Configurayion/Status via SMS Hardware, Software and Sensor Integration.	Schedule Refill at appropriate time Monitor usage of DG and reduce wastage of fuel Prevent theft

CS14: Fuel Monitoring System



CS15: Battery Monitoring System

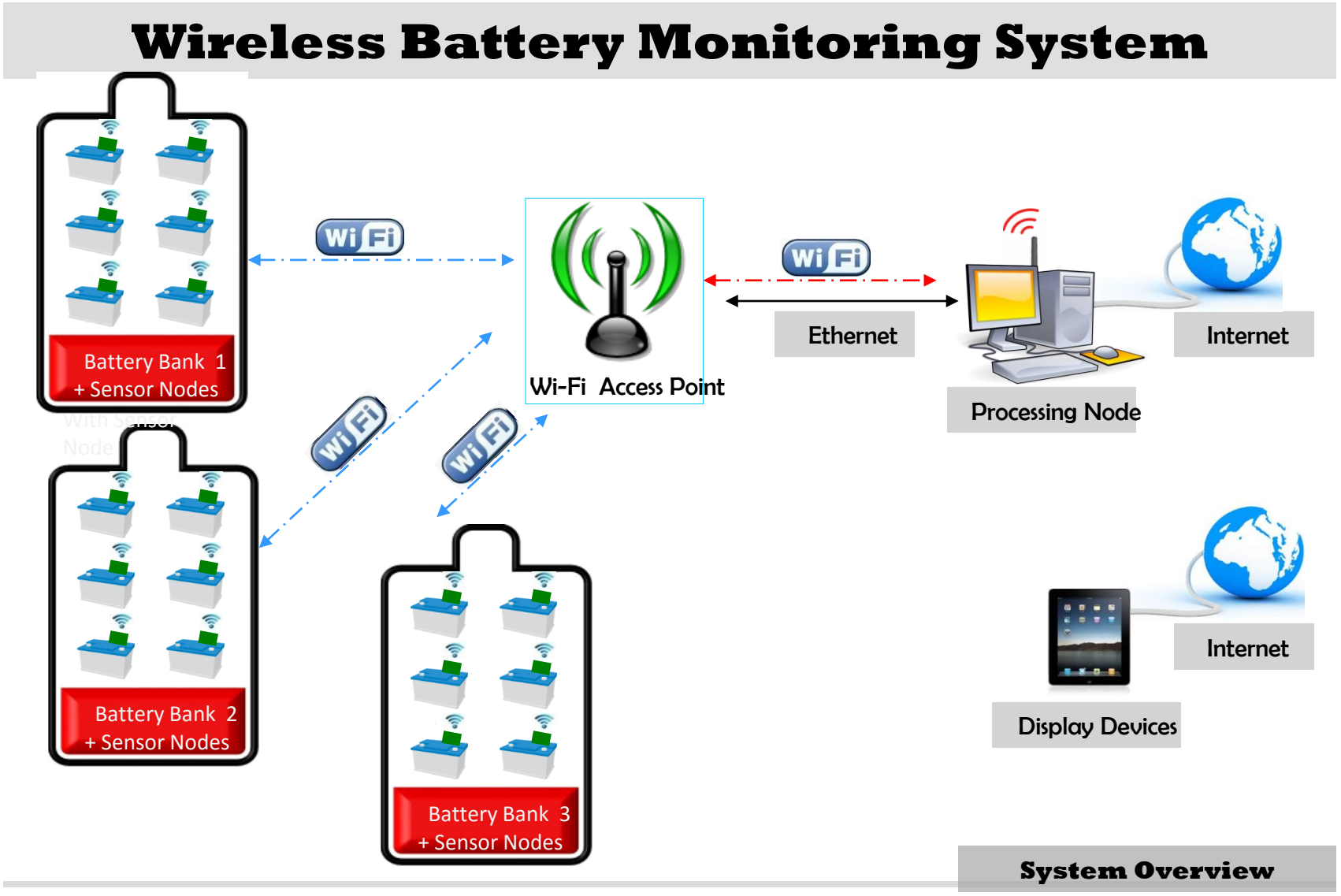
Client profile: Industrial automation OEM

Technology: Sensors, Wireless (WiFi/ GSM/GPRS), Lab View Integration and Real-time Operating system with small foot print, Language C

Business Need	What did Gadgeon do?	Business Benefits
▪ Reduce downtime of battery backup power ▪ Minimize manual inspection in hazardous battery bank pit	▪ Architecture and Design of Wireless Mote hardware ▪ Architecture, Design and Implementation of Wireless Mote software • Porting Free RTOS on the MSP430 MCU • Driver for UART, ADC (SPI), WiFi module (GS1011) and GSM/ GPRS module based on SIM900 chipset (Serial) • Node software to acquire data from sensors and communicate thru WiFi/ GPRS; Alarm Generation ▪ Hardware, Software and Sensor Integration ▪ Demo Lab view application on PC	▪ A BMS system can reduce the operational cost by 50% and prevents the breakdown considerably. ▪ No manual inspection in hazardous battery bank pit required during normal operations ▪ Early detection of problems resulting in more effective preventive maintenance

The solution framework could be extended to bring productivity improvements and enhance effectiveness in many industry processes.

CS15: Battery Monitoring System



CS16: MSP430 Medical Device

Client profile: Medical device consulting company

Technology: MSP430 (F5529), CC1101, Simpliciti, Sensors, SD card, USB, C, Code Composer Studio

Business Need	What did Gadgeon do?
Not to be disclosed	Architecture, Design and Implementation of Firmware • State machine code • Acquiring analog data via ADC • Driving GPIO according to state • Capturing data in SD card using FAT filesystem • Accessing data on SD card via USB from a PC • Format data in JSON • Entering Low power mode when not active • Playing audio using PWM • Led driver using 12C interface • Pulse generation using Compare functionality of Timer • Wireless data transfer using TI CC1101 radio and simpliciti protocol stack

CS17: FPGA Loader

Client profile: A Semiconductor startup with focus on wireless

Technology: Stellaris MCU, FPGA Passive Serial protocol, SPI Flash

Business Need	What did Gadgeon do?	Business Benefits

▪ Not to be disclosed	▪ MCU firmware
	  ▪ Receive file from PC via serial port
	  ▪ Crc validation for data chunks
	  ▪ Save file to SPI flash memory
	  ▪ Verify file sanity by checking crc
	  ▪ Load FPGA using passive serial protocol
	▪ PC application
	  ▪ Application to implement communication protocol with firmware and send files .
		▪ Not to be disclosed

CS18: Sine Wave PWM UPS

Client profile: Industrial automation OEM

Technology: Microcontroller, sys/bios, Power electronics, Pulse Width Modulation

Business Need	What did Gadgeon do?	Business Benefits
8 KVA UPS subsystem with Sine wave 0-250V AC output with regulation better than 0.2%.	Be active partner in System Architecting for the selection of appropriate microcontroller for the application. High level design of Hardware (Microcontroller board only)	This solution complements the OEM vendors ability to provide a complete solution to their customer
Inverter tracking mains frequency and phase when mains is available.	Designed and Implemented:	
Control of charger and DC-DC converter.	PWM functionality.	
Indications and alarms for the user based on operational condition.	Synchronization in phase and frequency with mains and different operating modes,	
	Dynamic load regulation using voltage/current feedback loops	
	Control of charging, Fan speed, DC-DC section and indication/alarms.	
	Inverter shutdown in error conditions.	

CS19:GreenHouse Monitoring/Control

Client profile: Corporate Farming

Technology: MSP430, Sensors, Wireless (WiFi/ GSM/GPRS), Lab View Integration and freeRTOS, Language C, Code Composer Studio

Business Need	What did Gadgeon do?	Business Benefits
▪ Ensure most appropriate climatic conditions to get better agriculture yield from unit area ▪ Minimize manual inspection and reduce cost of labour	▪ Reused more than 80% of Hardware and Software Architecture, Design and Implementation from Gadgeon's Battery Monitoring System ▪ Hardware, Software and Sensor Integration ▪ Android application for display and control	▪ Automatic and precise greenhouse climate control results in higher crop yield. ▪ Reduced labour costs ▪ Ability to monitor/control the Greenhouse climate remotely via Internet.

GreenHouse Monitoring/Control

CS20: WLAN MAC Porting

Client profile: A Semiconductor startup with focus on wireless healthcare systems

Technology: Wireless Sensors, WiFi, Language C

Business Need	What did Gadgeon do?	Business Benefits
Bringing out very low power and cost effective wireless Soc for medical application within the window of opportunity	Migrated third party WLAN MAC IP from a split architecture to a fully embedded one:Lower MAC in PCI card and higher MAC in windows to a fully embedded MAC running in the SoC. Ported from ARM7 TDMI to Cortex M0. Modified to take advantage of Hardware acceleration features. Implemented a propriety TDMA scheme. Added support for propriety dual PHY.	Parallel development of the software on an FPGA platform in parallel with HW development done by customer. Customer could focus on their key strengths in chip design area, while leaving software, system integration and other technical challenges to Gadgeon.

CS21: Bluetooth Conferencing System

Client profile: Consumer Electronics Startup

Technology: STA309A audio processor, STM32 controller, DSP TMS320C6748, Bluetooth, Octave, freeRTOS, C, Keil, Code Composer Studio, Noise cancellation DSP algorithms

Business Need

- Enable users to do conferencing even in noisy places using standard Bluetooth headsets. Mainly targeted for aged people with hearing difficulty.

What did Gadgeon do?

- Design and manufacture of hardware with following key components
  - STM32F1xx controller
  - STA309A audio processor
  - Bluetooth modules
- Architecture, Design and Implementation of Firmware for:
  - Configuring and controlling audio processor to mix audio
  - State machine for Bluetooth connection management
  - Support for firmware update over Bluetooth
  - Feature to download mixing configurations over Bluetooth
  - User interface using buttons and indications
- DSP algorithm development
  - Developed adaptive noise cancellation using LMS algorithm and able to achieve more than 12dB of noise suppression.
  - Developed Blind Signal Separation algorithm and studied its feasibility in the application.
  - Able to integrate adaptive noise cancellation algorithm in DSP eval kit to demonstrate the algorithm.

Business Benefits

- Understandable conversation in noisy places
- Portable conferencing device
- Ability to pair with off the shelf Bluetooth headsets

CS22: Cloud PDL Data Acquisition System

Client profile: A US based start-up

Technology: PIC32MZ2048ECH144, Dual Sensor Cards, Ethernet, C, MPLAB Harmony Software framework, MPLABXIDE

Business Need

- Under NDA

What did Gadgeon do?

- Optimizing the firmware on PIC32MZxx
  - Optimizing the download speed of the log files from Web Server running on PIC32
  - Compressing the log files in the SD card using LZMA compression algorithm
  - Adding Long File Name(LFN) support in File System and name the log file with user input data.
  - Optimizing the download speed by changing the TCP/IP buffer size of Harmony TCP/IP stack.

CS23: ZigBee Messaging Solution

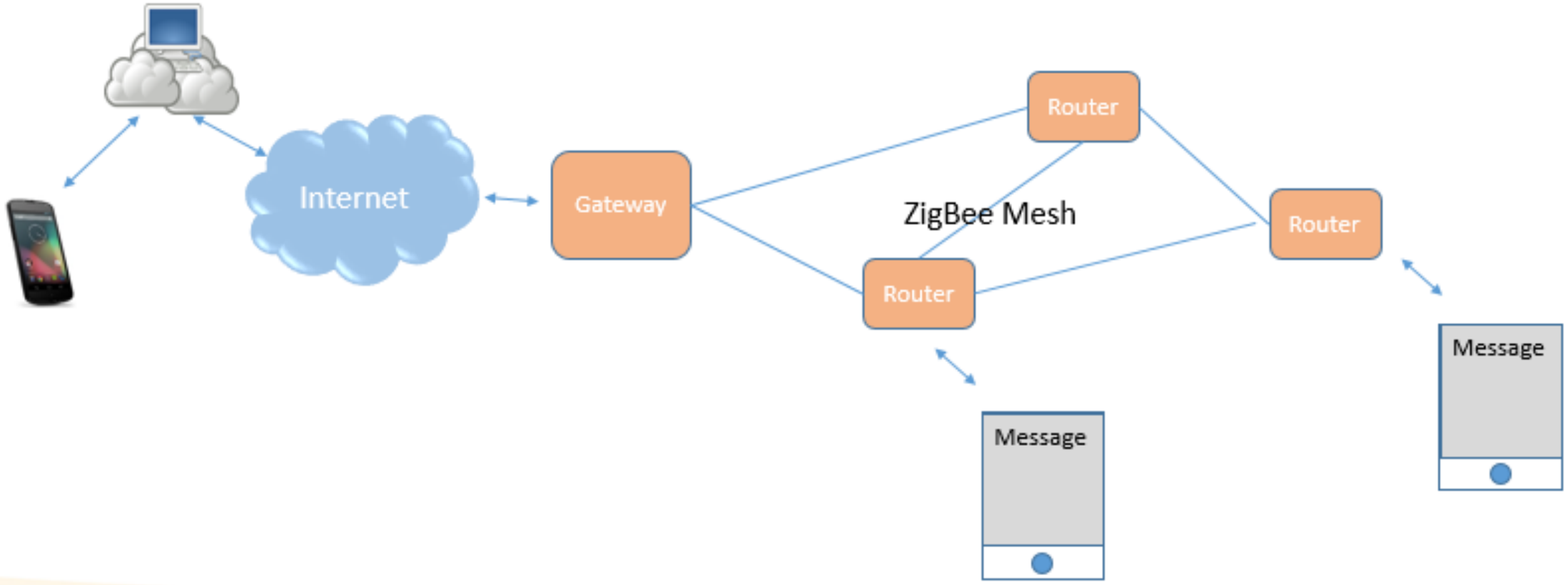
Client profile: Home and Building Automation OEM

Technology: Zigbee, CC2538, Z stack, IAR Embedded Workbench, Linux, Cloud Server, Mobile APP

Business Need	What did Gadgeon do?

▪ Not to be disclosed	▪ Architecture, Design and Implementation of Complete system including end nodes, router nodes, Linux Gateway, Server and Mobile Apps
	▪ Mote based on CC2538 with sharp memory LCD Display, Navigation buttons, LED driver, Buzzer, Audio subsystem, USB, fuel gauge, accelerometer and haptic
	  ▪ Complete Firmware for Mote, including state machine driven message display and responses
	  ▪ Location identification using IR and ZigBee
	  ▪ Power optimization for battery life
	  ▪ Download user image and configuration via ZigBee and firmware upgrade
	▪ ZigBee router nodes with LED display, buzzer and Audio subsystem
	  ▪ Acts as zigbee routing nodes
	  ▪ Display alerts via Audio and visual
	▪ Linux based Gateway node based on beaglebone black, add on LCD display, ZigBee interface using cc2538 COTS board
	  ▪ Complete software for the Gateway for transcoding between ZigBee and IP.
	  ▪ Uses MQTT for communication with cloud server.
	  ▪ Ability to broadcast, multicast or unicast based on number of recipients
	▪ Server and cloud application for configuration, and operation

System diagram



Why GadgEon?

- **Relevant Expertise**
  - ✓ 100+ years of overall Product Engineering experience
  - ✓ End to end Product Development – hardware & software
  - ✓ Expert level experience in BSP, Firmware & Device Driver development on Linux & VxWorks
  - ✓ Strong Expertize in Embedded Application development for Telecom/ Datacom and Industrial Automation sectors
  - ✓ Industry protocols
- **IP rights protection**
- **Proven processes**
  - ✓ Agile methodologies
  - ✓ Continuous Integration and Testing Framework
- **Competent Team**
- **Productivity focus**

Thank You

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