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## **Engineering Consultant**

I am an experienced product developer with over 30 years experience, primarily in the areas of medical devices and embedded system hardware and software. I have implemented many successful designs with involvement from initial concept to production prototypes.

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## **Areas of expertise**

- Conceptual / system-level design
- Generation of product / requirements specifications
- Microprocessor - based system design (AVR, ARM, MSP430, 8051)
- Embedded systems design (hardware and software)
- Digital design (CMOS, programmable logic, CPLD, FPGA)
- Analog design (A/D, D/A, low level sensing, signal processing)
- Short range / low power medical telemetry
- Low power wireless applications
- Surface mount technology
- Low power / low voltage circuit design
- USB devices
- Digital signal processing
- Pacing / defibrillation systems
- Hearing aid systems
- Software design (C, C++, Visual Basic, embedded)
- Windows software development (applications, DLL's, MFC, COM)
- Breadboarding, prototyping, troubleshooting
- Printed circuit board layout
- Short-run production builds / pre-production builds
- Manufacturing support
- Regulatory agency certifications (EMC, safety, FDA, ISO 9000, CE mark)

## Completed Projects

### *Hearing loss screener*

I designed a low system for quickly screening a patient's hearing for possible hearing loss.

### *Remote control camera platform*

I designed a system for controlling and monitoring an aerial camera system from the ground. This product includes a 2.4 GHz radio, video digitizer, video compression and motion control. The control unit is a handheld, battery operated device with a color LCD.

### *Low cost spectrum analyzer*

I designed a 2.4 GHz spectrum analyzer that displays a real-time frequency spectrum on a PC. This device cost less than \$100 (less than 5% of the cost of commercial units). I wrote an article on this design for a national magazine.

### *Gyro-stabilized servo motor*

I designed the first hobby servo with built-in gyro stabilization.

### *Motor controller*

I designed a controller circuit for a brushless DC motor for a device that treated sleep apnea.

### *Wireless camera*

I designed a 2.4 GHz wireless camera system. This product contained a CMOS image sensor as well as an IR illumination feature and a PIR motion sensor.

### *Wireless charging system*

I did a study on the feasibility of recharging an implanted medical device via inductive coupling.

### *Environmental data acquisition system*

I designed an embedded system for remotely measuring and storing data from temperature and humidity sensors. This system also used an ultrasound distance measuring circuit to determine snow depth. This embedded system communicated to a PC via a USB port where the sensor data was processed and graphed.

### *Wireless communication system*

I designed a wireless system for short range audio communication. This is a low voltage, low power system used in a hearing aid application.

### *Implantable hearing aid (Middle Ear)*

I did systems engineering for a company developing an implantable hearing aid. I was responsible for mathematical modeling and simulation of the system, evaluation of device performance, assessing the suitability of the system performance in relation to audiological requirements. I put together a system test suite consisting of a system simulation, device programmer, and automated test system used by engineers to predict and verify system performance.

### *Programmer for a programmable hearing aid*

I created the concept and designed a CompactFlash card to control programmable hearing aids. I designed the embedded hardware and software as well as a DLL to interface to the card to Windows software. The card was licensed to a number of other manufacturers and became the industry standard portable hearing aid programmer. Multiple patents were issued on this design.

### *Digital hearing aid design*

I designed the filtering for a DSP-based hearing aid. Client needs were translated in IIR filter coefficients to meet low-pass, notch and peak response requirements. I also designed an algorithm and wrote code for a hearing aid feedback manager.

### *Hearing-aid programmer application software*

I designed a Windows application in C++ that allows audiologists to tailor hearing aid settings to fit a patient's hearing loss. I also designed similar software for a Pocket PC.

### *Telemetry system for implanted device*

I did a study on RF telemetry techniques for a company designing an implantable drug delivery device. This led to work designing the telemetry hardware for this system. This hardware included an embedded microprocessor, RF, and other analog circuitry.

### *Implantable Defibrillator design*

I worked on an implantable defibrillator intended for implant in persons suffering from tachyarrhythmias. My work included the

design of a handheld telemetry system for communicating with the implanted device. I also designed a low power custom ASIC design for the implantable defibrillator and an FPGA prototype for the custom ASIC. I was involved with many clinical tests of the system as well as with U.S. and regulatory approvals. At the time of its introduction, this defibrillator was the smallest device of its kind.

#### *Remote-controlled hearing aid design*

I was the lead electrical designer for a startup company creating an advanced remote-controlled hearing aid system. My work included overall system design, analog and digital circuit design, software design, and hardware/software integration.

#### *Pacemaker programmer*

I led the electrical design of a PC-based pacemaker programming system. My involvement with this project began with preliminary conceptual studies and extended through the production phase. I defined electrical requirements and did the hardware design, which consisted of an embedded microprocessor system and analog circuitry to process and acquire electrocardiogram signals. I supervised the work of other engineers and technicians.

#### *Doppler ultrasound blood flow monitor*

I did the analog, digital and system level design for a Doppler blood flow monitoring device. I designed an RF Doppler circuit, a data acquisition system, and a signal processing hardware and software using a DSP microprocessor. I assisted with the clinical tests of this device.

#### *Laser gyro inertial navigation system*

I worked on the cockpit display and controls for a laser gyro inertial navigation system. This system attained 90% market share shortly after its introduction.

#### *Cockpit avionic displays*

I worked on the design of an electronic navigation cockpit display for the business aviation market.

### **Other**

I have been granted six patents.