Comtrade performs design, implementation and testing of firmware for a global company specializing in Electronic Shelf Labeling systems

Relying on Comtrade’s embedded software engineering and technology expertise, a world leader in Electronic Shelf Labeling (ESL) systems for large-scale retail environments redesigned its ESL product line to meet production and operation requirements.

It was of paramount importance to ensure that the newly developed electronic shelf labelling system behaves exactly like its predecessor.

Challenges

To remain competitive and increase profits, our customer had to find a way to reduce costs. The production costs of Electronic Shelf Labeling systems were a major factor in pricing and overall performance. The client’s goal was to reduce production costs by redesigning their product (new hardware and software), and to optimize costs by introducing new technology, which would enable automation of certain production processes.
The client’s solution consists of radio transmitters and antennas that send pricing and product data to battery-powered shelf labels via 36 kHz low-frequency (LF) signals using a proprietary air-interface protocol. The solution is in use in more than 5,000 stores in 50 countries. The main objective was to redesign hardware, use new components and bring everything into ASIC (Application-Specific Integrated Circuit) - ROM, RAM, 8 bit microcontroller, RF receiver, LCD driver, etc. In order to ensure the same functionality, the firmware also had to be completely rewritten.

Implementation of the previous ESL was done in the assembler on a 4-bit microcontroller with limited or no documentation. The new ESL had to behave exactly as the old model to ensure the two can be installed together in the same retail environment.

**Our Solution**

The hardware redesign was performed by our partner. All essential hardware components were put into one ASIC, thus reducing production costs and ensuring a power efficient system.

Comtrade was responsible for firmware design, implementation and testing. First, a protocol between the transmitter and receiver had to be analyzed and documented. Our in-house lab made a protocol recorder that helped us identify all of the bits in the communication process.
Based on the requirements, such as low power consumption, limited hardware resources, performance and stability, we decided to use Super Loop Architecture for this embedded system.

Great care was taken to ensure that the newly developed ESL behaves exactly like the old one. Our test environment was fully automated, from initiating the transmission of the commands sent to the ESL to verification of the result displayed on a LCD. Over 1,000 test cases were compiled to ensure all functions were 100% covered.

The firmware is programmed in pure C, driving LCD, handling receiver and performing all necessary functionalities of an ESL, such as receiving data from a transmitter, displaying data on LCD display, handling mathematical operations and processing all commands that could be received from the transmitter.

**About the Client**

Our client is a pioneer of electronic shelf labeling systems for the retail sector and has been on the market for over 20 years. To date, the company’s products and systems have been installed in more than 5,000 stores in 50 countries. The electronic shelf labels, available in a variety of sizes and form factors, all have a built-in screen for displaying prices of products on retail shelves.

**Results Delivered**

The final deliverable fully meets the end customer’s requirements. Now, the client can retire their old ESL and continue serving customers with the new, more reliable and less expensive solution.

Key capabilities and benefits include:

- All essential hardware components packed into ASIC (microcontroller, receiver, memory, LCD driver, firmware - ROM)
- Non-volatile memory to retain stored information when not powered
- Code optimized for performance, size and stability
- ESL is in low power mode 91% of the time to reduce battery consumption
Creating value through partnership

Comtrade Digital Services provides strategic software engineering services and solutions.

For over 25 years, we have enabled companies from various industries to innovate faster and reinvent their business models digitally, by using agile development methodologies, innovative technology and our business acumen.

We ensure global delivery and implementation in the fields of artificial intelligence, digital banking, embedded systems, energy, logistics, mobility & travel and quality assurance & testing.

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www.comtradedigital.com

Comtrade d.o.o.
Letaliska cesta 29b
1000 Ljubljana, Slovenia
T: +49 711 22254 233
E: info.de@comtrade.com