



Android based Braille Tablet for Visually Impaired

Introduction

Assistive Technologies play a critical role in easing connectivity and communication for individuals with sensory, physical or cognitive difficulties, impairments and disabilities enabling them to fully participate in society. In this case study we are looking at an intelligent Assistive device for the Visually impaired that aids students/professionals with better access to their work environment and improves their academic/professional performance.



“ This case study showcases Mistral's expertise in upgrading an existing assistive technology product keeping its mechanicals intact, while redesigning the hardware & software for increased performance, power efficiency and better features. ”

The Customer

The customer is a global leader in designing products in Assistive products for visually impaired and those with low vision. They offer a wide range of innovative products from custom designed Android tablets, digital audio book players, portable vision and reading systems to a line of electronic handheld magnifiers.

The Requirement

The Braille Notetaker is a tablet computer designed and developed for the visually impaired. The product uses 18 / 32 cell Braille display that serves as the output interface for the users and employs a Perkins keyboard that serves as the primary input medium. With the advent of technology and progress in software, the customer wanted to replace the Braille Notetaker with a custom designed Android tablet to realize the same functionalities. The requirement was to redesign the existing product to use a more powerful, yet power-efficient System-on-Chip (SoC) running the latest version of Android OS. Additionally, the new product needed to be compatible with the existing mechanical design, without any changes to the product enclosure.

Solution Provided

The existing version of Braille Notetaker was a single board solution that contained all the electronics on a single hardware platform. Mistral realized the new version with a modular approach by using a two-board solution. This featured Mistral's off the shelf System-on-Module - the 820 Nano SOM powered by Qualcomm Snapdragon 820 (APQ8096) SoC and a carrier board which had all the product specific interfaces. This involved modifying the existing product hardware to accommodate the 820 Nano SOM and its capabilities, i.e. removing components on the existing hardware and adding connectors needed for plugging in the 820 Nano SOM.

The 820 Nano SOM, is a compact, light-weight, System on Module, providing high processing capability; which addressed the video processing and low power requirements demanded by the product. Mistral modified the design of the carrier board to ensure the new modular design fits into the existing product enclosure.

Specifications

- ▶ Wireless
 - Wi-Fi 802.11a/b/g/n/ac 2.4/5.0 GHz 2x2 MU-MIMO
 - Bluetooth 4.2
 - GNSS (GPS and Glonass)
- ▶ Audio CODEC
 - Omni Directional Microphone
 - On-board stereo 1W Speakers
- ▶ External SD card socket with full SDIO interface
- ▶ Capacitive multi-touch screen
- ▶ Display
 - 7" diagonal LCD screen
 - HDMI for external display
- ▶ 18 or 32 cells Braille display with routing cursors (1 button per cell)
- ▶ 21MP camera with dual LED flash
- ▶ Connectivity
 - USB 3.0 type C port
 - USB 2.0 type A host
- ▶ Sensors
 - Haptic
 - 3D Accelerometer
 - 3D Gyroscope
 - 3D Electronic compass
- ▶ Power: +5VDC or 3.7V nominal, 5100 mAh battery

The Challenges

Dimension parameters: Since the approach involved redesigning the existing product hardware and electronics to accommodate the two-board solution there were challenges involved in meeting height restrictions to ensure reuse of the existing product enclosure.

This was achieved by analyzing the CAD designs of the product enclosure and the hardware (Nano SOM and the existing board), to identify a suitable position for placing the 820 Nano SOM by repositioning some of the connectors.

Thermal Conditions: It was found that the SoC was heating up as a result of high processing power requirements. This was observed when running process intensive applications which exercised some of the external peripherals. For example: to access a UHD video remotely over WiFi, decode and render it locally.

The room restriction around the 820 Nano SOM restricted adequate air flow resulting in unfavourable thermal conditions. Mistral addressed this by implementing a software algorithm to detect such conditions and take preemptive measures like turning off one of the processing cores to reduce the system load. This ensured continuous reliable functioning of the system.

Developments in Android Framework: Security features in recent versions of Android have checks that makes it difficult for an application to access intermediate software interfaces that would provide easy access to hardware. This meant that Mistral had to implement additional services by modifying the Android framework to provide access to non-standard hardware interfaces like Braille display, dual touch screen for Perkins keyboard and regular touch inputs etc. This ensured applications already functional on previous version to continue to function seamlessly on the new product.

Customer Benefits

Form Factor: Successfully re-designed the product within the dimensional & enclosure parameters so that the end user could seamlessly use the new product without the need to familiarize to a new user interface.

Processing Power: New product carries a more powerful, yet power-efficient System-on-Chip (SoC) running the latest version of Android OS. The presence of independent hardware engines enabled process intensive tasks like media encoding and decoding, sensor management and rendering high resolution content.

Faster Time to Market: Achieved faster time to market as most of the processing engines required to realize the features on the new Braille Notetaker was present on the 820 Nano SOM. This reduced the development effort to a great extent.

High Quality Image Processing: The customer was able to facilitate applications on the Braille Notetaker like OCR for reliable text-to-speech functionality, which is one of the primary features of the product. The new Braille Notetaker employs a 21MP camera sensor and the dedicated Image Signal Processor on the APQ8096 and its capability to handle images up to 4K resolutions enables the system to capture images and videos of the highest quality.

Android Support: Qualcomm provides extended support and an extended roadmap for Android. By using the 820 Nano SOM in the product, the customer is assured that the new Braille Notetaker gets regular updates, not only the new features of Android but also the fixes provided by Google for any potential security lapses.



Mistral Solutions Pvt. Ltd.,
60, Adarsh Regent,
100 Feet Ring Road,
Domlur Extension, Bangalore - 560 071
Tel: +91-80-4562-1100
Fax: +91-80-2535-6444
E-mail: info@mistralsolutions.com

Mistral Solutions Inc.,
43092 Christy Street
Fremont, CA 94538
USA
Tel: +1-408-705-2240
E-mail: usa@mistralsolutions.com

Branch Offices:
INDIA
• Hyderabad
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