

CONTROLS & SENSORS



Home Comfort Zones climate control system also uses an Amulet Technologies GUI chip in the user interface.



Guide to GUI

How to simplify development of the Graphic User Interface.

by **ken klask**

Ken Klask is CEO, Amulet Technologies, Santa Clara, Calif.

In today's era of continual technological advances, consumers have come to expect products and services that provide the latest in cutting-edge technology. Even the simplest coffee maker has a "high-tech" profile. Consequently, appliance manufacturers have found themselves competing to produce appliances that are not only innovative and advanced, but have an attractive "techie" look and feel as well. Implementing technologies that add visual appeal to appliances while increasing the ease-of-use factor, such as an effective Graphic User Interface (GUI), is becoming increasingly important.

Many appliance developers do not deal with Graphic User Interfaces on a daily basis, and may not be familiar with the most effective way to implement a visually appealing, technologically advanced GUI. Adding interactive graphics, fonts, and icons can more than triple the size of the software code required to run the device. If the code gets too complicated, it taxes the 8-bit and 16-bit microcontrollers normally used in appliances.

Adding an additional microcontroller is not only an expensive "bandage" solution for the manufacturer, but also extremely inconvenient for developers who then have to start over from square one, prolonging the development cycle. There are now simpler processes with new GUI technologies, such as that from Amulet Technologies, which allow the development of a more creative GUI to enhance the consumer experience while streamlining the whole GUI development process.

Pixel partitioning

With the Amulet Technologies approach, there is no longer a need to upgrade or replace the host processor, extensively rewrite and expand existing code to support a GUI, or create the requisite suite of conversion tools. The solution is to partition. Rather than force the host processor to assume responsibility for GUI tasks, a partitioned architecture adds a dedicated GUI microcontroller with a built-in graphical operating

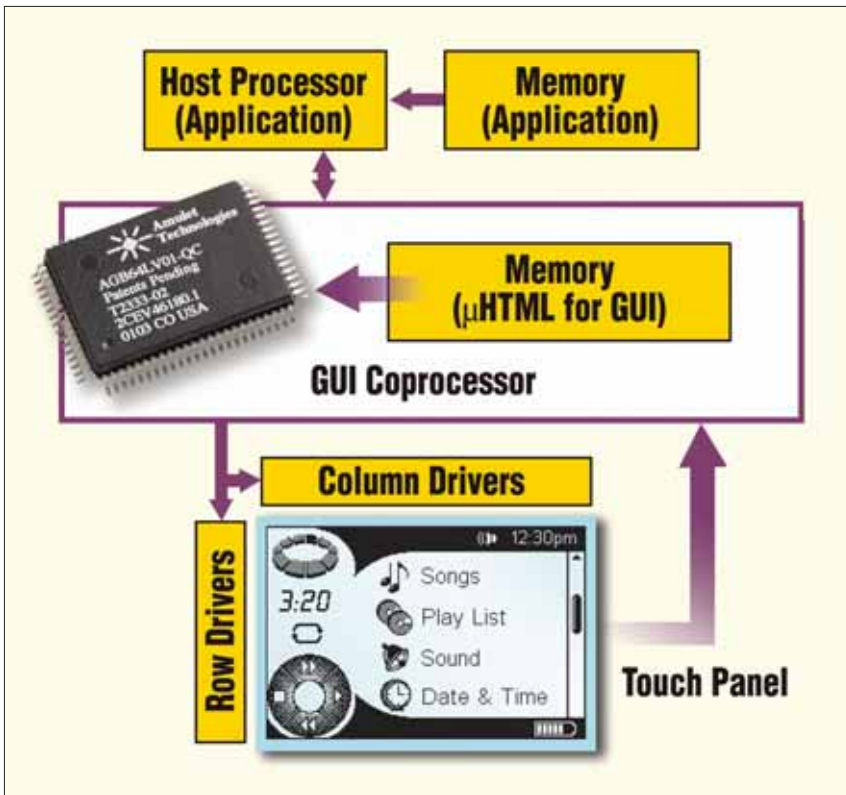


Fig. 1. Amulet system architecture.

system and complete set of tools specifically designed to manage the GUI, interact with the user, and control the LCD.

This design, as illustrated in Fig. 1, effectively splits the load, leaving the reliable legacy 8-bit microprocessor in place, fully leveraged, and virtually unmodified. In other words, the GUI functionality gets “bolted on” to existing code. Modifications to legacy code are limited to a very-low-bandwidth, bi-directional serial interface with the Amulet microcontroller.

The Amulet GUI chip is a combination LCD controller and user interface manager, handling all communications with the UI and the LCD. The Amulet CPU has task-specific opcodes for graphics rendering, I/O processing, and general purpose computing that enables the GUI kernel firmware to implement a highly efficient task scheduler. It is optimized to execute Amulet’s GUI kernel and component-based GUI firmware.

The chip renders GUI pages containing graphic images, widgets, and other UI objects directly to the LCD, eliminating the need for complex code to draw each pixel on the display. It also allows for tactile interaction, which can enhance the consumer experience with the

end product. Images and text are created in HTML, which is compiled into highly compact micro-HTML that uses much less memory.

Electrical connections between the Amulet control processor and the LCD are supported using a standard synchronous raster scan serial interface to row and column driver shift registers. Electrical connections between the host processor and Amulet control processor are provided through a simple UART interface using two-wire receive and transmit (RXD/TXD) with eight data bits, one stop bit, and no parity. The interface supports bit rates of 9,600, 19,200, 57,600, and 115,200 bps, which can be specified in the HTML document.

The serial protocol message structure communicated via the UART uses a leading byte

(Byte 0) to define the message type of operation such as read or write byte variable and invoke event handler. Byte 1 and Byte 2 identify, in ASCII, which byte to read or write. The remaining bytes contain the message payload or data.

The low data rate serial connection is fully adequate because the microcontroller only needs to transmit the variable data to the objects on the LCD. It does not have to transmit each and every pixel displayed.

Temperature example

Communication with UI objects can be illustrated by the following example. An oven manufacturer wants to add an LCD that displays the internal temperature. A good deal of the processing power of the 8-bit host processor would be consumed just to update this display. In a typical desktop PC application, for example, 50 percent of the CPU’s processing power is required to support the GUI. That percentage would be even higher for an embedded 8-bit processor. There simply may not be sufficient horsepower to support a GUI.

Using Amulet’s graphical operating system, however, only the variable temperature data would be communicated to the UI. In



Balboa EzWave Pool Control has a graphic user interface design that incorporates the Amulet Technologies GUI chip.

CONTROLS & SENSORS

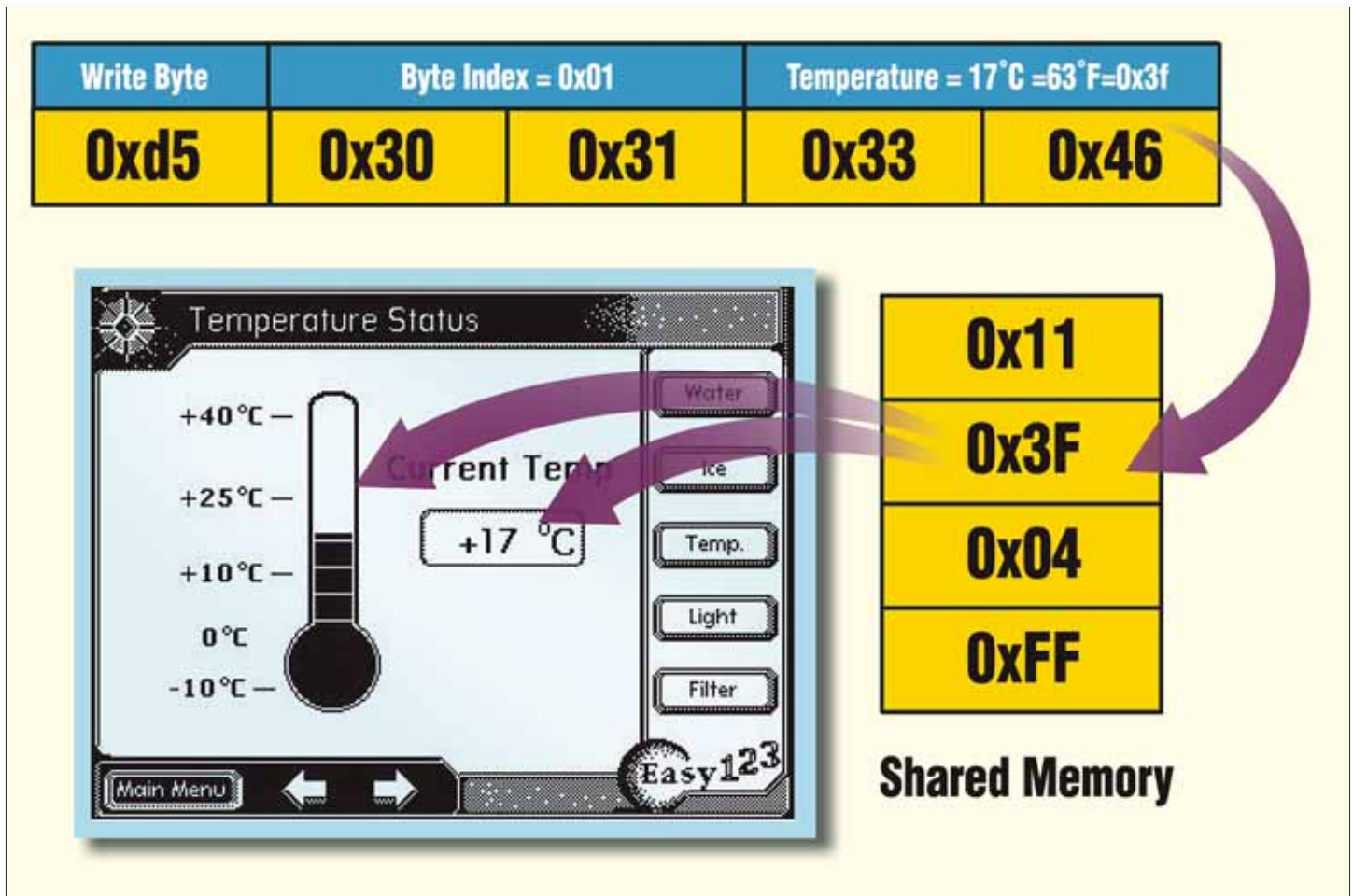


Fig. 2. Oven thermometer display.

Fig. 2, the table at the top shows a string of serial bytes from the UART. Byte 0 (0xD5) indicates a byte write operation. Bytes 2 and 3 (0x30 and 0x31) correspond to ASCII 0 and 1; for example, a byte index of 1. Bytes 3 and 4 define the temperature. The data value of 0x3F corresponds to 63 decimal (DegF). The Amulet software can represent this data in whatever way the appliance manufacturer chooses. On the LCD in Fig. 2, this data has been converted to display 17 DegC. This same data is also used to fill a percentage of the thermometer.

Only the raw temperature data must be transmitted, requiring just 5 bytes, compared to multiple screen redraws. The existing hardware and software remain in place.

Beyond GUI to GUE

As well as streamlining the GUI development process, Amulet provides appliance manufacturers with the means to simplify the consumer/application interaction process by creating a unique, visually appealing, and user-

friendly Graphic User Experience (GUE) for their customers. Consumers want to feel like they have the upper hand over the appliance, and when GUIs become too complex and do not provide enough interactive communication, it usually results in negative feelings toward the product or brand. Consumers want a user interface that is visually appealing, easy to use, and that communicates the direct effects of their commands; that is, the tactile experience of “push buttons.”

To meet those objectives, Amulet has made its technology compatible with complementing GUI technologies, such as the tactile feedback function on user interfaces. For example, when the consumer selects a button, they can actually see and hear it being pressed down on the display. This provides the type of positive end-user experience that can help an organization create an emotional connection with their target audience and help establish brand loyalty. By utilizing Amulet’s GUI technology, appliance manufacturers can add value to their products by improving their overall look and feel, as well as

provide their end users with the complete Graphic User Experience.

In today’s competitive appliance market, implementing GUI technologies can help appliance manufacturers differentiate their products. Amulet can assist by providing the overall Graphic User Experience and streamlining the GUI development process through techniques such as partitioning, and also by allowing multi-disciplined teams within an organization to collaborate on the visual creation of GUIs using commercial HTML authoring tools such as Dream Weaver and Front Page. This makes the job of the developer much easier because it reduces the amount of complicated code programming and permits the creation of multiple iterations of the GUI. ■

Visually Appealing. Simply Reliable.



Beyond Your Basic LCD Controller

Amulet Technologies™ Graphical User Interface (GUI) solutions empower your designers to utilize your LCD's full design potential. Chips and software from Amulet are optimized for 24/7 reliability and are compatible with most microcontrollers, LCD's and touch panels.

***Call Amulet today at (408) 244-0363
to discuss your GUI needs.***



Amulet Technologies
Empowering Flat Panel Displays

www.amulettechnologies.com