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SOME ASPECTS OF CONTROLLER DESIGN FOR A MULTIMEDIA LCD PANEL DISPLAY

Radu Arsinte(*), Laurentiu Gavra(**), Dorin Petreus (*), Catalin Constantin (**)

(*)Technical University Cluj-Napoca, str. Baritiu 26-28- Email: Radu.Arsinte@com.utcluj.ro
(**)Tedelco SRL, Calea Turzii 42, Cluj-Napoca ,Romania- Email:Laurentiu.Gavra@tedelco.ro

Abstract
This paper describes design aspects for a controller used in a custom passenger information display, in automotive information system. Using this system it is possible to present different kinds of information to passengers. Information examples are: advertisements, traveling information, video streams and a lot of other kinds of data that can be useful for the passenger. The controller is implemented using an 80C552 embedded chip.

Keywords: Multimedia, LCD display, Panel link, local controller, DVI

1. INTRODUCTION

This controller is implemented for a custom passenger information display ([1]), used in automotive information system. The complete information system exists out of:

- multimedia PC
- passenger information displays
- power supply
- network
- WIN2000 operating software
- presentation software

Using this system it is possible to present different kinds of information to passengers. Information examples are: advertisements, traveling information, video streams and a lot of other kinds of data that can be useful for the passenger. To keep the interest of the passengers and to allow advertisers to address their advertisement on time to the passenger, the information needs to be actualized several times per day or even continuously.

The display interface is designated to ensure the translation between the DVI interface and the LCD panel, to remotely display of information of the main computer. As the secondary function, the interface must verify local conditions (temperature, video signal presence, etc.) and validate/invalidate the display.

The interface must also ensure bi-directional communication through a special interface of the main computer using RS485 standard. This allows to individual remotely control some functions of every panel.

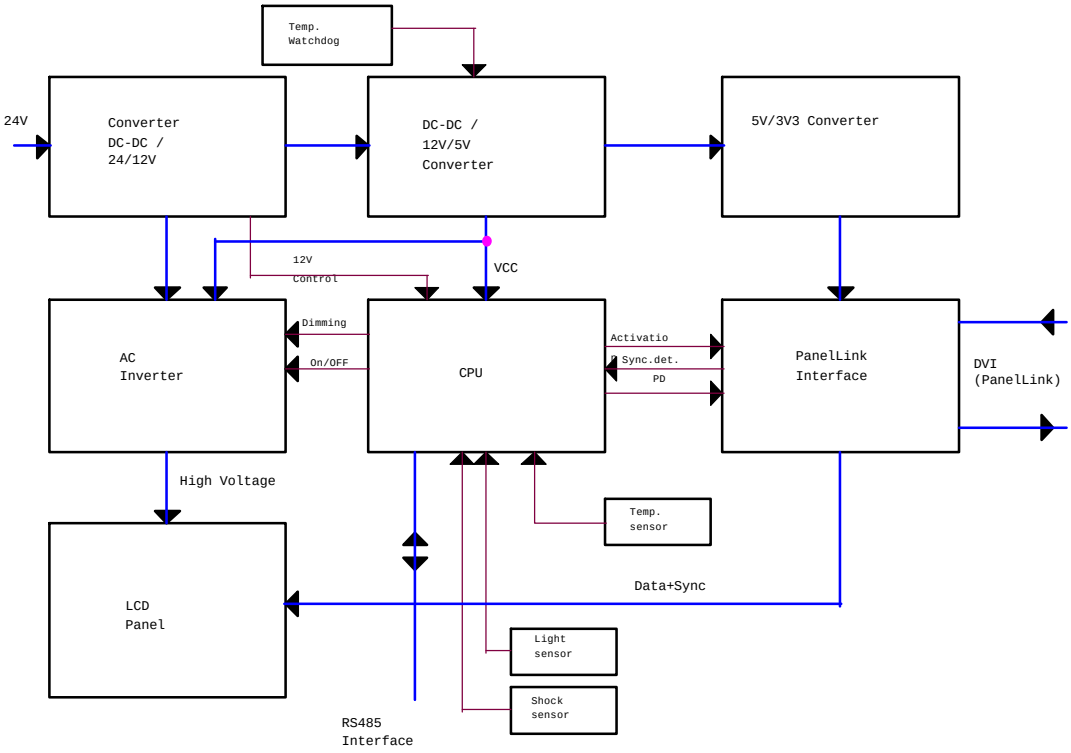

Fig.1. Block diagram of panel system

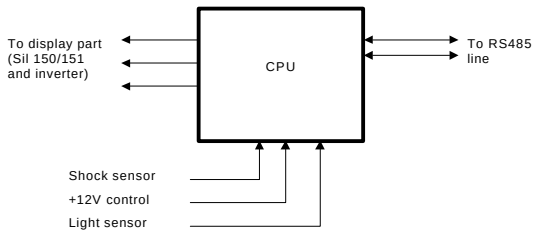

Fig.2. In system processor integration

The general diagram of the display system is presented in fig.1.

Main parts of the display are:

- Power supply – deliver 12V, 5V, 3,3V voltages needed by different parts of the LCD multimedia display. Those voltages are obtained using the 24V input voltage;
- AC inverter – delivers the high voltage for neon lamps used to backlight the LCD;
- LCD matrix panel – displays the information
- Panel Link interface – receives serial video from DVI video controller and sends the information to the local LCD matrix panel;
- CPU – controls the local functions of display, communicates with remote RS485 controller.

2. CONTROLLER STRUCTURE

The CPU part is build around an 87C552 ([1]) (or 80C552) processor. This processor was chosen because he contains all the resources needed for panel control.

The general diagram of the processor's integration in the system is presented in Figure 2.

Watchdog circuit delivers the Power-up reset, Brown-up reset and ensures also the monitoring of proper program running, by means of the WDI (Watchdog input). All these circuits are done using a specialized circuit (MAX813L).

The CPU oscillator is constructed using a quartz resonator, with a frequency of 11.059 MHz. This frequency is chosen taking into account the need for RS485 communication, the standard clock rates for baud rate (2400bps, 4800bps, etc.) resulting after dividing without any clock rate error.

CPU can be implemented in two ways: with or without external memory. This allows us to have up to 32Kbytes of program memory for large programs. This feature is particularly important in development phase, offering the possibility to use an EPROM emulator. For production phase or in small applications, when OTP circuits are used (87C552 version), external components are omitted and the program is written in internal PROM. This reduces the available program memory (8Kbytes), but eliminates two circuits.

The RESET part of schematics is implemented using the same MAX813L.

For storage of different parameters we have an EEPROM memory circuit connected through I2C interface. Parameters stored in this memory are permanent settings - serial number, fabrication week, baud rate - or temporary settings.

This memory can be programmed by the CPU or with an external I2C adapter connected on external jumper.

Temperature sensing is done using a LM75. This circuit is connected also through I2C bus, and delivers the measured temperature in serial format. The precision is +/- 2^{o} C, but is sufficient for our purposes.

Address setting is done using a pack of DIP switches. Addresses can be set in a range from 1 to 15, address 0 being reserved for the master computer.

The digital interface with other blocks of Panel Link is done using the pins of port P4. The signals are described in the following table.

Signal name	Dir.	Description
COM_EN	OUT	Activation signal for RS485 transmission (active High)
PD0	OUT	Activation signal for serial video interface (active High)
VENABLE	OUT	Activation signal for LCD panel display (active Low)
SYNCDET	IN	Indicate the presence of video signal at the input of serial video interface receiver (SIL151)
ON/OFF	OUT	Activates the high voltage inverter for LCD panel
SHOCKOUT	IN	Reflects the output of shock sensor part of schematics
TEST	IN	Pin used to apply the test mode for Panel Link

Analog signals are converted using port P5. The pin allocation of the analog port is described in the following table.

Signal name	Dir.	Description
ANAIN0	IN	Input for +12V power supply control
ANAIN1	IN	Input for light sensor reading
ANAIN2	IN	Input for analog output of the shock sensor amplifier

The shock sensor is connected on one controller's analog input. At this port, a large variety of sensor types can be connected. The signal delivered by the sensor is amplified and triggered. The two signals, analog and digital, are delivered to the 80C552, for shock sensing via a special part of the software.

Dimming control is implemented using the PWM output of the 80C552. The output is low-pass filtered and applied to the dimming input of the high-voltage inverter.

Communication is done using RS485 standard. Dedicated signals of the 80C552 (TxD and RxD) are converted into RS485 levels using a specialized circuit.

3. SOFTWARE SUPPORT

Software must implement all the functions required. These functions can be grouped in following blocks.

- Local control with respect to environmental conditions: ambient light and temperature sensing, shock sensing, dimming control of LCD panel
- Communication: I2C and RS485
- Video Serial interface control: sensing the presence of incoming signal and display validation

4. CONCLUSION

Controller implementation fulfills the requirements of initial specifications. Using a high performance microcontroller allowed us to minimize the number of external components and offers to the programmer many possibilities to optimize the software, without the need to write low level emulation libraries for RS485 or I2C communication.

Further optimization is possible by using a processor of newest generations, such as 80C554([3]), with an improvement of performance and a better EMC behavior.

5. REFERENCES

[1] *** - {2001} - Public Transport Infotainment System – fact sheet - Dzine Company
[2] *** - {1990} - P87C552 – Data Sheet – Philips Semiconductors
[3] ***- {2000} - 80C554/83C554/87C554 – Data Sheet – Philips Semiconductors