DK8051NC Application Note

1. Introduction

This application note covers 8051 Evaluation Board embedded with iinChip[™] W3100A, a hardwired TCP/IP chip ("W3100A"), integrated with CMOS-type camera to transfer video data over the Internet without any PC.

Main components to the Network Camera(NC) Application Module are as follows. NC Module is comprised of the Camera Sensor, M-JPEG CODEC, Memory and an interface with EVB8051. EVB8051 is comprised of 8051 MCU, Memory, NM7010A(W3100A+ Ethernet PHY+Transformer+RJ45) and an interface with NC Module.

2. How it Works

Picture 1-1 below is an actual image of the 8051 Network Camera Application Board with the NC module connected to the EVB8051.



Picture 1-1. DK8051NC

Picture 1-2 and Picture 1-3 each respectively displays the protocol stack and block diagram of the Webcam Application Module.

Application		
SOCKET APIs	M-JPEG CODEC	
TCP/UDP	CMOS Sensor	
IP	CIMOS Sensor	
MAC		
PHY	LEINS	

Picture 1-2. Protocol Stack



Picture 1-3. Block Diagram

2.1 Features

2.1.1 Internet Connection

Internet connection is made easy based on a simple interface between MCU and W3100A without any operating system.

(Refer to the datasheet for detailed information on W3100A)

- 2.1.2 Video Processing
 - Image Compression Algorithm: Motion JPEG
 - 1/3" Color CMOS Sensor
 - Video Mode: 320 x 240 CIF Format

2.1.3 Video Data Reception and Transmission

- HTTP(TCP) communication protocol is used
- Simplex mode is used

2.2 Operating Principle

First, 8051 MCU initializes the internal registries of CMOS Camera Chip (OV7620) and transmits the setting information on jpeg frame to M-JPEG Chip (LC82210).

CMOS Camera Chip transfers the video information received through Lens and Sensor to M-JPEC Chip in YUV Format. At this time, CMOS Camera Chip and MJPEG Chip need to be synchronized. Synchronization corresponds to the ZV Port Timing and proceeds as follows. Following the falling edge of VSYNC (Vertical sync pulse) signal, as HREF (Horizontal valid data output window) transforms from rising edge to falling edge (while at high), YUV signal will be considered as Valid Data, and the YUV signal is transmitted according to PCLK where 8bit Y signal and 8bit UV signal are combined to 16bit each.

Jpeg frame is created upon request from 8051 MCU to M-JPEG Chip, and then M-JPEG Chip saves the created jpeg frame in DRAM and sends the Interrupt to 8051 MCU regarding completed creation. When the Interrupt is received, 8051 MCU receives the jpeg frame from MJPEG Chip and saves the data in SRAM of EVB8051. At this time, 2 frames are saved in SRAM based on Double Buffering method.

When a request for jpeg frame is received from a remote PC over the Internet, 8051 MCU reads the jpeg frame from SRAM and transfers the data to iinChip[™] W3100A, and then iinChip[™] W3100A transmits the data to the remote PC.

2.3 Memory Map



ATMEL Version (EVB)

2.4 Components

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Model	Description
AT89C51RD2	MCU (Atmel)
IS62LV256-70T	32K x 8, SRAM (ISSI)
ATF16V8-15JC	PAL (Atmel)
MAX232	Dual RS232
RTL8201BL	PHY (Realtek)
iinChip™ W3100A	TCP/IP (WIZnet)

2.4.2 Camera Module

Model	Description
OV7620	CMOS VGA Video Digital Camera Chip (OmniVision)
LC82210LK UA0	Motion-JPEG Chip (Sanyo)
K4E1516120-TL50	1M x 16, DRAM (SAMSUNG)

* Refer to the datasheet for each part for detailed information

3. Conclusion

This DK8051NC provides a solution for direct Internet connection without connecting to a PC by embedding the TCP/IP function in the DK8051NC itself. In order to receive high-quality video from a remote location over the Internet, high network speed is required to process such a large video data size. This application provides such high-quality video resolution by incorporating iinChip[™] W3100A, a Hardwired TCP/IP Chip, which allows much faster transmission speed compared to other means of Internet connection. Furthermore, camera movement can be controlled from a remote location by incorporating a PAN/TILT network camera.

Above solution can be easily adapted to all areas of video feed and monitoring work such as traffic monitoring, home network, remote medical diagnosis, security/control system as well as an alternative solution to existing CCTV camera.