i386 Webcam Application Note

1. Introduction

This application note covers i386 Evaluation Board embedded with i2Chip W3100, a hardwired TCP/IP chip (“W3100”), integrated with CMOS-type camera to transfer video data over the Internet without any PC.

Main components to the Webcam Application Module are as follows. Camera Module is comprised of the Camera Sensor, M-JPEG CODEC, Memory and an interface with i386EVB. i386 Evaluation Board is comprised of i386 MCU, Memory, i2Chip W3100(TCP/IP), RTL8201(Ethernet PHY) and an interface with Web Camera Module.

2. How it Works

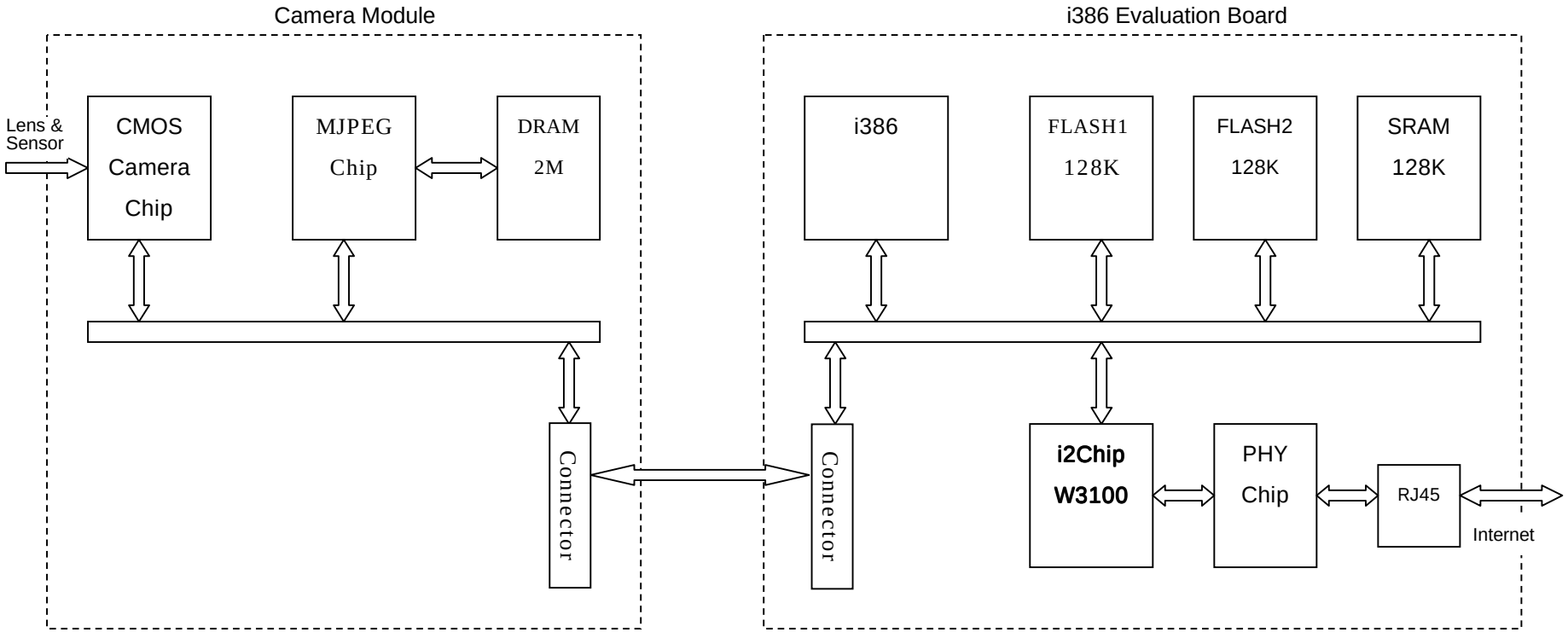
Picture 1-1 below is an actual image of the Webcam Application Module with the camera module connected to 386 Evaluation Board.

Picture 1-1. i386 Webcam Application Module

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

<table>
<tr><td colspan="2">Application</td></tr>
<tr><td>i2Chip Driver</td><td rowspan="2">JPEG CODEC</td></tr>
<tr><td>TCP/UDP</td></tr>
<tr><td>IP</td><td rowspan="2">A/D Converter</td></tr>
<tr><td>MAC</td><td rowspan="2">Image Sensor</td></tr>
<tr><td>PHY</td></tr>
</table>

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 W3100 without any operating system.

(Refer to the datasheet for detailed information on W3100)

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

- UDP communication protocol is used
- Simplex mode is used

2.2 Operating Principle

First, i386 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 i386 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, i386 receives the jpeg frame from MJPEG Chip and saves the data in SRAM of 386 Evaluation Board. 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, i386 reads the jpeg frame from SRAM and transfers the data to i2Chip W3100, and then i2Chip W3100 transmits the data to the remote PC.

2.3 Memory Map

0x00000 0x1FFFF	SRAM	Runtime Data Jpeg Image Buffer
	Unused	
0x40000 0x5FFFF	Flash2	Static Data Configuration Data
	Unused	
0x80000 0x8FFFF	W3100	i2Chip W3100 control
	Unused	
0xA0000 0xAFFFF	Camera Module	M-Jpeg Chip control
	Unused	
0xE0000 0xFFFFF	Flash1(ROM)	Webcam Driver Code

2.4 Components

2.4.1 i386 EVB

Model	Description
80386EXTC/FP	MCU (Intel)
AT29C010A	128K x 8, Flash Memory (Atmel)
KM681000C	128K x 8, SRAM (Samsung)
ATF16V8B	250gate, 20pin, PLD (Atmel)
MAX232	Dual RS232
RTL8201	PHY (Realtek)
i2Chip W3100	TCP/IP (WIZnet)

2.4.2 Camera Module

Model	Description
OV7620	CMOS VGA Video Digital Camera Chip (OmniVision)
LC82210	Motion-JPEG Chip (Sanyo)
GM71V18163	16M x 16, DRAM(Hyundai)

* Refer to the datasheet for each part for detailed information

3. Conclusion

This i386 Webcam Application Module provides a solution for direct Internet connection without connecting to a PC by embedding the TCP/IP function in the Web Camera 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 i2Chip W3100, 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 web 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.