

Low-cost Wireless Projector Interface Device using TI TMS320DM270

Arvind Raman, Mini Jain, T. C. Rajendra, S. Satheesh,
Sriram Sethuraman, Vikal Kumar Jain, Vinayak Prasanna Das
Ittiam Systems (Pvt.) Ltd., Bangalore, India
Email: sriram.sethuraman@ittiam.com

Personal computers today have 802.11(b/a/g)-based wireless connectivity. If it were possible to wirelessly connect laptops to a projector, multiple persons can connect and present content on their laptops on the projector. This typically requires another personal computer at the projector end that is wirelessly connected to the laptop that receives, decodes, and renders a compressed version of what was rendered on the display of the laptop. Including the PC and the software cost, such a setup costs quite a bit. Moreover, an application needs to run on the laptop that sends a coded representation of the screen. There are a lot of such solutions available such as the public domain vncserver/vncviewer, Microsoft Windows terminal client, and Citrix server/client. These schemes represent the screen using rectangular window segmentation and code the texture using multiple coding schemes (such as run-length coding, JPEG, hextile coding, etc.). In this demonstration, we present a low-cost, MPEG-4 based solution that eliminates the need for a PC at the projector end.

On the laptop, the screen buffer is captured using Windows GDI. The captured frames are compressed on the laptop using an MMX/SSE/SSE2 optimized MPEG-4 encoder running on the same laptop. The encoded stream is streamed over the WLAN to a streaming client. The streaming client is implemented on TI's low-cost DM270 processor. The DM270 consists of an ARM subsystem and a DSP subsystem. The ARM subsystem has an ARM7TDMI processor and supports an NTSC/PAL video encoder for composite video output and a compact flash interface. The DSP subsystem consists of a C5409 DSP, an imaging co-processor, a variable length decoding/inverse quantization hardware unit, and DMA capability.

Redhat's eCos operating system is ported to the ARM7 along with a TCP/IP stack. By writing a suitable 802.11b driver, a WLAN card with compact flash interface is interfaced to the TCP/IP stack. On the DSP subsystem, MPEG-4 decoding at VGA resolution has been implemented. The live screen capture server sends data to the streaming client using RTSP/RTP protocols (along the lines of the ISMA standard). The streaming client receives the data on the ARM side, and decodes it on the DSP side.

Though the ARM-side includes the NTSC/PAL video encoder, it can run only at a maximum of 30Hz refresh rate. Connecting the composite video to the projector suffers from jumpy video as the video is sent out as fields and thin horizontal lines will appear to jump up and down. It is necessary to refresh at a minimum rate of 60Hz for a VGA connection. While simple line doubling schemes are possible, they still cannot take the information from both the fields. Hence, line doubling still suffers from the jumpiness issue. To fix this problem, a frame buffer is needed. An innovative, low-cost, FPGA and SDRAM based solution is used to obtain a scalable VGA and higher display solution.

In this demonstration, the above setup will be presented. At less than 1Mbps, a very good quality, low delay solution will be demonstrated. The encoding load on the laptop is only around 500 MCPS. Since MPEG-4 based streaming is what is used, the same setup can be used to send natural video content from a server to a TV/projector enabled with the DM-270 based streaming client. Figure 1 illustrates the demo setup.

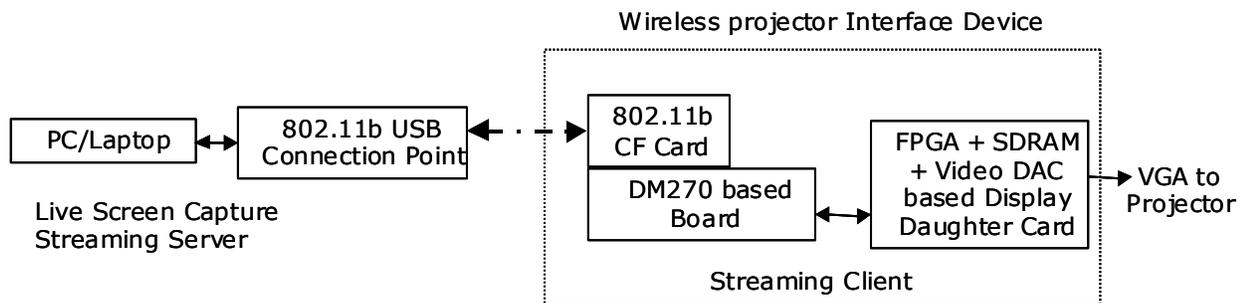


Figure 1: Wireless Projector Interface Device Demonstration Setup