Cost Effective Digital Signage System using Low Cost Information Device

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***Abstract*—Digital signage systems that include some computer devices are widely used for displaying some dynamic information, unlike wall ads that are unchanged for a certain period. At the replacement time of our university's digital signage system, we need to implement cost effective digital signage system. Therefore, we developed a brand-new style of the digital signage system using low-cost information device. In this demonstration, we introduce two prototype systems, 1) the signage display device, and 2) the central digital signage management system, which is now in implementing.**

Keywords—Digital Signage System; Low Cost Information Device; Raspberry pi

I. INTRODUCTION

Some digital signage systems that include some computer device are widely used. These systems can display dynamic information, unlike wall ads that are unchanged for a certain period. We are now operating various digital signage systems in our university for visualizing the power consumption. In the operation period, due to the aging of the computer equipment, we need to replace the signage display device. At this situation, we plan to develop brand-new style digital signage system using low-cost information device for reducing the system cost.

II. DESIGN AND IMPLEMENTATION

At first, we designed a digital signage display device. This display device can be autonomously managed to display the content. The system is required, 1) cost effectiveness of the device, and 2) flexibility of development. Therefore, it was decided to use an inexpensive single-board computer as a display device. Many of the single-board computers can be used with Linux OS; it empowers to develop quickly and more flexible. As currently available single-board computer, there are "Raspberry Pi"[1], "Beagle Board"[2], and "Intel Edison"[3] as the choices. We decided to use "Raspberry Pi" for the reasons: 1) Easily Available, 2) Reasonable Performance, and 3) Equipment Cost.

"Raspberry Pi" is a single board computer made by UK Raspberry Pi Foundation. CPU Processor is 700 MHz ARM 1176JZF-S in Model-A, Model-B, Model-A+, and Model B+. Model A(A+) is a basic model of Raspberry Pi. Model B(B+) has a wired network connectivity and more powerful memory than Model A(A+). It's supposed for using in the education of computer science, thus, Raspberry Pi has GPIO interface which can add a Serial Communication Port. The cost of Raspberry Pi Model A(A+) is about $20, Model B(B+) is about $30. Linux OS (Raspbian) is recommended to use for the Raspberry Pi's Operating System. By the GPU Supporting Function, playback of MPEG-4 Movies is comfortable on slightly lower spec CPU.

A. Implementation of Autonomous-style Signage Device

We implemented a proto-type digital signage display device, shown in Fig. 1. This proto-type device is used a Raspberry Pi Model B or B+. This device has customized Serial Communication Port through the GPIO interface. It has some functions to use in signage system are implemented on Raspbian. The storage system uses a SD Card, which is divided into two disk partitions, one is for operating system, and the other is for the signage content data. Total cost of the device is about $70.

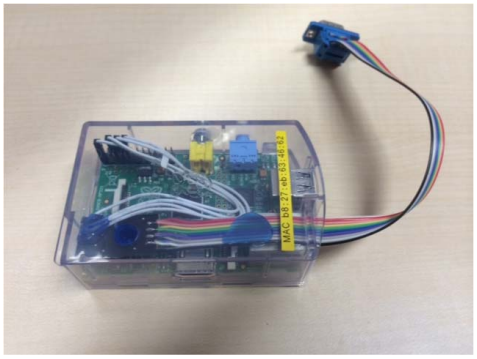

Fig. 1. Proto-type Implementation of the signage display device

B. Functions of Autonomous-style Signage Device

Our proto-type digital signage display device has following functions to display the content in stand-alone.

- **MPEG-4 Video Playback Function**: Signage device has a function to play the MPEG-4 movie (show in Fig. 2). This function uses the GPU support on Raspberry Pi. We use "omxplayer" to play the movie content. In order to play multiple movie content files sequentially, we implemented the module for following operations: 1) Read and play a first video file on omxplayer, 2) when the playback is completed, read and play the next video file automatically, and 3) after all video files finished, turn to the first video file to loop the video playback.

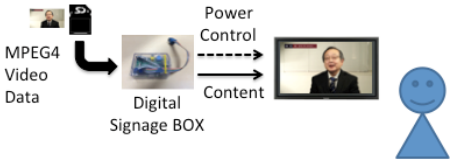

Fig. 2. MPEG-4 Video Playback Function

- **Rich Media Content (Flash Movie) Playback Function**: Raspberry Pi, as a single-board computer, is not so high computing power. For this reason, it's difficult to play another media content format, such as a Flash Movie. In order to prevent this playback problem, we implemented the separated content playback server called ``Media Supporter''. The operation flow of this server is shown in Fig. 3. "Media Supporter" has following functions: 1) Flash content playback, and 2) VNC (Virtual Network Computing)[4] server function. Initially "Media Supporter" plays the content on itself, and transfers the screen image data to target signage device. At this time, the signage device receives the screen image data, and renders the screen image directly to the frame buffer using "directvnc".

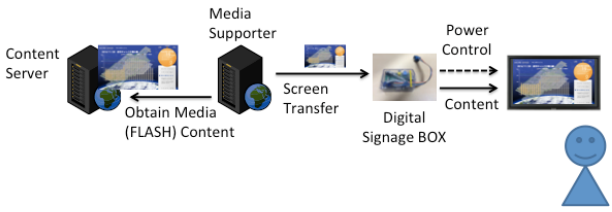

Fig. 3. Rich Media Content (Flash Movie) Playback Function

- **Display Power Control Function**: Since people to see the information is not always everyday in university, e.g.) School Holiday, digital signage system is not always necessary to display the content. Therefore, the signage device has a function to control the power supply of its monitor device in order to reduce power consumption on unnecessary time. This display control function is executed via the serial communications port. Our device can control the power on the SONY's LCD display and Panasonic's LCD/PDP display.
- **Web-based Control Function**: To control remotely by administrator, "Web User Interface" (WebUI) is also implemented on the signage display device (WebUI image is shown in Fig. 4). Administrator can easily control the signage display device (OS restart, Playback start, Playback pause, Playback stop, Skip to next content, and Playback status check) through this WebUI.

III. Intensive Management Architecture for Multiple Digital Signage Display Devices

We are now developing the centralized digital signage management architecture, and also demonstrate the proto-type work. Our architecture, shown in Fig. 5, includes following modules ("Device Manager", "Session Controller", and "Media Supporter").

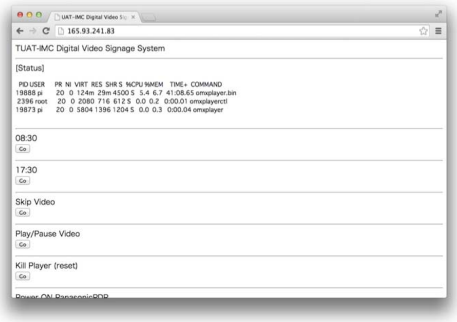

Fig. 4. Standalone Management WebUI

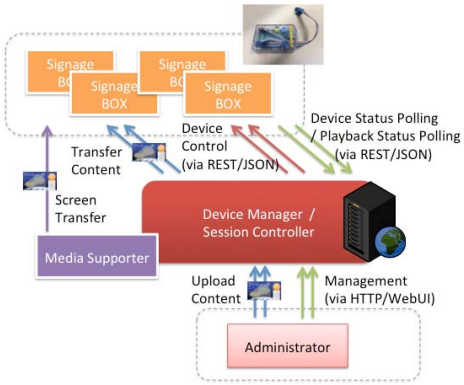

Fig. 5. Example of a figure caption. *(figure caption)*

IV. Conclusion

In our demonstration, we introduce our new cost-effective digital signage system. This signage display device is now in use on our university's many locations (e.g. cafeteria, student office, and HQ office). In this paper, we explained the design and implementation of the anonymous-style digital signage display device using a small and inexpensive information device in detail. We also illustrated the design of the intensive management architecture for multiple digital signage display devices. Our future work is to finish the actual implementation work of the management architecture, and evaluate the system.

Acknowledgment

This work is supported in part by the grants from TAF (Telecommunications Advancement Foundation), Japan.

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