

Specific Electronic Architecture for Large Width Ink-Jet Printing

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Abstract

Ink jet printing requires more and more data to provide to wide bar of heads. For this time we can find large array of jets. A minimum of 4 heads of 1000 jets each requires to load 20 Millions of pixels per second. ARDEJE built a new architecture based on PCI bus data path and link the remote PC to the moving print module by fibre optics mounted on the flat bed table machine.

ARDEJE advises companies which want to introduce industrial and productive ink-jet system for colour applications. ARDEJE can provide studies on jet print heads and ink circuit architecture to control D.O.D. piezo heads with heavy and complex ink formulations as pigmented and U.V. curable based.

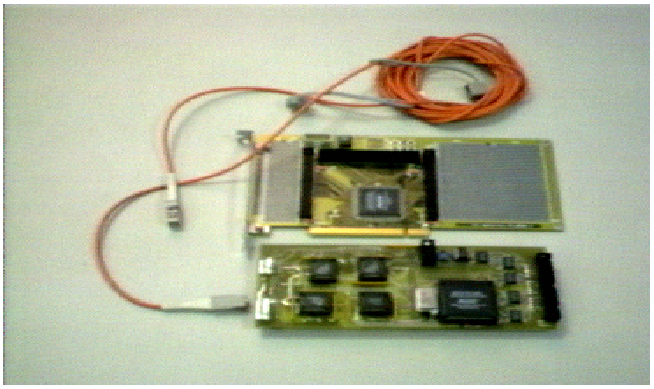

Figure 1. Data Path PCI Board

Introduction

First of all we shall come back to the requirements of the market and a short presentation of ARDEJE activity.

Our goal is to help textile companies to introduce productive machine for applications which requires short runs for T-Shirts, garments or sportswear.. Compared to other digital printing such as Electrography or Dyes Sublimation Transfer, the cost of ink jet printing will be lower than $1 compared to more than $2 for transfer, then the silk screen companies could provide short runs not at an higher price than they do with their traditional means. The ink jet direct printing process requires a flat table with fixed wide bar along the fabrics web or a print module moving across the fabrics web. For a fabrics web of 62 inches (1600 mm) large, we need at 300 dpi resolution to print 19000 dots. To make a such fixed wide bar requires a lot of nozzles per head which is not available today. We prefer then to choose the second way which is to move a large head across the web.

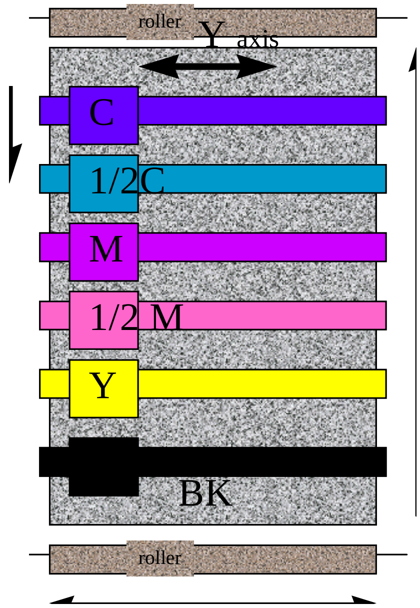

Figure 2. Architecture of flat bed machine.

To provide good productivity for short runs the flat bed machine must not be stopped between two images. Then the next image must be ripped before the flat bed machine finishes the present image.

The first T Shirt and textile sampling flat bed machine could run more than 40 pieces per hour. To be productive and profitable the rate must be improved at 100 to 200 pieces per hour. The C.I.J. heads proved not to be suitable to improve this rate. So we selected the MIT D.O.D. piezo heads in 1995 to improve his machine.

This head can accomodate complex pigmented inks. Pigmented inks are required for T-Shirt printing and the curing system is very simple compared to reactive dyes which require two steps of curing and rinsing. This head can fire at about 5000 rasters per second.

Figure 3. Ink jet printing on T-Shirt by EMBLEME

Because the system was tested with four heads to secure all the ink circuit and the inks. In the meantime a new architecture was built to provide a lot of data to drive 32 MIT heads, 8 heads per colour, which is equal to 1000 jets per colour.

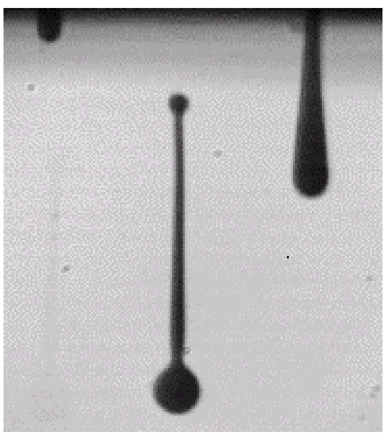

Figure 4 . Drop formation

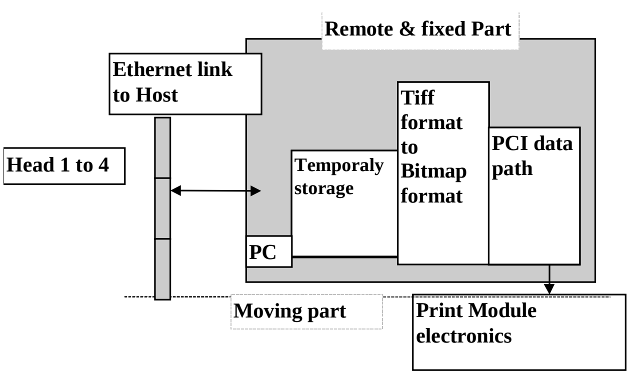

Figure 5. Data Processing Architecture

Architecture Presentation

The industrial ink jet colour applications requires a high productivity (more than 50 m² /hour)) a lot of data (more than 20 Millions of dots per second to be transmitted from a remote computer to the electronic part of the printer.

But for a range of 50 m² to 100 m² , the cost must not be over than $10,000. This is the goal set by ARDEJE in order to provide a whole architecture to control data and ink jet supply system such as valve actuators and pressure sensors.

This architecture is based on power PC which can control in the same time new files from a Host Computer, download data from Hard drive to RAMdisk and translate the bitmap (TIFF or HPRTL) to a bitmap file process by the PCI board. Because the print module electronics is moving at a speed fats 1 m/s with acceleration rate of 1 g, this electronics do not have any electronics which can be damaged by vibrations. This electronics is composed of translator drivers .

The PCI Data Path was designed to drive the data for first MIT heads. The PCI bus has been selected because the bandwidth is very large 33 M words of 32 bits per second which allows us to provide data for the 8 MIT heads in 60 microseconds . To download data to this board, an interruption signal is required every 12 millisec. The O.S. is not interrupted for a long time. This architecture runs around WINDOWS 95 and NT WINDOWS without problems when not a lot of THREAD are involved and priority number one is given to the PCI Data path.

The choice that has been made between several bus (SCSI, USB, ISA) was that PCI is the most affordable solution because it does not require any extra processor to make the link between passive electronics on board of the moving system and the PC microcomputer. Only special ASIC's were designed to drive the PCI complex core and a back end suitable for the MIT heads. The back end core manages the transfer of data from PCI bus to the buffer RAM, the interruption transfer , acknowledgements and the serialisation to the printing heads.

In the case of the fibre option, those two ASIC's manage the data transfer on the fibre optics.

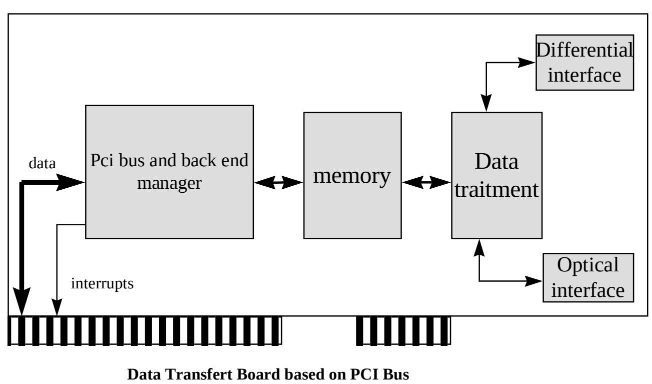

Figure 6 . PCI Data Path Architecture

Future Improvements

This core can be upgraded in case of use of different printing heads such as TRIDENT, SPECTRA, XAAR HP to cite a few.

The change will be made between the buffer and the second ASIC which converts the data and drives the signals to the heads.

In terms of operating systems (0.S.), we are in the process of evaluating the possibility to use other O.S. than Microsoft working around POSIS architecture.

Data conversion from TIFF or HPRTL are in the process of being implemented in the multitasking environment.

Conclusion

This data processing approach using PCI Data path is presently very affordable for application in the range of 50 m² to 100 m² per hour. This solution is suitable on common Operating Systems as WINDOWS 95 or NT WINDOWS.

ARDEJE can provide experience on such applications and is opened for future collaborations.

Acknowledgements

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Biography

Patrice Giraud graduated from l’Institut Polytechnique de Grenoble (INPG) with a degree in electronics and data processing. In 1982, he joined IMAJE as one of the early members of the company. After quiting Imaje, he first founded EMBLEME which assembled continuous ink-jet garment printers and then ARDEJE a company specialised in the development of special electronic architectures and software for large width ink-jet printers.