Innovations in a Mature Scanner Market

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Abstract

It becomes increasingly challenging to innovate in a mature market, but Hewlett-Packard (HP) flatbed scanners are meeting the challenge with its latest innovations: Automatic Photo Feeder, HP Memories Disc Creator software, and Instant Lamp Warmup.

HP is first to market with the Automatic Photo Feeder (APF), which scans and feeds up to 24 photos in one operation. To prevent damage to the original photo, each individual photo is gently transported on a cushion of air above the scanner glass. The photo is held in place during the scan by a vacuum before continuing to the output tray. The APF can scan directly to disc using the HP Memories Disc Creator software.

HP Memories Disc Creator software lets you create a photo show from your digital images by writing them to a recordable disc for viewing on a PC or television with a compatible DVD player. A Memories Disc is an enhanced version of the Video CD (VCD) standard that supports multiple uses on multiple hardware platforms. Unlike any VCD on the market today, the Memories Disc's single format is compatible with PCs and Macs, consumer electronic devices (such as DVD players), and retail photo-finishing hardware (like the Kodak PictureMaker Kiosk).

Another HP first-to-market innovation is "instant scanning" achieved with Instant lamp warmup. Lamp-warm-up time is eliminated after the first scan as the cold cathode fluorescent lamp (CCFL) is kept in a ready-for-scanning state with minimal power consumption. A wire is wrapped around each CCFL, and the wire is only energized when the CCFL is off.

Introduction

Innovating in a mature market is a big challenge. It does not take just one innovation, but it takes many, continuous creations. This article will touch on three flatbed scanner innovations from the ingenious minds of HP. One is built into the flatbed hardware (Instant lamp warmup), one is a flatbed accessory (APF), and one is software (HP Memories Disc Creator software).

Automatic Photo Feeder (APF)

The automatic photo feeder is divided into three logical parts: the pick mechanism, the transport mechanism, and the eject mechanism.

Figure 1. HP Scanjet 5550c Scanner with Automatic Photo Feeder

The pick mechanism begins the scanning process by picking up one and only one photo. It uses a passive separation system vs. the active system used on most document feeders. The passive system is gentler by using a roller to push down on the stack of photos allowing only one photo to bypass a built-in shelf.

Figure 2. Underneath Side of APF

The transport system takes the "picked" photo and guides it to the scanning location. Four seamless Hypalon belts gently pull the photo from the pick mechanism past the

one-way deskew fingers. The belts then reverse to move the photo backwards until the photo stops on the first deskew finger sensor. The belts continue in reverse until touching aligns the photo edge to all three deskew fingers. This also detects the length of the photo. Now the belts are returned to their normal, scanning direction.

Figure 3. Four Belts and Three Deskew Fingers

Photos naturally want to hit the scanner glass so all the way through this process the photo is held up and away from the scanner glass by two vacuum chambers located above the belts. Each chamber contains a standard computer-cooling fan. The first vacuum chamber holds up the leading edge, while the second vacuum chamber holds up the trailing edge, and both are used to hold the photo stationary during the actual scan.

Finally the eject mechanism takes the scanned photo and places it in the exit tray. A sensor at the bottom of the exit tray signals a successful scan to the host scanner so it may begin another scan.

Photos are more complicated than documents to scan in an automatic feeder mainly because of the variety of finish types and the preciousness of the photos. Therefore new challenges had to be overcome:

- Prevent damage and jams
- Sticktion
- Static
- Curled photos
- Scratches
- Dust

Photos tend to be more sentimental and variable in materials then documents, therefore, preventing damage is extremely important. If a jam is detected, the eject mechanism sensor and the deskew finger sensor will stop the photo from moving any further along in its designated path as soon as possible to ensure photo protection. The photo feeder shuts down immediately and the user is notified via the scanning software and / or the LCD scanner window on the front panel of the host scanner. The customer can then lift up the APF and remove the photo undamaged.

Not only is it desirable to keep the photo off of the scanner glass for scratch prevention, but also glossy photo finishes combined with humidity will cause what we call "sticktion." In extreme circumstances sticktion can be so powerful that a photo stuck to the scanner glass can be used to pull the scanner across a table! So the photo feeder minimizes photo-to-glass contact by sucking the photo away from the glass with the two vacuum chambers.

Along with sticktion there is static to contend with. Cool or hot dry air increases the amount of static that can cause photos to stick together.

Environment conditions and photo storage methods sometimes result in photos that are not flat but tend to have curly edges or waviness. This can make it almost impossible to eject photos if the curl bends down to touch the glass and it pointed away from the eject mechanism. This is solved by adding a patented, miniscule "pick" that "kicks-up" the curled edge of the photo similar to a finger nail dislodging a suction cup by breaking the suction's seal by lifting up an edge.

Scratches to photos not only cause inferior scans but are not desirable to the physical photos. Scratches can be caused by non-smooth edges or dust. Dust comes from the elements and from the photos themselves. Special attention was given to polish surfaces that have contact with the photo, in addition to statically discharged materials in the input area. Cleaning sheets made of 50% isopropyl alcohol and 50% water help prevent dust problems and are to be used after assembly and periodically.

HP Memories Disc Creator Software

Scanner hardware innovations are complemented by scanning software innovations, so HP created software that provides the customer with a method of organizing, archiving, and viewing all the images from the APF. A personalized photo show can be created complete with a title page and individualized music. Printing single photos is a snap and you can even create a jewel case insert.

A Memories Disc wizard guides the customer through a step-by-step disc creation process. Creating a photo album is as simple as dragging files/images into an explorer-like window where they can be previewed, rotated, and sorted before burning to disc.

Not only can the customer scan directly from the APF, they may also select files from the following sources:

- A hard disk in your computer.
- Removable storage media accessible on your computer, including another Memories Disc, a data CD, a connected digital camera, or a floppy disk.

Use the View My Album page to verify that you have the correct images for the Memories Disc. The order of the images displayed here is the same order you'll see in the created photo show.

Figure 4. View My Album Page

From the Select Music File page the customer customizes the photo show by selecting a background music that will be played during the photo show. Music can be from an audio CD, a music file supplied with the software, a file from the customer's hard disk, or none at all.

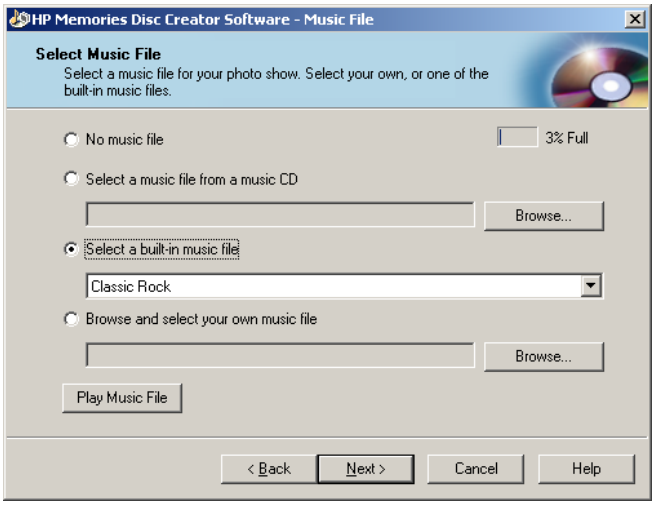

Figure 5. Select Music File Page

Now the customer selects settings for the actual burning of the Memories Disc. The Select Settings page allows the customer to determine how many seconds each image will be displayed before displaying the next image, in addition to recording speed, Video CD (VCD) format, and a CD writer.

The number of seconds each image is displayed during the photo show can be between 2 and 10. The smaller the image display time the more photos you can fit on a disc.

Ideal recording speed depends on the system. The default recording speed is optimized for the customer's individual system configuration, although lower speeds provide the most reliable results when burning a Memories Disc.

Selecting a VCD format depends on what part of the world the customer is in. Different countries use different television signal formats, which are applied to the Video CD format:

- NTSC -- Standard in North America, Japan, and parts of South America.
- PAL/SECAM -- Standard in Africa, Asia, Europe, and parts of South America.

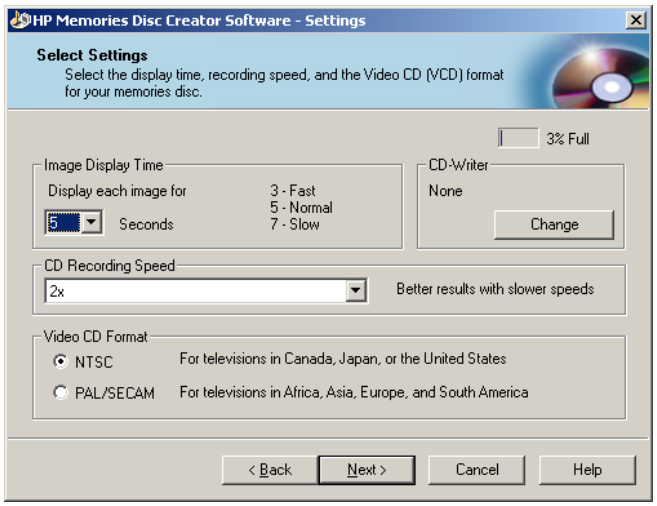

Figure 6. Select Settings Page

Instant Lamp Warmup

Scanning a shoebox full of photos is a mammoth task, the APF helps to tackle this task, but HP decided to go one step further with the use of instant lamp warmup. Most scanners use cold cathode fluorescent lamps (CCFLs) that require substantial time to stabilize the lamp profile and light intensity between periods of inactivity. These lamps are still preferred because of their high light output, high-energy efficiency, long life expectancy, low cost, small physical size, and the ability to control brightness. HP uses a method of keeping the CCFL in a ready-to-scan state using instant lamp warmup.

Before going into the specifics for HP's instant lamp warmup, a brief discussion regarding the physics of typical CCFLs is a must. Inside a CCFL there is a mixture of mercury and a fill gas (i.e., Argon) used to enhance the ionization of the mercury vapor. When an electric field is applied to the electrodes, the electrons will collide with the fill gas atoms and in turn the fill gas atoms and electrons collide with the mercury atoms to enhance ionization. These collisions excite the mercury atoms above their stable ground state. When the mercury atoms return to their stable ground state, ultra-violet energy is released.

When analyzing stability and ultra-violet output for typical CCFLs, temperature effects cannot be ignored. The goal for HP's Instant lamp warmup is to keep the CCFL in

pre-heated state even when the scanner is not in use. Optimum mercury vapor pressure for CCFLs is achieved around 45-65 degrees Celsius, which results in higher efficiency or light output.

HP uses a straightforward approach to pre-heat the CCFL using a highly resistive, small diameter wire to dissipate heat in a uniform manner along the length of the CCFL. Basically the high resistive wire needs to dissipate a minimum amount of power while the lamp is off in order to keep the mercury at a heated state warm enough to enable lamp stability in less than two seconds after turning on the CCFL and turning off the wire. (i.e. wire ON = CCFL OFF, wire OFF = CCFL ON).

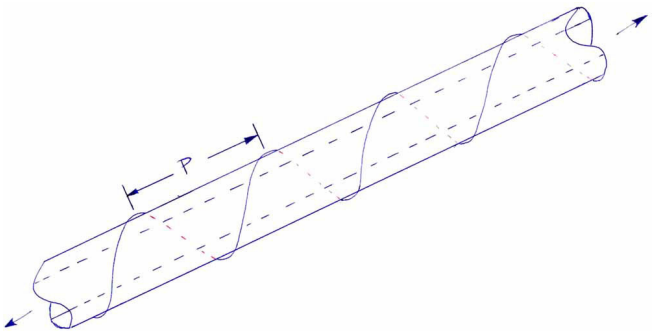

Figure 7. Lamp with Wiring

The amount of power needed to dissipate appropriate amounts of heat is almost equivalent to the amount of power used to ignite the CCFL under normal operating conditions. This wattage determines the length of wire, pitch, and total number of wraps used to keep lamp-warm-up time, after ignition, to less than two seconds.

If Instant lamp warmup is enabled, the lamp will have current running through the wire to keep the correct amount of dissipated power in the lamp to virtually eliminate the need for lamp warm-up.

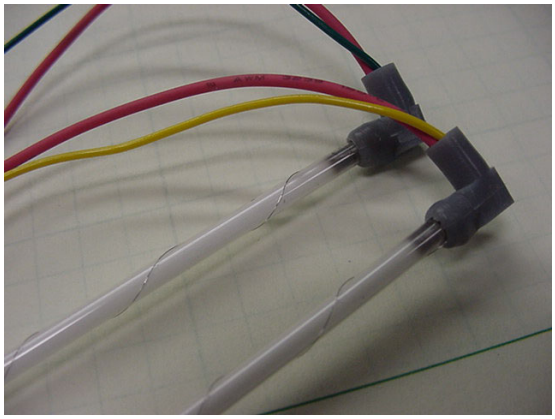

Figure 8. Lamps Wrapped with Instant Lamp Warmup Wiring

Creating Instant lamp warmup was not without its own challenges. It took many hours of experimentation before determining the specific wire resistance, diameter, pitch, wire length, end-cap connections, and number of wraps required to maintain the desired resistance. Wrapping the wire consistently on a fragile lamp without breaking was not trivial as the wire must be in contact across the entire CCFL while maintaining the appropriate pitch.

The customer must be able to enable/disable Instant lamp warmup for Energy Star rating due to the requirement for the scanner to default to its lowest power mode--without Instant lamp warmup.

HP has a patent pending regarding CCFL wrapped with a heater wire and the machines for manufacturing same.

Conclusion

To be a leader in any market, new and creative ideas are mandatory in order to keep customers' loyalty and interest. Of course, it becomes more and more difficult to conjure up never-ending innovations as the years pass. Hewlett-Packard has stepped up to the plate with the Automatic Photo Feeder, Memories Disc Creator software, and Instant Lamp Warmup, which can all be found on the HP Scanjet 5550C scanner.

Acknowledgements

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References

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Biography

Jeanine L. Eves received her BS in Computer Information Systems from Colorado State University. Jeanine currently is a member of the HP Digital Imaging Scanner Performance Team (SPT), which is responsible for image quality, as well as overall scanner performance. In addition she is responsible for image-quality testing software, and has been in the scanner business for four years. She is a member of IS&T.

Todd J. Anderson received his BS in Electrical Engineering from Colorado State University. Todd is a member of the R&D Organization at HP developing products for Digital Imaging. Todd has lived in Colorado his entire life and enjoys backcountry sports.