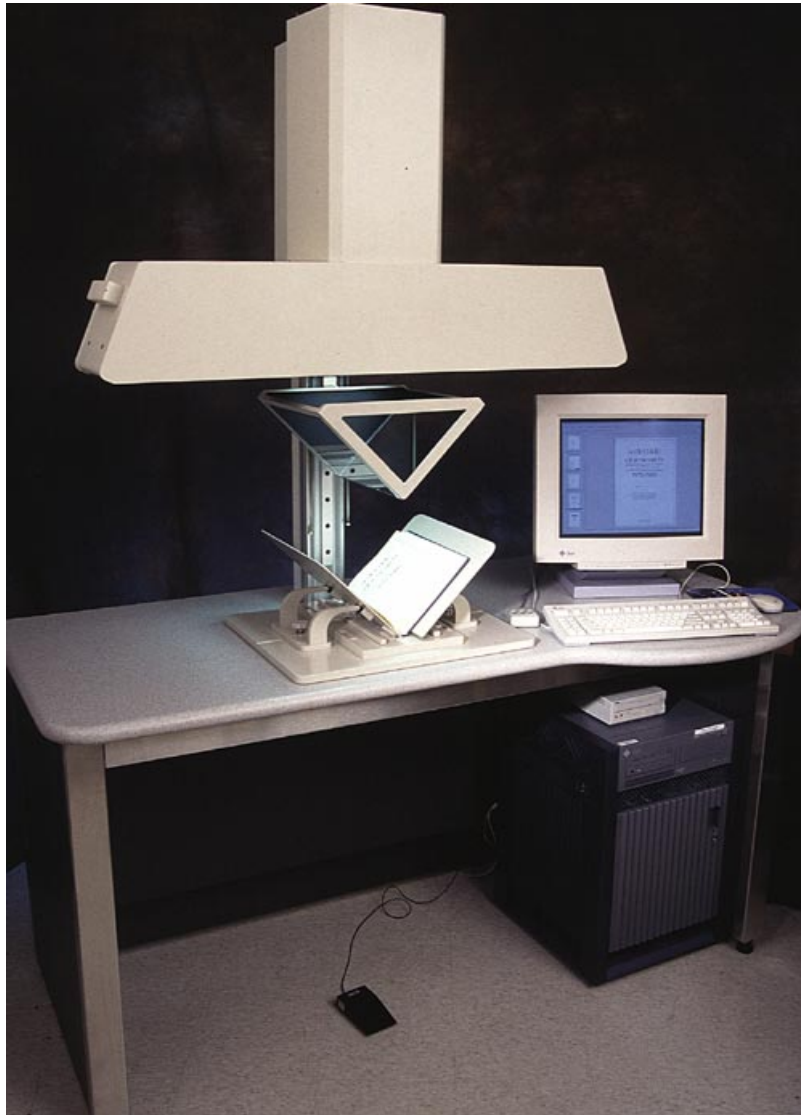


parc

Palo Alto Research Center

Bookscanner



System components

Power supply

The power supply switch is located on the back panel of the bookscanner and powers the lamps, camera and CDROM writer. It requires a 110V supply.

Wedge platen

The platen moves up and down by hand and is lowered onto the book for imaging.

Book cradle

The book cradle holds the book and has adjustments for the angle and the separation to allow for different book sizes.

Camera assembly

The camera assembly contains a 4000x4000 pixel, CCD camera, along with shutter, optics and a counterweight. The assembly is connected to the wedge and is lowered when the wedge is brought down onto the book.

Control buttons and foot pedal

The control buttons trigger imaging of the book, and this function is duplicated by the software and partially by the foot pedal. Three LEDs indicate the status of the imager;

Buttons:

left button: left page only
middle button: both pages
right button: right page only.

LEDs:

green; ready
red; scan in progress
yellow; image processing and saving to disk in progress.

Foot pedal; press to scan both pages.

Computer

X86 PC with Redhat 7.2Linux

Specifications

Electrical

Power Cabinet: 120V AC, 2A
Computer: 120/240V AC, 15A

Throughput

Grayscale: 360 pages/hour
Color: 120 pages/hour

Optical

Optical Specifications	
Resolution	300 spot per inch (on page)
MTF	> 50% at 6.2 lp/mm (on page)
Magnification	0.1772 (5.64:1)
Aperture	F/11
Integration Time	0.12 sec – Grayscale 0.32 sec – Red 0.32 sec – Green 1.08 sec - Blue
Depth of Field	10 mm
Field	10.5" x 12.3"
Distortion	< 0.01%

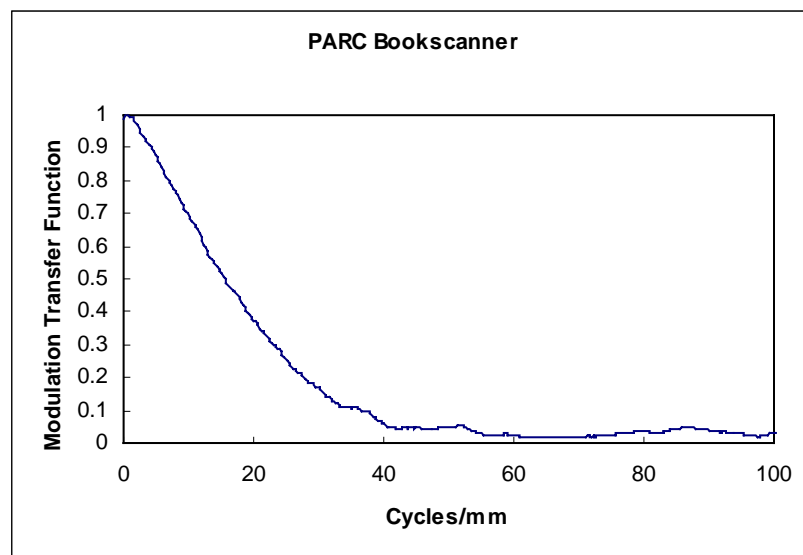


Figure 1, MTF for optical system and CCD measured at the CCD.

Bookscanner operation

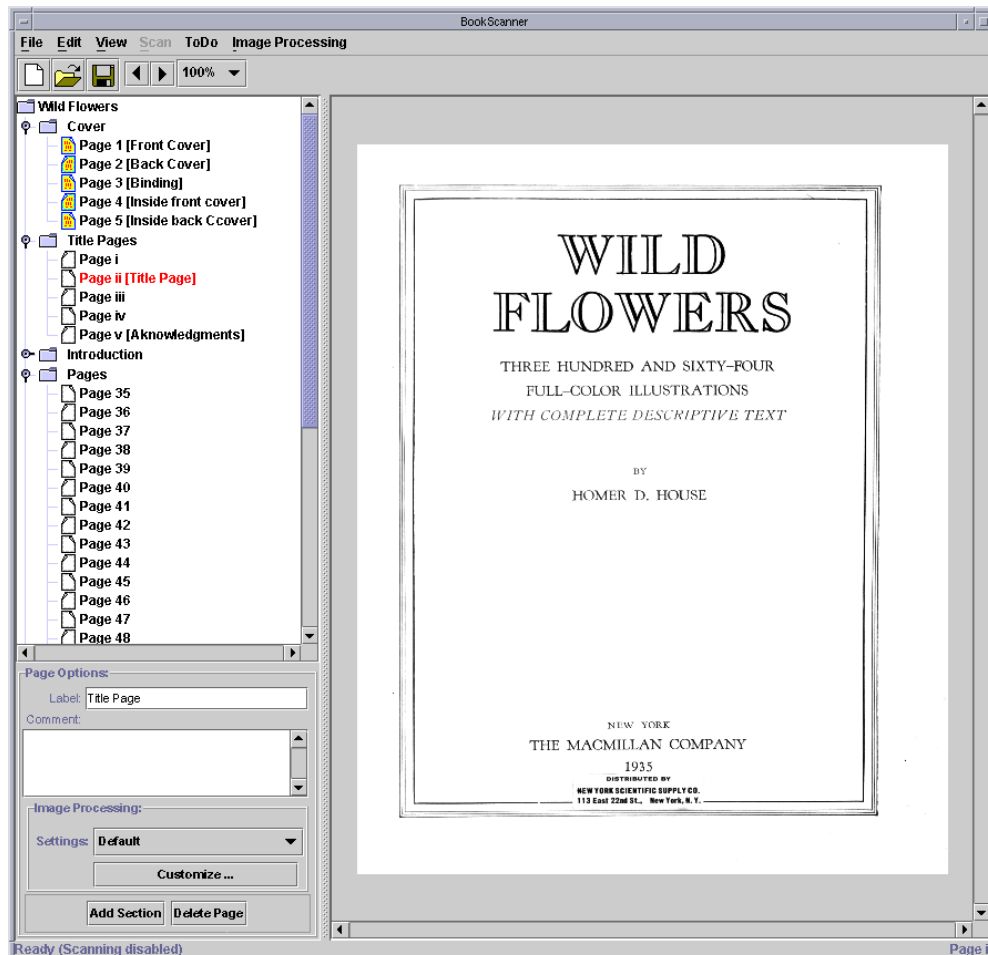
Power up scanner, computer and monitor

Apply line voltage via the power switch located in the upper right hand corner as you face the back of the scanner table. You should immediately see the platen illuminators light up and hear noise from the rotating mirror initializing. The noise should cease after 15 seconds.

Power up the computer through a switch on the back and energize the monitor via a power switch located on the front at the lower right hand side. The computer takes about 4 minutes to come to a login prompt.

Start the applications program.

Enter the login name, "bookscan", at the prompt. This will bring up the Gnome environment and start the Bookscan program. At this point the system is ready to scan books.



Set up the scanning configurations.

To begin scanning of a book, title, author name, disk location and reference data is entered into a properties dialog box. A default image-processing template is then created or selected from previously saved templates.

Position the book on the platen.

The basic operation involves placing the book in the cradle face-up, lowering of the platen onto the book which causes the cradle to partially close the book onto the 90° angled face of the platen, illuminate the book, capture one page, then rotate the switching mirror and capture the other page. Further scanning continues by lifting the mechanically assisted platen, turning the page, and repeating the process. In this configuration, two pages are captured without having to flip the book around, the book binding is supported by the cradle, and stress on the binding is also minimized by having the open book angle be 90° instead of 180°. The function of horizontally translating platform is to allow the book to center itself as the platen is lowered. The operator has the ability to exercise judgment as to the amount of pressure to apply to the book. If need be, the platen can be lowered to barely touch the gutter of the book while the operator brings the hinged cradle sides up with his/her hands to provide gentle contact of the pages to the glass platens. This concept combines high productivity with minimal stress on the book.



Scan book

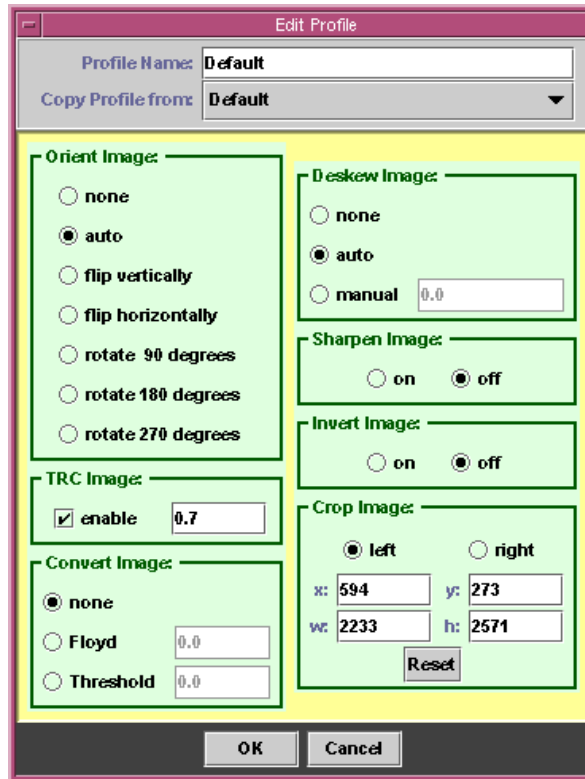
The software user interface is Java based with image capture and processing routines written in C and C++. The operator is initially presented with an image viewing sub-window and a book structure selection portion of the application window. An image-processing template is then created or selected from previously saved templates. At this point, scanning is initiated either from the application, a 3-button scanner mouse (left page/both/right page), or a foot switch (both pages). The foot switch enables the operator's hands to concentrate on the book/platen interaction to minimize impact on the book and ensure the quality of the image during capture.

Calibration.

The operation of the bookscanner is designed for optimization of throughput and image quality. A scanning session begins with the capture of calibration images. Dark images and images of white sheets for each channel are used to calculate pixel wise gain/offset information to compensate for fixed system noise and inhomogeneous illumination. An IT8 color target is then imaged and analyzed to produce a color correction lookup table. The image of the target and lookup table is then saved to accompany the collections to be scanned to verify scanning accuracy at a later date. The subsequent scanning operations produce gain, offset, color and bad pixel corrected, full field images intended as archival quality images.

Image processing

The profile template describes a set of image processing routines geared for rendering the image in the best possible way. Initially, this may be set for viewing the images on the computer screen. At the present point, this includes crop area (right and left), orientation (auto-orient, flip, rotate), deskew, bitonal threshold, invert, sharpen, and the application of a tone reproduction curve (TRC) for background removal. A profile is setup as the default initially, but individual pages may have specific profiles as needed.



The screenshot shows the 'Edit Profile' dialog box with the following settings:

- Profile Name: Default
- Copy Profile from: Default
- Orient Image:**
 - none
 - auto
 - flip vertically
 - flip horizontally
 - rotate 90 degrees
 - rotate 180 degrees
 - rotate 270 degrees
- Deskew Image:**
 - none
 - auto
 - manual 0.0
- Sharpen Image:**
 - on
 - off
- Invert Image:**
 - on
 - off
- TRC Image:**
 - enable 0.7
- Convert Image:**
 - none
 - Floyd 0.0
 - Threshold 0.0
- Crop Image:**
 - left
 - right
 - x: 594 y: 273
 - w: 2233 h: 2571
 - Reset

Buttons: OK, Cancel

Saved images

During the book capture process no image-processed images are saved. Processed images are rendered as needed on the fly from the "archive" images. The book image file index and associated metadata is saved as a text file. After capture, or at a later time, the book can be "published". In this manner predefined image-processing steps can be applied to the archived images in a manner best suited for the intended viewing device and audience, such as a printer or display with particular output characteristics