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RUNTIME USER OPTION TO ACHIEVE COLOR CONTROL ON THE PRINTED OUTPUTS

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Runtime user option to achieve color control on the printed outputs

User personalization/customization always has higher significance in any product segments. Every enhancement in this area helps in bringing out better user centric product experience. This abstract details on one such feature in the printers.

There are existing user options for a print that enables the user to print in draft, normal or best quality mode. Along with these, user can also choose to print the output in black only or color. These options are either applied for the entire job or the entire page.

However, there exists no option to control individual colors in the print output. Sometimes, users might also like to print a content with a tinge of specific color. For some of the printed outputs, user might want to enhance a specific color. For example: while printing a nature landscape photo, user might want to enhance the green color (to be printed at even better quality than other colors) in the photo. To achieve this, user must manually edit the photo using photo editor tools before printing.

Our idea is to provide a printer settings option “Output Color Control” to achieve this. This option would be provided during the launch of a print job. The user interface (control panel, software driver, SmartApp, etc) will launch a color palette on choosing this option. User can customize the color density based on their choice. Based on the user chosen color and density the print preview will be modified and shown to the user. Using the print preview user can further customize the output colors. After completing the customization user can initiate the job. Printer firmware would take this input color option and apply the required enhancements on the job. The printed output would reflect the user chosen color enhancements.

Existing and proposed changes in the firmware

For printing, printer firmware uses different tables. Each table serves different purpose like converting RGB to KCMY data, edge correction, halftoning etc. This section explains the role of “Halftone Tables” and the options to achieve the color controlled output through this table.

Halftone Tables:

Halftone tables are responsible for print quality. They are used to control the toner density (amount of toner to be deposited) in the output media. The toner deposit amount of all the supplies (KCMY) will not be same. So, printer firmware has individual halftone table for each color supply. Below are the default halftone tables for color products,

- Halftone Table Cyan
- Halftone Table Magenta
- Halftone Table Yellow
- Halftone Table Black

Printer firmware will maintain a default halftone table for each color. These tables will not be used directly, as the default halftone tables will not give better output. To get better output during printing, printer firmware will have to recreate the halftone tables. This recreation requires below additional information,

- Correction tables (stored in printer firmware)
- Density index (reported from engine during calibration)

Correction tables:

Correction tables are an array with index from 0 to 255. This array will have the density values required for recreation.

Density index:

Density index will be reported from engine during the calibration process. Density index will be in the range of 0 to 255.

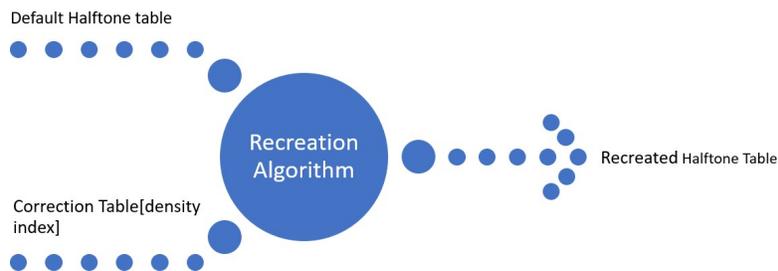
Printer firmware will initiate the calibration process in certain conditions. For example, after first boot, after printing certain amount pages, etc. During the calibration, engine will examine the amount of toner deposited in the Image Transfer Belt. Engine will use this value for further analysis and report the density index to the printer firmware.

This index value will be used to select proper density value from the correction table array.

Existing approach to recreate the halftone tables:

Consider, printer firmware uses “Halftone Manager” component to perform the recreation of halftone tables. Below are the steps it would use for the recreation process:

- 1) Read the default halftone tables stored in the printer firmware
- 2) Read the correction tables stored in the printer firmware
- 3) Get the density index
- 4) Read the value from the correction table at density index
- 5) Perform recreation using recreation algorithm



Proposed approach to recreate Halftone Tables based on user input

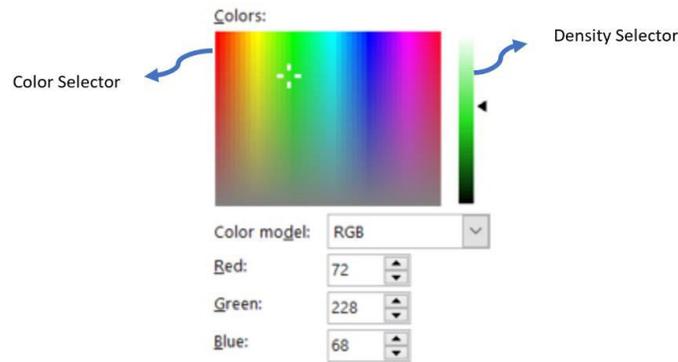
The same “Halftone Manager” component described above can be used to recreate the halftone tables based on user input.

Halftone Manager requires default tables, correction tables and density index to perform the recreation. Here, instead of getting the density index from engine, printer firmware will read the user selected density index (from print job settings) and pass it to the Halftone Manager. So, Halftone Manager can recreate the halftone tables based on the user inputs.

Steps to achieve this:

- 1) User will be provided with a color palette while launching the job. This color palette will be available in all user interface like Print UI, Software Driver, etc.

The color palette will look like below,



Using the “Color Selector” user can select the color and using “Density Selector”, user can adjust required density for the selected color. The value selected using the Density Selector will be used as density index in the printer firmware.

- 2) The selected color and density index will be passed to printer firmware via print job settings.
- 3) Upon receiving the print job, printer firmware will extract the user selected color and its density index from the job settings.
- 4) Printer firmware will convert the extracted RGB color to CMYK format.
- 5) Using the CMYK value printer firmware will identify the toner(s) required to produce the color.
- 6) The identified toner and extracted density index will be sent to the Halftone Manager.
- 7) Halftone Manager will recreate the tables using provided density index value.
- 8) This new halftone tables will be used to print the job.

The printed output would have the color controlled based on user’s choice.

Disclosed by Devi Vellingiri, Anusha . and Puviyarasu V, HP Inc.