Seamless Publication Using 3D Proofing

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Abstract

The main motivation of this work is to expose professional level commercial print services to broad non-professional markets. In spite of increasing simplicity in content creation due to advances in authoring tools, publishing is still complex and reserved for professionals. To that end, there is high potential value in eliminating or reducing the barriers for non-experts to submit jobs for commercial printing, and in seamlessly connecting new non-professional content sources to the commercial printing environments. Our solution simplifies and automates the submission process by providing a workflow to replace the complex interaction between print buyers and commercial print experts. A key enabler for this workflow is an interactive and intuitive interface, which provides a soft proof of the finished product by a high-fidelity 2.5D/3D interactive model that captures the geometry and dynamic layout of the print product.

Introduction

Imagine a house renovation project, in which you decide to order a new cupboard by calling the local carpenter and asking for "A white cupboard with four doors, six drawers and twelve shelves". Those of you who renovated furniture realize that this is not the way things work. If the carpenter will manufacture the cupboard based on this description the chance it will be the one that you imagined is slim. To ensure that the cupboard will meet your expectations, the carpenter and you will need to meet, where the former will provide drawings of the cupboard or previously made similar products as a proof for the future product until the order is approved.

Ordering a professional commercial printing may be as complex as ordering a cupboard. The print buyer communicates explicitly with the print service provider and describes the intent of the print job such as the product type (e.g., booklet, flyer), page style (e.g., size, weight, glossiness), cover style, binding type, folding and more. Similar to the cupboard example the chance that a printing job will come out as expected based on this description alone is small. The ambiguities and the lack of formalization in the intent description may lead the print service provider to produce a different product with different look, feel, usability, and consequently impact, albeit with the same content. For example, consider a print request for a saddle-stitched booklet with 54 letter size pages. Since saddle-stitched binding requires the number of pages to be a multiple of four, the result of a 54 pages request is unexpected. Different print service providers may handle such a request differently depending on their imposition settings: some may leave two blank pages, while some may repeat the cover page. To overcome this, the print service provider produces a proof and may have to produce several proof iterations until fully approved by the print buyer for fulfillment. This is a long and complex process, which strongly affects the total cost of production and consequently limits commercial printing to professional buyers who avoid many of the trivial issues.

The main challenge in this work is to find ways to expose non-professional print buyers to commercial printing and publishing by simplifying the submission process and providing a soft proof of the product as an interactive, high fidelity 2.5D/3D rendered model of the product as it may look after fulfillment by a print service provider. Such an interface will reduce the overall price of commercial printing and in parallel increase the accessibility of both nonprofessionals and semiprofessionals to professional high quality publishing.

Related Work

For many years, front-end authoring tools were the focus of research and development in the printing and publishing industry. Tools such as Microsoft Office [1] and Adobe's creative suites [2] enable the unprofessional consumer to create impressive line-art and professional looking documentations. Algorithms for automatic layout and page composition such as in [3] and [4] allow the consumer to concentrate on the content and automate adjust and visualize the layout in real-time.

Regardless of the advance in content creation, publishing remains a barrier. Even though many of the authoring tools enable definition of basic intent characteristics such as page size, layout for odd and even pages, etc. many publishing requirements remain undefined. To close this gap, some publishing tools concentrate on limited type of products, which predefine some of the publishing characteristics. For example, MagCloud [5] professionalizes in

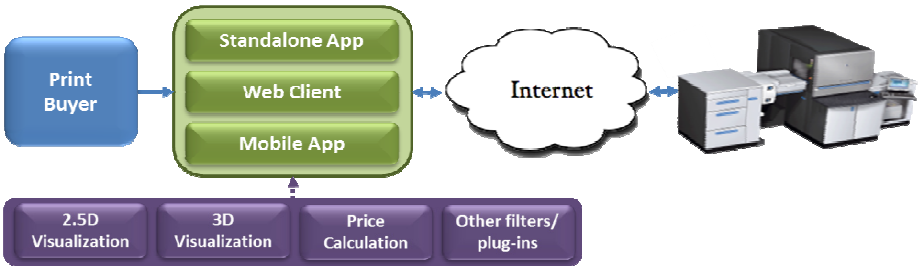

Figure 1: A scheme of the seamless publication system

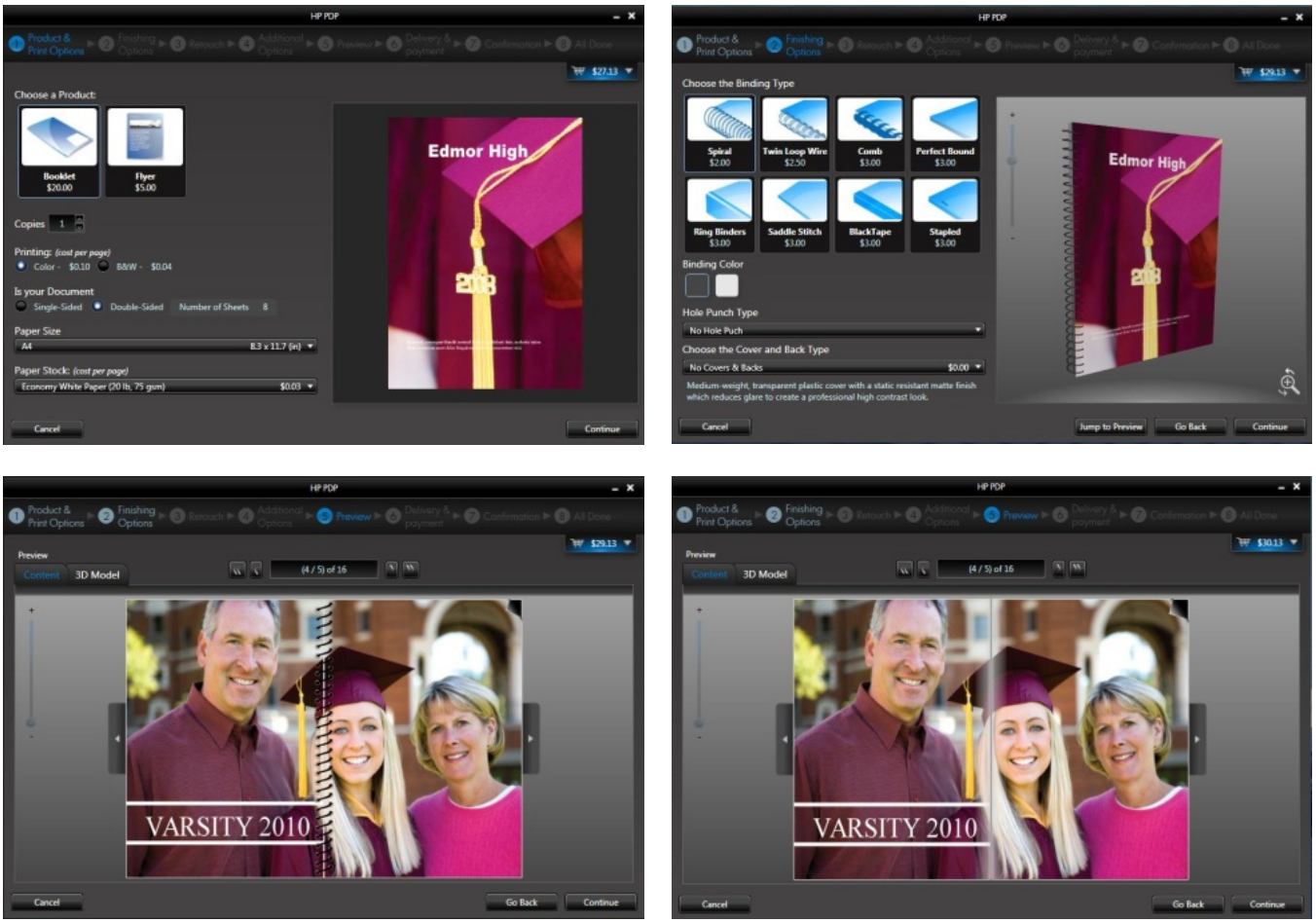

Figure 2: Selected screenshots from a standalone interface of the publishing driver. Top-Left: product type selection and print options. Top-Right: finishing options and soft proof using the interactive 3D preview. Bottom-Left: flip through content soft proof using the 2.5D preview. Bottom-Right: flip through content soft proof of an alternative binding option

magazine publishing. Once the consumer signs in and uploads the content, only limited parameters are left to be customized before a professional looking magazine is ready for fulfillment. Templates (e.g. [6]) are another example for print products with pre-defined intent characteristics. The consumer has just to select the best matching template from a list and to apply the content. In fact, since templates pre-define all the intent characteristics, they may be considered as hard-coded products, which the consumer cannot change.

Some print service providers allow limited product customization by enabling consumers to define selected intent characteristics. Mimeo [7] and Hiflex [8] use a web interface and 2.5D preview for soft proofing. Nevertheless, Mimeo's solution is restricted to one provider only and to a specific set of products. Our solution is general enough to be integrated to any print service provider. It supports proliferation of products and visualization with a reliable 3D view of the print products.

Although soft proofing is a key feature in any automatic publishing scenario, many applications limit it to layout visualization. In [9] a realistic rendering of a print product is considered by evaluating the bidirectional reflectance distribution functions of a printed page. To the best of our knowledge, our work pioneers the realistic and high fidelity soft proofing by combing realistic color and material synthesis together with the geometry of the product such as: binding, cover, etc.

Seamless Publication

The seamless publication approach for this challenge is to design and implement a modular interactive platform for seamless commercial printing submission that includes: (i) an Internet server (ii) interface and (iii) computation and visualization modules. Figure 1 presents a scheme of this approach.

Internet server: The internet server module provides information regarding the print service provider and accepts print jobs. The information consists of the capabilities and the type of print products the provider can accept and fulfill. For example, consider a print service provider that supports only letter size pages and only perfect-bind or spiral bindings. When a print buyer selects this provider only the letter size is enabled under the page

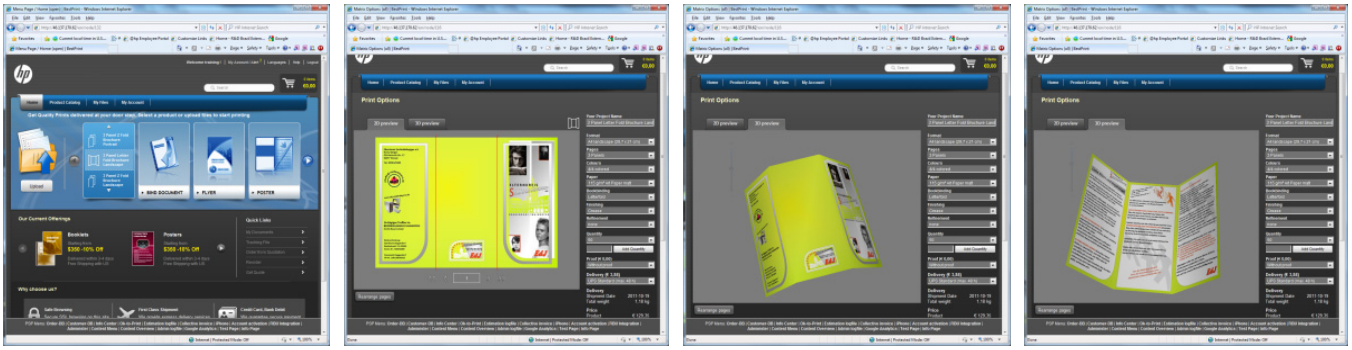

Figure 3: Screenshots from a demo of a web interface workflow (left to right): product selection and document upload, print options and validation, 3D previews (third and fourth images). As in the driver version, 3D navigation is also available.

size selection and only perfect-bind and spiral are enabled under the binding selection options.

Interface: The interface will enable print buyers to interact with the system. It should be prevalent, have accessibility to the print content, and visualization capabilities. It can take many forms, for example: (i) a print driver application with a wizard based interface, which may be launched independently or from the default print dialog. (ii) a web based interface, which is a selection-based interface where the buyer selects the properties that best match the job's intent. (iii) an App interface for mobile operating systems with a similar functionality.

Modules: Modules are computation and visualization-processing components, which provide services to both the interface and the Print Service Provider (see Figure 1 for an illustration). They may include a 2.5D rendering module visualizing the content layout on each page, a 3D rendering module providing an overall look of the product, filters which may adjust the print content to the print intent (e.g. retarget a page designed for A4 paper size to fit into a letter size page), and cost calculation. Each of the modules is independently implemented which makes it relatively easy to port between interfaces and reuse in other applications.

The overall flow of our solution is as follows: A print buyer launches one of the interfaces and uploads the content of the job as a PDF file, or any other supported file format. Depending on the platform and operating system, the buyer may choose the File-Print option and select the publishing driver from the list of installed printers. In both the standalone application and the print driver interfaces, a wizard-based interface will guide the buyer through the different steps of setting the job intent. Figure 2 shows select parts of the wizard flow. Prior to submitting the job, the buyer may proof the product using the 2.5D/3D interactive rendering that provides a realistic look and feel of the fulfilled product. In the web interface, the default browser will be launched forwarding the buyer to the print provider web site, where a selection interface is provided. As in the standalone interface, the buyer may proof the product using the embedded 2.5D/3D renderer. Figure 3 demonstrates a possible web flow. Each of the interfaces communicates with the print service provider through the Internet module to receive details regarding the print capabilities of the service providers and to provide details regarding the job. On the other side, each interface communicates with the relevant plug-in modules for calculations, filters and rendering tasks.

The soft proof of the print product using 2.5D and 3D interactive visualization is a key feature of our solution. This feature potentially replaces the expert consultation that is usually required with the submission of new product. Indeed, much of the interaction between the print buyer and the print service provider is with respect to how a product will look like if certain selections are made, and to a certain extent the implied cost. All these are enabled with a high fidelity virtualization of the look and feel of the finished product. The implied flow is that if a selection is possible, the tool will visualize the resulting product including how the content will fit on the product and the resulting look and feel of both the finished product and its various pages. Thus visualization plus an automated price quote can replace expert consultation and expectation calibration regarding the look and feel and the price of the finished product.

Specifically, as is depicted in the lower part of Figure 2, visualization allows the user to detect flaws in the design (content or intent) and to make proper adjustments before committing. For example, the bottom-left image in Figure 2 shows a booklet with a spiral binding. A closer look into the image will show that the spiral destroys the image by punching holes along its middle axis. Having seen that, the print-buyer would likely replace the spiral with a different binding type such as perfect-bind or saddle stitch, which is more appropriate for this case. Bottom-right image in Figure 2 shows the "re-selection" of the binding for this brochure. The print-buyer returns to the binding selection stage selects a different binding option and validates the selection using the 3D and 2.5D soft proof. Notice that since the print buyer has seen the finished product and approved it, even if the selection was eventually spiral binding, the print service provider can rest assured that the selection was a conscious one on the side of the buyer, and can therefore to fulfill the job as requested.

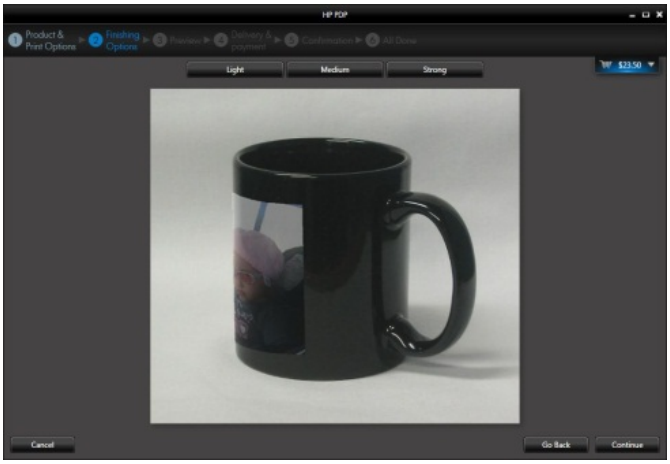

Figure 4: A special print- product, a Coffee Mug with a personalized image embedded on it.

The system may also support special products that enable the print service providers distinguishing their products and expertise. Figure 4 shows a Coffee-Mug with a personalized photo embed on it. A print-buyer may order such a Mug by selecting it among the different products the system provides and loading the image to be embedded. The 3D soft proofing system will render the 3D model of the Mug with the buyer's photo textured on it simulating the result of the product.

Results

We have implemented a prototype of our platform. First, a print driver version was developed as shown in Figure 2. As a key feature, special attention was given to the 2.5D and 3D visualization. To evaluate their performance and accuracy, special [10]

test jobs were compared against real products fulfilled by a local print service provider. The products resembled the soft proof, and where needed, we adjusted the model accordantly so that the adjusted model qualifies now as a realistic soft proof for the print shop workflow.

To understand the advantage in using a print driver for commercial publishing, a user study was performed where potential users were asked to rank the driver usability. The results were overwhelmingly positive. The majority of the users ranked the driver as easy to use and intuitive and confirmed that it simplifies the publishing procedure and increases efficiency and buyer's confidence in online ordering.

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