Executive Summary

Agfa-Gevaert Group produces and distributes an extensive range of analog and digital imaging systems. They have expressed a need for an automated system to measure the quality of the images, in particular the gloss. Currently they have technicians physically taking gloss readings, which not only is very labor intensive, but also has low repeatability rate.

Jeti Media Sense has proposed a solution outlined below. It consists of accurate motorized apparatus that will enable a user to choose the step size of the gloss readings and will automatically develop a graph representing the data. This design consists of three major parts: The frame; which will provide two degrees of movement to the head, the head; which will house the control board and place the gloss meter on and off the page, and the software; which will command the motors and collect the data.

On a 4 foot by 6 foot media taking one sample every 5mm requires approximately 89,172 samples. This project aims to lower the time humans must dedicate to acquire these samples from 50hrs [1] to less than an hour. While the proposed solution will still require a significant amount of time to measure and record all these readings the vast majority of this time is spent autonomously without the need of a human operator. This improvement would both save the company significant labour costs while expediting their research in the relevant field.

The proposed time line found below will result in a finished working prototype ready for deployment in industry by the end of November. Simultaneously a final report will be completed documenting all the development and research involved as well as a fully functional user manual.

It is estimated this project will take approximately 540hrs to complete and cost approximately $500 dollars. Funding will come from Agfa, The University of Guelph School of Engineering, and Jeti Media Sense.

This project not only represents an advancement in quality assurance for Agfa, but also a step further into the field of digitally quantifying the physical world around us.

1. Background and Introduction

Agfa Graphics is a leading supplier of prepress solutions for the commercial, newspaper and packaging printing industries. In addition, they are rapidly expanding their assortments into the growing market of digital inkjet printing with the development of state of art printers and specialized inks. Some of their printing applications include, but are not limited to posters, banners, signage and displays, textiles and decoration.

Agfa Graphics have expertise in UV curable inks specially designed for Agfa's various models of multi-pass, wide format UV inkjet printers. UV curable inks are stable, allow fast curing and are easy to handle. The excellent jetting performance and good adhesion on a wide variety of substrates enable a wide range of indoor and outdoor applications [1]. The high image quality, vibrant colors and perfect edge sharpness combined with good outdoor light stability guarantee heavy duty industrial printing results.

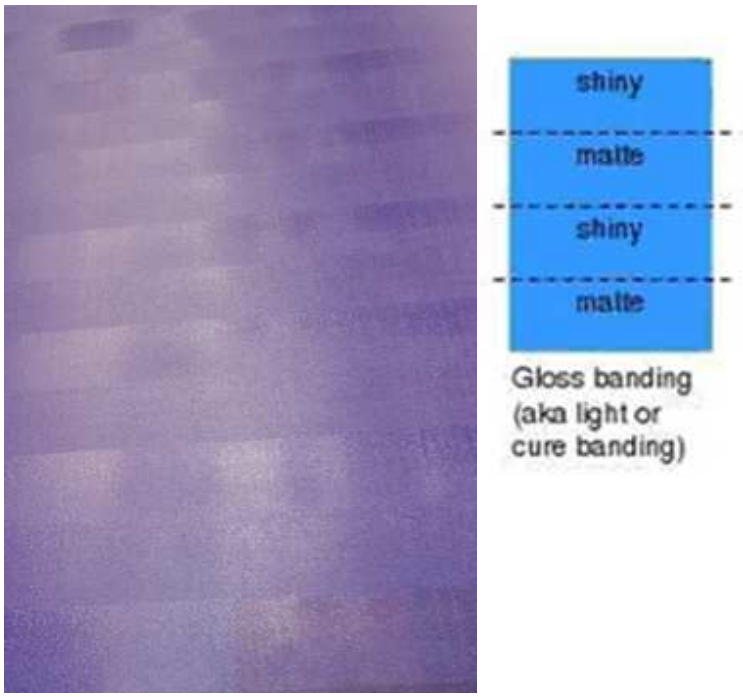

Figure 1: Gloss Banding

However, gloss banding problem degrades the print quality of the UV inkjet printers. Gloss banding occurs during the UV curing of an image (print), when the ink dries unevenly thereby creating uneven gloss distribution. Figure 1 shows this problem where one line has shiny finish and the other is dull matte.

In the past Agfa has tried to minimize the impact gloss banding on several older models using tools such as ink restrictions, lamp settings and the overall tuning of the machine. However, in high speed machines like Titan and HDC it is becoming increasing difficult to tackle this problem through the conventional means [2]. Hence, it important to first have a better understanding of this phenomenon.

There are several factors that can possibly reduce gloss banding such as speed of the head carriage, number of passes, type if ink, type of UV bulb used, etc. Large amount of gloss samples for different colors on different types of media with different machine setting are needed for the same. The gloss samples will also help decide suitable UV lamp setting for curing the ink for both flexible and rigid substrates and will provide reliable adhesion data for each media using certain ink setting or coating [3].

A gloss meter is used for the taking gloss readings (how shinny) of an UV printed sample. Currently at Agfa, the gloss samples are recorded by placing the gloss meter on the printed sample for every 5mm over the length and width of the printed media (see Figure 2). This method of data collections requires two technicians working for approximately of 5-6 hours for a period of 1 week [3]. Moreover, with this data collection process it is not possible to produce repeatable results even for identical types of media and machine setting (number of passes, ink density and lamp setting).

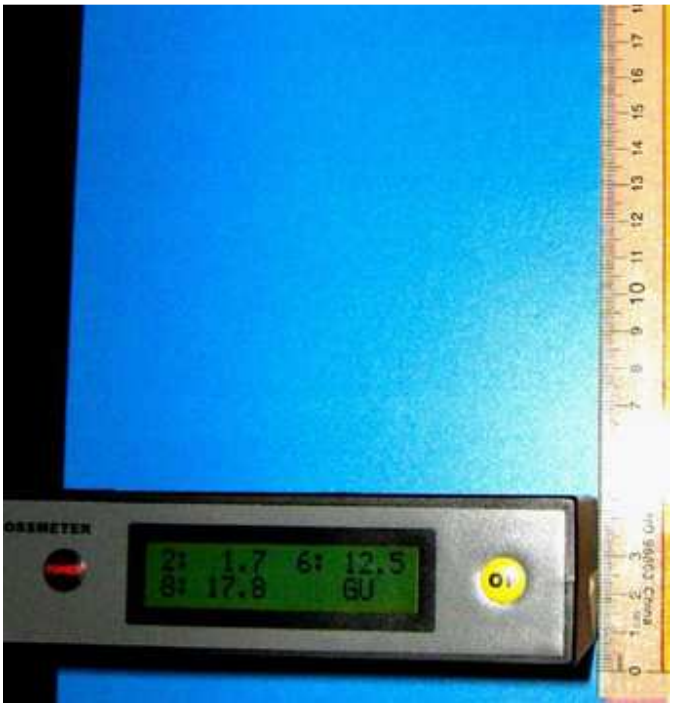

Figure 2: Recording Gloss Samples

Agfa Graphics has expressed a need of an effective and accurate system for quantification of gloss samples to have a better understanding of gloss banding phenomenon. A semi-automatic system that would require minimal human supervision and can collect data for different media sizes was requested by Agfa. This scanner will help Agfa to gather huge gloss data for variety of print samples by varying all the machine settings and thus fully understand the gloss banding phenomenon. In future, they can also use this media scanner for quantifying other factors like density of colors, by just replacing the gloss meter on the scanner.

2. Proposed Work

This design can be separated into three major components which include both software and hardware aspects. From the hardware perspective, a portable device must be constructed which is capable of scanning a minimum picture surface of 4 feet by 6 feet. The software component requires the digitalization of data and its storage in a standard format.

The SD Storage will be removable and contain a CSV file that can be easily read by any computer that has Microsoft Excel installed.

2.1 Frame

The frame will be used to support the gloss meter and move it between sample locations. For the purpose of clarification, the 'head' will be used to describe the main component that contains the gloss meter. The proposed construction of the frame utilizes two anchored threaded rods in the lateral direction. These will be placed on either side of the media to be scanned and are labeled as Lateral Rod 1 and Lateral Rod 2 in Figure 3 below. These rods will provide lateral movement to the third rod which is suspended horizontally between the first two. The second direction of movement will be accomplished with a similar design which will allow the head to move perpendicularly to the initial 2 rods. This design will allow the head to be moved to any position in the two dimensional environment.

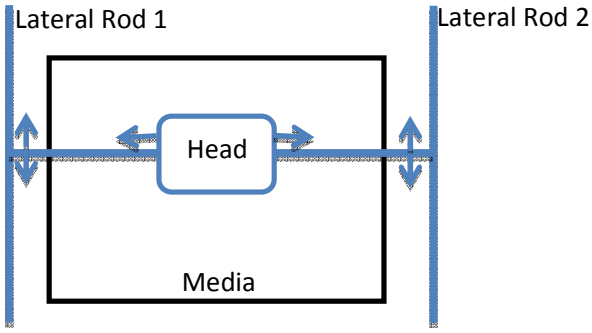

Figure 3: Over Head View of Proposed Solution

2.2 Head

The head will contain the gloss meter, the control board, as well as a solenoid that allows the gloss meter to lift off the surface while it travels. This solenoid is necessary as it will prevent the head from dragging along the printed surface which can possibly cause damage to the finished media. The gloss meter will be placed, the measurement will be read and stored, then, the gloss meter will move safely to the next sample location. Figure 4 demonstrates some avenues through which information and physical motion is translated throughout the system.

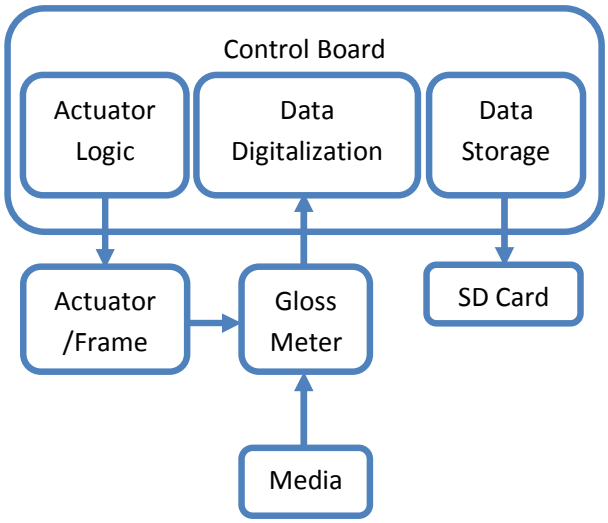

Figure 4: Overview of Components

2.3 Software

The final component is the software which is used to control the motors, and ultimately produce a quantitative view of the media that was scanned.

The Control Board in the proposed design must be plugged into a computer which has our front end software installed to receive the dimensions of the media, the interval desired and the starting position of the actuator before the process beings.

The proposed solution will enable a user to simply plug a SD card into the head, and once the task is completed, the results can be taken to a computer nearby and imported directly into excel.

3. Criteria and Constraints

3.1 Constraints:

- Cannot damage the media/finish
- Must be portable to be brought to finished media
- Must produce a table in a standard format
- Must be capable of scanning a minimum of 4 feet by 6 feet area
- Must be capable of scanning different sizes of media at different intervals

3.2 Criteria

- Maximize the repeatability of the data acquisition
- Maximize the accuracy of the readings
- Minimize the time it takes to complete the scanning
- Maximize the simplicity of the user interface

4. Schedule and Budget

4.1 Deliverables

Interim Report.....October 17, 2012

Final Report.....November 29, 2012

Poster Presentation.....November 28, 2012

4.2 Timeline

Table 1: Schedule of Tasks

Tasks	Start Date	Duration(Days)	End Date
Research	30-Aug	40	09-Oct
Hardware Design	14-Sep	25	09-Oct
Software Design	14-Sep	25	09-Oct
Interim Report Writing	01-Oct	15	16-Oct
Building Prototype	17-Oct	30	16-Nov
Testing	05-Nov	15	20-Nov
Refining	10-Nov	15	25-Nov
Final Report and Poster	13-Nov	15	28-Nov

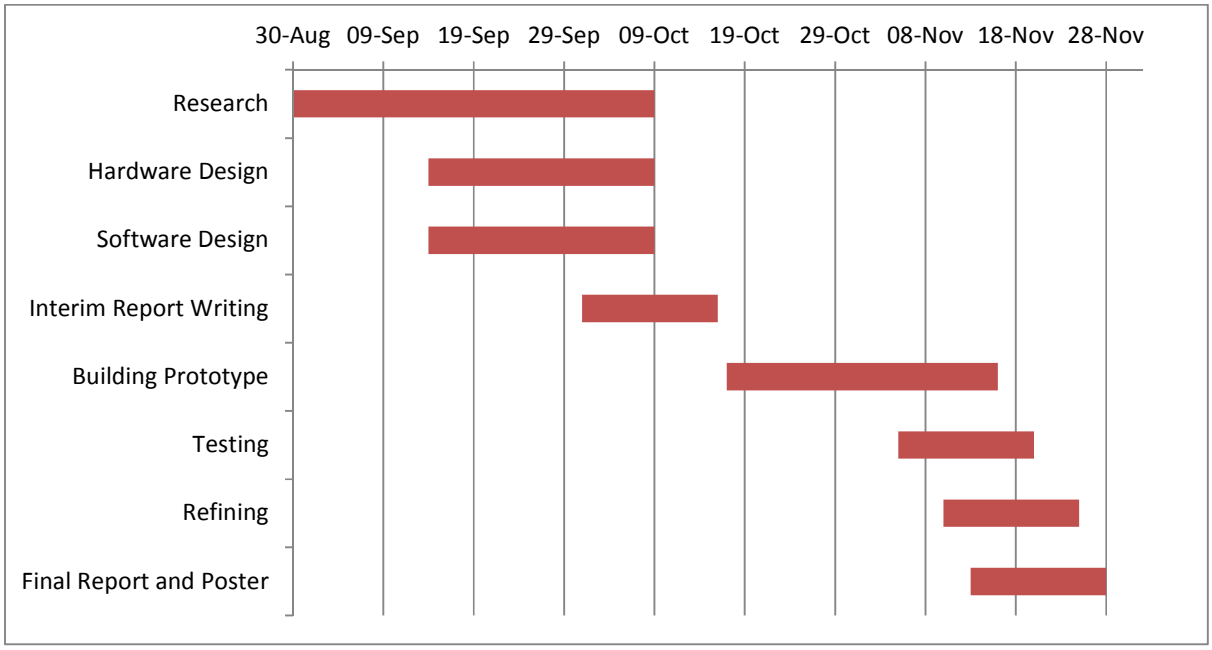

Figure 5: Gantt Chart of Tasks

4.3 Budget

Table 2 below is an approximation of the design components and their price list. The gloss meter and additional materials may be provided in part by Agfa Graphics.

Table 2: Component Costs

Component	Price (CAD$)
Gloss Meter	~300.00
Motors (3)	~100.00
Frame Components	~30.00
Control Board	~40.00
Miscellaneous	~30.00
Total	**~500.00**

5. References

1. "Inkjet Inks," *Digital Printing, Products and Solutions*, [Online]. Available: http://www.agfagraphics.com/gs/global/en/internet/maings/products_solutions/digital_printing/inkjetinks/index.jsp. [Accessed Sep. 2012]

2. C. Driver, N. Hine & E.Huchla, "Gloss Banding," *Agfa Graphics Eng. Documents*, vol. 1.6, Jul.2011.

3. C. Driver, A. Al-abassi & B.Yuen, "Jeti: Flatbed & Roll to Roll Gloss Test," *Agfa Graphics Eng. Documents*, Jul.2012.