Design Project #2
DIGITAL PRINTING SYSTEM
Introduction to Engineering Design
EDGSN 100 Section 014

Team Alpha
Team 5

Adam Bielski, apb5173@psu.edu
Robby Creese, rec5208@psu.edu
Matt Coleman, mwc5448@psu.edu
Nick Routh, nar5178@psu.edu

Submitted to: Prof. Berezniak

Date: 12/2/2011
DIGITAL PRINTING SYSTEM

Table of Contents

1.0 Introduction............................................................................................................. Page # 2
2.0 Project Objectives.................................................................................................. Page # 2
3.0 Project Development.............................................................................................. Page # 2
4.0 Customer Needs Statement..................................................................................... Page # 2
5.0 External Research.................................................................................................... Page # 2-3
6.0 Concept Generation................................................................................................. Page # 3
7.0 Concept Selection..................................................................................................... Page # 3
8.0 Final Design............................................................................................................ Page # 3-4
9.0 Conclusions............................................................................................................. Page # 5
10.0 References.............................................................................................................. Page # 5

List of Figures

Figure # 1  Figure Title............................................................................................... Page # 3
Figure # 2  Figure Title............................................................................................... Page # 3
Figure # 3  Figure Title............................................................................................... Page # 4
Figure # 4  Figure Title............................................................................................... Page # 4
Figure # 5  Figure Title............................................................................................... Page # 4
Figure # 6  Figure Title............................................................................................... Page # 4
Abstract (Executive Summary)
In this project it was attempted to design a device that would measure the speed of the paper traveling through a printer. The design process was used to come up with multiple solutions as how to determine the speed of the paper. The solution that was decided upon for this problem was to embed lasers within the pathway to use LIDAR to determine the speed.

1.0 Introduction
This product is meant to improve the information determined while printing. When printing requires very exact data speed is very often needed. It was decided to create a very detailed way to determine speed to improve a printer. The design process was used to identify the problem and attempt to gather information on the project. It was determined how much the customer needed and exactly what they wanted after this. Research was done to determine what would be the best way to determine speed. After research was completed multiple ideas were generated that could solve the problem. Then the best solution was determined out of the original possible ones. Finally the design was created using Solidworks and then evaluated to see its effectiveness as well as possible improvements.

2.0 Project Objectives
The project objective was to measure paper velocity as quickly and accurately as possible. The accuracy was the most important part, but speed is determines how efficient the printer can become.

3.0 Project Information
The project was required to measure the velocity of the paper moving between approximately .25 and .75 meters each second. This will help the printer to adjust to create a more effective and exact printer so the ink can be applied with the changes in velocity as the picture is created. The measurement devices are supposed to be able to measure the paper within a .25 % tolerance in both directions.

4.0 Customer Needs Statement
The customer would prefer this design to be affordable, quick, and accurate. The design needs to have accuracy as its first priority so that it works for the purpose it is designed. It would need to be affordable next so it will actually be able to be used. Then of least importance it would need to be quick in order to add an extra level of efficiency to the design.

5.0 External Research
Most research was done on the internet to determine which ideas could work and to compare them to each other in the three properties of price, accuracy, and effectiveness. The ideas of microswitches, scales, and laser speed measurement were considered in this project. Multiple
websites were used to research these ideas so that the decision between ideas could be made as well informed as possible.

6.0 Concept Generation
We looked at many things when generating concepts. One idea was to use lasers to measure the speed of the paper while it travelled through the printer. Another idea was to use microswitches to measure the speed as paper travelled over them and to use the calculation of speed by setting them a fixed distance apart and then measuring the travel speed. Here is an example of a speed gun. Smaller ones would be planned to be used and put inside the pathway.

Figure 1: Large laser speed detector

Another idea was to plant microswitches inside the pathway and have the paper set them off to time how long it takes to travel a distance.

Figure 2: Picture of a microswitch being held down by the wood.

The final idea that was generated was to use a weight measurement device in multiple parts of the pathway to determine where the center of mass, therefore the paper because of a uniform density, was and calculate how fast that was changing to determine the speed of the paper.

7.0 Concept Selection
The concept of using the laser to determine speed was chosen due to its accuracy, speed, and cost. It was extremely accurate and able to take speeds over 10,000 times each second so any random error would be almost impossible to occur and make an impact. The microswitches could be easily missed by the paper if it bent the wrong way and be hit by a later part, providing a very inaccurate reading. Using scales throughout the paper would also have the same problem if the paper bent while inside the pathway and provide an inaccurate reading if it had upward and downward curves. It also reports the data back as fast as the wire can travel, which is just as fast as the scale but slightly faster than the microswitch for the time to make activate. It would also be fairly cheap to produce as well and definitely affordable for the paper company.

8.0 Final Design
The final design had lasers across the top layer of the pathway of which the paper would travel through. The lasers were designed to have two measurements taken at the same time so they would end up much more accurate and that an outlier would not be included in the result.

Figure 3: Printer View 1

Figure 4: Printer View 2

The pathway was designed to be curved since the weight measurement would not work in a curved pathway and that was part of the reason why this idea was selected.

Figure 6: Pathway view
9.0 Conclusions

The project was a success since it created a very feasible solution to the problem of measuring the speed of paper traveling through a printer’s path. It was able to measure the speed very effectively as well as being able to do it quickly. It was also cheap and therefore was able to meet all of the customer’s needs and desires. It was unique in the way in which it was able to take over 100,000 readings of each piece of paper every second that it travelled, therefore keeping it effective, and allowing for adjustment for changes before it affects the result.

10.0 References

"Everything you need to know about police radar, laser and speed cameras in New South Wales."


