DVT Serial Number Recognition System

Alex Austman, Scott Fowler, and Jo VandenDool

Abstract. In this paper, a design solution is presented which optimizes an existing DVT serial number recognition system installed at CAMTAC in Guelph. The design outlines a method to configure the system, which includes a number of hardware and software parameters. Furthermore, a background script was developed to allow more time for characters to be recognized as well as to reduce erroneous character recognition. Preliminary tests show that the design improved serial number recognition by 85 percent...

Key words: optical character recognition, OCR, Cognex, FrameWork, DVT

1 Introduction

CAMTAC, a factory located in the city of Guelph, employs an optical character recognition (OCR) system to read serial numbers engraved into parts that pass by in one part of the manufacturing process. This system was originally installed five years ago, and has never functioned properly. Currently, the system fails often because it fails to recognize all of the characters in the serial number and thus the code must be entered by hand. The reason for the failure are incorrect parameter settings and an insufficient background script (which is used to send the serial number to a PLC). The system can be configured using a number of parameters. Hardware parameters include: lens size, aperture, & focus. Software parameters include shutter speed, size and location of soft sensors (which detect characters), minimum character width (in pixels), maximum character area (in pixels), number of characters to detect, and character subsets to detect. Once the serial number is read it is sent to the plants computer database and recorded for future reference. In the event of an erroneous serial number being read, database information corruption will occur. While it is difficult to put an exact price on the effect of these errors (a credible source did suggest costs of approximately $60,000 per year), it is sufficient to say that errors may cause future problems if a client returns an off- specification or damaged part for warranty service. Furthermore, part tracking becomes an issue.

2 Conceptual Design/Methodology

This project attempts to outline a set of steps that can be used to configure the Cognex DVT Legend 530 camera, as well as modify the software script, to recognize serial numbers in any environment. The design focuses on both tuning configuration parameters such as aperture, shutter speed, minimum character width, as well as defining character subsets and making use of a background script to increase the likelihood of a complete serial number being recognized and decrease the likelihood of characters in those serial numbers being incorrectly identified.

3 Detailed Design

3.1 Hardware Settings

The two main hardware parameters are the aperture and the focus. The goal is to get an image that clearly displays the characters but blurs the area around the characters. The reason for this is because the software uses contrast as a means of identifying characters and a blurred image will have very little contrast while a sharp one will have much more. A small aperture setting blurs background detail and so the design calls for starting with the smallest aperture possible.

3.2 Software settings

The following parameters were configured using the FrameWork software: Number of characters to detect, Minimum character width, Maximum character area, Shutter speed, and Identification threshold. Using a separate soft sensor for each position in the serial number and configuring them to each recognize one character inside of that sensors area, as opposed to one soft sensor to detect the entire serial number, increases the success of each sensor. Setting the number of characters to only one and defining the minimum character area lessens the possibility of characters being falsely detected. Setting the maximum character area causes the soft sensor to focus on the pixels forming the character and not those surrounding them. The shutter speed setting is crucial for letting in the correct amount of light. The recognition threshold should be set low to allow for a high recognition rate, while the background script handles erroneous recognitions.

3.3 Background Script

This component of the solution loops until every character has been recognized, or until a set amount of time elapses. It then records the character detected by each sensor along with the score it received. It then uses the

scores in combination with the frequency that each character was recognized to determine the characters of the final serial number. In the event that each soft sensor recognizes a character, the serial number is placed in a register common to the software and the PLC. In the event that a character is not detected for each soft sensor, a flag message of all zeros is placed in the register which indicates that a human operator needs to be called to the keypad to enter the serial number manually.

4 Testing

Testing was done in a rather scientific manner. Each of the variables was held constant except for one. The one variable that was not held constant was adjusted through its possible range of values (or otherwise reasonable range of values)until the best possible recognition score was achieved. The value deemed the best for that particular variable was then held constant throughout the rest of the testing as each of the subsequent variables was tested for its optimum value.

	Sensor 0a	Sensor 2a	Sensor 2b	Sensor A	Sensor 3	Sensor 0b	Sensor 1
0.3m	F	F	FP 370 Gets 3&4	P 634, P 624	P 560	F	F
0.4m	P853, FP615(6)	P418	FP324(1), P589	P874	F	F	FP459 P384
0.5m	P859	FP284 P581	FP411	P816	P481 FP467	F	P384 FP484
0.6m	FP599 P806	P298	FP374	P836	F	F	P396 FP463
0.7m	F	FP277 P308	FP357	P714	F	F	F
0.45m	P859	P615	FP318 P496	P855	F	F	FP 478
0.52m	P838	P463	FP376	P874	P463	F	P384 FP480

Fig. 1. Focal Length Testing

As can be seen in Fig. 1. Focal Length Testing above, where 'P' denotes a true identification of a character, 'FP' denotes a false identification of a character and 'F' denotes a character not being recognized at all, a focal length of 0.4m to 0.52m seems to yield the best recognition scores.

5 Discussion

The background script is the workhorse of this system. Without it the system is not capable of reliably recognising the characters simultaneously and therefore could not send a complete serial number to the controlling PLC. It is important to note that without properly setting the parameters, the script would be worthless as it capitalizes on the fact that the correct character will either be recognized the most often, or with the highest score. This allows all the recognized character's scores to be summed then divided by the frequency of recognition so that the correct character will have the highest score. In completing this project, it was important to approach the system strategically. Initially settings were changed haphazardly and results were poor or inconclusive. Systematically and iteratively testing each tuneable parameter yielded concrete results that were significantly better, and provided a solid base of information useful to CAMTAC.

6 Acknowledgements

We would like to extend a special thank you to Mike Minogue for meeting with us to provide a detailed explanation of Camtacs current serial number acquisition system, as well as Dr Medhat Moussa and Antony Savich for their invaluable insight.

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