Real-Time Assessment of Cutting Blade Durability and Performance

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ABSTRACT

This paper describes the design a system for large scale industries identify the most appropriate time to change a cutting blade with maximum accuracy for better performance of machine. Metal tubes are an essential component of products made for many industries. Tubes vary in shape, size, and weight, depending on their function. Tube industry produces a range of shapes and diameters using application specific materials. Cutting machines are used in industries must be cut with end-finished and precision. So machines are designed such a way to reduce change-over time, increase productivity, improve set-up accuracy and increase the profit of large scale industries. Aim of this system is increase the productivity by reducing time by time to change a cutting blade with accuracy.

I. INTRODUCTION

Ever since of civilization, humankind's insatiable yearning has led him to many breaking inventions and discoveries. In industries tubes must be cut with precision and end-finished. Today's market requires tube manufacturers to offer competitive pricing by controlling costs and investing in their business. Tube manufacturers require a very fast tube cutting system to achieve the higher volumes to minimize costs. The machine must be reliable to minimize time and easily serviced to maximize availability. To increase profit, the tube manufacturer must be able to quickly respond to consumer demands. An effective machine must also be easily operable by minimum effort, lower cost technicians and integrated into a processing system to identify the most appropriate time to change a cutting blade with maximum accuracy for better performance of the machine.

II. LITERATURE SURVEY

Blades wear is a common phenomenon in cutting process, which directly affects machine-finishing precision, the efficiency and the economic efficiency. Investigation of tool wear can greatly improve the machine-finishing efficiency, and reduce the processing cost, and have enormous economic effect. Industry statistics indicated that tool failure was the primary factor caused the machine breakdown, which accounted for the shutdown of the 1/5 to 1/3 during the total downtime of the machine tool [1]. Studies showed that if machine tool is equipped with monitoring and detection system, it can reduce 75 percentages the downtime, and enhance productivity percentage 10-60, and even raise machine utilization above 50 percentages [2]. Therefore, it is necessary to research the process in tool condition monitoring technology to prevent the work piece scrap caused by tool failure, and to ensure the cutting machine works with trouble-free operation as long as possible. To identify the most appropriate time to change a cutting blade with maximum accuracy for better performance of the machine. The direct measurement methods include discharge current measurement, optical fiber measurement, micro-structure of coating method, resistance measurement method, ray measurement method, as well as computer image processing method. While the indirect measurement methods use the physical quantities, which are mainly related to the cutting process, such as cutting force, torque, cutting italics machine, work piece geometry, chip shape, noise or vibration intensity. The direct method of tool condition monitoring has two obvious shortcomings. On the one hand, it needs to stop machine to detect the tool state that occupancies production time. On the other hand, it cannot check the sudden damages during the cutting process, which is subject to a certain restrictions on its use [8]. Therefore, the indirect method has become the mainstream of academics who have studied in domestic and foreign designations Tool condition monitoring techniques are generally consist of the sensor signal acquisition, signal processing and feature extraction and pattern recognition device. The basic structure of the tool condition monitoring system was presented in Figure 1.

III. MATERIALS AND METHODS

This system mainly has three sections. First section describes the main block of system. Second is pre-processing and data extraction finally will be output section.

Block diagram

Block diagram consist of a cutting machine with circular cutting blade, camera, computer system, microcontroller, mobile. Camera takes frame of cutting blades in frequent time periods. The system processes the frame of cutting blade using canny edge detection method of image processing and find out the arch length of the half circle of blade. Wear and tear effect the blade the arch length size frequently reducing. The change will be calculated and find out the fixed range of limits, these value define cutting machine efficiency. The system goes down these limit microcontroller system provide an alarm and SMS to the supervisor mobile.

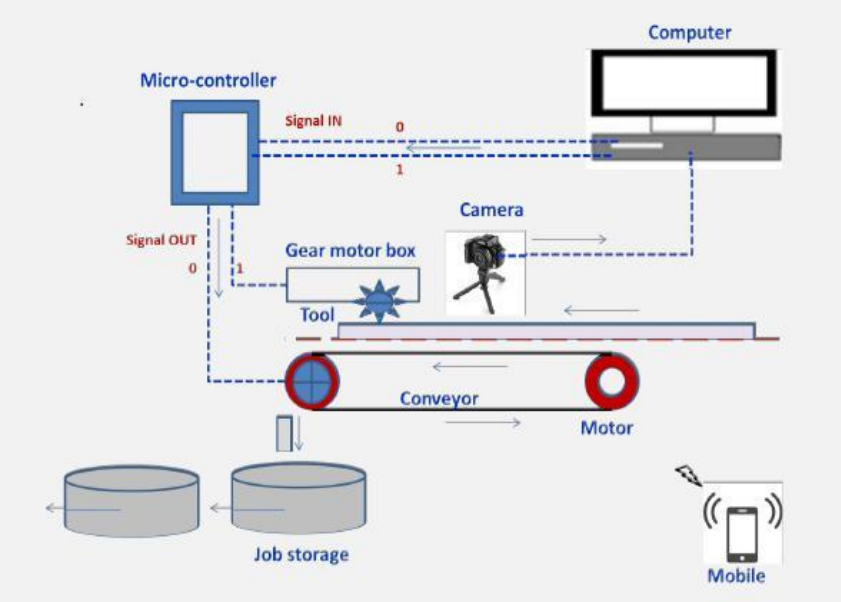


Figure 1: Block diagram

Pre-Processing and Data extraction

Computer system consists of training and testing phase. Both phases have input data that will be images of cutting blades. In training phase the collected data will be trained and stored like a reference database. In testing phase the collected data classified based on the reference data base using classification program. And recognized character will be transferred into output section. In this system the recognized character is the arch length of the saw.

Pre-processing is an improvement method of the image data that reduce distortions or improve some image features important for further processing. Frame image of blade convert BGR color space to grayscale color space. Grayscale image is an image that has a defined grayscale color space, which maps the stored numeric sample values to the achromatic channel of a standard color space. Edge detection is an image processing technique for finding the boundaries of objects within images. It works by detecting discontinuities in brightness. Edge detection is used for image segmentation and data extraction in areas such as image processing, computer vision, and machine vision. Canny edge detection is popular method to find the edges of image. First draw the contour in boundary of image and using canny edge detection find the edge. Using arch length command finds the perimeter of the blade. Arch length command gives the number of pixels in the boundaries

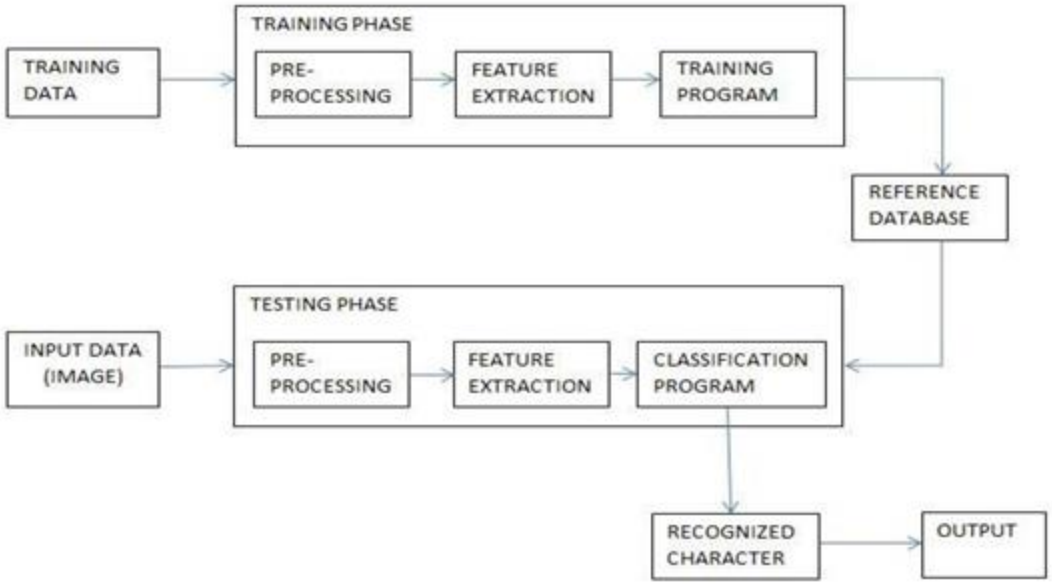
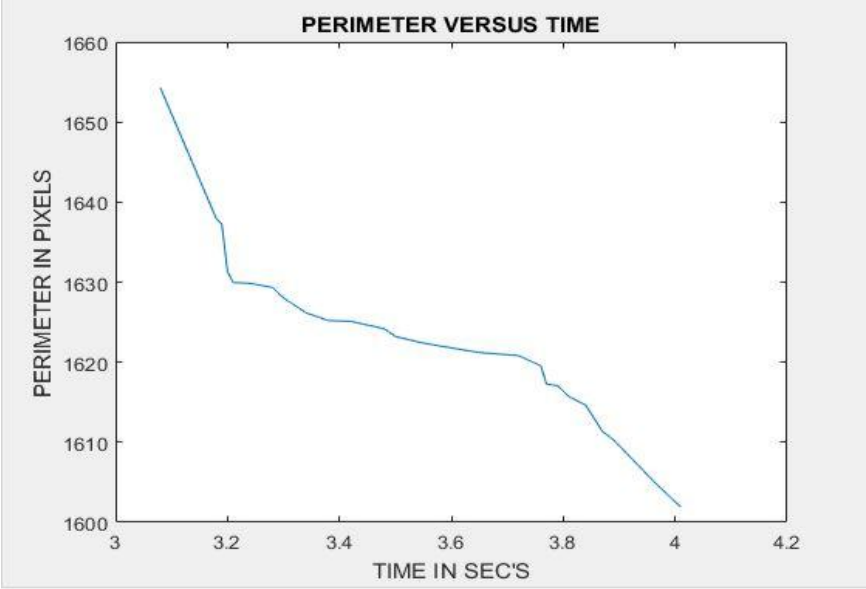


Figure 2: Pre-processing and data extraction

IV. RESULTS AND DISCUSSION

The project analyzed a cutting machine with circular blade in bright plastic industry. This cutting machine will be used for cutting the aluminium pipe with diameter 1.5cm. The blades contained around 320 teeth in blade with height of 2mm. System found half blade arch length and find the time to cut a pipe. In this system the blade wear and tear would be gradually increasing. The graph shows the result of the system.



Graph shows the arch length increases the cutting speed of machine increases, also the profit increase. Time of cutting blade to cutting a pipe increase when the wear increase.

V. CONCLUSION

The proposed system will be identifying the most appropriate time to change a cutting blade with maximum accuracy for better performance of the machine. Cutting machines are designed to reduce change-over time, improve set-up accuracy, and increase productivity. This system is the productivity by reducing time by time to change a cutting blade with maximum accuracy

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