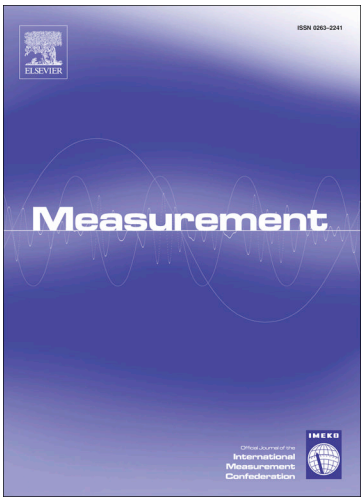

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PII: S0263-2241(18)30128-3
DOI: https://doi.org/10.1016/j.measurement.2018.02.029
Reference: MEASUR 5277

To appear in: *Measurement*

Received Date: 23 October 2017
Revised Date: 1 February 2018
Accepted Date: 15 February 2018

Please cite this article as: B. Yu, T. Qiao, H. Zhang, G. Yan, Dual band infrared detection method based on mid-infrared and long infrared vision for conveyor belts longitudinal tear, *Measurement* (2018), doi: https://doi.org/10.1016/j.measurement.2018.02.029

Dual band infrared detection method based on mid-infrared and long infrared vision for conveyor belts longitudinal tear

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Abstract: In mining operation, the longitudinal tear detection of conveyor belt is of great significance to safety production. A novel method, named Dual Band Infrared Detection (DBID), is proposed to detect the longitudinal tear of conveyor belts in this paper. The DBID method is based on the collaboration of mid-infrared and long infrared vision. The DBID sensor device captures the lower surface images of conveyor belt. The feature of tear or scratch and tearing precursor can be extracted by analyzation of captured images. The DBID method is verified by experiments and practice, including the capturing of dual band infrared images (mid-infrared and long infrared images), image preprocessing, and tear detection. The DBID method is not only unlimited by visual condition, but also much more accurate and reliable compared with the Integrative Binocular Vision Detection (IBVD) method presented before which meets the requirement of real-time online detection.

Keywords: Longitudinal tear detection; Dual band infrared detection (DBID); Infrared spectrum; Mid-infrared and long infrared vison; Hough line detection.

1. Introduction

Conventional through belt conveyor [1] is applied in the underground coal mining generally. Conveyor belt is the chief part of the whole belt conveyor. Whole fabric core conveyor belt [2] and steel cord conveyor belt [3] are two common kinds of belts applied in belt conveyor. The steel cord conveyor belt is usually used in the large capacity, high speed, and long-distance transportation of coal. In coal mining, the hard impurities [4] such as schistose gangue and metal bolts may tear or scratch the conveyor belt during transportation. Longitudinal tear is much more common compared with other tears of belt conveyor such as horizontal tear. Generally, the distance of longitudinal tear is rather long if it happens, resulting in the whole belt being replaced, which may cause long downtime of coal mining operation. Therefore, longitudinal tear detection of conveyor belt has become a key problem that must be addressed in coal mining production. With development of computer vision, it is widely used in many areas, such as medical treatment [5-7], transportation [8-9], safety inspection [10-11], military [12-13] and so on. The purpose of computer vision is taking place of human eyes, to recognize, track and measure the targets, which is non-contact, real-time, accurate, and stable. As a result, the detection method of belt longitudinal tear based on computer vision is proposed in this paper.

Currently, computer vision technology has become a tendency in conveyor belt longitudinal tear detection. For instance, Li and Miao [14] proposed an improved SSR algorithm based on line-scan digital camera. Yang et al. [15] proposed a method and