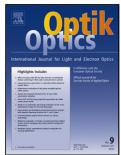# Accepted Manuscript

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Computer Vision based Train Rolling Stock Examination

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Abstract—**Train Rolling stock examination involves visual observation of the moving train around 30Kmph to find defective bogie parts. A train coach moves on a couple of bogies consisting of wheels, suspension and other binding hardware. The health of the bogie decides the safety of the train. Railway personnel perform the rolling stock examination manually raising questions on reliability. Here we propose to use computer vision algorithms for extraction and localizing defective bogie parts from working parts. A wide-angle high-speed camera captures the moving train without motion artefacts. The objective is to use a single shape prior to power the level set function for object segmentation. Here we show the bogie part segmentation with one shape prior model for the entire length of the train. Experimentation on similar train bogies under different lighting tests the robustness of the level set functional with single shape prior. The proposed algorithm handles topological spatial deformations of the bogie parts in the video effectively. Segmenting defective parts with non-defective shape priors makes the algorithm independent of defect localization in the bogie part. This novel idea of computer vision based rolling stock examination using high-speed video can lessen human errors and aid in developing a crewless rolling stock examination. Further, the proposed work can be extended for early detection and prevention of rail accidents due to transit part failures.**

Index Terms—**High speed video analysis, Intelligent Rolling Stock Examination, Shape prior models, Shape Invariant Level sets, Train Bogie defect segmentation.**

I. INTRODUCTION

According to India Risk Survey 2012, around 15% of the industrial accidents happen in India and 90% of them are due to human errors and lack of proper maintenance of rolling stock. Here "Rolling Stock" is defined as moving machines with wheels, suspension, baring, etc. available on trains, which are designed for specific purpose. Engineering industry has contributed significantly in the economic growth of India. More than 17 lakh people are employed in this sector. The rate of fatal accidents amongst industrial workers is showing an upward trend. Most of the industrial accidents are caused by

(a) Contact with exposed moving mechanical parts
(b) Flying Parts
(c) Fire
(d) Human Errors

The field of computer vision and its applications had made inroads into every field of engineering and sciences. One such novel application is being formulated in this work for monitoring train rolling stock. The moving and rolling portions of a train are called rolling stock. Rolling examination is vital for passenger trains to identify defects that are generated during movement of trains at high speeds. This process has ensured train safety for many decades now.

Railway safety is one of the primary responsibilities of all the rail operating companies around the globe from the invention of railroads two centuries ago (http://www.intlrailsafety.com/capetown/3_024_amitabh.doc). With the development of computer technology in the recent decades, most of the safety systems in the world have become computer controlled. Two such systems are airways and seaways which have become fully automated by adapting computerization. Railroads are not far behind. In this framework, a number of methods have been proposed to monitor rails and rolling stock using computer vision (Ashwin, 2014; Kishore, 2015).