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شبكة المعلومات الجامعية

التوثيق الالكتروني والميكروفيلم

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التوثيق الإلكتروني والميكروفيلم

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قسم

نقسم بالله العظيم أن المادة التي تم توثيقها وتسجيلها
علي هذه الأقراص المدمجة قد أعدت دون أية تغيرات

يجب أن

تحفظ هذه الأقراص المدمجة بعيدا عن الغبار

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Railway Inspection using Digital Transformation Techniques

A Thesis submitted in partial fulfillment of the requirements for the degree of Master of Science in Civil Engineering
(Public Works)

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Statement

This thesis is submitted as a partial fulfilment of Master of Science in Civil Engineering, Faculty of Engineering, Ain Shams University.

The author carried out the work included in this thesis, and no part of it has been submitted for a degree or a qualification at any other scientific entity.

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Date:24 May 2021

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Thesis Summery

Railway track inspection is a critical task in railway maintenance operations. It is periodically done for preventing hazards that can have significant legal and financial consequences. Inspection is usually operated manually by trained human operators walking along the railway track, searching for visual anomalies, or by using traditional surveying techniques. This is time-consuming, not accurate, and inefficient.

These traditional methods of inspection cost a lot of work hours and effort from both engineers and technicians, which can be saved by using digital techniques non-contact systems such as Terrestrial laser scanning. Terrestrial laser scanners can provide complete digitization for the environment surrounding the Railways right of way and tracks. Moreover, they are also widely applied for rail track surveys, clearance measurements, infrastructure reconstruction, tunnel mapping and much more.

The effectiveness of rail inspection depends on the efficiency and accuracy of the inspection method used and the necessary equipment. It also depends on the knowledge, skill, ability, and experience of inspectors.

This thesis proposes a complete solution for railway non-contact inspection using high definition (HD) phase shift (PS) static terrestrial laser scanning (TLS). The proposed solution can help in doing fast and immersive data acquisition and data analytics for inspection. The solution will help in monitoring the tracks and their supporting mechanisms. Also, it will use and rely on the in-depth data analysis from the change detection between two scans at different epochs to detect the rate of change during this period.

The methodology applied in this research:

The proposed method of railway inspection applying the digital transformation concept using the terrestrial laser scanning (TLS) to get accurate Inspection data for railways environment which lead to powerful and ease Asset management is structured in 3 phases:

Laser Scanning data Acquisition with accurate planning for scanner location and relative target’s locations

Laser Scanning data processing which includes filtration and registration

Laser Scanning data comparison and verification with standard cross section of rail and with another absolute data from total station to ensure the accuracy

The thesis consists of seven chapters

Chapter 1 (Introduction)

This chapter depicts the research problem definition, objectives, methodology, scope of this thesis and contents.

Chapter 2 (Literature review)

This chapter presents the essential background knowledge related to this thesis.

Chapter 3 (Review for maintenance)

In this chapter, Various maintenance strategies available in railway industry were outlined

Chapter 4 (Review for inspection techniques)

In this chapter, Various inspection techniques available in railway industry were outlined.

Chapter 5 (Research Methodology)

This chapter describes the research approach, verification for the laser scanning technique accuracy.

Chapter 6 (Results and analysis)

This chapter presents the results for the comparison and verification done between the point cloud and the standard cross section of the rail, different point cloud epochs and the absolute data from total station inspection.

Chapter 7 (Conclusions and recommendations)

This chapter presents conclusions and recommendations completing the final issue in thesis methodology and fulfilling thesis objectives.

Keywords:

Railway, Maintenance, Inspection, laser scanning, point cloud.

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