

Systematic Review

A Systematic Review of Automated Construction Inspection and Progress Monitoring (ACIPM): Applications, Challenges, and Future Directions

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Abstract: Despite the subjective and error-prone nature of manual visual inspection procedures, this type of inspection is still a common process in most construction projects. However, Automated Construction Inspection and Progress Monitoring (ACIPM) has the potential to improve inspection processes. The objective of this paper is to examine the applications, challenges, and future directions of ACIPM in a systematic review. It explores various application areas of ACIPM in two domains of (a) transportation construction inspection, and (b) building construction inspection. The review identifies key ACIPM tools and techniques including Laser Scanning (LS), Uncrewed Aerial Systems (UAS), Robots, Radio Frequency Identification (RFID), Augmented Reality (AR), Virtual Reality (VR), Computer Vision (CV), Deep Learning, and Building Information Modeling (BIM). It also explores the challenges in implementing ACIPM, including limited generalization, data quality and validity, data integration, and real-time considerations. Studying legal implications and ethical and social impacts are among the future directions in ACIPM that are pinpointed in this paper. As the main contribution, this paper provides a comprehensive understanding of ACIPM for academic researchers and industry professionals.

Keywords: automated construction inspection; automated progress monitoring; automated inspection technologies; automation in construction; systematic literature review



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1. Introduction

Construction inspection is currently a task performed mostly by human inspectors through manual visual inspection procedures. In these traditional procedures, inspectors refer to a set of plans, specifications, manuals, and standards to check different elements' compliance with the criteria defined by these references. Depending on the type and size of the project, inspectors from different specialties of civil, electrical, and mechanical are involved in these manual inspections [1].

Despite the subjective and error-prone nature of these manual inspection procedures [2–6], this type of inspection is still the common process in most construction projects. However, in the last few decades, there have been attempts to utilize advancing tools and technologies for automating the inspection processes in construction projects. Automated techniques are also used for progress monitoring purposes to evaluate progress deviations.

Recent advancements in technology have significantly impacted the construction industry, particularly in the areas of inspection and progress monitoring. The integration of Automated Construction Inspection and Progress Monitoring (ACIPM) systems has emerged as a pivotal factor in enhancing efficiency, accuracy, and safety in construction projects. With the deployment of various tools such as Laser Scanning (LS), Uncrewed Aerial Systems (UAS), and Building Information Modeling (BIM), the industry is witnessing a paradigm shift from traditional manual inspection methods to more sophisticated, automated solutions. These technologies offer the potential to not only streamline the inspection process but also provide real-time data, facilitating active decision making.

Systematic Construction Inspection

Guillaume Favre

A red circular graphic with a gradient, appearing as a semi-circle or a partial circle, located to the right of the author's name.

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Congressional Record United States. Congress,1972 The Congressional Record is the official record of the proceedings and debates of the United States Congress It is published daily when Congress is in session The Congressional Record began publication in 1873 Debates for sessions prior to 1873 are recorded in The Debates and Proceedings in the Congress of the United States 1789 1824 the Register of Debates in Congress 1824 1837 and the Congressional Globe 1833 1873 **Risk Assessment in Fixed Guideway Transit System Construction** Ali Touran,1995 **Description of Licensing Systems and Inspection of Nuclear Installations** OECD Nuclear Energy Agency,1980 Expert Knowledge-based Inspection Systems Jorge de Brito,Clara Pereira,José D. Silvestre,Inês Flores-Colen,2020-05-19 This book provides a novel approach to building pathology in current buildings Drawing on the available literature hands on experience and fieldwork inspections it presents a systematic perspective on the pathology of the building envelope The book addresses natural stone claddings adhesive ceramic tiling renders painted surfaces External Thermal Insulation Composite Systems ETICS architectural concrete surfaces windows and doors framing and claddings for pitched and flat roofs In addition to highlighting selected materials and construction elements the book proposes a global classification system for defects and their probable causes together with in situ diagnosis methods and repair techniques It also identifies the relationships between defects and causes diagnosis methods and repair techniques and the interdependence between different defects presenting these relations in the form of correlation matrices Support files with detailed information and an inspection form are also provided Selected case studies are presented to illustrate the value of a guidance system in fieldwork Given its scope the book offers a valuable guide particularly for researchers building inspectors civil engineers architects and maintenance planners **ACI Manual of Concrete Practice** American Concrete Institute,2002 **Report on Tests on the Unit System of Reinforced Concrete** Unit Concrete Steel Frame Co,1906 ... Report of the Commissioners appointed to inquire into the condition of the Exchequer (now Board of Trade) Standards ,1872 **The Engineering Record, Building Record & the Sanitary Engineer** ,1895 *AIA Journal* ,1983 Index Medicus ,1881 **Regional Industrial Buying Guide** ,2001 The Massachusetts register ,2016 **Housing Systems Proposals for Operation Breakthrough** National Research Council (U.S.). Building Research Advisory Board,United States. Department of Housing and Urban Development,1971
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Table of Contents Systematic Construction Inspection

1. Understanding the eBook Systematic Construction Inspection
 - The Rise of Digital Reading Systematic Construction Inspection
 - Advantages of eBooks Over Traditional Books
2. Identifying Systematic Construction Inspection
 - Exploring Different Genres
 - Considering Fiction vs. Non-Fiction
 - Determining Your Reading Goals
3. Choosing the Right eBook Platform
 - Popular eBook Platforms
 - Features to Look for in an Systematic Construction Inspection
 - User-Friendly Interface
4. Exploring eBook Recommendations from Systematic Construction Inspection
 - Personalized Recommendations
 - Systematic Construction Inspection User Reviews and Ratings
 - Systematic Construction Inspection and Bestseller Lists

5. Accessing Systematic Construction Inspection Free and Paid eBooks
 - Systematic Construction Inspection Public Domain eBooks
 - Systematic Construction Inspection eBook Subscription Services
 - Systematic Construction Inspection Budget-Friendly Options
6. Navigating Systematic Construction Inspection eBook Formats
 - ePub, PDF, MOBI, and More
 - Systematic Construction Inspection Compatibility with Devices
 - Systematic Construction Inspection Enhanced eBook Features
7. Enhancing Your Reading Experience
 - Adjustable Fonts and Text Sizes of Systematic Construction Inspection
 - Highlighting and Note-Taking Systematic Construction Inspection
 - Interactive Elements Systematic Construction Inspection
8. Staying Engaged with Systematic Construction Inspection
 - Joining Online Reading Communities
 - Participating in Virtual Book Clubs
 - Following Authors and Publishers Systematic Construction Inspection
9. Balancing eBooks and Physical Books Systematic Construction Inspection
 - Benefits of a Digital Library
 - Creating a Diverse Reading Collection Systematic Construction Inspection
10. Overcoming Reading Challenges
 - Dealing with Digital Eye Strain
 - Minimizing Distractions
 - Managing Screen Time
11. Cultivating a Reading Routine Systematic Construction Inspection
 - Setting Reading Goals Systematic Construction Inspection
 - Carving Out Dedicated Reading Time
12. Sourcing Reliable Information of Systematic Construction Inspection
 - Fact-Checking eBook Content of Systematic Construction Inspection
 - Distinguishing Credible Sources
13. Promoting Lifelong Learning

- Utilizing eBooks for Skill Development
- Exploring Educational eBooks

14. Embracing eBook Trends

- Integration of Multimedia Elements
- Interactive and Gamified eBooks

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appointment of competent persons to manage oversee and perform any such work

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anchorage means a place a fixing or a fixture to which a lifeline or lanyard is connected for fall restraint or fall arrest 1 3 3

authorised manager means a person appointed by his employer or the principal as the competent

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