Harnessing the power of AI (Artificial Intelligence) in Construction

Best practices with Cupix

CUPIX
BUILD SMART

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The Evolution of Construction Documentation

This ebook embarks on a journey to explore the opportunities presented by leveraging AI for taking basic 360 videos and turning it into powerful 3D spatial context to facilitate automated construction site monitoring and progress tracking.

Construction sites are rapidly being transformed into smart working environments due to the increasing advancements of emerging *digital technologies. A large volume of images, videos and other forms of data are generated on construction sites such as progress reports, real-time equipment, assets and site monitoring, which are mostly unstructured. The data collected has the potential to be aggregated in BIM and analysed using advanced AI techniques to optimise site performance in all key areas such as planning, design, safety, quality, scheduling and cost.

Adoption of digital construction AI techniques has helped to enhance automation and provide better competitive advantages compared to traditional manual and conventional approaches. AI has been applied to tackle complex problems and support decision making for real world construction sites.

Some of the trends in key AI Construction applications that are experiencing a paradigm shift include:

- The move from blueprints to BIM. (Building Information Modelling)

- Challenges of traditional documentation methods. (inaccuracies and lack of real-time updates)

- Emergence of digital photography as a documentation tool to track the building lifecycle has revolutionised image based construaction data.

Footnote: * "Temporal image analytics for abnormal construction activity identification", Zi-Hao Lin, Albert Y. Chen, 2021
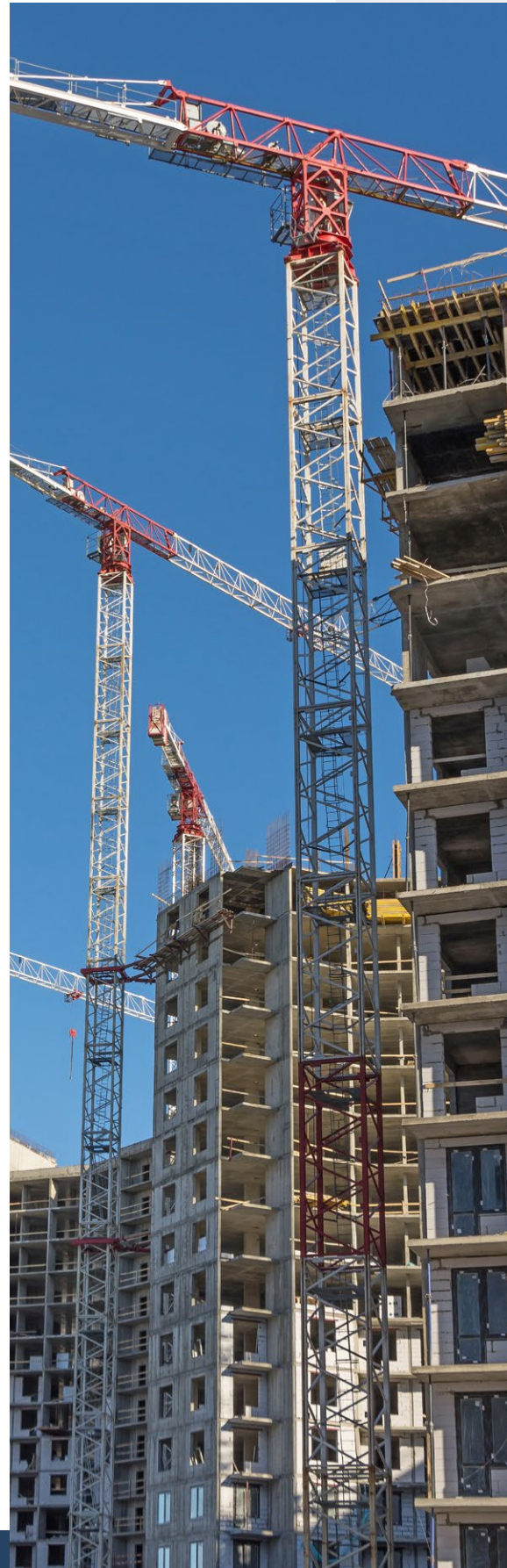
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The Power of AI in Reality Capture

Meeting project deadlines is the most critical milestone for owners during the construction phase. Various circumstances may compromise productivity or even cause construction delays, consequently identification of rework in a timely fashion is vital for effective project management. To discover any issues, image analysis and construction process analysis is a competitive advantage. Traditional approaches for this goal include on-site supervision and monitoring of surveillance videos, but these processes are labour-intensive and time consuming.

AI-powered image analysis or reality capture, automates progress tracking by analysing construction site photos captured by drones, cameras, or smartphones. Machine learning algorithms then identify changes in construction site conditions, such as completed tasks, material deliveries, and equipment movement.

By comparing current images with historical data, AI can accurately track project timelines, detect delays, and predict potential bottlenecks. Real-time progress monitoring enables project managers to make data-driven decisions, optimise resource allocation, and ensure project milestones are met on time.

In addition, by leveraging advanced algorithms and machine learning techniques, construction professionals can streamline project management processes, improve safety outcomes, and ensure the delivery of high-quality construction projects.

Opportunities of AI in Construction

	AI Advantages in construction	Limitations in traditional construction technology
Machine Learning	Relevant predictive and prescriptive insights Increased efficiency Cost savings Improved safety Efficient utilisation of resources Reduced mistakes and omissions	Incomplete data Learning from streaming data, dealing with high-dimensional data, scalability of models and distributed computing
Computer Vision	Faster inspection and monitoring Better accuracy, reliability and transparency Cost effective Increased productivity Increased safety	Total scene understanding Action recognition of equipment and/or workers Improvement of tracking accuracy and effective visualisation of tracking results
Estimation and Scheduling	BIM for cost and time estimation Construction site analytics	Deep learning for cost and time estimation Project control on construction sites Construction performance analytics Site layout planning

03

Implementing AI-Powered Digital Spatial Maps and Photo Data Capture: Best Practices

When it comes to data accuracy, utilising AI and enabled computer vision technologies from an off-the-shelf 360° video to generate digital spatial maps has now evolved to be much more cost effective than the traditional laser scanners.

Here are some other best practices to consider:

- Integration with existing systems: Seamless integration of AI-powered 360° video data capture with project management platforms, BIM software, and other construction management tools.

- Data privacy and security considerations: Ensuring compliance with data protection regulations and adherance to industry standards and regulations regarding data protection, confidentiality, and access control.

- Training and Support: Providing training programs for construction professionals to effectively utilise AI tools and interpret insights generated from video capture.

Fueled by groundbreaking technological advancements, an innovative trend is emerging that masterfully blends the implementation of both 360 photo documentation and Spatial digital twins. This pioneering approach, known as "Spatial Digital Twin Creation from 360 cameras," is led by industry forerunners such as Cupix.

This new approach takes advantage of utilising a consumer-grade 360 cameras, similar to other tools used for 360 photo documentation. However, what sets Cupix apart is its ability to generate a spatial digital twin map using AI (Artificial Intelligence) technology. This combination of a familiar tool and the innovative application of AI of CupixWorks from Cupix, creates a unique and leading edge solution. Consequently, it fills in the voids left by 360 photo documentation by offering depth perception, a bird's-eye view or "google map" of the site, dimensional measurements, and an immersive integration with the BIM workflow.

"As a result of implementing Cupix, we have significantly been successful in supporting the construction and safety workflows on our client's worksites."

Mitch Medway

Regional Digital Lead, Places Business Unit ARCADIS, Australia
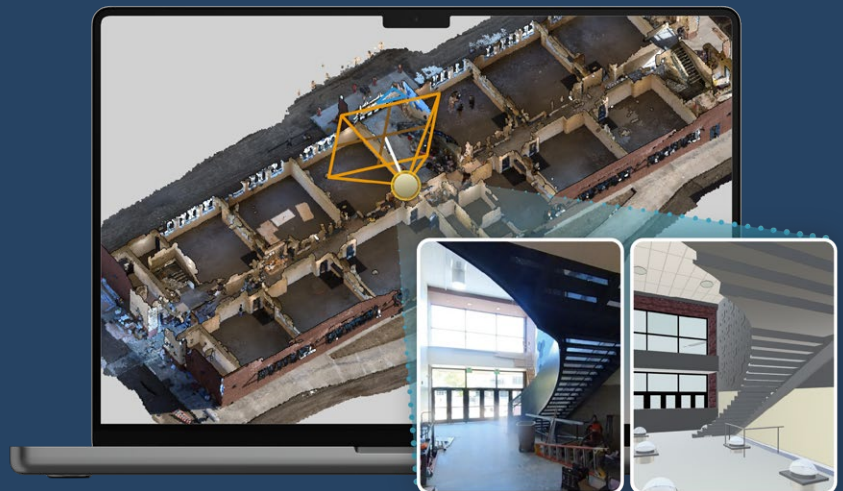
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CupixWorks from Cupix Leading the Way

Cupix is spearheading this transformative wave with its unparalleled "Spatial Digital Twin software" partnered with a "Consumer-Grade 360 camera" solution. Utilising Cupix's proprietary AI-Engine, CupixWorks can convert user-captured 360 videos into spatial digital twins at lightning speed. What distinguishes Cupix in this arena is our simplification of the process, high-quality spatial map generation, all-encompassing integration with BIM, and the ability to utilise traditional Spatial digital twin data from laser scans or drone photogrammetry for BIM verification.

Here's how Cupix has enhanced its proprietary AI engine:

Quality Assessment

AI analyses photos to assess their quality, identifying issues such as blurriness and exposure problems. This helps ensure that only high-quality images are used for generating Spatial digital models or virtual tours.

Progress Tracking

AI-powered image analysis provides spatial contextual details of the construction site conditions captured in photos. For example, it can track progress milestones, and expose deviations from project plans based on the 3D point cloud and visualisation within the images.

Integrating AI capabilities into photo reality capture workflows within platforms such as CupixWorks significantly enhances their utilisation for construction project management, enabling better documentation, analysis, and decision-making throughout the construction process.
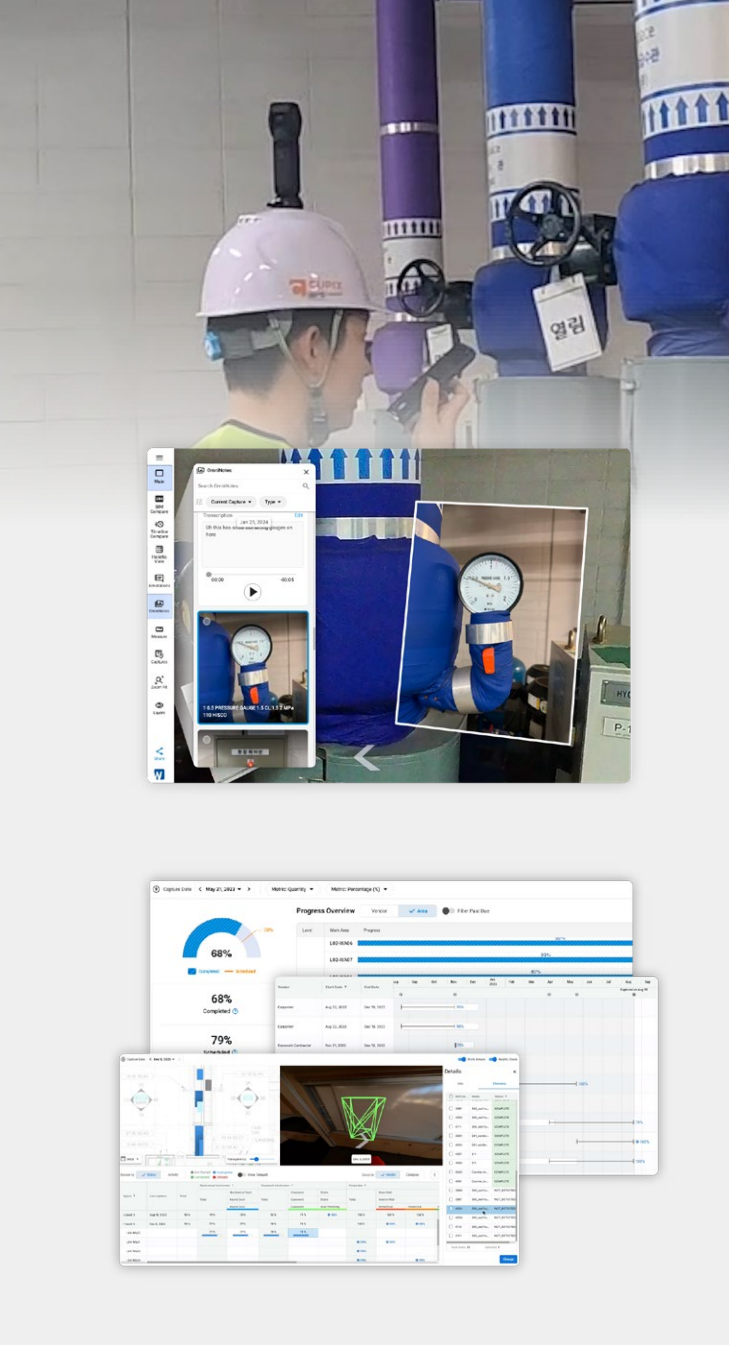
"We have selected Cupix to efficiently capture construction site progress and seamlessly integrate 3D models with the physical world. Cupix allows us to track progress and has improved on-site and off-site decision making."

Ramsay Horton
Head of Innovation, Built, Australia

05

Future Trends and Innovations

AI is positioned to revolutionise the construction industry in several ways, enhancing efficiency, safety, and sustainability. Some trends likely to emerge also include:

Predictive Analytics

AI can analyse vast amounts of data to predict project outcomes, including material requirements, project timelines, and potential risks. This allows for better decision-making and resource allocation.

Smart Construction Sites

AI-enabled sensors and drones can monitor construction sites in real-time, tracking progress, detecting safety hazards, and optimizing workflows. This data-driven approach improves efficiency and reduces the risk of accidents.

Generative Design

AI algorithms can generate and evaluate design alternatives based on specified criteria such as cost, structural integrity, and energy efficiency. This enables architects and engineers to explore a wider range of design options and identify optimal solutions.

Safety Monitoring and Compliance

AI can analyse video feeds from cameras installed on construction sites to detect safety violations, such as workers not wearing proper protective gear or unauthorized personnel accessing restricted areas. This helps ensure compliance with safety regulations and prevents accidents.

As we stand at the nexus of construction and AI, the opportunities for capturing the reality of construction data through photo capture are boundless. By harnessing the power of AI (Artificial Intelligence), we can transform static images into dynamic sources of actionable insights, driving efficiency, safety, and sustainability in the construction industry. Let us embrace this journey of innovation, **#Build Smart!**

About Cupix

Cupix offers the construction industry an advanced Spatial Digital Twin platform that enables construction sites to be mirrored into virtual spaces, with measurable spatial context, in minutes.

The flagship product, CupixWorks, is a SaaS platform that transforms 360° photos taken by off-the-shelf with 360 cameras into a virtual Spatial digital twins and provides a cloud-based unified platform for industry data formats. It leverages AI to provide construction progress insights to customers and is used by building and infrastructure clients across various projects. For more information and/or demo go to www.cupix.com.

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