NAC Executive Insights

Use of Artificial Intelligence in Construction Safety

Key Points

- This Executive Insight serves as a guide for construction professionals in harnessing the potential of artificial intelligence (AI) for enhanced safety.
- Five AI technology application areas are addressed: computer vision for hazard detection; predictive analytics; wearable technologies; autonomous equipment; and proximity warning systems.
- Specific technologies using AI, with references and hyperlinks, showcase the real-world implementation of AI in improving construction site safety.

Introduction

The engineering and construction industry is experiencing a transformative shift with the integration of AI. Applying AI in the industry is evolving rapidly, particularly with respect to construction safety.

This Executive Insight cites specific AI applications and provides references and hyperlinks for each one to showcase the real-world implementation of AI in improving construction site safety. Readers are encouraged to explore the links. They serve as a guide for industry practitioners.

The five AI applications addressed include:

1. **Computer Vision for Hazard Detection**: Computer vision plays a pivotal role in identifying safety hazards in real-time. Companies employ AI algorithms to analyze images and videos from construction sites, enabling the detection of unsafe working conditions and noncompliance with safety protocols. This proactive approach significantly contributes to accident prevention.
2. **Predictive Analytics**: Predictive analytics in construction safety utilizes AI to analyze historical safety data, to predict potential risks, and to enable proactive interventions. This data-driven approach enhances decision-making, leading to improved safety standards on construction sites.
3. **Wearable Technologies**: Wearable technologies equipped with AI are empowering construction workers and enhancing safety. For instance, AI monitors workers' movements, tracks locations, and provides real-time alerts for potential safety concerns. This integration of AI technology contributes to a safer work environment by addressing risks promptly.
4. **Autonomous Equipment**: The advent of autonomous construction equipment brings AI to the forefront of safety. AI-driven bulldozers and excavators operate without human intervention,

minimizing safety risks associated with manual operation. This technological leap enhances construction site safety by reducing human exposure to hazardous tasks.

5. **Proximity Warning Systems**: Proximity warning systems leverage radio frequency identification (RFID) technology and AI. These systems detect workers' proximity to moving vehicles or machinery, and issue timely warnings to prevent accidents. This application is crucial in preventing collisions and ensuring a safer work environment.

The following sections explore each of these areas of AI deployment to enhance construction safety.

Computer Vision for Hazard Detection

Specific examples of AI in computer vision for hazard detection in construction safety include the following. The list is far from exhaustive.

- Smartvid.io™
  - Application: Analyzing images and videos from construction sites to identify safety hazards, such as workers not wearing proper gear or unsafe working conditions.
  - Reference: Smartvid.io — AI for Construction Safety (https://www.smartvid.io/)

- OpenSpace™
  - Application: Using AI and 360-degree cameras to capture and analyze construction site images, identifying potential safety issues and tracking changes over time.
  - Reference: OpenSpace — Construction Site Documentation (https://www.openspace.ai/)

- Procore Safety Qualified™
  - Application: Integrating AI into Procore's construction management platform to analyze safety data and identify potential hazards, improving overall project safety.
  - Reference: Procore — Safety Qualified (https://www.procore.com/products/safety)

- Reconstruct™
  - Application: Employing AI and computer vision to create 3D visualizations of construction sites, allowing for real-time hazard detection and safety analysis.
  - Reference: Reconstruct — AI-Powered Construction Data (https://reconstructinc.com/)

- Sensera Systems™
  - Application: Using AI in construction site cameras for hazard detection, monitoring worker activities, and providing alerts for potential safety concerns.
  - Reference: Sensera Systems — SiteWatch (https://www.senserasystems.com/sitewatch/)

Predictive Analytics

Specific examples of AI being used in predictive analytics for analyzing safety data and predicting potential risks in construction safety include:

- Predictive Solutions™ by Industrial Scientific
  - Application: Utilizing predictive analytics to analyze historical safety data and predict potential risks, enabling proactive measures to enhance construction site safety.
  - Reference: Predictive Solutions — Safety Analytics (https://www.predictivesolutions.com/)

- IBM Maximo Worker Insights™
  - Application: Using AI to analyze worker behavior and safety data to identify patterns, predict potential risks, and improve overall safety on construction sites.
  - Reference: IBM Maximo Worker Insights (https://www.ibm.com/cloud/maximo/worker-insights)

- Intelex Predictive Analytics™
  - Application: Applying AI algorithms to safety data in the Intelex platform to identify trends, predict potential hazards, and help organizations proactively address safety concerns.
  - Reference: Intelex Predictive Analytics (https://www.intelex.com/products/predictive-analytics)

- Avetta Predictive Analytics™
  - Application: Employing AI-driven analytics to assess contractor and supplier safety data, predict potential risks, and help construction companies make informed decisions.
  - Reference: Avetta — Predictive Analytics (https://www.avetta.com/solutions/predictive-analytics)

- Sphera Predictive Analytics™
  - Application: Using AI to analyze safety data and predict potential risks, allowing construction companies to take preventive actions and improve overall safety performance.
  - Reference: Sphera Predictive Analytics (https://sphera.com/solutions/predictive-analytics/)

Wearable Technologies

A third example of AI being used to enhance construction site safety is wearable technologies. Use case examples include:

- Triax Technologies — Spot-r Wearable™
  - Application: Triax's Spot-r Wearable monitors workers' movements, tracks location, and provides real-time alerts for potential safety concerns on construction sites.
  - Reference: Triax Technologies — Spot-r Wearable (https://www.triaxtec.com/spot-r/)

- DAQRI Smart Helmet™
    - Application: DAQRI's Smart Helmet is equipped with augmented reality features and sensors, enhancing worker safety by providing real-time information and warnings in their field of view.
    - Reference: DAQRI Smart Helmet (https://daqri.com/)

- Cat® Wearable Technologies™
    - Application: Caterpillar's Cat® Wearable Technologies include fatigue-monitoring devices that use AI to track workers' movements and alert supervisors to potential fatigue-related safety risks.
    - Reference: Cat® Wearable Technologies (https://www.cat.com/en_US/by-industry/construction/technologies/cat-wearable-technologies.html)

- Ekso Bionics – EksoVest™
    - Application: EksoVest is a wearable exoskeleton designed to reduce the physical strain on construction workers, enhancing safety and reducing the risk of musculoskeletal injuries.
    - Reference: Ekso Bionics — EksoVest (https://eksobionics.com/industrial/)

- Guardhat™
    - Application: Guardhat's smart hardhat incorporates sensors and AI to monitor workers' health and safety, providing real-time alerts for potential hazards and ensuring timely responses.
    - Reference: Guardhat — Smart Hard Hat (https://www.guardhat.com/)

Autonomous Equipment

Specific examples of AI being used in autonomous equipment to reduce construction safety risks are illustrated in the following examples. This listing, like other previous examples, is not intended to be exhaustive but rather illustrative.

- Built Robotics™
    - Application: Built Robotics develops autonomous construction equipment, such as bulldozers and excavators, that use AI to operate without human intervention, reducing safety risks.
    - Reference: Built Robotics — Autonomous Construction Equipment (https://www.builtrobotics.com/)

- Caterpillar Command for Dozing™
    - Application: Caterpillar's Command for Dozing utilizes autonomous technology and AI to enable dozers to operate autonomously, minimizing safety risks associated with manual operation.

- Reference: Caterpillar Command for Dozing (https://www.cat.com/en_US/by-industry/construction/technologies/command/cat-command-for-dozing.html)

- Komatsu SMARTCONSTRUCTION™
  - Application: Komatsu's SMARTCONSTRUCTION integrates autonomous construction equipment with AI, optimizing operations and reducing safety risks by minimizing human exposure to hazardous tasks.
  - Reference: Komatsu SMARTCONSTRUCTION (https://www.komatsuamerica.com/smartconstruction)

- SafeAI™
  - Application: SafeAI retrofit kits add autonomous capabilities to existing construction equipment, enhancing safety by reducing the need for human operators in potentially dangerous tasks.
  - Reference: SafeAI — Autonomous Retrofit Kits (https://safeai.ai/)

- Suncor Autonomous Haul Trucks™
  - Application: Suncor, a mining company, uses autonomous haul trucks equipped with AI to transport materials, reducing safety risks by eliminating the need for human drivers in certain areas.
  - Reference: Suncor — Autonomous Haul Trucks (https://www.suncor.com/en/about/technology-innovation/autonomous-haul-trucks)

Proximity Warning Systems

There are several specific examples of AI being used in proximity warning systems to enhance construction site safety. These include:

- ZoneSafe™
  - Application: ZoneSafe offers proximity warning systems using RFID technology and AI to detect the proximity of workers to moving vehicles or machinery, issuing warnings to prevent accidents.
  - Reference: ZoneSafe — Proximity Warning Systems (https://www.zonesafe.net/)
- Honeywell Connected Plant Personal Gas Safety™
  - Application: Honeywell's proximity warning system uses AI to monitor workers' exposure to hazardous gases, providing real-time alerts to enhance safety on construction sites.
  - Reference: Honeywell Connected Plant Personal Gas Safety (https://www.honeywellprocess.com/en-US/explore/products/control-monitoring-and-safety-systems/wireless/gas-detection/personal-gas-safety)

- MotionMiners™
    - Application: MotionMiners employs AI in wearable devices for workers, creating a proximity warning system to prevent collisions and enhance overall safety on construction sites.
    - Reference: MotionMiners — Proximity Warning Wearables (https://www.motionminers.com/)

- SiteZone Proximity Warning System™
    - Application: SiteZone's Proximity Warning System uses RFID technology and AI to detect the proximity of workers and machinery, reducing the risk of accidents on construction sites.
    - Reference: SiteZone Proximity Warning System (https://www.sitezone.com/)

- Zone-Ex™
    - Application: Zone-Ex offers an intrinsically safe proximity warning system for hazardous environments, utilizing AI to enhance worker safety by preventing collisions and accidents.
    - Reference: Zone-Ex — Proximity Warning Systems (https://zone-ex.com/)

Summary

This Executive Insight aims to guide construction professionals in harnessing the potential of AI for enhanced safety, ultimately creating a safer working environment for all stakeholders. The integration of AI in construction safety is a multifaceted approach encompassing computer vision, predictive analytics, wearable technologies, autonomous equipment, and proximity warning systems. The descriptions and references of real-world AI technologies provided in this Executive Insight highlight the tangible benefits of AI in mitigating safety risks and promoting a safety culture of proactive management on construction sites.

For construction managers, implementing AI in safety requires a strategic approach. Employing a combination of computer vision, predictive analytics, wearables, autonomous equipment, and proximity warning systems can create a comprehensive safety ecosystem. Continuous training for workers on AI-enabled tools is essential, fostering a safety-conscious mindset. Regularly updating safety protocols based on AI insights and investing in cutting-edge technologies will help position the engineering and construction industry and its project sites at the forefront of safety innovation.

Reference

REAL TIME SAFETY SYSTEMS; Patent No. US 9,082,284 B2; Inventor: Robert Prieto

About the Author

Bob Prieto was elected to the National Academy of Construction in 2011. He is a senior executive who is effective in shaping and executing business strategy and a recognized leader within the infrastructure, engineering, and construction industries.