SIX CUTTING EDGE TECHNOLOGIES TO IMPROVE SAFETY ON CONSTRUCTION SITES

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According to OSHA, there were 971 worker fatalities in 2017 in the construction industry alone. One out of every five deaths that occurred in private industry occurred in the construction field. More than half of the construction industry deaths were the result of what OSHA calls the "Fatal Four," which consists of falls, being struck by an object, electrocutions, and being caught in/between equipment or objects. According to the Associated General Contractors of America, the construction industry grew by 23,000 jobs in September 2018, which is a 4.5% increase from the previous year, and brings the total construction workforce to its largest total in a decade. With a relatively large influx of new workers into an industry that can be inherently dangerous, safety on the job site is more important than ever.

Fortunately, new technology to combat the "Fatal Four" is being adopted into the construction industry at a rapid pace. New technology is being utilized to better train the workforce and to plan the project better to enhance safety, in addition to making the jobsite safer for workers once construction begins.

WEARABLE TECHNOLOGY

When most of us hear the term "wearables," we think of counting our steps with one of the popular brands of fitness trackers. However, wearable technology is actually defined much more broadly, and constitutes any electronic device or sensor that collects and sends data to and from the wearer to a smartphone or a computer. In the construction industry, wearable technology is now being utilized to track a variety of information personal to the worker in order to monitor their activities and help keep them safe.

Current wearable technology used in the construction industry can use biometric sensors to monitor fatigue levels and track vitals in an effort to prevent injury. Many wearables contain GPS or radio-frequency identification (RFID) technology to allow managers to track each worker's location at a given moment and alert them if they enter into unauthorized areas. Wearable technology can be used to send alerts to avoid collisions or unauthorized use of certain tools or equipment, and to monitor whether personal protective equipment is being utilized. Some wearable technology can also send an alert in the event of contact with a hazardous materials. Wearables can be used to send an alert in the event of an unwitnessed fall where the worker is unable to call for help, and can help rescuers locate trapped workers more easily. Wearable technology can also improve evacuation speed in the event of an emergency.

Wearable technology can be implemented into bands/watches and into clothing such as vests, jackets or hats. A company called SolePower even manufactures boots that contain biometric sensors, GPS/RFID tracking technology, and a cellular 4G module that comes equipped with kinetic chargers that are powered by walking. (www.solepowertech.com/industrial/).

DRONES

The use of drones, or Unmanned Aerial Vehicles (UAVs), in the construction industry has exploded over the past several years. One of the many benefits of their increasingly widespread incorporation into the industry is their ability to make the construction site safer in a variety of ways. On large construc-

tion sites, drones are used to provide managers with a real-time, first-person view of the work being performed for use in accident prevention. Drones are also being used to perform visual, thermal and infrared sensors for inspections of hard-to-reach areas such as roofs, scaffolding, flashing, windows, and unstable or unsafe areas. Some drones are equipped with LIDAR technology to create 3D maps of job sites. Drones are also being used to inspect areas where there is a risk of exposure to hazardous substances. Some companies are using drones to transport tools, equipment and materials to dangerous places as well. In certain situations, drones are even being used to control unmanned construction vehicles.

EXOSKELETONS

Robotic exoskeletons have not yet been widely adopted in the construction industry, but it is easy to see their potential impact in the future. Exoskeletons are suits that consist of a light metal framework, that, when worn by workers, can make objects being lifted seem lighter or even weightless. Exoskeletons were first developed for the military, but have since found application in the healthcare and manufacturing industries. Exoskeletons are being produced that contain motors or batteries to assist with lifting or hauling (known as "active") or without (known as "passive"). Passive, unpowered systems are obviously less expensive and are becoming more popular than active systems in the manufacturing industry, according to industry professionals.

There are several different types of exoskeletons that would have application in the construction industry to reduce injuries. Some consist of a mounted arm attached to a counterweight worn on the lower body, which would be useful in operating tools. Other exoskeletons provide back support for bending down and lifting, while others can be worn on the lower body to support crouching or standing for long periods at a time. Finally, some full-body powered suits exist to assist with a variety of lifting and carrying tasks.

BIM

Building Information Modeling, or "BIM," has been available for a while, but has continued to evolve in recent years and is becoming more widespread in use. The National Institute of Building Sciences defines BIM as "digital representation of physical and functional characteristics of a facility. . . a shared knowledge resource for information about a facility forming a reliable basis for decisions during its life-cycle; defined as existing from earliest conception to demolition." (NBIMS-US, 2016). BIM includes 3D-modeling of a given project, but increasingly involves much more information than just a model that can be manipulated in software. BIM software tools can also include data pertaining to scheduling, cost and as-built operations. Much of the discussion surrounding BIM focuses on the financial benefits and improved efficiency that can result from advanced coordination between the design/construction teams and planning using BIM tools. However, those same improved efficiencies can result in a much safer jobsite as well.

Generally speaking, BIM tools can be used to reduce risk by identifying potential hazards early on in the planning phase and continuing throughout the life of the project. Some BIM tools incorporate automated safety rule checking, which can define when and where personal fall protection or perimeter protection should be utilized. The ability to simulate each construction process in advance makes it easier to develop the most efficient safety strategy possible. BIM results in streamlined communication between all parties involved in the construction process, which can result in fewer accidents. Another safety benefit to utilizing BIM tools is that it allows for offsite prefabrication of certain components of a structure, which allows for construction in more ergonomically favorable conditions than the job site itself.

VIRTUAL REALITY

Virtual reality is another relatively new technology that has multiple practical applications in the construction industry. VR is being utilized in the development of training programs for workers that can place them in immersive, true-to-life scenarios that use sight, sound and even motion to provide training for a particular job in a safe environment. VR technology can even be used in conjunction with technology such as BIM to allow workers to be trained in a virtual mockup of their construction site. Heavy equipment operators can also use VR to be trained on a particular piece of equipment on a simulated jobsite like the one where they would be working.

The primary benefit of VR training is to provide realistic training in an environment that is completely safe. Individuals who are better "hands on" learners could be trained more quickly than with other types of training. Retention of the material should also be higher than other traditional forms of training because VR training is more realistic and immersive. Training using VR allows for the creation of more risky scenarios than other forms of training, which should also improve the quality of the training. VR training would also allow for endless repetition, as well as a safe environment to test and evaluate new processes. VR training provides the trainers with better means to evaluate the progress of the trainees.

SELF-DRIVING VEHICLES

Driverless cars are projected to be publicly available for the first time later this year. Self-driving technology and remote-controlled vehicles are being developed and incorporated into the construction industry because they can increase productivity and efficiency. Self-driving vehicles also promote safety by reducing or eliminating human error and by allowing equipment to operate in areas that may be too hazardous for human drivers, allowing the operator to manage the project from a distance.

Autonomous trucks and other equipment have already been adopted to some extent in the mining industry, and industry leaders believe they will soon become mainstream across the entire construction industry. Heavy construction equipment is already available that can integrate 3D modeling of the job site with GPS, collision avoidance technology and other technology to autonomously create the grades that are specified in a 3D model, for example. Such technology not only increases productivity and efficiency, but also promotes a safer jobsite.

In terms of the technology discussed above, the future is here. More widespread adoption in the construction industry will occur as the cost continues to decrease and more applications for each are developed. As that occurs, the number of deaths or injuries resulting from the "Fatal Four" will be diminished, and productivity should be increased as well.

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