Using the Internet of Things to Connect the Smart Worker

Using ruggedized devices and IoT applications can help workers be more productive and safe

Executive Summary

Unprecedented numbers of skilled workers are retiring while energy companies find themselves in a turbulent marketplace. Utility companies face market disruption from distributed energy resources (DER), and oil and gas companies must cope with oil prices at near-historic lows. The pressures to cut costs are greater than ever, while worker safety and productivity remain a high priority.

The Internet of Things (IoT) is bringing new capabilities that can transform the industrial workplace. New ruggedized devices are becoming available, including devices that can be used in hazardous locations. Many devices, such as ruggedized tablets and wearable biometric and gas sensors are available today. Over the coming months, smart glasses and helmets will also be available for use in the field.

These connected devices will enable a new generation of smart, energy workers who will have information at their fingertips. Tablets will allow field operators to access standard operating procedures, safety checklists, and maintenance programs at the job site. Connected gas and biometric sensors can alert workers to fatigue and unsafe environmental conditions while directly notifying the home office that assistance is needed. Augmented reality with smart glasses and helmets will allow hands-free access to information.

These smart worker solutions can help companies improve worker safety and improve on-the-job productivity and training.

Figure 1. Smart worker solutions can alert workers and the home office to hazards in the environment and automatically log the incident for investigation – speeding emergency response and improving communication of potentially hazardous events.

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Alerts for Smart Workers in the Field

Smart Worker Device Alert:
High H₂S
Evacuate area.

Home Office Alert:
High H₂S in Area A
Confirm Worker A does not need immediate assistance.

Incident Program:
Automatically logs incident of high H₂S in Area A with Worker A.

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Business Challenge: Loss of Skilled Labor Adds Existing Market Strain

Energy companies—utilities, oil, and gas—are experiencing increasing strain on their resources from loss of skilled labor in a retiring workforce as well as pressure from a rapidly changing marketplace. Utilities are experiencing market disruption caused by new distributed energy resources (DER) and declining power usage. Oil and gas companies are experiencing near-historic low oil prices. Both industries are challenged to keep operating costs low and also remain productive and competitive with fewer and less experienced workers.

Focusing on field workers, who often operate in complex, hazardous environments, is one way in which energy companies can help improve productivity and safety. The Internet of Things (IoT) is helping to create new opportunities for improving the way people work.

Wireless devices used by consumers are often not suitable for the rugged conditions in the field or on the factory floor. But new devices, such as smart glasses, tablets, gas sensors, smart helmets, and biometric sensors that use wireless and Bluetooth* connectivity and which are suited for use in industrial and hazardous locations are becoming increasingly available. These devices offer new applications that can help businesses operate more efficiently such as augmented reality for faster and more accurate equipment maintenance and field training. They also enable monitoring of worker health and safety in hazardous environments.

Connected Worker Examples

Efficient, Accurate Pump Repair

Today, pump mechanics receive work orders at the beginning of their shift. In the case of pump repair, the mechanic must have training on the specific equipment and how to repair it. Without knowing the exact cause of the problem, the mechanic also takes a range of parts and tools. He also needs to know the pump location. Once on site, the mechanic performs a job safety analysis to ensure that he can safely start work.

This highly manual scenario relies on the experience and knowledge of a highly skilled workforce. However, as many experienced workers in the energy sector are retiring and new and relatively less experienced workers are entering the workforce, advances in IoT technology can make it easier and safer to complete jobs.

In the near future, a mechanic can receive details of the work order while in the field, as well as confirmation that the pump has been prepared for maintenance. The mechanic will be able to find the pump using geolocation and complete the job safety analysis on a tablet. They may also receive alerts about safety concerns regarding the specific equipment or the general area. If the mechanic is not familiar with the pump, they can virtually access the manual using smart glasses or watch a short how-to video. Any problems or changes to the repair can be noted electronically—capturing the exact repair method directly. As the repair is being made, a wearable gas sensor can alert the worker, as well as the office, if the pump has not been properly made safe and if there is a potential hazard due to combustibles or hydrogen sulfide leaks. The office can then confirm that the worker is okay or send help if needed. When finished, the worker can then close the work order while still at the pump and gain approval from operations before moving to the next job.

Whether working on a pump in a refinery, a power plant, or other energy industry environment, tablets and smart glasses can enable mechanics to access information directly, minimizing the need to rely only on prior experience with the specific make or model. Repair methods and problems can be immediately documented, making future analysis and troubleshooting easier.

Health and Safety Monitoring

Energy companies train and maintain their own emergency response teams (ERTs). These teams are on-call to respond to a variety of safety situations from fires and chemical releases to rescuing injured workers. These safety events can be minor and resolved in a few minutes; or they can be major, lasting for hours and requiring additional assistance.

Current technology provides ERT employees excellent personal protection equipment (PPE) for high-temperature exposure during fires, as well as self-contained breathing apparatus (SCBA) for low oxygen or toxic gas environments. However, currently nothing alerts the ERT or Incident Command when a worker is reaching his or her physical limitations—only the workers themselves are able to monitor their own physical conditions. Likewise, external conditions may suddenly change with situations involving hydrogen sulfide, low oxygen, or high levels of carbon monoxide.

Or in the worst case—such as an ERT member becoming incapacitated—there is often inadequate information about the cause. These scenarios place rescuing responders at risk as well.

With biometric and gas sensors, supervisors can track employee situations in real-time on their mobile devices.
With biometric and gas sensors, ERTs and Incident Command can track employee situations in real-time and quickly respond to changing situations. These connected biometric and environmental sensors can also help lone workers who operate in remote locations. Biometric sensors can determine if a driver is becoming too tired to safely drive and alert them to pull over and rest. Additionally, if a worker is injured on the job site or encounters a hazardous condition (like high H₂S), the main office can be notified immediately that he needs assistance.

**Solution Value: Improving Worker Safety While Reducing Costs**

Smart worker solutions provide workers with the data they need, where they need it—at the job site. For example, connected, ruggedized tablets allow pump mechanics to access repair procedures and schematics at the pump site during the repair. And future technology may enable heads-up displays on glasses and provide information in a hands-free format that lets the mechanic remain focused on the task. Gas and biometric sensors can notify workers if the environment is not safe, as well as alert the office if immediate help is needed. These solutions can help energy companies and other organizations improve safety and reduce costs.

The benefits include:

- **Reduction in necessary experience.** Using smart glasses to access videos, manuals, and other data to perform repairs reduces the need for workers to have years of prior experience with equipment models or carry multiple repair manuals.
- **Improvement in lone worker safety.** Lone workers, whether on the job site or in transit, can face dangerous situations with high risk of injury. Biometric monitoring lets the office know immediately when someone is injured and needs assistance.
- **Reduction in fatigued workers.** When operating facilities encounter problems it can lead to long days for workers. Monitoring a worker’s condition with biometrics can indicate when it is time for a break, regardless of standard time limits, helping prevent accidents due to fatigue.
- **Improvement in emergency response.** Full situation awareness leading to quick assessment of developing hazards is imperative when an ERT is activated. Incident Command can respond immediately if a worker suffers injury or needs assistance.
- **Reduction in operating costs.** Smart worker solutions can help reduce operating costs by delivering real-time information. And with data captured during maintenance, companies have better visibility into overall equipment health and trends.

**Solution Architecture: Smart Worker Solutions**

Workers are equipped with wearable IoT devices such as biometric sensors or smart glasses. These devices transmit important data through sensor hubs to Intel® IoT Gateways that aggregate the information and perform basic analytics, as seen in Figure 2. These gateways, which can reside on the service truck or in the facility, can perform analytics at the edge as well as send data to the cloud where more sophisticated analytics can be performed and the data can be viewed throughout the organization.

**Figure 2.** The smart worker architecture can vary by use case, but uses the same foundational concepts of transmitting data from wearable or portable devices through a sensor hub and gateway to the cloud for near real-time analytics and access throughout the organization.
Conclusion

Energy companies face dramatic market changes and pressures to reduce cost. Smart worker solutions, using ruggedized devices and IoT applications, can help less experienced workers be more efficient while also improving worker safety.

Industrial workers in large facilities or those who work alone in remote sites can benefit from improved access to information. Whether it is learning to guide them through repairs on unfamiliar equipment or alerts about hazardous conditions, smart worker solutions can improve productivity and help keep workers safe.

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