
Accelerate Productivity and Generate ROI with Wearable Computers

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How smart industrial companies can unlock productivity and safety with augmented reality

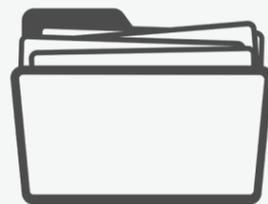


Industrial companies are making significant investments into digital transformation and increasingly adopting Internet of Things (IoT), machine learning and cloud technologies. Many organizations, however, have failed to consider how to shift employees' day-to-day activities to most effectively maximize the new technology – and capture the associated ROI.

Why Connected Worker Programs are Central to Digital Transformation

43%

plan to update outdated systems but workers are still using "pen and paper" to record their data



"many industrial workers are still using "old ways" of working, such as notecards or cumbersome, oversized binders and manuals for training and reference materials"

Ready for change

Though Gartner found that 43 percent of organizations are already using or plan to implement the IoT, many industrial workers are still using "old ways" of working, such as notecards or cumbersome, oversized binders and manuals for training and reference materials, or are lugging around tablets and laptops

Industrial workers use these materials and outdated technology to refer to instructions and schematics and track equipment repairs and data entry, among other tasks. It's a time-consuming process: Many organizations find that workers spend too much time reviewing information and entering it into technology systems and not enough time completing the core functions of their job. In other words, they have lower "wrench time", or the percentage of total available time that employees spend executing work rather than performing administrative tasks.

As a result, despite advances in automation, productivity across many U.S. industrial sectors is declining. According to a U.S. Department of Labor study, productivity fell in 2017 for most manufacturing sectors, including computer parts, fabricated metal products, wood products, chemicals, apparel, food, plastics, beverages and electrical equipment. In construction, productivity growth has remained flat since 1994.

And that's not the only issue these "old ways" of working create. Physical reference materials and handheld devices contribute to expensive safety problems. They lessen situational awareness, require workers to take their hands off equipment or safety harnesses while working and are often difficult to use or set up while working in the field.

How do gather information

In addition, although pen and paper may be fairly easy to use, they don't enable companies to gather the type of worker data needed to power the analytics and business intelligence programs required for digital transformation.

What's clear is that the industrial workplace has evolved to a new digital frontier, but industrial workers are still stuck with "the way we've always done things" in their core activities. With most industrial companies now competing in a global economy, these productivity sinks and safety issues are holding companies back from achieving global market leadership. A better way of completing training or reviewing materials and data onsite is understandably needed. The answer lays in "connected workers" that use modern augmented reality (AR) wearable computers. In the past, gains in productivity often came at the potential expense of safety, or vice versa, but modern connected worker programs utilize AR to unlock capabilities that cost-effectively enable gains in both productivity and safety simultaneously.



Increased safety and knowledge transfer happens when workers stop needing to carry around binders of paper information on job sights and have data at their fingertips.



2017

According to a U.S. Department of Labor study, productivity fell in 2017 for most manufacturing sectors, including computer parts, fabricated metal products, wood products, chemicals, apparel, food, plastics, beverages and electrical equipment.

1. "Gartner survey shows that 43 percent of organizations are using or plan to implement the Internet of Things in 2016." Gartner.com. 2016.
2. "Productivity and Costs by Industry: Manufacturing and Mining Industries – 2017." Bureau of Labor Statistics news release. April 19, 2018.
3. "The construction productivity imperative." McKinsey & Company. July 2015.

The Facts

AR-Empowered Humans Are the Missing Puzzle Piece

You've probably seen headlines that claim that AI, robotics and other technology is taking over warehouse, factory and industrial jobs. The reality is that most tasks completed by engineers, service technicians, facility managers and environmental health and safety officers take a high degree of skill – skill that technology can't currently replicate.

Millennial turnover costs the U.S.

\$30.5 Billion

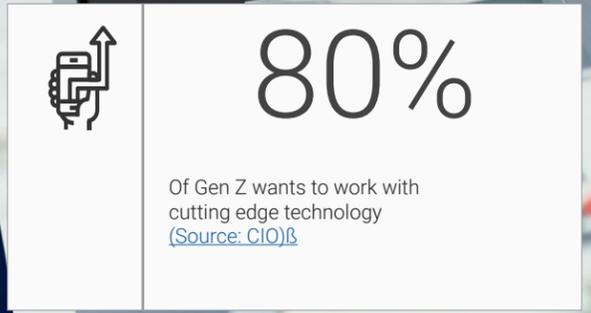
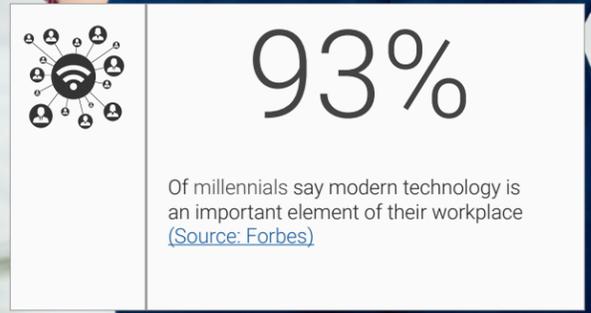
Even the most advanced technology available today can't fix, adjust or visually assess a problem with the accuracy and insight that human workers can -- which means workers themselves are the most critical source of productivity gains available to companies that are digitizing their operations.

Most industrial sectors are facing a shortage of skilled workers. In an age in which unemployment has plunged to just 4 percent, unhappy or unengaged workers are less likely to stay in their positions. And as older industrial workers age out of the workforce, that gap is being filled with millennials and members of Gen Z who prefer to learn through digital means and expect technology to be a central aspect of their jobs. AR presents an opportunity to attract and retain these digital native workers and provide the tools they need to be most productive.

By extending digital transformation to workers, industrial companies can unlock greater productivity and safety while overcoming the skills gap. To do so, however, transformation initiatives must bring digital tools to workers' point of use and enable workers to view information while the work is happening, or in situ. These connected worker programs enable real ROI in the core tasks that workers focus on every day. No technology is better suited for on-the-job use in industrial environments than AR-powered wearable computers.

How wearable computers increase productivity and safety

Industrial companies use these ruggedized, head-mounted computers with extendable boom-arm displays to speed the delivery of information to workers so that they can work more safely and effectively. Hands-free wearable computers bridge the gap between digital transformation and workers' day-to-day activities. They can attach to safety helmets, are compatible with safety glasses and other safety gear, and they utilize high-resolution micro-displays that effectively put what appears to the user as a 7-inch Android tablet screen just within workers' field of view, like a personal dashboard one can glance down at.



How wearable computers increase productivity and safety

The result of this in situ, point-of-view experience is far faster troubleshooting, reduced employee air travel time, improved customer wait time, increased production time, lower error rates and increased workload capacity.



Wearable computers intrinsically deliver greater productivity and safety by providing workers with hands-free access to information and with voice-navigated instructional videos. Workers are armed with immediate access to IoT data, manuals and schematics, work and safety procedures and training materials. When issues arise, workers can contact a more experienced member of the team and share what they are seeing via a front-facing smart camera.

Wearable computers also reduce digital distractions. It's common knowledge that texting and driving is dangerous, but what about fixing a piece of machinery while looking up information on a tablet or laptop? In many industries such as mining, oil and gas or chemical manufacturing, processes that require employees to take their hands-off equipment to access manuals or technical material can pose a similar level of risk as texting while driving. And with so many workers already walking around the shop or in the field with their heads buried in their smartphones or tablets, providing alternatives that deliver necessary information without distraction is central to increasing safety.

4. "America's Growing Labor Shortage." The Economics Review at New York University. August 17, 2018.

5. "Millennials are the largest generation in the U.S. labor force." Pew Research. April 11, 2018

Hands-free wearable computers enable newer workers to learn more quickly and solve more advanced challenges

In addition, hands-free wearable computers enable newer workers to learn more quickly and solve more advanced challenges, earlier in their careers, through on-the-job learning. A study from Iowa State University and Boeing found that when novice workers were empowered with tablet-based AR, they were able to complete a wide range of tasks such as assembling a firearm or following safety procedures on their first day with significantly better performance – defined as the median number of errors – than workers who were given the information on a desktop. Workers using the tablet AR had a median of one error, compared to eight for workers using desktops to access information.

In short, the potential impact of wearable computers on industrial businesses is massive. Companies that have implemented wearables as part of a connected worker report results that include:

more productive workforce⁶

32%

higher quality output⁷

30%

greater utilization

20%

greater efficiency

50%

6. "Fusing self-reported and sensor data from mixed-reality training."

Iowa State University and The Boeing Company, Interservice/Industry Training, Simulation and Education Conference. 2014.

7. UpSkill.io, 2018.

8. UbiMax.com, 2018.

What to look for in your hands-free wearable computer solution

To build on your digital transformation initiatives and empower workers with AR, look for a wearable computer that includes the following features:

Purpose-built AR for industry

Typical AR solutions aren't designed for the tough environments in which industrial employees work. To integrate wearable computers successfully into your employees' core functions, look for a solution that is designed from the ground up to be rugged, dust-proof and drop-proof.

Hands-free voice operation

This is a critical requirement for welders, technicians, plant operators and others who require the use of their hands to fix or operate equipment or walk around a facility while referencing information. Technology that uses hand gestures take workers' hands off of machinery and could decrease situational awareness critical to comply with environment, health and safety (EHS) compliance rules.

Limited head movement

Solutions that require workers to move their head more than 90 degrees can cause neck pain with daily use, and some older workers may have difficulty moving their head more than 45 degrees to the left or right. Your employees should be able to view all information on their device without moving their heads excessively.

Clear line of sight

Ensure that your wearable computer doesn't block workers' field of view, which is key for enabling situational awareness and keeping focus on the task at hand. The device should not obstruct peripheral vision or cause workers to concentrate on a fixed screen location, which causes eye strain. Some immersive solutions can contribute to these issues due to their fixed-focus view, the way in which they put information directly in the field of vision and the dark color of glass used.



How Situational Awareness Drives Greater Safety

According to the Occupational Safety and Health Administration (OSHA), the most frequently cited standards include lack of fall protection, scaffolding issues, failure to lockout/tag out, accidents with powered industrial trucks and improper machine guarding.¹¹ Though there are many strategies for decreasing these incidents, industrial businesses may not have considered the potential for each to be reduced through greater situational awareness and visibility. Warehouse, manufacturing and shop floor workers are often pushed to work quickly, and when their focus is drawn away by physical documents, smartphones, tablets or laptops, the potential for accidents only grows. Enabling greater situational awareness, or understanding of potential threats, is the solution. It allows workers to:

- Think critically about their task.
- Identify potential hazards in their surroundings.
- Anticipate issues that may occur in the future.
- Prevent costly errors.



¹¹ "Commonly used statistics." OSHA.gov. 2017.

How to use wearable computers to improve productivity

Follow these tips to harness the power of wearable computers to enact digital transformation and achieve fast results with your connected worker program without trading safety for productivity:

1. Start with user training:

Your workers will require a certain amount of instruction on how to use wearable computers, including where to position them so that they don't block line of sight, how to ensure that the device is stable on the head or safety gear, and how to make the screen accessible for long periods of time. Set aside time to coach employees on the use of the device before rolling it out – just 15 minutes can make a difference in early productivity gains and in the level of safety when using the wearable computer.

2. Select applications with industrial-ready design:

Enable greater productivity out of the box by sourcing approved independent software vendor (ISV) applications that are optimized for your device. Providers that can deliver content optimized for your device may be endorsed by the solution manufacturer. Apps should have a limited amount of information on each screen to reduce digital distraction, be navigable with limited use of voice commands and provide support systems to help workers access information.

3. Visualize IoT data:

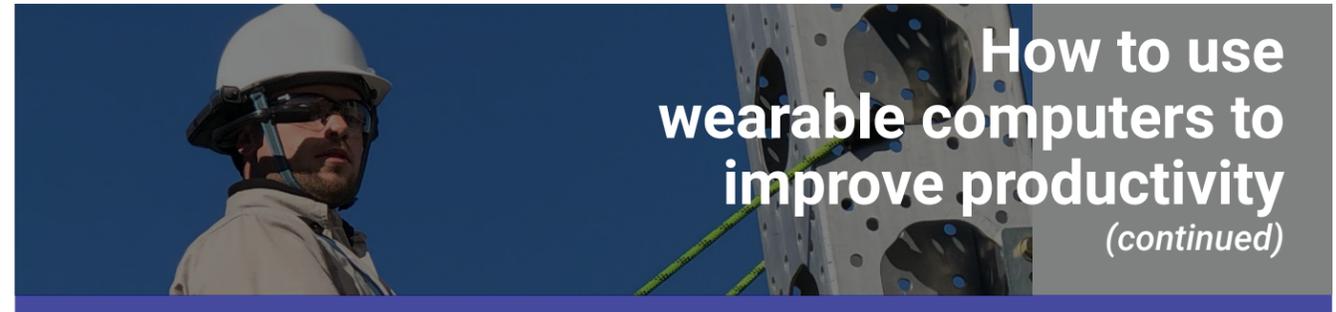
Many workers, such as facilities managers, oil refinery operators or food and beverage equipment operators, rely on touch panels or human machine interfaces to view crucial data on their machinery. These interfaces, however, are often located in a control room rather than next to the equipment itself. By connecting your wearable computers to your IoT data, workers can view the information needed to uncover issues, implement repairs or make adjustments while they are out on the facility floor without having to walk to the control room.

For example, the control room at one food and beverage manufacturer is located 200 yards from the equipment. Adjustments to temperature, cook time, flow rate and concentration of impurities must be made on every batch to ensure a quality product. The time spent walking back and forth to the control room to confirm the changes that need to be made could be spent on an increased number of product batches. Seeing that information live on a wearable computer enables the worker to make adjustments without trekking to the control room, potentially saving hundreds of thousands of dollars annually.

4. Institute a remote mentor program:

Empower your workers to quickly resolve issues by facilitating knowledge transfer between employees with a remote, live-video enabled mentor program. In industrial settings, there's no substitute for live video to show an expert a problem with a piece of equipment or a challenge a technician experiences in the field. It reduces the time for a trainee to learn how to execute a task, enables employees to come to a shared understanding of a problem more quickly and limits the number amount of interactions required to resolve problems. Employees can often solve an issue in one visit -- rather than the two or three needed to consult with an expert or look at spare parts when wearable computers are not involved.

In action, this cuts substantial time from the equipment repair process and ensures a higher level of productivity for both workers and equipment. Consider the case of an international van manufacturer whose customer faced a maintenance issue that led to a van being out of service for 21 days. By using wearable computers, the manufacturer's service technicians were able to use live video to show a remote expert the issue, obtain real-time guidance and fix the van in just 38 minutes.



5. Enable hands-free document review in the field:

Enable hands-free document review in the field: Most industrial companies have hundreds of existing technical drawings, manuals and operating procedures available. With wearable computers, you can repurpose this content for hands-free use while workers are in the field. Voice commands allow workers to view and navigate these materials without stopping to search for the right document or pausing view information while working.

For example, one manufacturer of food products has more than 1,200 documents related to the process used to produce its chips, including temperature of machines, timing, settings for thickness, concentrations of salt and more. These documents are housed in a binder, and employees must leave their equipment to review it and confirm they are using the right settings. If the company instead digitized the documents and provided access via wearable computers while workers were making adjustments, they could save significant amounts of time.

6. Provide guidance on in-progress workflows:

Wearable computers can be used to share step-by-step instructions that workers can follow while they're working. It prevents them from losing the flow of the procedure and having to remember where they paused, which adds time to a process. In fact, when compared to desktop and tablet model-based work instructions, workers with tablet AR-based instructions were as much as 20 minutes faster⁹ Viewing workflows while on the job also increases safety through more accurate completion of work – for some activities such as equipment repairs, making the right fix with the right parts at the right time is essential to ensuring that equipment doesn't later malfunction and impact the safety of all workers in a facility.

This use of wearable computers has numerous applications for industrial companies, including for workers at retail warehouses. For example, by viewing pick orders, quantities and locations on wearable computers, warehouse staff can more rapidly pull orders with accuracy and reduce the number of trips they take to find the right products. This can increase order fulfillment speed by up to 46 percent.¹⁰

<p>Coach employees</p>  <p>15 MIN</p> <p>Set aside time to coach employees on the use of the device before rolling it out – just 15 minutes can make a difference in early productivity gains and in the level of safety when using the wearable computer.</p>	<p>Information at the source</p>  <p>100K+</p> <p>Seeing that information live on a wearable computer enables the worker to make adjustments without trekking to the control room, potentially saving hundreds of thousands of dollars annually.</p>	<p>Increase productivity</p>  <p>46%</p> <p>Staff can more rapidly pull orders with accuracy and reduce the number of trips they take to find the right products. This can increase order fulfillment speed by up to 46 percent.</p>
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9."Fusing self-reported and sensor data from mixed-reality training." Iowa State University and The Boeing Company, Interservice/Industry Training, Simulation and Education Conference. 2014.

10."Augmented Reality for Retail and eCommerce." UpSkill website, 2018.

Connect your workers to meet productivity while meeting or exceeding safety compliance goals

Hands-free, AR-enabled wearable computers are a vital part of digital transformation. Just as the industrial enterprise is evolving, so too, must the way that workers view and access information if organizations are to achieve their mandate for improved productivity and safety. As companies move on from “old ways” of working, wearable computers present an opportunity to have an immediate impact on the workforce of those who implement them.



Understanding Intrinsically Safe Example: Hazardous Environment

Devices which can be used in the potentially explosive environments without causing an explosion are called Intrinsically Safe devices.

The intrinsically safe design technique is based on limiting energy, electrical and thermal to a level below that required to ignite a specific hazardous atmospheric mixture.



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