VUZIX®

View the Future®

PREPARING FOR THE FACTORY OF THE FUTURE WITH VUZIX SMART GLASSES

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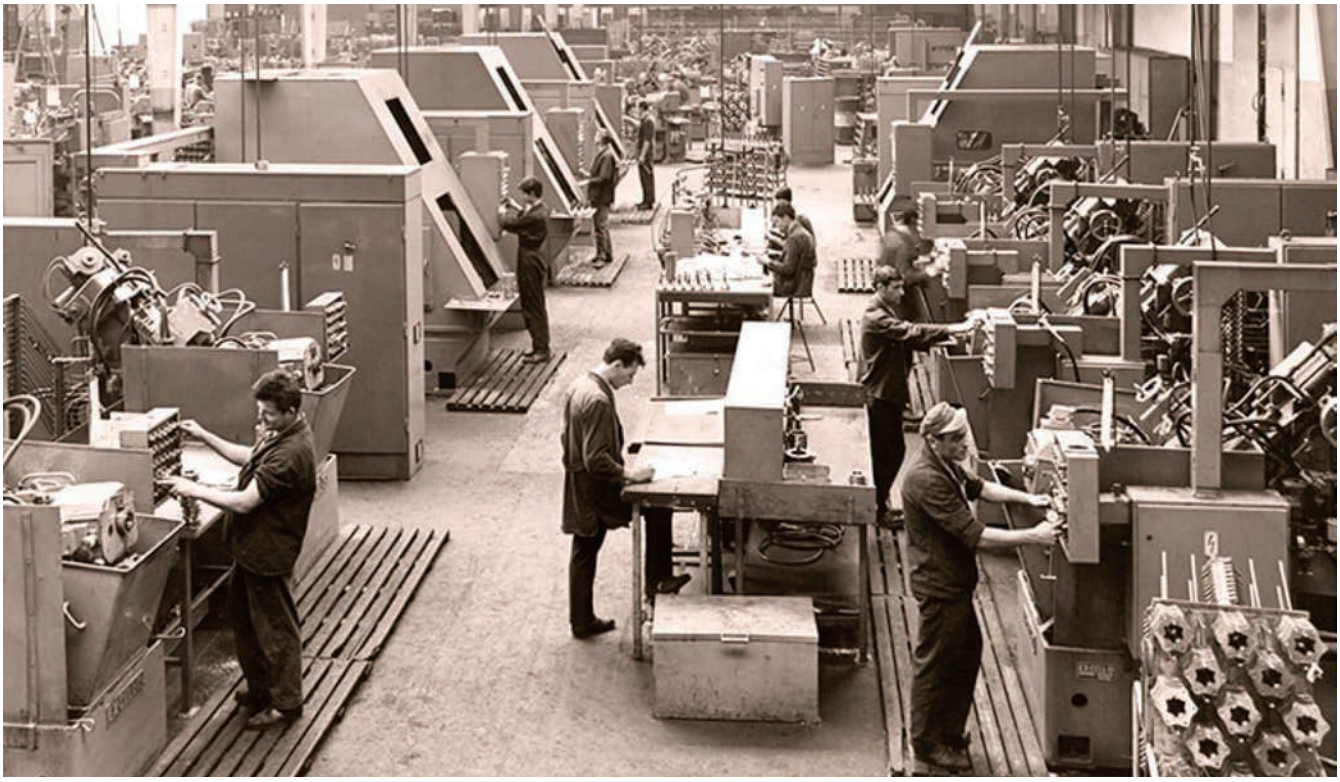
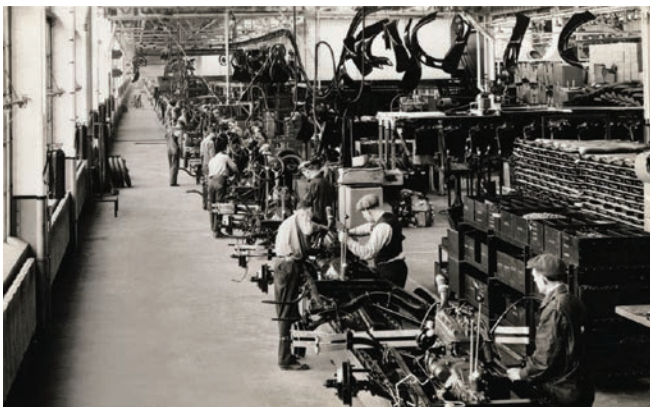
1 Introduction: Factory Manufacturing Today

Today's manufacturers face change on multiple fronts: a technological renaissance is giving rise to the Industrial Internet of Things (IIoT) and forcing the industry to transform the look, systems and processes of the modern factory. At the same time, domestic and global competitive pressures, along with a changing workforce, call for new approaches to workforce development—even a re-examination of the human worker's role in the factory. The industry's driving factors, however, are unchanged: Since the dawn of the Industrial Revolution, manufacturers have turned to technology in pursuit of faster production, higher quality, and reduced costs. Now, they must figure out how to turn such challenges into opportunities by embracing digital disruption. If they are to thrive in an environment of tighter timelines, higher customer expectations and increased competition, they must decide where, not if, to invest in emerging and new technologies.



GKN Car Components Factory Floor, 1950s.



At its height, the Ford Rouge employed more than 100,000 people. Ford cars were completely assembled from the chassis up on a moving conveyor, and then driven off the line under their own power.

Modern automotive assembly line.

A. Disrupting Factors in Manufacturing

THE QUEST FOR LEANER MANUFACTURING

While robotics and mobile technologies have helped to speed up operations and improve quality, consistency and efficiency, truly lean manufacturing has not yet been fully achieved.

The common use of printed data and work instructions, computers stationed away from the point of action, off-site experts who must travel to sites to address problems, and training that occurs away from the point of production…all of this gives rise to errors and inefficiencies in manufacturing operations.

THE LABOR CRUNCH

Over the next decade, in the U.S. alone, 3.5 million manufacturing jobs are going to be vacated or created, yet only 1.5 million will be filled. Factors creating the labor shortage include the retirement of baby boomers, the nature of millennials, advances in technology, and the stigma still carried by many about blue collar jobs. As career veterans leave the factory, manufacturers are struggling to attract and retain skilled workers to replace them. Though millennials are now the largest talent pool, they're also more likely to regularly change jobs, and get discouraged by lack of advancement opportunities and having to use out-dated technology.

DOMESTIC & GLOBAL PRESSURES

Despite modernization, industrial manufacturing in the many sectors of the Western World has been on the decline, with more and more factories having moved overseas to take advantage of cheaper labor and raw materials. But changes within the geopolitical landscape could reverse that trend, exacerbating the skills gap and escalating the need to speed up new employee training.

Manufacturers will have to be capable of quickly adapting to new industry regulations and trade policies affecting their distributors and suppliers.

INCREASING AUTOMATION

Robots and Artificial Intelligence (AI) are expected to displace 7% of the existing American manufacturing workforce by 2025. But that doesn't mean that humans will disappear from the plant floor. Robots are gradually taking over repetitive and dangerous tasks, but complex and expensive unmanned technology cannot yet match human capabilities such as dexterity, creativity, management and innovation. Although the industry isn't headed towards full automation anytime soon, the role of the manufacturing worker is evolving. Some jobs are becoming obsolete and new jobs are being created. The workforce will need technological support and training to keep up in an increasingly automated world.

B. Real-Life Pain Points in Manufacturing

PRODUCTION

Manufacturing involves humans and machines working together to assemble hundreds or thousands of parts, in precise order, quickly and accurately. And often the hitch is that assembly isn't standardized. In this age of customization, several variations of a product are manufactured in a single facility, requiring varying instructions, workflow interruptions to check printouts or screens and, when required, waiting for outside help to resolve issues. In many facilities, workers retrieve and record data away from the line. Often their work instructions are hard-to-follow PDFs that soon become outdated. Even with hand-held mobile devices, getting the right information can impede completing a task, and that leads to mistakes.

TRAINING

To learn to work on multiple operations or lines in a manufacturing facility, new hires typically undergo lengthy, classroom-style, manual-based training. This is passive learning; studying technical manuals, poring over procedural documents, receiving verbal instructions, watching videos and following instructor demonstrations. None of that is ideally suitable for the new multi-generational workforce. Younger employees are used to getting information in just a few clicks, and are less likely to respond to sit-down, instructor-led courses. Instead, active on-the job training has been proven to be the most effective, as it allows for improved retention, and lets new workers train while contributing to the plant's productivity.

QUALITY ASSURANCE

Repetitive motion and delays, un-ergonomic devices and unsatisfactory training methods don't just hurt productivity, they create a perfect storm for errors. Inspectors memorize checklists, use written documentation or manually log findings, but these methods leave room for miscommunication, and defects go uncorrected down the line. Despite the use of mobile solutions, inspection failures still occur, and that has an impact on safety, customer service and the bottom line.

MOBILITY IN THE FACTORY TODAY

Over the last several years, manufacturers have incorporated tablets, smartphones and laptops into their operations. While these devices have helped to deliver greater speed and accuracy, they're often also distracting, cumbersome, and not durable enough for some environments. As the role of the worker evolves, and manufacturers put sensors on equipment and automate large areas of their operations, the combination of Smart Glasses and Augmented Reality will be critical.

C. Manufacturing Applications for Vuzix M-Series Smart Glasses

The comfort and capabilities afforded by the Vuzix M-Series, along with the power to visualize information with augmented reality, are being applied by manufacturers to simplify training steps and provide real-time information and guidance to workers.

COMPLEX ASSEMBLY

Vuzix Smart Glasses equipped with appropriate Augmented Reality software are ideal for complex manufacturing processes that involve variation and long checklists. On the assembly line, the smart glass wearers can use voice commands to view step-by-step instructions, diagrams and other guiding information superimposed on real-life assemblies they are tasked with. Different voice commands or barcodes can even bring up unique assembly instructions for custom orders.

This hands-free instructional support directly in the worker's field of view helps to speed up production, cuts error rates, and improves safety. Employees are able to work faster with first-time quality, shave off minutes and hours of assembly time, and often even avoid repetitive motion injuries and error-induced accidents. Computer Vision, with visual recognition technology, provides another layer of quality control, as managers 'look' through the built-in camera worn by the worker to validate each step.

MAINTENANCE & REPAIR

Vuzix Smart Glasses improve the servicing of equipment by providing hands-free information, facilitating live remote support, and using artificial intelligence to detect issues. Engineers can view real-time machine data and 3D models, detailed instructions from back-end systems, or video tutorials overlaid on top of real machines. The technology is also capable of 'listening' for abnormal sounds like a whirring or high pitch and automatically creating an associated maintenance order.

The M-Series Smart Glasses can be used to live-stream a manufacturing technician's view of a situation to a remote expert, who sees what the technician sees and verbally guides him through the correct maintenance procedure. Reduced travel and faster issue resolution reduce downtime, saving millions of dollars and extending the careers of the industry's most experienced workers.

Manufacturing Applications

QUALITY INSPECTION

Workers use Vuzix M-Series Smart Glasses integrated with the manufacturer's quality management system (QMS) to pull up inspection checklists, verbally confirm actions, take audio notes, call other technicians, and instantly upload their findings.

The heads-up, hands-free form factor allows QA inspectors to move around and do hands-on testing. Instead of filling out forms or typing up reports, they're able to objectively document issues upon discovery using the smart glasses' camera, and update their QMS in real time ensuring that work is not duplicated and defects are addressed faster. Factory workers can use AR overlays to help spot defects, or Artificial Intelligence and computer vision to reduce human subjective judgement altogether.

TRAINING

Augmented Reality Training is often considered a more intuitive and effective learning method, compared to training via manuals or videos. It's also preferred by millennials, a generation that grew up on video games, smart glasses and computers. AR-enhanced programs can help minimize training costs for manufacturers, allow for faster on-the-job training, and can capitalize on experienced workers' knowledge through telepresence and first-person training.

Augmented Reality even allows manufacturers to fold training right into production activities. New employees can be deployed more immediately, wearing Smart Glasses to guide them through step-by-step instructions and near fool-proof visual aids overlaid on the parts and equipment they need to assemble and operate. Veteran staff can use Smart Glasses to record videos with voice notations of intricate assemblies, handling and other procedures, creating valuable training material that usually shortens the learning curve for their replacements.

Smart Glasses are already in use by some of the world's largest manufacturers, including major car companies. The automotive industry is a great case study for Smart Glasses: high variability on the modern vehicle assembly line presents a classic manufacturing challenge that cannot be solved by automation alone. The complex exception handling processes involved in industries like automotive assembly call for a smart device capable of enabling workers of all skill levels to deal with variability.

2 Next-Generation Intelligence in Manufacturing: Vuzix M-Series Smart Glasses on the Plant Floor

Smart Augmented Reality Glasses are now disrupting enterprise mobility, allowing users to work heads-up and hands-free and remain contextually aware. Smart glasses are simple to operate, and are the most efficient way to receive task-based information, record, and log data. They provide optimum untethered mobility and access for the wearer, and as the user interface includes Augmented Reality with audio and visual overlays, they deliver better real-time capabilities and information than other types of mobile devices.

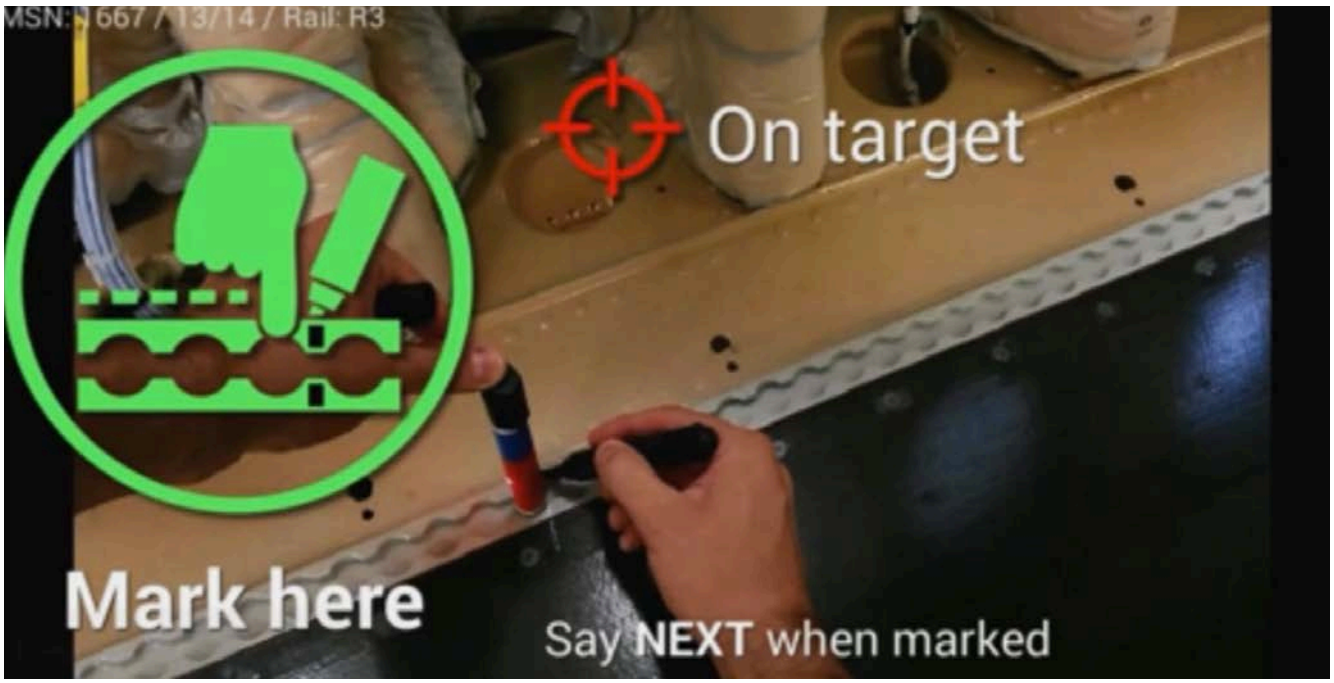
Smart Glasses provide a much-improved user experience over manuals, binders and hand-held devices, all of which can slow or impede work. The innovation lies in putting information in employees' line of vision, when they need it.

VUZIX SMART GLASSES ENABLE:

- Hands-free access to information (step-by-step instructions, diagrams, videos);
- Computer Visions (for scanning codes, text, numbers, step verification, task completion);
- Hands-free, point-of-view corporate documentation (audio and visual);
- AR overlays for remote support and communication (audio and visual);
- Real-time, see-what-I-see communication (for remote collaboration and support from a technician or supervisor).

These capabilities are essential to the advancement of the manufacturing workforce and to the growth of the manufacturing sector.

Connecting Workers to the Floor: Vuzix M-Series Smart Glasses



Product variation, inadequate training methods, and incomplete work instructions that slow down employees are common issues negatively impacting manufacturing operations today.

With a form factor that complements on-the-job training, and user-experience functions that can enhance quick knowledge capture, Vuzix Smart Glasses promise to help organizations improve fixed rate productivity and worker satisfaction.

When navigating the enterprise floor computing hardware market, two things stand out in Smart Glasses: wearability and ruggedness. Workers cannot properly concentrate if the device is uncomfortable and/or ill-fitting, and the device has to be able to stand up to a wide variety of conditions and wearer behavior.

The Vuzix M-Series Smart Glasses are the most wearable and ergonomically versatile computer on the market on the market. With multiple mounting options and an array of ingenious accessories, they can be worn by nearly anyone, regardless of which eye is dominant, and whether or not the employee is wearing prescription glasses, a cap, or a hardhat.

Right Eye Mountable
Over Glasses

Safety Glasses
With Optional Prescriptions

Head Band
Left or Right Eye Capable

Hard Hat
Left or Right Eye Capable

Left Eye Mountable
Over Glasses

Remote Battery
All Day Operation

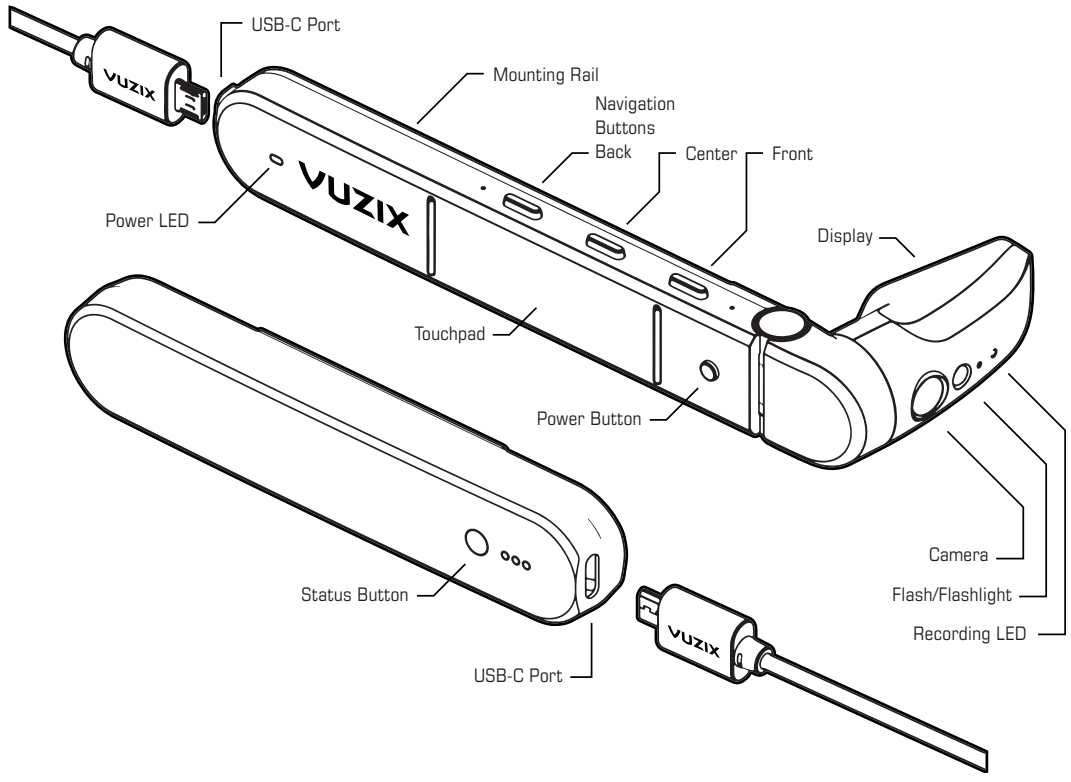
State-of-the-Art Manufacturing: Next-Generation – Vuzix M400 Smart Glasses

Vuzix M400 Smart Glasses provide most of the features and capabilities of a modern smartphone, in a hands-free wearable device. Bluetooth 4.0 connectivity allows them to pair with Android devices or connect wirelessly with Wi-Fi. Integrated head-tracking provides an angle of current view for unprecedented situational awareness.

In addition, the M400s include the Qualcomm® Snapdragon™ XR1 platform, the first dedicated XR platform designed to accelerate high-quality video, audio and interaction on Smart Glasses.

The Vuzix focus on wearability and ergonomic form factor, combined with the power of the Snapdragon XR1, drives Smart Glasses performance and functionality to the next level.

The Vuzix M400 Smart Glasses are ruggedized against water, dust and dirt, and operate via voice, button-press, and gesture controls. All of this allows for comprehensive and precise manufacturing operations.



Vuzix M400 Smart Glasses: Specifications & Features

TECHNICAL SPECIFICATIONS[1]

OPTICS

- Display resolution: nHD color display
- Display type: OLED
- Aspect ratio: 16:9
- Field of View (diagonal): 16.8 degrees, equivalent to a 5 in. mobile device screen seen at 17 inches
- Brightness: > 2000 nits
- Contrast: > 10,000:1
- 24-bit color with true black
- Supports left or right eye use

SYSTEM

- 8 Core 2.52Ghz Qualcomm XR1
- 6GB LPDDR4 RAM
- 64GB internal flash memory
- Android 8.1 OS
- OS and apps OTA upgradeable
- MDM available from multiple partners

CERTIFICATIONS

- IP67
- Drop safe to 2 meters

UNIVERSAL M-SERIES RAIL FOR VARIOUS MOUNTING OPTIONS

- Vuzix M-Series Rail Eyeglass frames without lens (standard)
- Weighs less than 3 oz.
- Eyeglass frames with lens
- Safety glasses
- Hard hat mount
- Headband mount
- Peltor headphone mount

BATTERY

- 135mAh internal battery supports hot swapping of external batteries
- 1000 mAh head-worn USB-C external battery with 3-level LED indicator
- Can be powered by 3rd-party USB battery packs in place of head-worn battery
- 2 – 12 hours of operation based on external battery choice

CONTROLS

- 3 control buttons
- Voice control – customizable and supports multiple languages
- 2 axis touchpad with multi-finger support

AUDIO

- Integrated speaker (up to 97db output)
- Triple noise-cancelling microphones
- BT audio: HSP / A2DP

CAMERA

- Up to 12.8-megapixel stills
- Up to 4k30 video
- Improved auto-focus (PDAF)
- Improved optical image stabilization
- LED flash/scene illumination
- Barcode scanning

CONNECTIVITY

- USB 3.1 Gen 2 on USB Type-C
- Wi-Fi 2.4/5Ghz 802.11 a/b/g/n/ac
- Bluetooth 5.0 BR/EDR/LE

INTEGRATED HEAD TRACKER

- 3-degree of freedom head tracking
- 3 axis gyro
- 3 axis accelerometer
- 3 axis mag/integrated compass

GPS

- GPS / GLONASS

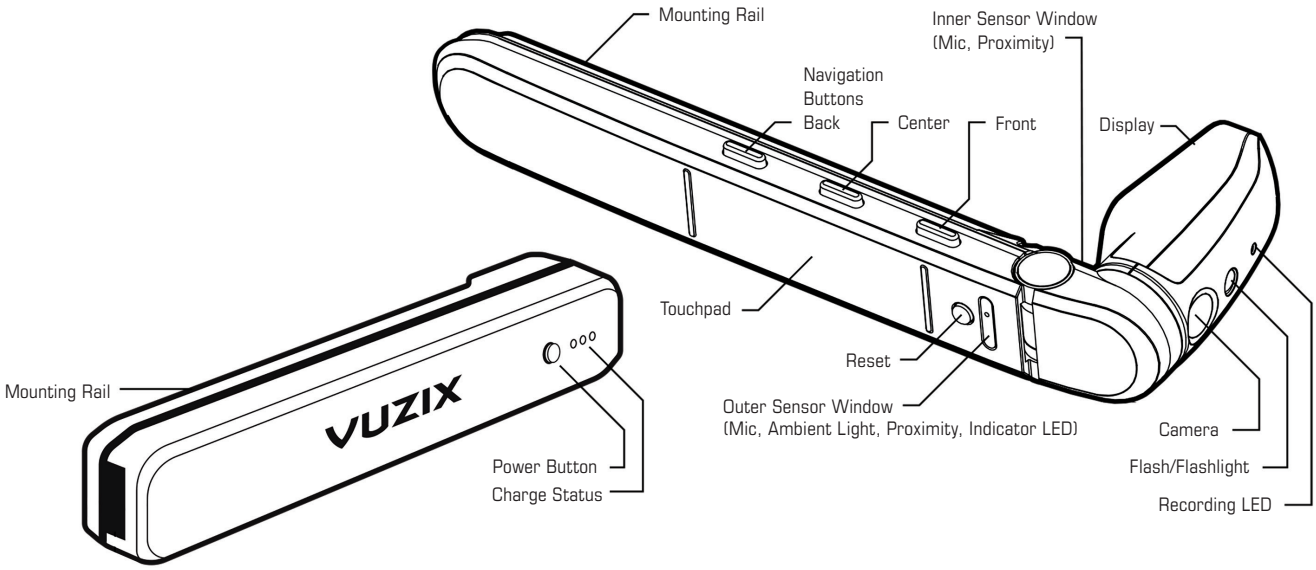
Compare all Vuzix products here:
www.vuzix.com/products/compare-vuzix-smart-glasses

[1]*Specifications are subject to change*

State-of-the-Art Manufacturing: Vuzix M300XL Smart Glasses

Vuzix M300XL Smart Glasses provide most of the features and capabilities of a modern smartphone, in a hands-free wearable device. Bluetooth 4.0 connectivity allows them to pair with Android devices or connect wirelessly with Wi-Fi. Integrated head tracking provides an angle of current view for unprecedented situational awareness.

They are ruggedized against water, dust and dirt, and operate via voice, button-press, and gesture controls. This enables workers to more effectively perform manufacturing functions on the plant floor.



Vuzix M300XL Smart Glasses: Specifications & Features

TECHNICAL SPECIFICATIONS[1]

OPTICS

- Display resolution: nHD color display
- Aspect ratio: 16:9
- Field of View (diagonal): 16.7 degrees, equivalent to a 5 in. mobile device screen seen at 17 inches
- Brightness: >2000 nits
- 24 bit color
- Supports left or right eye use
- Dual Core Intel Atom CPU
- 2GB system RAM
- Android 6 OS
- 64GB internal flash memory

CONTROLS

- 4 standard Android control buttons
- Voice control – customizable and supports multiple languages
- 2 Axis touch pad with gesture

UNIVERSAL MOUNTING OPTIONS AVAILABLE

- Eyeglass frames with or without lens
- Safety glasses
- Hard hat mount
- Headband mount

BATTERY

- 160mAh internal battery supports hot swapping of external batteries
- 860mAh external battery
- Can be powered by a USB battery pack for extended run time
- 2 – 12 hours of operation based on external battery choice

INTEGRATED HEAD TRACKER

- 3-degree of freedom head tracking
- 3 axis gyro
- 3 axis accelerometer
- 3 axis mag/integrated compass

CONNECTIVITY

- USB Micro-B 2.0
- Wi-Fi b/g/n/ac – Dual-B 2.4/5 GHz
- BT 4.1/2.1+EDR

AUDIO

- Ear speaker
- Dual noise canceling microphones

CAMERA

- Up to 10 megapixel stills
- Up to 1080p video
- Auto-Focus
- Optical Image Stabilization
- Flash/scene illumination

SENSOR SYSTEMS

- Proximity inward facing
- Proximity/ALS outward facing

Compare all Vuzix products here:
www.vuzix.com/products/compare-vuzix-smart-glasses

[1]*Specifications are subject to change*

3 The Future of Vuzix M-Series Smart Glasses in the Factory

While advanced sensors, data analytics and artificial intelligence are improving manufacturing operations, additive manufacturing, advanced materials and automation are redefining physical production and reorganizing the factory. The last piece of the puzzle is the workforce: a factory cannot be 'smart' until the humans on the line are connected; to be connected, workers literally have to wear technology.

As standard manufacturing tools and workflows often become incompatible with the pace of the modern factory, and the learning style of the new generation of plant workers, Vuzix Smart Glasses are connecting human workers with smart machines, critical knowledge sources, and one another in assembly, quality control, training, and procurement. Beyond the manufacturing plant, they are being worn to replace hand-held devices and paper documents in the field, on the building site, in the warehouse, along the supply chain, in the office, and even at hospitals.

It cannot be overstated just how revolutionary a heads-up, hands-free form factor is for modern workers. Within the crowded enterprise technology hardware sector, Vuzix M-Series Smart Glasses stand out thanks to their ergonomic design, solid track record of success and dependability, and range of capabilities made possible by key software partnerships and device accessories.

Today, the Vuzix M-Series is one of the most widely deployed devices of its kind across the globe, digitally transforming businesses in the widest variety of use cases for any single wearable device.

To learn more about improving factory operations with Vuzix M-Series Smart Glasses, visit: www.vuzix.com

A new dawn arrives at the headquarters and production facility of the world renown Vuzix smart glasses and augmented reality manufacturer in Rochester NY, USA.

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