

**CASE STUDY:**  
VUZIX SMART GLASSES AT THE  
CHI MEI MEDICAL CENTER, TAIWAN

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We thank Vuzix Senior Engineer Shen-Fang (Sam) Cheng for co-authoring this case study.

Photos courtesy of Chi Mei Hospital: <http://er.chimei.org.tw/en/> and Shen-Fang (Sam) Cheng.

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**EMERGENCY**

EMERGENCY



# 1 Introduction: The Chi Mei Medical Center

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It comes as no surprise that medical professionals in Taiwan were early adopters of communication, testing and imaging technologies, as and when they became available. One reason for this is their use of the Medical Center Model, where an urban hospital also operates satellite hospitals in smaller cities and rural areas.

An example of this is found in Southern Taiwan, where the Chi Mei Medical Center operates three hospitals—the main hospital in Tainan City, and two regional hospitals in Jiali and Liouying. Chi Mei is the largest integrated healthcare system in its region, with 2,493 beds, 39 medical departments and 6,100 employees. It is known as the country's innovator—it introduced robotic surgery, and it houses state-of-the-art angiography and radiotherapy systems. And its Precision Medicine Laboratory uses advanced genetic sequencing platforms, next-generation genetic sequencers and big-data analytic tools for drug development.

Chi Mei is also well-known as a pioneer of emergency care in Taiwan. Now, to facilitate and streamline this care, and improve outcomes, Chi Mei has incorporated another hi-tech tool: Vuzix Smart Glasses.



Photo Credit: Wikimedia Commons – User: Cmhc54220

# 2 In the Emergency Room

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*Ambulance paramedics arriving with a patient at Chi Mei Medical Center.*

Emergency rooms are hives of activity where teams of skilled professionals treat everything that comes their way. Treatments can range from stitching cuts, to delivering babies, to dealing with strokes and traumatic brain injuries. But each time a patient arrives, the process is the same: the problem is evaluated, information is collected, treatment begins, information is shared and, in many cases, a specialist takes over the patient's care. Amid all of this, there are often x-rays and blood tests, monitoring machines and fluid transfusions. There are many people involved, and all are working in a small amount of space.

Through it all, two key elements are information and time. Doctors need information to treat their patients properly,

and everything must be done quickly. Delaying treatment for a stroke or a heart attack, even for a few minutes, can make the difference between life and death. Each minute must count.

This is where Vuzix Smart Glasses come in. This ingenious piece of technology allows seamless, instant, see-what-I-see communication between everyone involved in the treatment of patients. In a hands-free, heads-up format. No one waits for information, and priceless time is saved.





# Vuzix M400 Smart Glasses in the ER

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*ER physicians and nurses inside the busy Chi Mei Medical Center.*

In traditional emergency situations, patients are treated by paramedics in transit, and the ER staff awaits their arrival. But, with Vuzix Smart Glasses, Chi Mei doctors can begin to treat patients *before* they arrive at the hospital. When paramedics and ER staff are wearing smart glasses, everyone is fully connected. Doctors can see patients—in real-time. They can see what the paramedics are looking at. They can ask questions, hear the answers, and view monitors. They can find out what other health conditions are present, and discuss what information paramedics were able to collect about medications and medical history. Attending physicians can remotely conduct examinations of consciousness, paralysis, severity of multiple trauma and burns—even the degree of aneurysm rupture, and begin to lead the treatment process.

Chi Mei Medical Center serves rural areas as well, and many patients come from its satellite hospitals in Jiali and Liouying. When wearing smart glasses, ER doctors at Jiali can arrange simultaneous consultations in multiple departments, and ask attending physicians to decide the order of treatment. An ER physician at Jiali can discuss the severity of an aneurysm rupture with a specialist from the main hospital in Tainan City, and the two doctors can determine when the patient should be transferred.

Throughout the patient's transport, the doctors from these two hospitals can have a detailed discussion about the patient's condition—wherever they are, and while they're both looking at the patient.



*Vuzix Smart Glasses also fit perfectly when worn over Personal Protective Equipment (PPE).*

## In the Intensive Care Unit

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*Dr. Cheng remotely adjusts the speed and flow of an artificial heart.*

In the Chi Mei intensive care unit (ICU), each patient is assigned an attending physician. But the main emergency room at Chi Mei Medical Center has 100 beds and that physician may be elsewhere in the unit. With Vuzix Smart Glasses, that distance disappears.

For example, STEMI (ST-Segment Elevation Myocardial Infarction) is a very serious type of heart attack, where one of the patient's major arteries is blocked and a large part of the heart muscle is unable to receive blood. At the same time, the patient may also be suffering a stroke. A rapid medical response is crucial.

In this scenario, ICU staff can share a live video and test results with the attending physician, who can evaluate the patient's condition—from any location, and in real time. That physician can determine the appropriate direction of treatment, while monitoring the patient's heart rate, blood pressure, respiration, oxygen level, and central venous pressure. The doctor can order insertion of an intra-aortic balloon pump, or an immediate transfer to surgery.





# State-of-the-Art Collaboration

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*Surgeons wearing Vuzix Smart Glasses confers with an off-site specialist while operating.*

Any surgical procedure is a team effort; a collaboration of doctors, nurses and technicians. Often, the surgeon wants to call on the expertise of a specialist, but that specialist may be miles away. Surgeons have tried connecting with specialists through the use of smartphones, but this is far from ideal—the lighting is spotty, angles don't show what the surgeon wants to share, or the camera blocks the correct viewpoint.

With Vuzix Smart Glasses, doctors can view and share surgeries without any such challenges. Vuzix software provides full HD live-streaming and advanced options such as brightness adjustment and zoom capability. The glasses provide complete see-what-I-see communication, so everyone sees exactly what the surgeon sees, in real time. Surgeons can share and explain their techniques, and they can consult with specialists who may be miles away from the hospital. Everyone wearing smart glasses can view the surgery, monitor the patient's condition and discuss the best way to proceed. Post-surgery, the surgeon, the specialist, and the original attending physician, can observe and discuss the patient's recovery, from wherever they are.

And what do physicians think of Vuzix Smart Glasses?

Dr. Bor-Chih Cheng, Chi Mei's Chief of Cardiovascular Surgery, comments on the use of Vuzix glasses during a recent procedure.

*"The Vuzix M400 Smart Glasses provided hands-free full HD video-streaming performance for a 16-hour surgery. After the operation, the technology provided instant communication between the surgeon and the ICU. The glasses are lightweight, easy to use and allow us to use our hands to treat patients while communicating with each other. They are a terrific tool for providing care and collaboration. We couldn't be happier with any piece of technology."*



*Dr. Bor-Chih Cheng wearing Vuzix M400 Smart Glasses.*



# Sharing Experience and Expertise

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*Guiding junior physicians to perform clinical tasks at the Chi Mei Medical Center.*

The sharing of knowledge is crucial in the advancement of medicine, as experts must share their experience with those who are new to the profession. At Chi Mei Medical Center, Vuzix Smart Glasses are also used to teach junior physicians.

When training surgeons, the best way to do this is via a live video, however this can pose significant challenges. The cost of recording and streaming a surgery can reach \$35,000, plus the process is time-consuming, there is little room for the required extra people and the quality is often poor. But when everyone is wearing smart glasses, interns can see what the surgeon is doing—precisely and in real time.

This can apply to any procedure. When all parties are wearing the glasses, senior physicians can use the Vuzix see-what-I-see technology and superb audio capabilities to provide step-by-step instruction in any area. It could be recognition of symptoms, wound suturing, catheter implantation or bone-setting. The junior physician can ask questions and make observations. This can be done from anywhere, to anywhere, and with all parties participating heads-up and hands-free.

*Dr. Cheng instructing a junior physician controlling a ventricular assisted device.*



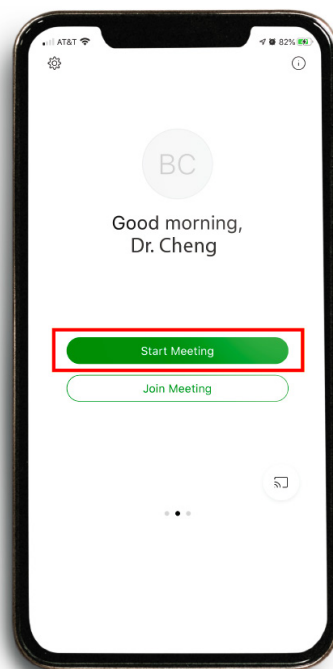
# Hands-Free Full HD Video Streaming via Conference Calling

A healthcare environment always involves sophisticated equipment. Aside from the product benefits, the key factor in mass deployment is accessibility. Any piece of technology must not require a lot of training time, as staff needs to be able to grab and go, especially in urgent situations.

**EASE OF USE SCENARIO:** A patient has suffered a stroke and has lost consciousness. They have a traumatic brain injury, and have been taking medicine for cardiovascular disease. A healthcare worker is trying to reach physicians who have this patient's medical history and are familiar with their condition.

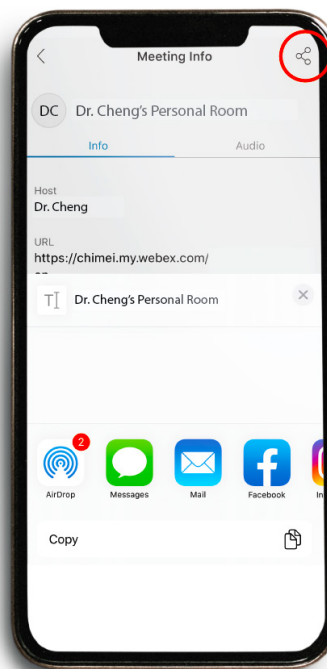
## Step 1

The healthcare worker uses their phone to start a conference call.



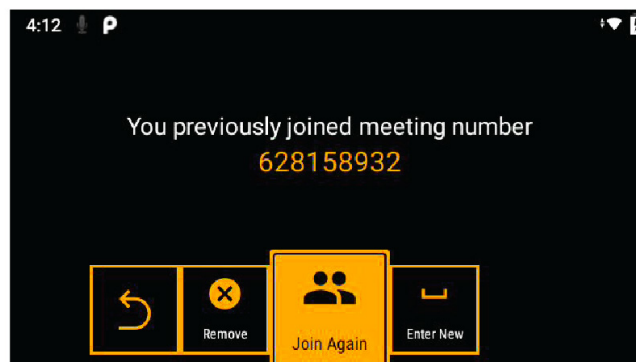
## Step 3

And then shares or texts the meeting link with specialists across departments and hospitals.



## Step 2

They put on the Vuzix M400 Smart Glasses and join the conference call.

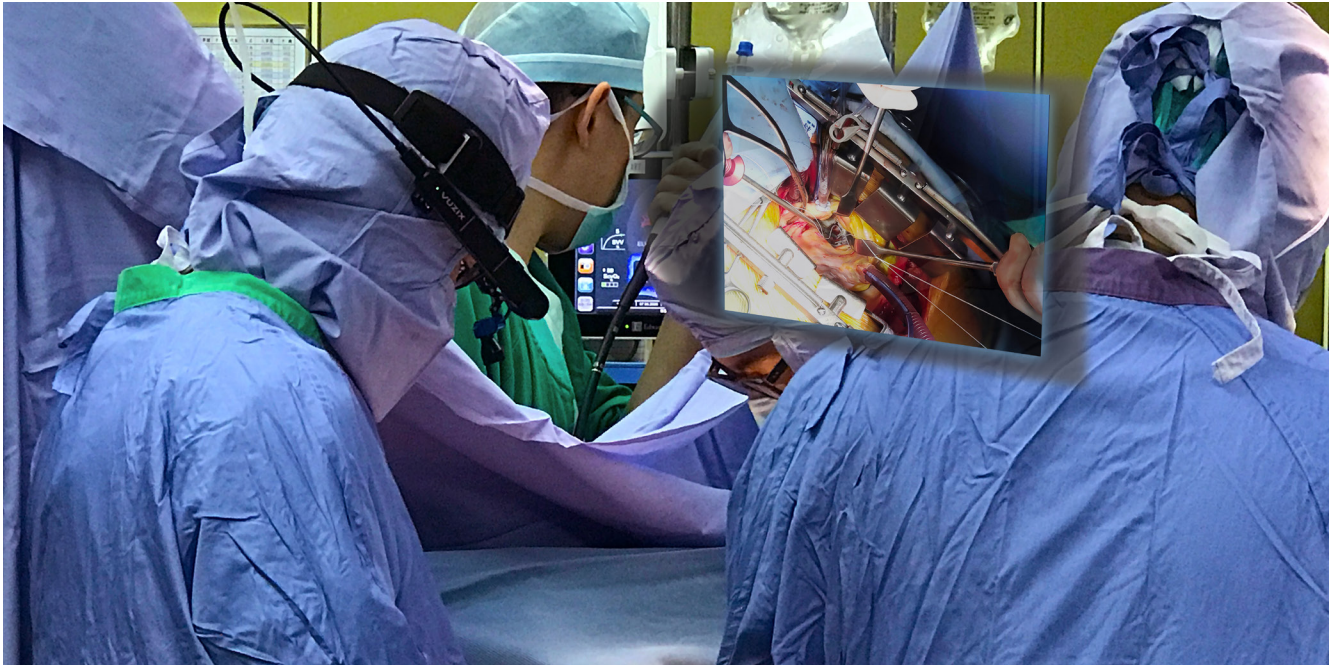


Screen view on Vuzix M-Series Smart Glasses





# 3 Augmenting Healthcare Delivery with Vuzix Smart Glasses



*A mitral rhythm repair and sinus restoration operation with the inset video image provided by Vuzix M400 Smart Glasses. The surgeon is able to consult with an off-site specialist using streaming see-what-I-see video communications.*

The Vuzix form factor assists wearers in focusing on complex tasks, providing a hands-free user experience to guide other professionals and enhance quick knowledge capture.

When navigating the increasingly crowded enterprise and medical hardware market, three functions stand out in smart glasses: wearability, ruggedness and battery life. Users need to properly concentrate in comfortable units that run for 6-8 hours, enabling extended run-time for longer operations.

Vuzix M-Series Smart Glasses offer two battery options. The high-capacity battery provides three hours of video streaming or up to 8 hours of device stand-by. Connecting glasses with a remote battery bank allows for 8+ hours of video streaming. An internal battery on the main unit allows users to hot swap and insert a fresh battery without powering down the glasses.

The Vuzix M-Series Smart Glasses are the most wearable, secure and ergonomically versatile on the market. With multiple mounting options and an array of ingenious accessories, they can be worn by anyone, regardless of which eye is dominant, and they work well with prescription glasses, PPE, face coverings, and devices.



**Right Eye Mountable**  
Over Glasses



**Left Eye Mountable**  
Over Glasses



**Head Band**  
Left or Right Eye Capable



**Safety Glasses**  
With Optional Prescriptions



**High Capacity Battery**  
Hot-Swappable  
Enables Full-day Operation  
Video Streaming



**Remote Battery**  
All Day Operation /  
8 Hours Video Streaming



# Vuzix Healthcare Software Solutions for M-Series Smart Glasses

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A solution is not complete without both hardware and software. Vuzix not only provides top-notch smart glasses, but also works with software partners who are experts in the healthcare industry, and who are compliant with the Health Insurance Portability and Accountability Act (HIPAA) and/or the General Data Protection Regulation (GDPR).

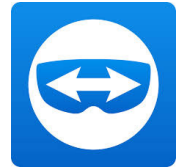


## **Webex Teams Connector**

For continuous teamwork in a secure work space. Everyone can contribute to video meetings, conference calls, white boarding, and more.

## **TeamViewer Pilot**

Provides easy, fast, and secure remote assistance to identify and solve problems while you work. Use this app to receive remote assistance for all kinds of health care issues.



## **Zoom for Healthcare**

This is an HIPAA/PIPEDA-compliant conferencing application. Start or join a meeting with face-to-face conversations, see-what-I-see video, screen sharing and more.

## **Genzō by 1 Minuut**

Genzō is the all-in-one app for healthcare providers. This mobile solution makes it possible to chat, make video calls and use Smart Glasses within your own organization and in a secure environment.

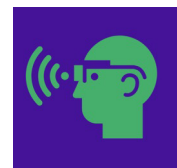


## **XpertEye**

AMA's XpertEye suite is a hands-free solution enabling physicians, nurses, trainees and support workers to see what you see, including assisted reality, dynamic workflow management, and online scheduling.

## **Telepresenz**

An augmented reality telepresence solution that connects remote users to mentors, experts, or supervisors, enabling remote learning on a scale that has never before been imagined.



**Note:** Click the app name or logo to be taken to its page in the [Vuzix App Store](#). XpertEye links to AMA's XpertEye website.



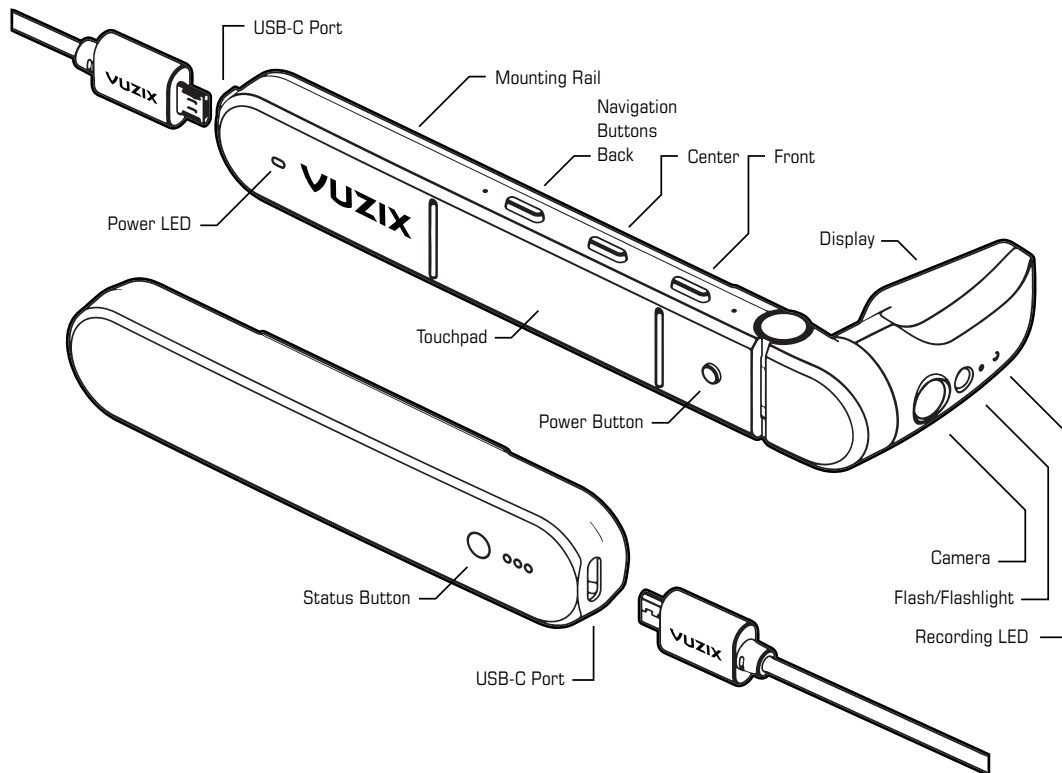
# Next-Generation Healthcare Technology: Vuzix M400 Smart Glasses

Vuzix M400 Smart Glasses provide most of the features and capabilities of a modern smartphone, in a hands-free wearable device. Bluetooth 5.0 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. And they come with built-in high contrast OLED displays for incredibly crisp and easy-to-view video.

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 healthcare delivery, anywhere.



# Vuzix M400 Smart Glasses: Specifications & Features

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## TECHNICAL SPECIFICATIONS<sup>1</sup>

### 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 9 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](http://www.vuzix.com/products/compare-vuzix-smart-glasses)

*1. Specifications are subject to change*

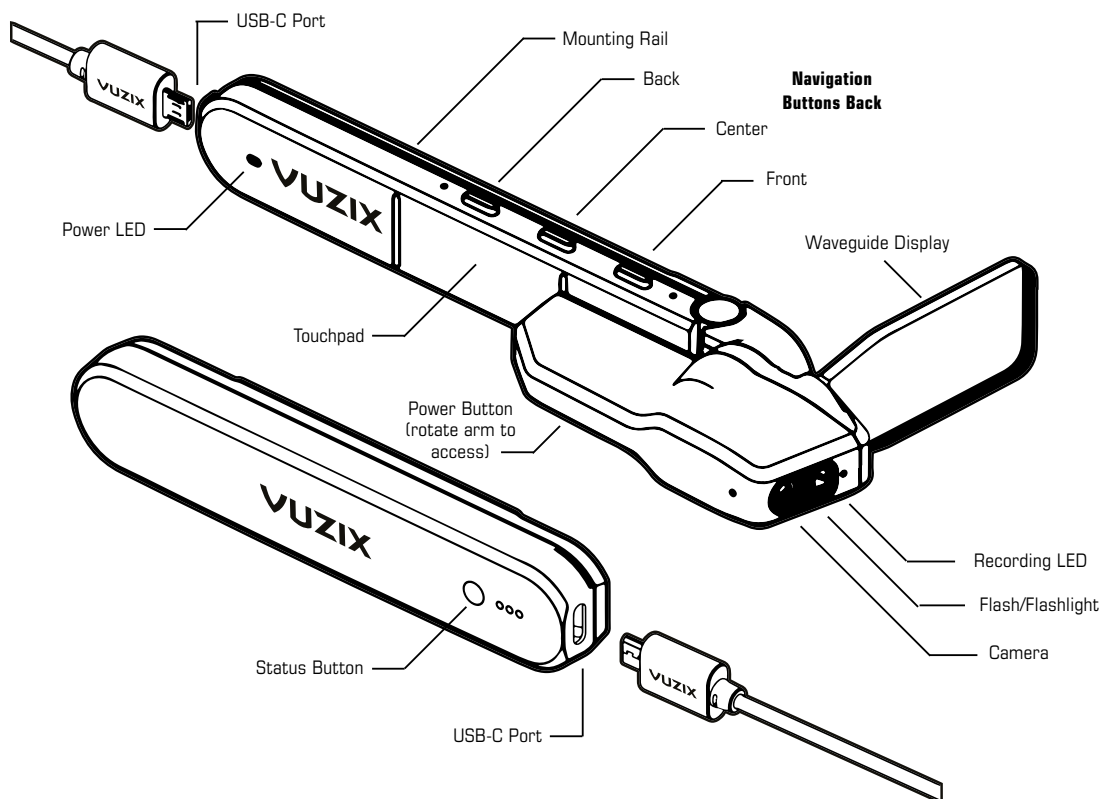


# Market-Leading Optics for Telemedicine Solutions: Vuzix M4000 Smart Glasses

The M4000 utilizes Vuzix' see-through Waveguide optics and is designed around the M400, thus maintaining the same usability and comfort. Vuzix added Waveguide optics to the platform, providing a see-through display mounted on the same functional ergonomic M400 design.

Vuzix M4000 Smart Glasses provide most of the features and capabilities of a modern smartphone, in a hands-free wearable device. They can connect to the internet/intranet wirelessly, via Wi-Fi. Bluetooth 5.0 connectivity allows them to pair with Android or iOS devices, or other Bluetooth devices. Integrated motion and GPS tracking provides an unprecedented situational awareness experience, and allows for device tracking.

These smart glasses also use the purpose-built Snapdragon XR1 processor for smoother operations and higher functionality. The M4000 continues the Vuzix commitment to evolving the smart glasses industry.



# Vuzix M4000 Smart Glasses: Specifications & Features

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## TECHNICAL SPECIFICATIONS<sup>1</sup>

### OPTICS

- See-through Waveguide optics<sup>2</sup>
- Display resolution: WVGA color display 854x480
- Display type: DLP
- Aspect ratio: 16:9
- Field of View (diagonal):  
28 degrees, equivalent to an  
8.5" mobile device screen seen at 17"
- Brightness: >1000 nits
- Contrast: >see through 500:1
- 24-bit color
- Supports left or right eye use

### GENERAL

- 8 Core 2.52Ghz Qualcomm XR1
- 6GB LPDDR4 System RAM
- 64GB internal flash memory
- Android 9 OS
- OS and apps OTA upgradeable
- MDM available from multiple partners

### CERTIFICATIONS<sup>3</sup>

- IP67
- Drop safe to 2 meters

### MOUNTING OPTIONS

- Vuzix M-Series Rail Eyeglass frames without lens (standard)
- Viewer weighs less than 3.3 oz.
- Eyeglass frames with lens
- Safety glasses
- Hard hat mount
- Headband mount
- Peltor headphone mount

### BATTERY

- 135 mAh 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 4k30fps 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

## HEAD TRACKING

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

## GPS

- GPS / GLONASS

*1. Specifications are subject to change*

*2. Waveguide is infield replaceable*

*3. Targeted certifications*





# 4 The Future of Vuzix M-Series Smart Glasses in Healthcare Delivery

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Technological advancement and artificial intelligence are revolutionizing the way healthcare professionals conduct training, and diagnose and treat patients, whether the changes take place in offices, ambulances, or medical facilities.

The last piece of the puzzle is people but, in order to provide healthcare services, the people who deliver them need efficient tools. Given the benefits involved in hands-free work, technology that delivers that capability is key.

Vuzix M-Series Smart Glasses connect humans with smart machines, critical knowledge sources, and each other. They are rapidly replacing hand-held devices, and can apply to nearly all healthcare services functions. The use of Vuzix Smart Glasses facilitates significant gains in cost savings, service delivery and positive outcomes.

Within the crowded Wearable Technology sector, the Vuzix M-Series Smart Glasses stand out. Their ergonomic design, range of capabilities, software partnerships and device accessories have earned Vuzix a 20-year success record. In addition to proprietary hardware designs, production techniques, and an innovative software platform, those years of experience include thousands of pilot programs and deployments with Fortune 1000 companies. Today, Vuzix Smart Glasses are among the most widely deployed devices across the globe, digitally transforming service provision in the widest variety of use cases for any single wearable device.

To learn more about this exciting technological tool, visit: [www.vuzix.com](http://www.vuzix.com)



*Vuzix M400 Smart Glasses*

*Vuzix M4000 Smart Glasses*





A new day dawns at the headquarters of the renowned manufacturer of smart glasses, Vuzix Corporation in Rochester, New York.

**VUZIX**<sup>®</sup>  
View the Future<sup>®</sup>  
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