



Press Kit  
20 April 2015

## **MINI Augmented Vision.** **A revolutionary display concept enhances safety and convenience.**

**Munich.** At the Auto Shanghai 2015 show, MINI is revealing its vision for connectivity between augmented reality (AR) eyewear and the car. The MINI Augmented Vision project thereby embraces one of the major trends of the future: AR technologies enhance reality by overlaying the field of vision with supplementary digital information, usually by means of computer generated graphics. And the real and virtual worlds are set to merge more and more in the future while driving as well.

Probably one of the best-known examples of an augmented reality application is the offside line that is superimposed on television screens while watching a football match. And if smartphones have the necessary app installed, they can show additional information about historic buildings or museum exhibits when the camera is pointed at them.

Today, head-up displays already make it possible to project important driving information onto the windshield so that it appears in the driver's field of vision. In the future, augmented reality glasses will supplement this technology with an alternative solution. MINI Augmented Vision demonstrates the potential benefits of integrating this type of eyewear into MINI vehicles.

### **MINI Augmented Vision: the idea**

"If you drive with MINI Augmented Vision, you will see more", says Dr. Christoph Grote, Senior Vice President Research, New Technologies, Innovations. MINI Augmented Vision makes it possible to enjoy a whole new driving experience that offers increased safety and added convenience functions. The aim is to interconnect mobility applications inside and outside the vehicle, fusing mobility/automotive applications with trademark MINI lifestyle in the process. MINI Augmented Vision thus lives up to its name in every regard by showcasing a vision of intelligent connectivity between MINI vehicles and augmented reality glasses in a characteristic MINI design.

Cutting-edge see-through technology combines with a large field of view to allow the wearer to see overlaid images without having to look away from the road.



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This means that navigation instructions, for example, are displayed directly in the lenses of the driver's eyewear, so that the driver can focus their attention on the road at all times and concentrate entirely on the traffic. At the same time, tracking technology helps to ensure that no other drivers or road hazards are concealed by the extra displays. Besides showing navigation information, incorporating the AR technology into glasses paves the way for additional functionality when the head turns in other directions, such as the ability to look through the car door while parking, for example, as well as for functions outside the vehicle.

### **From vision to prototype**

MINI Augmented Vision incorporates the Qualcomm® Snapdragon™ 805 processor, a product of Qualcomm Technologies, Inc., for the glasses, and Qualcomm® Vuforia™ mobile vision platform, a product of Qualcomm Connected Experiences, Inc., that provides the technology used for determining position of the glasses inside the car. The eyewear was also produced with assistance from ODG (Osterhout Design Group), a leading manufacturer of AR eyewear, who provided its optical and electronic technology, development and manufacturing support. BMW Group Research and Technology is responsible for overall project management, development of the application software and vehicle link-up, as well as overall technical implementation.

MINI entrusted the design of the glasses, the colour scheme and the digital user experience to the worldwide renowned BMW Group subsidiary Designworks. This was where a technical device was turned into a lifestyle product that succeeds in translating the MINI design idiom to eyewear. When it came to designing the AR visuals, it was their seamless integration that posed the greatest challenge. Designworks devised a user experience for MINI that allows the wearer of the glasses to perceive the various AR states in a very realistic form with a natural flow. The "motion design" concept therefore offers a means of orientation and structure to make it easier for the user to find their bearings in their real world with its augmented reality overlays.



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The Qualcomm Snapdragon 805 processor from Qualcomm Technologies, Inc., is built into the upper section of the casing, which also features inertial sensors and cameras. These are used for determining position of glasses in the vehicle and are not intended in any way for producing and storing videos or photographs as far as the application is concerned. The glasses furthermore include two stereoscopic HD displays for three-dimensional vision as well as WiFi, Bluetooth and GPS technology. The glasses can also be customised, for example by fitting optical lenses for spectacle and contact lens wearers.

The augmented reality glasses can in principle be connected to different vehicles provided they are suitably equipped. As a permanent internet connection is not required for the purpose of connectivity, there is no need for an additional SIM card either. The glasses can, however, connect to a smartphone via Bluetooth or WiFi in order to retrieve or download data when away from the vehicle.

### **See-through technology increases safety and comfort**

The combination of innovative see-through display technology and positional tracking technology is one of the stand-out features of MINI Augmented Vision. The glasses show relevant information in the driver's direct field of vision without obscuring other drivers and road hazards. The wearer of the AR glasses can therefore see the overlaid information without having to look away from the road. This is the crucial difference between MINI Augmented Vision and "look-to" technologies – where the wearer has to deliberately focus their gaze on a small screen outside their primary field of vision.

Even in this prototype, safety is a top priority for MINI. Whenever the vehicle is on the move, only relevant information is displayed in a perfectly clear, very reduced form – and in a safe area outside the relevant traffic situation. The glasses' large display area, together with the way in which the display of virtual content is linked to the outside world and the vehicle by means of tracking, ensures that drivers have a clear view of the primary traffic situation at all times.



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### **Operation**

A MINI app runs on the glasses both inside and outside the vehicle. Inside the vehicle, MINI Augmented Vision is linked up with MINI Connected and operated using controls in the vehicle, such as the steering-wheel buttons. When outside the vehicle, the AR glasses can be operated with the controls on the right temple, comprising a touchpad on the top and three buttons on the bottom.

When in the vehicle, the driver is even able to control certain functions of the glasses with a simple turn of the head. While parking, for example, the glasses will show external camera views of the wheels when the driver turns their head toward the appropriate wheel. Eye-tracking or voice control have not been integrated as yet, but are certainly a feasible option for future applications.

### **Functions and application scenarios**

The MINI Augmented Vision eyewear is designed for use while driving, but it can also be used before and after the journey. The key functions of MINI Augmented Vision include:

- Destination entry for navigation and transfer to vehicle: users can intuitively select addresses as journey destinations when outside the vehicle as well. When looking at a poster for an event, for example, the event venue is flashed up and can be confirmed as a possible navigation destination. Upon the user's return to the MINI, this destination is automatically transferred to the vehicle for route guidance.
- First Mile / Last Mile: this function is helpful if the driver finds a parking spot that is still some distance from the actual destination. In such situations, MINI Augmented Vision can guide the driver from the parked vehicle to the journey's final destination even if they are travelling on foot.



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And when it's time to return to the vehicle, the wearer of the AR glasses can let MINI Augmented Vision navigate them back to where they parked. The navigation data is transferred seamlessly between vehicle and glasses when getting in and out of the car.

- **Head-up display functions:** MINI Augmented Vision shows vehicle speed, speed limits and similar driving-relevant information in the driver's primary field of vision. This information is transmitted by the vehicle and always appears in the glasses in the same, vehicle-linked position above the steering wheel to make sure that no other drivers or road hazards are obscured by the display. The driver has a clear view of both the traffic situation and all important information at all times.
- **Contact-analogue navigation and points of interest:** contact-analogue navigation arrows seem to be projected directly "onto" the road, allowing the driver to pay attention to the traffic at all times. A contact-analogue display of points of interest along the route or of free parking spaces in the vicinity of the destination is also possible. The contact-analogue graphics have also been designed so as to not conceal any other driver or road hazards. Thanks to the glasses' large field of view, information on points of interest can be displayed in a position above the actual traffic situation. The contact-analogue navigation arrows likewise mark the road without any danger of obscuring anything.
- **Messaging:** a small icon is shown in the glasses when a message is received. The vehicle reads out the SMS, message or email on request. For safety reasons it is not possible to display the text while driving. This ensures that the driver stays focused on what's happening on the road and is not unnecessarily distracted.
- **X-Ray view:** images from cameras installed on the vehicle exterior appear in the appropriate context to provide a virtual view through parts of the vehicle (such as the A- and B-pillars, doors etc.). This makes it possible to see concealed areas, such as the blind spot when turning right. This function boosts safety considerably, especially when driving in urban areas.



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- **Augmented Parking:** facilitates parking by projecting the images from two cameras housed in the passenger-side mirror into the glasses. In this way, the distance between the wheels and the curb can be clearly and easily ascertained. Projection likewise takes place in the right context here, in other words when the driver is performing a parking manoeuvre and turns their gaze to the nearside front wheel.

### Technical specifications

At the heart of MINI Augmented Vision is a Qualcomm Snapdragon 805 processor whose integrated System-on-Chip (SoC) design includes Qualcomm® Krait quad core central processing unit (CPU) achieving a clock speed of 2.3GHz per core, Qualcomm® Adreno™ 420 graphics processing unit (GPU) and digital signal processing (DSP) within a single chip. Android 4.4 is installed as the operating system. Additional features include two cameras for tracking and the virtual elements, as well as a 1,400 mAh battery in each of the two temples. The battery service life of the prototype is therefore perfectly adequate for demonstrating the MINI vision.

The glasses come with two stereoscopic HD displays for three-dimensional vision, each with a resolution of 720p (1280 × 720 pixels) and based on LCoS (Liquid Crystal on Silicon) technology. With diagonals of 18 mm to 7 mm, LCoS displays are classified as micro displays. Despite their small size, LCoS displays are suitable for high-definition images. In addition to this, they offer a maximum contrast ratio of 1000:1. LCoS displays comprise a silicon film, a fine layer of liquid crystals and a thin glass panel.

Here are the technical specifications at a glance:

- Processor: Qualcomm® Snapdragon™ 805 processor
- CPU Frequency: 2.3 GHz per core
- RAM: 2 GB
- Display resolution: 720p (1280 x 720 pixels), stereoscopic display
- Format: 16:9



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- Field of view / field of display: FOV 28°
- Projection/display technology: LCoS displays
- Operating system: Android 4.4
- Camera technology: 5 MP

### Outlook

“MINI Augmented Vision was developed as a research prototype to demonstrate the potential of linking up visionary AR glasses to vehicles,” explains Dr. Jörg Preißinger, Project Manager for MINI Augmented Vision, BMW Group Research and Technology, adding: “In future, the system will continue to be developed and honed with the aim of turning the vision into reality.” Many of the technologies used are still undergoing development. Refining all the technologies involved while working to enhance the MINI Augmented Vision system as a whole will help to ensure that, in future, our customers are able to enjoy an intuitive style of information presentation during their day-to-day mobility.

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#### **The BMW Group**

With its three brands BMW, MINI and Rolls-Royce, the BMW Group is the world's leading premium manufacturer of automobiles and motorcycles and also provides premium financial and mobility services. As a global company, the BMW Group operates 30 production and assembly facilities in 14 countries and has a global sales network in more than 140 countries.



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In 2014, the BMW Group sold approximately 2.118 million cars and 123,000 motorcycles worldwide. The profit before tax for the financial year 2014 was approximately € 8.71 billion on revenues amounting to € 80.40 billion. As of 31 December 2014, the BMW Group had a workforce of 116,324 employees.

The success of the BMW Group has always been based on long-term thinking and responsible action. The company has therefore established ecological and social sustainability throughout the value chain, comprehensive product responsibility and a clear commitment to conserving resources as an integral part of its strategy.

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