Panoramic optimization using specialist 180-degree wall mounted cameras

DOCUMENT PURPOSE

The purpose of this document is to provide a deep-dive into single-sensor Fisheye panoramic imaging .

We will first give readers an overview of single-sensor fisheye technology and its benefits and then highlighting the main differences with multi-sensor technology.

We will then go deeper into what the word "panorama" means for 360-degree cameras. Once the limitations of these types of views are explained, we will advocate for the use of dedicated 180-degree Fisheye panorama technology. This optimises the design and construction of 360-degree cameras to generate panoramic views.

We will finally close by highlighting possible use cases for 180-degree panoramic cameras.

Just a few years ago, Panoramic and Fisheye cameras were a novelty, but today this technology has taken the leap to the mainstream. It now forms an integral part of a surveillance solution providing total situational awareness and retrospective investigation capabilities, not possible with traditional cameras.

Panoramic and fisheye cameras have become a "must have" tool in many different industry segments including retail, gaming and transportation. Their ability to monitor large areas gives a unique and unparalleled view, but also allows additional information to be gathered. For example, the flow of people and traffic can easily be seen, which could provide an insight into additional revenue opportunities or highlight areas of improvement for customer safety.

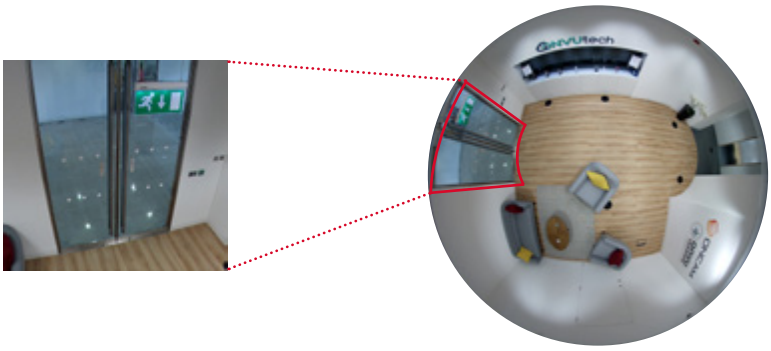
How Panoramic and Fisheye Cameras Benefit Users

Both 180- and 360-degree surveillance cameras provide wide area coverage which can provide benefits in two main ways.

They can help reduce the number of cameras required compared to traditional narrow field-of-view (NFoV), reducing the installation time and costs. Alternatively, they can be added to complement existing systems to improve the coverage and provide views and features not achievable with NFoV or Pan Tilt Zoom (PTZ) cameras.

One of the other main advantages is that the whole scene is recorded at all times. This means that evidence is never missed, and Operators are not required to ensure cameras are pointing in the right direction. Where ever an incident occurs in the scene, users can investigate it quickly and efficiently by dewarping the image either live or retrospectively. Dewarping is when software is used to take any area of the original warped fisheye image and flattened to have the look and feel of a more traditional video stream.

Example 1: dewarping technology



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What is the difference between single and multi-sensor technology?

Wide angled and panoramic views can be achieved in two ways; single sensor or multi-sensor technology. In Single sensor cameras the view is created by a single Fisheye lens, whereas multi-sensor technology uses an array of multiple NFoV cameras. These different, separate views are then stitched together to create a single Panoramic image.

Each technology has benefits over the other depending on the use case and customer requirement.

Multi-sensor cameras tend to provide a higher overall resolution but are much larger units and aren't always suitable for indoor installations where aesthetics or size may be important. The multi-sensor array can also create blind spots in the scene, especially under the camera when mounted in ceiling mode.

Single sensor cameras don't suffer from this, and have an uninterrupted view thanks to the single Fisheye lens. They also come in much smaller form factors making them ideal for internal environments or where a more discreet installation is required. The single sensor also means that there is no potential image stitching issues or difference in exposure settings which can be the case for multi-sensor cameras.

Creating Panoramic view from 360 Fisheye Cameras

Panoramic views can be created in different ways using a 360-degree single-sensor camera depending on how the camera is mounted.

- **Ceiling mount panorama**: In this example, the Panorama is created by flattening a section of the outer ring of the native 360-degree image and presenting it to the user as a single 180-degree strip. A Double Panorama is when both halves of the outer ring of the native 360-degree image are flattened and shown as two 180-degree strips. Views created in this way however have a blind spot compared to the native fisheye as objects placed under the camera lens won't be captured.
- **Wall mount panorama**: In this example, the Panorama view is taken from a crop of the centre of the image. This type of Panorama tends to result in a relative low resolution and does not always provide the edge-to-edge view from the original Fisheye image.

Ceiling mounted 360-degree cameras can offer a wide coverage of an entire scene, but present issues when put into a Panorama mode. When wall mounted, because the hardware configuration is not optimised for that view, the resulting image can lack definition and information.

How do specialist 180-degree wall mount cameras differ?

Specialist 180-degree single sensor camera are purpose built to provide wall mount Panoramic views. By optimising the placement of the Fisheye lens, the full width of the sensor is utilised, providing users with an uninterrupted high resolution image Panoramic image.

In addition to the hardware optimisation, on board dewarping software can remove the Fisheye lens distortion meaning vertical lines are straightened to give the viewer a more familiar and natural view.

Another important factor when considering 180-degree wall mount cameras is the installation angle of the camera. Some installations will require the camera to be installed high up and then angled down to focus on the area of importance in the scene. When this is done, the camera should have the ability to correct the on-board dewarping to compensate for the Installation angle and provide the user with the optimum dewarped Panoramic view.

180-degree or 360-degree cameras: which are better?

180-degree and 360-degree cameras should be considered complementary. The two different technologies are designed to address different needs and perform different functions. 360-degree cameras are best used in ceiling mode, to monitor large spaces, while 180-degrees cameras are optimised for wall mount applications, where users want to have better view of passing traffic and possibly look at faces, while capturing a wide area of coverage.

Ideal Use Cases for 180-degree Technology

As we've seen, 180-degree technology is optimized for wall mount applications, giving it a wide scope of application,

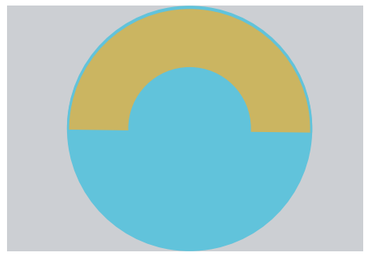
For example, in a casino or inside hospital corridors, users can obtain the best possible imagery of only the necessary areas. In train stations, security personnel can observe the traffic of the whole platform from a single screen, simplifying the way they carry out their daily work.

In hotels and restaurants, long corridors that lead to guest rooms require constant and clear surveillance, and when multiple floors and hallways need to be monitored, the cost and bandwidth associated with capturing this video can be a hindrance. Implementing a dedicated 180-degree solution can reduce bandwidth and the number of cameras needed to cover the area.

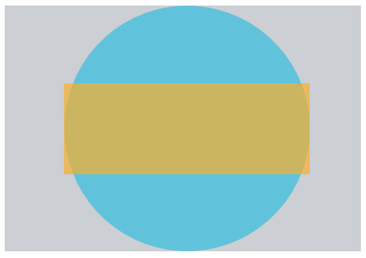
Large-scale resorts and hotels also have the added challenge of expansive spaces that also have a certain aesthetic appeal, which means they need an unobtrusive way

Examples of panorama in 180-degree and 360-degree cameras

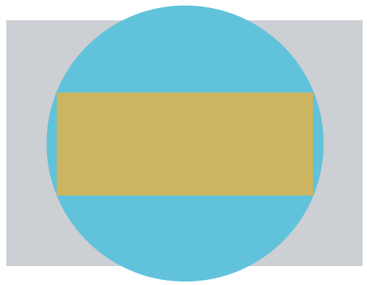
Example 2: panorama in a **ceiling mounted 360-degree** camera



Example 3: panorama in a **wall mounted 360-degree** camera



Example 4: optimized panorama in a **specialized wall mounted 180-degree** camera



Sensor
Lens
Area covered by the panorama

Example 5: panorama in a **wall mounted 360-degree** camera tilted 20-degrees down

Example 6: optimized panorama from a **specialized wall mounted 180-degree** camera tilted 20-degrees down with on-board dewarping correction

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to monitor common areas. Guests require a relaxed atmosphere, and the feeling of having cameras pointing from all directions can be off-putting. A single 180-degree camera is often all that's needed to continuously monitor a large area instead of a higher number of standard cameras.

In education, school common areas where incidents are more likely to occur include hallways and various access points across a campus, making a 180-degree camera solution a solid choice for enhanced coverage. The wide-open nature of today's campuses can also be a challenge for security officers in this market, which is why 180-degree coverage is critical to monitoring all areas of a campus and its perimeter. Video technology can also be instrumental in monitoring group activity and alerting staff to suspicious or unusual behaviour, or any vandalism or theft that may occur on a campus.

Viewing the World in 180 Degrees

Today's organizations require integrated security solutions that use the best possible video data available, and as businesses look to increase situational awareness, 180-degree single sensor solutions are supporting the more widely used 360-degree cameras in the design of smart surveillance solutions.

The Oncam Evolution 180 Range has been specifically designed to offer users higher resolution Panoramic+ views which leverage advanced image adjustment features such as Scene Offset and Oncam Angle Compensation Technology (ACT) to give more valuable, usable video data for continued security and for streamlining operations. This technology is truly changing the way users see the world - one degree at a time.

Example 7: Panoramic+ image from an Oncam Evolution 180 Outdoor Camera

FIND OUT MORE

We hope this white paper was informative and instructive. If you would like to discuss this topic further, please get in touch with the Oncam team, we would be happy to assist you. Feel free to drop us an email or call directly on the number below.

Alternatively, you can find more information on our website:

360-degree technology and products

180-degree technology and products

ABOUT ONCAM

Oncam is an independent, specialised IP video and technology company with a reputation for being one of the most innovative firms in today's market. Oncam's sole focus is on 360-degree and wide angle smart IP video - working with partners to deliver high-value business solutions for customers that leverage Oncam's award-winning technology. Find out more about our company and products by visiting our website.

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