



by **Schneider** Electric

White Paper

Issue 1

Emerging Trends in Panoramic Cameras

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Overview

Panoramic cameras are the fastest growing segment of IP cameras today, projected to have a compound annual growth of 30% by IHS. They have been around for over a decade but several developments in recent years have dramatically increased their relevance.

The value proposition they offer is compelling to any security video installer who has ever had to wrestle with striking that balance between covering everything in sight and staying within a budget. Fixed cameras do a great job of constantly covering narrow fields of view with great detail, but don't take in the whole scene. PTZ cameras are perfect for tracking people and objects at a distance from a single location as long as you have actively monitored surveillance, but could be looking in the wrong direction during an event.

What panoramic cameras bring an operator is the ability to assess a wide field of view at a glance and zoom in for some detail as needed. From a single camera, a single mounting location, and often with a single cable, they can cover a 180 degree or 360 degree field of view, bringing total situational awareness to that space. Done right, panoramic cameras enable you to record everything in the field of view all the time and zoom in for detail live or forensically. So you miss nothing.



Single sensor panoramic cameras



There are two primary types of panoramic cameras – single sensor fisheye cameras and multi-sensor panoramic cameras. Single sensor fisheye cameras with a 360 degree field of view have been around a while and they present an affordable entry point to the category. They have been increasing in resolution over the years with 5 MP sensors at mainstream and 12 MP sensors around the corner. The higher resolution, of course buys you additional detail at distance. It should be pointed out, that the image circle from the fisheye lens does not use the full extent of the sensor, so the effective resolutions are significantly lower than those of the sensor depending on whether you have a 360 or 180 degree configuration. Further, the resolution of fisheye lenses drops of dramatically from center of the lens to edges where it can be as low as 30% that at the center. The 360 deg models of these cameras, tend to be ceiling mounted and wind up having the lowest resolution where you need it the most, looking furthest away from the center of the lens.

There is another class of single sensor camera that uses panamorphic lenses. Even these implementations, which distribute resolution across the lens differently, still have a large variation in resolution across the lens.

Still the value of getting a situation at a glance intuitively and affordably has brought excellent growth to the single sensor category. What has also made a difference is the emergence of client-side de-warping in the category. This enables you to capture and record everything in the field of view at full resolution and then at the VMS client, view any piece of it, at some detail, live or in playback much like you would with a PTZ camera. Not all single sensor panoramic cameras support client side de-warping. And without this all you see de-warped is a limited number of streams with no ability to forensically view at detail every piece of the image.

In summary, single sensor panoramic cameras offer a great user experience providing situational awareness as well as immersive views at affordable prices. Where they are limited is in the ability to get more detail at distance.

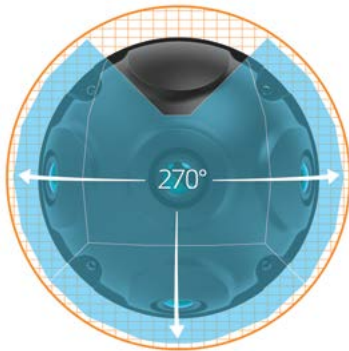
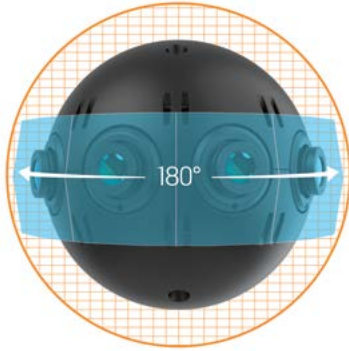
Multi-sensor panoramic cameras



Multi-sensor panoramic cameras have been around for while as well. And they do a great job of bringing more detail at distance. By ganging together 3 or 4 imagers, you can get more pixels across the field of view. Further, these cameras use conventional fixed IP camera lensing with much greater uniformity of resolution across the lens. As a result, for the same nominal resolution, you can get more pixels on target with a multi-sensor camera than you can with a single sensor camera.

Where traditional multi-sensor panoramic cameras have fallen short is in the user experience. They have typically presented a stream from each of the sensors they have. At the VMS you first need to manually arrange these in order to see a panorama. With a 180 degree configuration, you have shot at this. With a 360 field of view, this is totally non-intuitive. Also, if the sensors and lenses are not perfectly aligned, you have to deal with overlaps that bring double images or gaps where you have missing coverage. Finally, each of these sensors is optimized for white balance and brightness differently, resulting in a tiled appearance. The human eye is acutely sensitive to anomalies in scenes. Any discontinuities in image draw attention away from what an operator is really looking for in the scene– people and objects that shouldn't be where they are.

Panomersive cameras



More recently, a new class of panoramic camera has become available on the market, that brings together the intuitive user experience of single sensor cameras with the excellent detail at distance of a multi-sensor cameras. Called panomersive cameras, these are multi-sensor cameras, that stitch and blend images presenting at the VMS seamless panoramas and multiple intuitive immersive views where you can pan, tilt and zoom in for excellent detail. They also enable you to capture and record everything at full resolution and frame rate and with client-side de-warping allow you to get any portion of the image in detail, live or later.

These panomersive cameras are available in 180, 360 and a unique 270 degree configuration. Panoramic cameras find application in a wide set of vertical markets from mission critical spaces like transportation and city surveillance to more cost sensitive space like education and retail. A 180 degree configuration is great for mounting on wall covering indoor lobbies or outdoor building perimeters. A 360 degree configuration is ideally suited for covering intersections of aisle ways from above or parking lots outdoors. The 270 degree model provides wall to wall coverage when mounted on the outside corner of a building and has a sensor looking directly downwards, enabling you to cover doorways on the wall as well.



Non-panoramic Multi-sensor cameras

It should be noted that not all multi-sensor cameras are panoramic. There are some multi-sensor cameras that give you excellent flexibility in where they can be pointed and zoomed in, but don't cover the entire space contiguously. In essence they are 3-4 fixed cameras in a single housing with a separate unconnected stream for each. There are other multi-sensor cameras aimed at replacing traditional PTZ cameras where lenses are focused at different distances, but the maximum field of view is under 60 degrees.

Performance vectors – the usual suspects

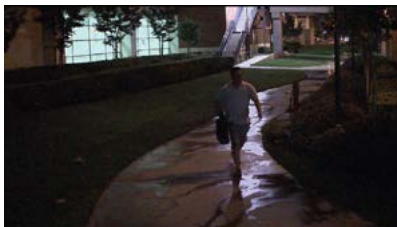
In the last few months there have been several new announcements of panoramic cameras with a focus on higher resolutions and frame rate. Resolutions as high as 48 Megapixels at 10 FPS and 24 Megapixels at 30 FPS have been announced. Higher resolutions certainly bring additional detail at distance. However, high resolutions unaccompanied by decent low light performance and wide dynamic range are the equivalent of empty calories in the security space. Higher frame rates deliver closer to real time performance – at a price. The higher bit rates that accompany them place an undue burden on storage and bandwidth costs. There is work on the horizon on more efficient compression in h.265 encoding. When this is in place in both cameras as well as at the VMS, higher resolutions and frame rates in panoramic cameras will be more widely deployed, especially if they also come with great image quality.

It's still security video

At the end of the day, a panoramic camera still needs to do the job of protecting people and property in security video applications. A space that has challenging lighting conditions that are constantly varying. It is still important to extract security detail from low light night time scenes. Lobbies with sunlight streaming in while you also have dark corners offer a different all too common challenge. Not have night time traffic scenes blown out by headlights and taillights is also an on-going problem. You need excellent image quality from your panoramic camera to discern detail in these conditions. Low light performance has been constantly improving in IP cameras and so has Wide Dynamic Range capability. These technologies are essential for dealing with the tough lighting conditions we face in security video. Low Light and WDR have tended to pursue separate paths, with some cameras optimized for one or the other. In some instances, cameras have manual controls that ask you to bias them one way or the other. In recent years there have emerged technologies like SureVision that deliver great low light and wide dynamic range performance at the same time, all the time.

Panoramic cameras have the potential to offer innovative possibilities at the Video Management system. For example, the multiple immersive views that panoramic cameras provide could be preconfigured for use by different operators. With video analytics, panoramic cameras also offer the promise of being able to detect people and objects and then have a VMS track these with a conventional PTZ.

The ability to cover so much, with increasing detail, and with improving user experience and image quality, all from a single camera is what will continue to propel panoramic camera growth well into the future.



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