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# Benefits of Multi-Sensor Panoramic Camera Technology

Release 1.0

White Paper

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## Introduction

The current crop of high-definition, megapixel cameras cover large areas and deliver superior images and analytics that improve security with fewer cameras. As good as megapixel cameras are, they still capture only a portion of the scene. Securing large areas with adequate camera coverage can be challenging, even with PTZ cameras. PTZ cameras rely on active monitoring and can still miss important information or security-threatening events in another part of the coverage area. The market now demands more than just high-resolution images: a security camera must survey a wide area and offer intelligence at the edge, all while reducing the cost of ownership. Multi-sensor cameras fill this need perfectly. A single, fixed-lens multi-sensor camera offers a panoramic field of view that delivers video for a much wider area that suits stadiums, retail and commercial spaces, and large sensitive installations. A properly positioned multi-sensor camera replaces multiple fixed and PTZ cameras while expanding forensic video images, and many deliver advanced analytics that offer real-time business data. This data can be used to increase sales, plan for future events, and to review overall security implementation.

## Pan, Tilt, Zoom Cameras

Today, video surveillance technology has advanced substantially, resulting in over \$27.5 million in global revenue<sup>1</sup>. According to 2016 IHS data, one of the fastest growing segments trending in the video surveillance market is panoramic cameras. In fact, panoramic cameras are forecast to outsell pan, tilt, zoom (PTZ) cameras in 2017<sup>1</sup>. The primary reason for this shift is that a PTZ camera cannot see the entire scene at one time. PTZ cameras can zoom into a particular area of interest for a closer, detailed analysis, but increasing detail in one part of the scene leaves a larger part of the scene without surveillance, resulting in a lost video opportunity. One benefit of a PTZ camera is its ability to track information as it moves through a scene; however, the camera can only capture one series of images at a time. Therefore, if the camera is busy capturing information in one location, an incident in another location could go unviewed unless the location employs multiple cameras, raising the security budget.

## Fisheye Cameras

To help combat these PTZ challenges, the fisheye, single sensor, 360° panoramic camera was introduced to the market. The fisheye gained popularity due to its many advantageous qualities such as its wide range of view, decreased blind spots, and the ability to view a full 360° scene without the need to install multiple cameras. The fisheye, however also came with limitations. The technology for a fisheye panoramic camera required the video to undergo a “dewarping” process so security professionals could make sense of the circular image. However, this process caused 25 percent of the pixels to be lost during transmission. In addition, the optical circular shape of the lens prevented the rectangular sensor from using all of its

<sup>1</sup> IHS 2016 Report

pixels effectively, resulting in a 50 percent of pixel loss. Therefore, lower quality images, especially at the edges of the sensor, were an obstacle. Although these cameras have their place in the market, customers wanted the benefits of a panoramic image with a wider field of view but without the shortcomings of first generation fisheye cameras.

### **Introduction to Multi-sensor Cameras**

In an effort to meet increasing customer requirements for a more advanced panoramic offering, the multi-sensor panoramic camera was introduced to the video surveillance market in 2006. Multi-sensor panoramic cameras vary by manufacturer; however, most are designed to encompass several single image sensor cameras into one housing for a 180° or a full 360° panoramic view.

Often referred to as video blindness, 45 percent of screen activity can be missed from a live operator just after 12 minutes of monitoring. Since these cameras provide a single stitched, wide field of view image, an operator's effectiveness for increased situational awareness can vastly be improved.

### **Multi-sensor Technology**

Multi-sensor cameras are free from the focal length restriction that hampers the performance of most fisheye cameras. This lack of restriction allows a multi-sensor camera to capture video from greater distances with a clearer picture.

Multi-sensor panoramic cameras solve several problems that occur in most fisheye cameras, such as pixilation, definition differences between image center and image edge, and image distortion. These cameras integrate the images from multiple sensors and stitch the images together using advanced imaging algorithms. The result is a panoramic image that is free of distortions and does not require de-warping, delivering a seamless image. The benefits of multi-sensor panoramic cameras are apparent, as these cameras offer complete and continuous coverage of an area to deliver forensic-quality video of an event.

Most multi-sensor panoramic cameras bundle the hardware and software necessary to produce a distortion-free panoramic image into one housing with a larger field view. The camera splices several HD video channels into a panoramic video image with high resolution. The splicing algorithm is highly integrated into the front-end camera with parallel real-time operation on the system, making the multi-sensor camera equivalent to a monitoring product. The undistorted, 180°, or 360° (according to the camera's specifications) panoramic image, with an ultra-wide angle, solves problems, such as loss in resolution and a smaller coverage area, that are inherent with a fisheye camera. Finally, the camera transmits the image to the back-end management platform via a network connection.

“The result is a panoramic image that is free of distortions and does not require dewarping.”

## Using a Multi-sensor Camera

Multi-sensor cameras require some special attention during installation and commissioning to ensure that the camera captures the largest area and delivers superior video quality.

- Determine the surveillance scene and the level of details that are required. Ensure the camera is mounted in intersections or heavy traffic areas in open spaces. Avoid placing the camera in view of a large obstruction or a constantly moving object. For 360° views, do not mount the camera in a corner.
- Determine a proper mounting area that captures the application's requirements. Make a decision about the quality of the image that the application requires. Is detection-level surveillance adequate or does the application require identification-level images?
- Mount the camera at least 15 ft - 20 ft (4.60 m - 6.10 m) above the surface, and aim the camera 100 ft (30.48 m) toward the horizon for every 10 ft (3.05 m) that the camera is mounted above the surface. This ratio minimizes image distortion and scene curvature. Keep in mind that every 10 ft the camera is mounted above the ground, a 10 ft blind spot below the camera is produced. For example, a camera mounted 20 ft above the ground should be aimed 200 ft toward the horizon and a 20 ft blind spot below.

“...drastically simplify the planning and installation process.”

## Multi-sensor ROI

Multi-sensor cameras are designed to make the overall design, installation, aesthetics, and post forensic analysis simpler. For an integrator or installer, the primary benefit of a multi-sensor camera is that it can drastically simplify the planning and installation process. A single housing with multiple sensors does the job of several single sensor cameras, simplifying an application in terms of cabling, networking, VMS licenses, and installation. As an added bonus, the application is more aesthetically pleasing.

In the event that video surveillance recordings need to be viewed for forensics, combing through data for multiple, overlapping cameras will take longer as compared to only having to view one set of recordings. As a result, a single multi-sensor not only streamlines the installation for a cleaner, less cluttered look but it saves time when searching for forensic data.

Another way that multi-sensor cameras can reduce expense is with the VMS license. When multiple cameras are deployed, a separate VMS license is typically required for each camera. However, most multi-sensor cameras only require one license which saves money.

A final convenience that the multi-sensor provides is its ease of maintenance. In the event of an outage, the installer only needs to troubleshoot one camera, saving time at the job site and reducing labor costs.

## Multi-sensor Applications

In the next decade, billions of dollars will be spent on new construction and renovation projects – a major opportunity to build video surveillance into each project. Deploying the right video surveillance system is essential to providing a secure environment. There are a variety of applications that would benefit from the convenience of a multi-sensor camera. Here are a few:

### Healthcare Overview

Healthcare security is a unique challenge. Statistics show that hospital crime and violence are growing at a staggering rate. As healthcare facilities continue to face a wide variety of security threats (theft by employees or visitors, violence or threats from visitors or patients, and crimes of opportunity), administrators are challenged with how to ensure the right solutions are in place to meet their growing video surveillance needs.

### Healthcare Installation

For a streamlined look and feel, a multi-sensor panoramic camera eliminates multiple single sensor cameras at the corner of a building or on a parking lot pole. Besides the improved aesthetics, panoramic cameras offer a higher return investment due to a reduction in video management system (VMS) licenses, a higher savings on installation, and less cabling and maintenance. Another location that a multi-sensor can provide value is at the corner of an intersecting hallway or corridor. Since the images from the three camera sensors are stitched together, blind spots are minimized and critical details are retained so that the entire flow of events are captured at once. For a retrospective analysis, less video is required to comb through, saving investigators time so that criminals can be caught and taken off the street faster.

### Education Overview

A student's environment can impact his or her education; therefore, it is essential for students to have a safe environment throughout their learning experience. Security cameras are shown to reduce the challenges associated with campus violence or vandalism and are an indispensable tool for identifying and resolving issues as they arise. Deploying the right video surveillance system for your school's application is essential to providing faculty, students, and visitors a safe environment.

### Education Installation

One problem many schools struggle with is proper access control for visitors. By implementing school security cameras at entrance doors, security personnel and administrators can monitor visitors and ensure they are authorized to be in a particular area, while still allowing students to move freely around the campus.

Cameras mounted near main entrances and in administrative offices can help track and record each visitor as they enter and exit the facility. These areas are excellent opportunities for monitoring the building for general, high-alert, or terrorism-related surveillance. High resolution, multi-image technology provides the responding security personnel with a wider field of view than standard IP cameras. As a result, schools that are on a tight budget receive better coverage with fewer cameras.

“...it is essential for students to have a safe environment.”

“...retail shrinkage from shoplifters and other causes costs U.S. retailers about \$42 billion a year.”

A multi-sensor camera deployed at hallway intersections or aligned and mounted above cafeterias mounted above tables for a 180° view provides excellent situational awareness for capturing details. Additionally, a multi-sensor camera provides added value when installed onto campus emergency call boxes or where walkways connect to the campus.

### **Retail Overview**

According to the 2015 Global Retail Theft Barometer, retail shrinkage from shoplifters and other causes costs U.S. retailers about \$42 billion a year.<sup>2</sup> As a result, retailers often deploy video surveillance as an effective tool not only for preventing shoplifting, but to provide visual evidence for fraudulent claims. As retail environments continue to face a wide variety of security threats such as employee/customer theft, organized retail crime (ORC), violence/threats from disgruntled employees, vendor fraud, and crimes of opportunity, security personnel are challenged with how to ensure the right solutions are in place to meet their video surveillance needs.

### **Retail Installation**

Retail store owners and managers are correctly concerned about safeguarding their store from shoplifters, but they cannot lose sight that 43 percent of lost revenue comes from employee theft. Unfortunately, employee theft can be due to an addiction, and a store full of easily accessible goods can be tempting to employees with past or present shoplifting addictions. A multi-sensor camera placed over aisles or cash registers provides detailed information for verifying missing inventory. Additionally, a 180° view multi-sensor camera deployed throughout warehouse aisles or over a manufacturing assembly line provides situational awareness for capturing a detailed analysis.

### **Intelligent Business Analytics**

As criminals and technology become more sophisticated, owners of retail spaces (department stores, gas stations, convenience stores), commercial properties (malls and multi-use buildings) and public venues (stadiums and city centers) demand more intelligence from their cameras, not just surveillance but business analytics that deliver real-time data and analysis. Therefore, some multi-sensor cameras include built-in intelligent video analytics to further improve the efficiency of video monitoring and provide additional value to the end-user.

A video surveillance camera equipped with intelligent video analytics can analyze real-time images to instantly detect and alert the user to suspicious activities according to the user's parameters. As a result, security personnel can alert the proper responders quickly and with confidence. Additionally, intelligent video analytics add sense and structure to a video surveillance system so that operators are more efficient and can focus on additional duties.

<sup>1</sup> IHS 2016 Report

<sup>2</sup> National Retail Federation

<https://nrf.com/media/press-releases/retail-inventory-shrinkage-increased-452-billion-2015>

Intelligent video analytics works by using metadata so that evidence can instantly be retrieved for all objects that entered or exited the scene. As a result, intelligent video analytics saves operators time when searching for an event due to less recorded video to sort through. In addition, since fewer false positives are triggering data recordings, a savings on storage is realized.

## **Conclusion**

Without a doubt, a multi-sensor camera reduces the total number of single-sensor cameras required to provide effective surveillance, thus lowering the total cost of ownership while not sacrificing video coverage. And, thanks to the camera's ultra-wide field of view, a single multi-sensor camera can do the job of several standard definition cameras at a fraction of the price.

Panoramic fisheye cameras and PTZ cameras still fulfill a valuable role, offering many advantages for certain types of applications. Multi-sensor cameras have a place in today's video surveillance systems, especially in reducing the number of cameras deployed on a network for a higher ROI. In many cases, a mix of PTZ, fisheye, and multi-sensor cameras may best serve the application's requirements.

## About Dahua

Dahua Technology is a global leader in video surveillance solutions with the world's second largest market share, according to a 2015 IHS report. With more than 5,000 professionals on our R&D team, we believe in investing and building strong capabilities for new technology and innovation. We are dedicated to providing cutting edge products, technology, and solutions to our customers. We hold a total of 770 patents and our comprehensive product portfolio includes advanced video surveillance products and solutions and related software, access control, VDP, alarm, intelligent building management systems, and intelligent traffic management systems.