SUPREME
A NEW DEFINITION OF HD

White Paper

VIVOTEK Supreme Series Professional Network Camera- IP8151

VIVOTEK
BUILT WITH RELIABILITY

Contents

1. Introduction

IP8151 represents the first in **VIVOTEK**'s **SUPREME** series of professional security cameras, integrating a host of professional features and unparalleled image quality for discerning users and demanding applications. One of the key characteristics of the IP8151 is the newly developed SONY Exmor[1] 1.3 Megapixel CMOS image sensor, designed for situations which require exceptional performance in nighttime and low light conditions. While megapixel cameras traditionally require a high level of lighting for maximum picture clarity, with the improvement in new sensor technology, the resulting IP8151 camera offers as one of its significant features **Supreme Night Visibility**.

Fig.1 IP8151 is the first VIVOTEK Supreme Series network camera.

A conventional megapixel image sensor is the same size as a standard VGA CMOS sensor, with more pixels at a smaller size in the same area to achieve the improved picture clarity. The drawback of this traditional sensor design is that the change in light sensitivity raises the dB value of the signal-to-noise ratio. In other words, a traditional megapixel CMOS sensor produces more noise under low light conditions due to its physical limitations, resulting in more light required for a clearer picture.

To combat this, VIVOTEK utilizes sensor technology and digital signal

[1] Exmor is a trademark of SONY Corporation.

processing for higher sensitivity by increasing the amount of light captured and reduce noise when analog-digital (A/D) conversion, thereby improving the low light performance of a megapixel IP camera. **Supreme Night Visibility** is a key feature of VIVOTEK's latest product offerings, allowing for low light visibility in color equal or better to that of traditional analog or CCD cameras. First introduced in the IP8330, and with continued refinement in the IP8151, this feature is key for users looking for exceptional low light visibility.

2. Sensor Technology

The sensor technology used in the IP8151 is a groundbreaking technology developed by SONY for the Exmor sensor, featuring the column-parallel A/D conversion technique that meets or surpasses the performance of CCD sensors while retaining the benefits of CMOS. This new generation of CMOS sensors combines high sensitivity with low noise, eliminating the traditional drawbacks of megapixel CMOS sensors. As shown in Figure2, a pixel on a CMOS sensor consists of an on-chip micro-lens, color filter, and inner lens to collect light, followed by the wiring layer and photodiode. When the light passes through the micro lens, color filter, and inner lens, it reaches the photodiode for photon-to-digital conversion. Between the inner lens and the photodiode is the wiring layer. If the wiring layer is too thick, it inhibits or obstructs photon gathering, and thus reduces the light sensitivity of sensor. On the other hand, by using copper (Cu) wiring to reduce the thickness of the wiring layer, it allows the light to be collected effectively. As a result, the camera provides color images with excellent sensitivity and visibility, even in nighttime conditions.

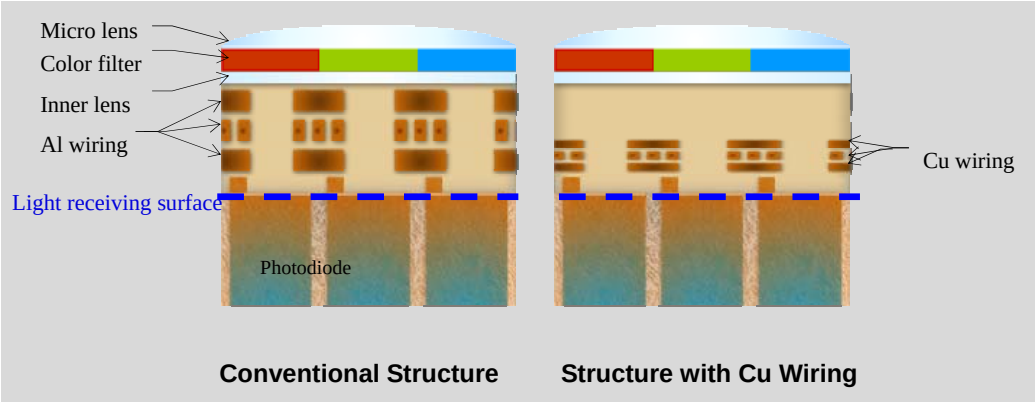

Fig. 2 Cross-section of a pixel on a CMOS sensor.

3. Noise Reduction

High quality video and images rely on not only the image sensor, but also the image signal processing (ISP) technology, which has been the expertise of VIVOTEK for complete integration of the components of camera sensor technology.

As the light signals are converted into electrical signals by the photodiode array, these signals are then sent to the analog-to-digital conversion (ADC) circuits, located adjacent to the photodiode on the upper portion of the chip. Electronic noise is generated during the conversion process of analog signals reaching the A/D converter (Figure 3). Under certain conditions, even the occurrence of single-electron noise will be visible in the image.

The new A/D conversion circuit design enables automatic noise cancellation and reduction to dramatically improve the image quality of analog signals before A/D conversion. After conversion, the noise is further reduced for noise-free signals and unparalleled image quality (Figure 4).

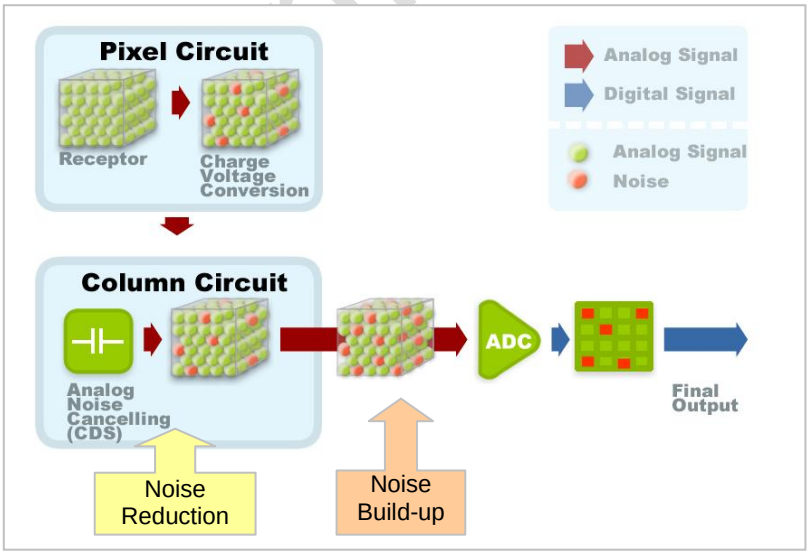

Fig. 3 Signal processing in a conventional CMOS sensor.

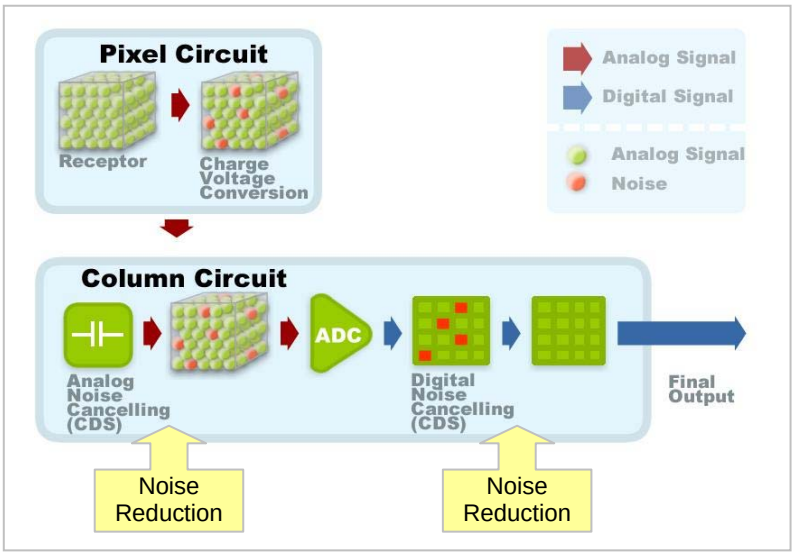

Fig.4 Signal processing in the SONY Exmor sensor.

4. Application

SONY's **Exmor** has already been deployed in consumer electronics such as digital cameras and digital camcorders and has proven to be a great success in capturing video in low light conditions. Thus, with the IP8151, which features the IMX035 sensor specifically designed for the security market, this next-generation camera can surpass the performance of traditional cameras in low light environments.

Although most IP camera vendors recommend a minimum of 40 pixels per foot in a scene to capture details such as license plates or faces, during nighttime and poor lighting conditions, this can grow to as many as 120 pixels per foot. With the improved light sensitivity of the IP8151, a scene which may have required 120 pixels per foot previously may be recognizable at 95 pixels per foot or lower, even in low light conditions! Thus, a scene which may have required a higher megapixel camera may now easily be captured with the 1.3MP IP8151 camera.

Let's look at a real-world example where security is prevalent: casinos. The lighting in the interior of a casino or around the gaming machines may not provide enough ambient lighting to monitor activity clearly. At the same time, bright lighting may not always be possible as they may interfere with the atmosphere or décor of the locale. In such cases, the

importance of monitoring with a suitable camera such as IP8151 with sufficient performance in low light such is ideal. The megapixel resolution can help to monitor important details much more clearly, with details such as face recognition and players' movements easily recognizable. At the same time, low light sensitivity allows the camera maintain a high shutter speed to avoid blurring that may occur when monitoring a moving object.

Fig.5 The additional clarity of the IP8151 results in more ease in distinguishing vehicle features.

Another example where low lux megapixel cameras are ideal is highway or traffic monitoring. Typically, an extremely high shutter speed is required to capture vehicles moving at high speeds, especially for license plate recognition. This may not be as difficult in day time, but at night, merely a high shutter speed is not enough; it also needs to be paired with more lighting and/or better light sensitivity. By utilizing the new VIVOTEK IP8151 and the Exmor sensor for low light sensitivity, the additional clarity results in clearer recognition of distinguishing vehicle features, offering better clarity and a 15-20%+ improvement in pixels per foot required.

5. H.264 Real-time 1.3 Megapixel

In addition to low light sensitivity, the IP8151 has also adopted Texas Instruments' newest video processor chipset named DaVinci[2], which is specifically geared toward professional video applications has a number of features which also help to enhance image quality even further. The chip itself features an ISP (Image Signal Processor) which allows for additional processing of the raw video captured by the lens and sensor, reducing the burden on the camera CPU and allowing for video quality on the level of CCD sensors. Although CCD sensors are commonly believed to feature better image quality than CMOS, the combination of the Exmor sensor and DaVinci chipset has flattened these discrepancies, and offers benefits such as reduction in phenomena such as blooming and smearing which can commonly occur with CCD sensors.

Fig.6 The superb performance of the IP8151 is on par with CCD cameras, even in night mode.

Beyond the ISP, the power of the DaVanci chipset allows for the perfect transmission of 1.3-megapixel resolution video at 30fps compressed with H.264. The H.264 compression technology is able to decrease bandwidth usage and storage space up to 30% compared to MPEG4 and is the common accepted standard for professional IP Surveillance today.

[2] DaVinci is a trademark of Texas Instruments.

6. Conclusion

Megapixel technology is one of the key driving factors behind the growth of Network cameras. Traditionally, megapixel cameras require more light to achieve the picture clarity for object identification. With 1.3-megapixel being the most popular megapixel camera standard today, VIVOTEK has explored how to achieve better image quality and usability through integration of the latest technologies. By using not only the SONY Exmor sensor for Supreme Night Visibility, but also 30fps, H.264, and much more, the IP8151 sets the standard in all fields of surveillance applications.

*Fig.7 Example of **Supreme Night Visibility** of the IP8151 in an extremely low light environment.*

Note: All screenshots in this document were taken with a 60mm lens.

VIVOTEK INC.
6F, No.192, Lien-Cheng Rd., Chung-Ho, Taipei County, Taiwan
Tel: +886 2 8245 5282 Fax: +886 2 8245 5532
E-mail: sales@vivotek.com http://www.vivotek.com

VIVOTEK USA INC.
470 Lakeside Drive Suite C, Sunnyvale CA 94085
Tel: 408-773-8686 Fax: 408-773-8298
E-mail: salesusa@vivotek.com