WHITE PAPER

Enhanced IR Technology

Adaptive IR and Smart IR

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1. Introduction

IR Basics:

To integrate Infrared (IR) LED illumination for overcoming the poor low-light performance has become a common yet essential technique for surveillance cameras. To better understand that, it is first crucial to realize three key specifications for all IR illuminators, incident angle, incident distance, as well as power consumption, all of which are trade-off among on another by varied applications.

Incident angle is how wide in degrees that an IR illuminator can cover, e.g. 30°, 60°, 120°. Incident distance is how far the IR light can reach, which may vary among different incident angles. Power consumption is another important factor in that IR LEDs require heavier power consumption when it comes to the larger angle and the longer distance a camera desires to reach and cover.

Under the logical constraints on power consumption, the incident angle and achievable distance is always a tradeoff for IR illuminator. If the IR illuminator is wide, it can cover wider FOV (Field of View) but with the limited achievable distance. If, on the other hand, the IR illuminator is narrow, a long distance can be achieved but the covered area is limited, thus causing the dark edges effect of the image. And to cover both wide view and long distance, an IR illuminator will require much larger power consumption instead.

1. Introduction

Spotlight / Overexposure Issues:

In general, there are 2 major problematic issues on conventional IR-equipped camera. One is concretely the “spotlight” effect in which IR lights are projected on the scene unevenly, and the other is “overexposure” issue occurred on the near object specifically.

Spotlight:

The spotlight effect, which results in poor FOV (Field of View), is generally caused by camera built with a highly concentrated small IR illuminator in order to make camera size compact and achieve the required illumination distance under power constraints.

On the circumstance of IR camera with vari-focal zoom lens, the issue becomes even much severer because the FOV of the camera varies with the lens’ focal length (zoom positions). The conventional IR illuminator design is not able to cover the dynamic FOV range and thus generate a more deteriorated spotlight effect on the wide end.

Spotlight Effect from Traditional IR illuminator

1. Introduction

Overexposure:

The overexposure is the other major issue on the IR integrated camera. The issue happens when an object is physically close to the IR camera and the power of the IR illuminator remains the same. The effect of overexposure hence occurs on the object and the most of evidentiary details of the object will be compromised.

Overexposure Effect from Traditional IR illuminator

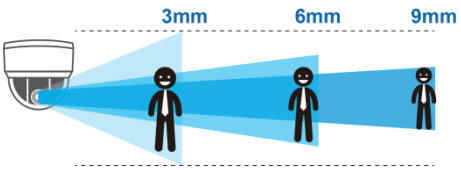
2. Enhanced IR Technology

To address the spotlight and overexposure issues, several advanced IR technologies have been developed by Topview on the aspects of either the brand-new IR illuminator physical design or the intelligent AE (Automatic Exposure) algorithm.

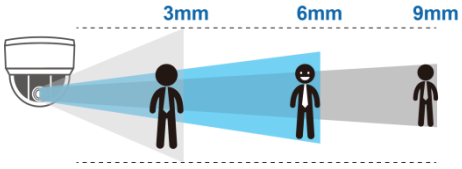
The brand-new IR illuminator cameras with motorized zoom lens can automatically adjust the IR incident angle to pair with the dynamic FOV, thus producing an even and proper IR illumination. The intelligent AE IR cameras, on the other hand, can automatically prevent the annoying overexposure effect when an object close to the IR camera is detected, further refining the necessary details of the object.

Adaptive IR Feature:

Based on the innovative IR illuminator design, Topview's Adaptive IR technology is composed of multiple groups of IR LEDs, each of which has different incident angles. In addition, the intensity of every group of IR LEDs can be manipulated individually. An even IR illumination on the image can be therefore achieved via fine-tuning the intensity of each IR LED group. Moreover, the optimization of IR LED intensity is applied on different zoom positions of vari-focal camera. Namely, the camera is able to maintain the uniformity of IR intensity across the dynamic FOV range.



Camera with Adaptive IR



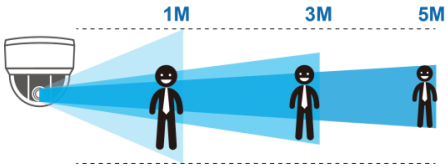
Camera without Adaptive IR

Left: Adaptive IR Off (Dark Angles); Right: Adaptive IR On (Dark Angles Eliminated)

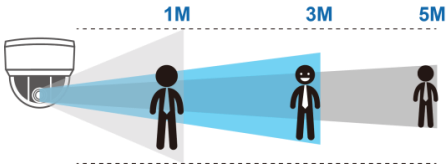
2. Enhanced IR Technology

Smart IR Feature:

Focusing on the advanced intelligent AE (Automatic Exposure) algorithm, Topview's Smart IR technology is developed to keep the close object from overexposure effect under low-light environment. Based on the pure SW (Software) enhancement, the Smart IR feature can be applied on all current platforms available. In implementation, according to the prompt analysis of exposure histogram information, the overexposure effect on the close object can be detected wisely, and the camera will dynamically adjust the shutter speed as well as the sensor gain to prevent the overexposure. Also, additional digital WDR will be exerted to preserve the details on the dark area if necessary.



Camera with Smart IR



Camera without Smart IR

Left: Smart IR OFF (Overexposure); Right: Smart IR ON (Overexposure Eliminated)

2. Enhanced IR Technology

Bandwidth Savings:

One additional advantage, bandwidth saving, comes along with the adequate IR illuminator design. Logically, when the IR light is poor, the camera will enhance gain control to maintain image brightness, which unavoidably results in digital noise.

More bandwidth is required for encoding when noise level heightens. Consequently, with more adequate IR light, the camera consumes less gain control, thereby reducing bandwidth demands.

3. Conclusion

Topview's proprietary Enhanced IR solution, which is based on innovative IR LED design and intelligent AE algorithm, provides optimized low-light image quality with adequate IR illumination. With the innovative Adaptive IR technology, the IR-built vari-focal cameras can still grasp a crystal image under dynamic range of FOV. Above all, the Smart IR further prevents the overexposure effect on the object in the close proximity of the IR camera. The groundbreaking IR technology certified by Topview will be generally applied to all Topview IR series cameras within near future.