



High Megapixel Advantages and Tradeoffs

Application Notes

Version <1.0>



Technical Support Team

Revision History

Date	Version	Owner	Description
2014/07/12	1.0	Ichiro	First Released

Preface

High definition / megapixel resolution technology enables network cameras to provide higher resolution of video images than previous analog CCTV, i.e. the good ability to see much more details or have a wider coverage. In fact, this is the most important key consideration in video surveillance applications.

But, almost every vendor offers 1080p. And almost everyone claim they have excellent performance. The big question now is how we choose these high quality cameras? How to measure or define the performance? Is camera with 5MP much better much better than 2MP? Is a 5MP camera 2 times better than 1080p as pixel count proponents claim? How do I choose the best one? Or which one is best for me?

In the following chapters, we will introduce the advantages and disadvantage of high megapixel cameras, provide the recommended scenarios for different cameras. And there will be a comparison with real example to different resolution cameras which is under different environment parameters.

High Megapixel camera scenarios

High resolution camera can provide much detail and cover wider area. It is suitable for the applications which need to recognize or detect objects. When you need to see the more details, for instance, License plate, facial recognition, or cashier monitoring, you will need a higher resolution camera. But always keep in mind to maintain sufficient light.

The Advantage of High Megapixel Camera

Cover much wider area

You can imagine you were security manager in a shopping mall, for instance, your primary goal of a camera installation may be to watch for the presence of people and view their movements, but you do not need to know the identification of individuals. In this case, the aim is to obtain a general overview of a scene. Under this circumstance, you don't need very high resolution camera.

However, what if you need both wide overview and detail at the same time? In past solution, sufficient resolution and coverage of a scene may be achieved with several megapixel cameras. You have to deploy many cameras, which have their dedicated use. Some of them are focus on detail, and others are used to shoot an overview image. But, with higher resolution cameras (5MP or higher), you can have wider field of view than general megapixel camera (2MP or lower), also. You don't need to use so many units to cover whole area. The total amount of cameras can be reduced.

Much detail

These are the demanding situations where you need to be able to identify persons or objects in a specified scene. This could be point-of-sales monitoring where it is necessary to clearly see every items, or situations where you need to be able to identify a face or a car plate.

High detail images can be achieved by installing a network camera with a telescopic lens or a lens with zoom capability to enable a closer view of the area of interest, or by placing the camera close to the area to be monitored. Using higher

resolution cameras in all such cases will provide even higher resolution images with more details than a HD network camera.

Better video source for more applications

The high resolution video recorded on a digital IP camera provide clear and better video for viewing and reviewing (playback). The clearer the video, the easier to get more information. Since high resolution camera can provide much more detail in the video, so it will help your application or software to identify the characteristics and suspect.

The tradeoff of using High Megapixel Camera

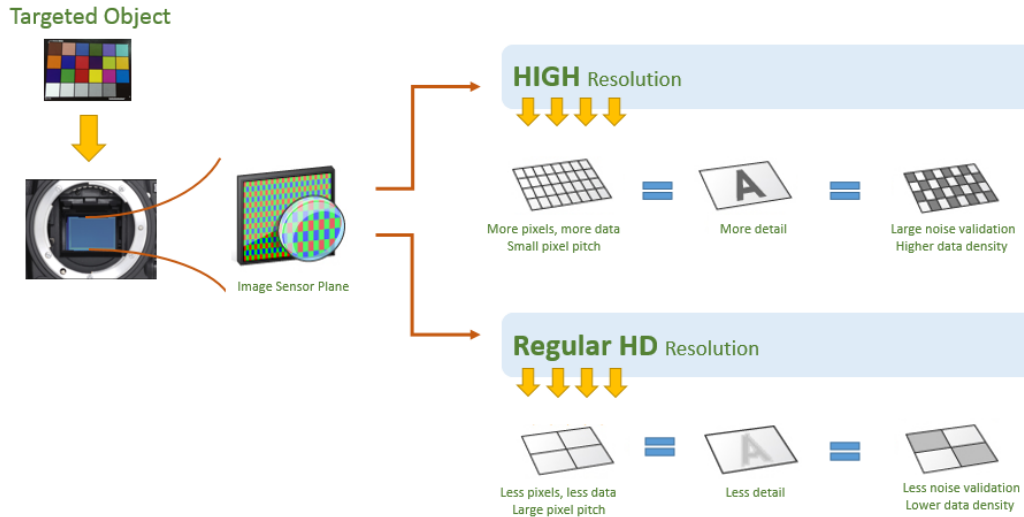
Much noise in low light environment

What makes it hard for a high resolution camera to see clearly in low-light conditions is noise; or that extraneous signaling data which the camera mistakenly includes with the image because of the low-light conditions. The main reason is the image sensor size and the density of data on image sensor.

In most of high resolution camera, the sensor size is almost the same with general HD network cameras (1/2.7", 1/2.8", 1/3"). But, there are much more pixels and digital data should be recorded. As a result, the possibility of including extraneous signaling data will be increased as well. These artifacts in the digital signal processing by the camera will cause the video stream to degrade in quality, become blurred and lose definition.

Besides, the problem might be amplified much when some image parameters are set to be increased. For example, the AGC (Auto Gain Control) could cause some bad effect on the video encoder becomes overwhelmed by the level of noise present.

The best solution to reduce the noise is to use larger image sensor. With larger image sensor size, the density of data on sensor can be reduced and noise will be less too. However, the larger the size is, the higher cost you need to pay. To keep the price in a reasonable range, there are less vendor to choose the approach.



Consume much resource on PC when viewing the video

Demanding on the computer, because of the high definition image decoding to consume more CPU resources, decoding a high resolution (5MP+) network camera, roughly equivalent to two to four time decoding a HD network cameras.

Need much more network bandwidth and storage capacity

High resolution video need more storage capacity. Since the videos contain much more detail in each pixel and unit. So certainly it uses more space to keep the record. If you press 5M stream computing, each video will occupy about 45~50MB space per minute, the same ratio 2M network camera will be 30~35MB.

The Experiment to different scenario

To valid our assumption, we design some experiments. We use three different resolution Surveon IP cameras, whose resolution are 2M, 3M, and 5M.

From the view of hardware, in each scenario, all cameras are put at the same point. The distance between target and camera is fixed. Besides, we also checked the SOC, and keep all SOC the same brand. As a result, we can said that the only difference is the resolution. From software, we use the same version of firmware, and the same browser. All the image parameter are reset to factory default and all configuration are all the same, including Iris sized, shutter speed, and brightness...etc.

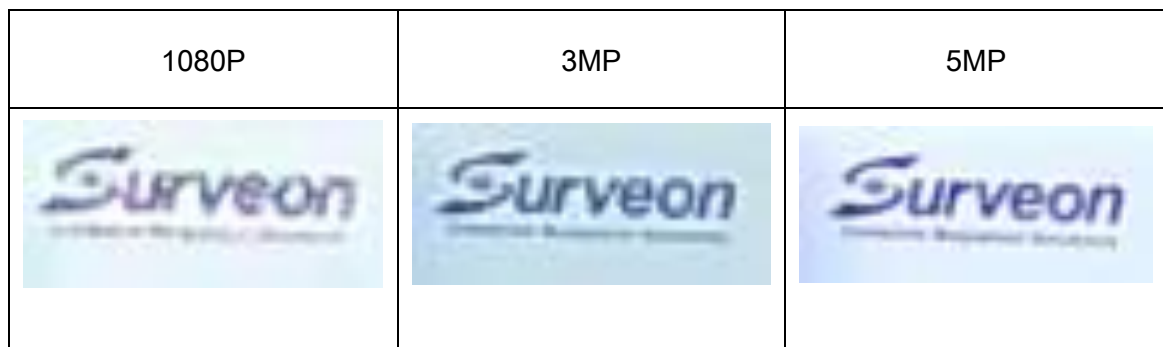
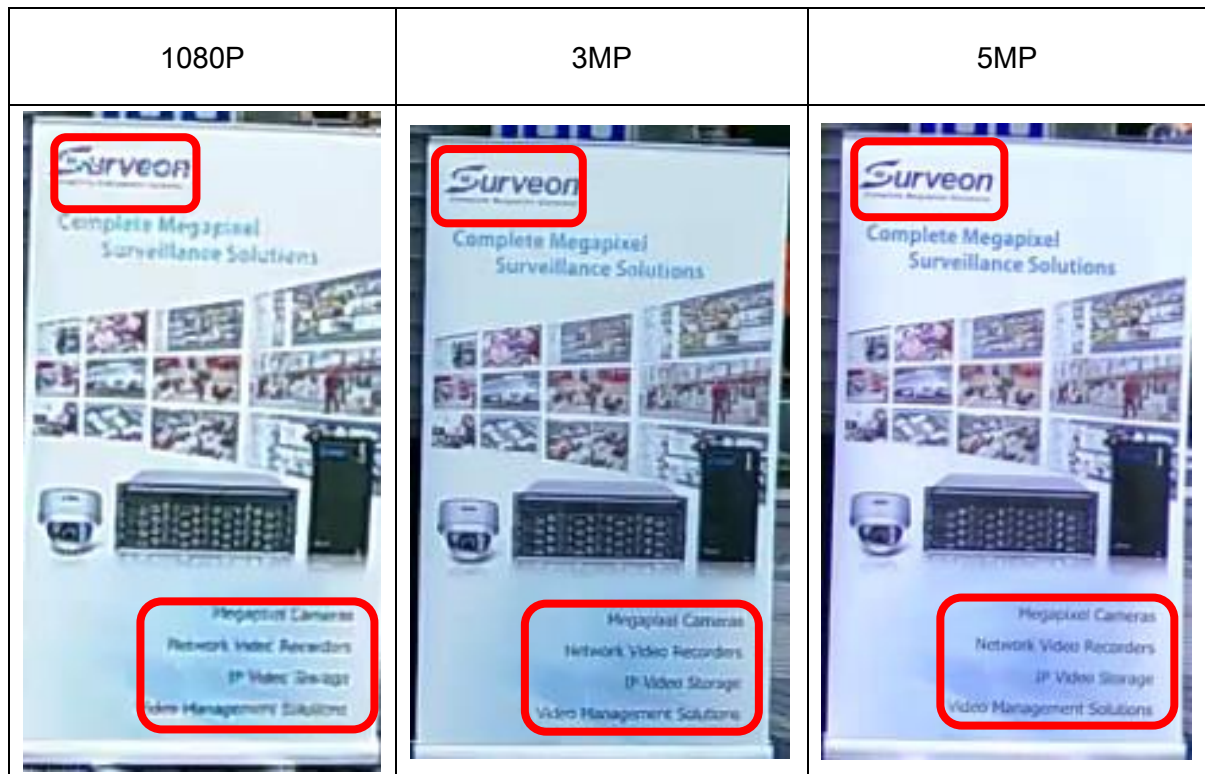
Our experiments are to show the image quality of different resolution camera with different LUX. We want to know the relation between resolution and the light/LUX. You can find the result in the following.

1. LUX = more than 10000 LUX

Distance = 25M

Original picture and real scene.





First one is a well-lit, outdoor environment with great sunlight. Under such an environment, higher resolution can have both much detail with good image quality. The image shows that the image is taken under enough Light and well focus. You can see the higher resolution camera can display much detail. Also, the line on the wall and the door is cleared and sharper.

2. LUX = 116

Distance=3M

Original picture and real scene.



1080P	3MP	5MP

1080P	3MP	5MP

The second scenario is under medium light. It is indoor environment with fluorescent light. When the LUX is not high enough, the higher resolution camera already has some noise. In the experiment result, you can see the 5MP image shows some noise on the edge. Regarding to image quality, 3MP is the best. The image is bright and keep more detail.

3. LUX = 3

Distance = 3M

Original picture and real scene.



1080P	3MP	5MP

1080P	3MP	5MP	Original picture

1080P	3MP	5MP	Original picture

The third one is a low light environment. Under a low light environment. You can see the noise is very obvious in 3MP and 5MP. 2MP can still see the title, and the detail of red poster. But in 5MP, you can hardly recognize the word, and the noise is very high. You can also see the lower part of picture, it is not visible in 3MP and 5MP.

4. LUX = less than 1, night mode

Distance = 2M

Original picture and real scene



1080P	3MP	5MP

1080P	3MP	5MP	Original picture

When the camera switches to night mode, the image will be displayed only in black-and-white. We use the IR-LED to provide the extra light. The effective distance to the IR LED is about 20M~25M.

Similar to low light environment, 1080P can still see clear title, and the detail of subtitle. But in 5MP, you can hardly recognize the word, and the noise is very high. The edge is blur, not sharp either. You can also see the lower part of picture, the date in 3MP and 5MP are also unrecognized.

Summary

Please always be reminded, high resolution cameras might have much noise under a low light condition. So you should always provide enough extra light source in your environment.

Besides, you should take the installation position into consideration as well. Good location can get much brighter; good angle can make the target in image clearer.

High resolution camera can't always make your image quality good. There are several factors should always be taken care of simultaneously. The balance of lighting, camera angle, install position and proper resolution will be the key point of capturing a video.