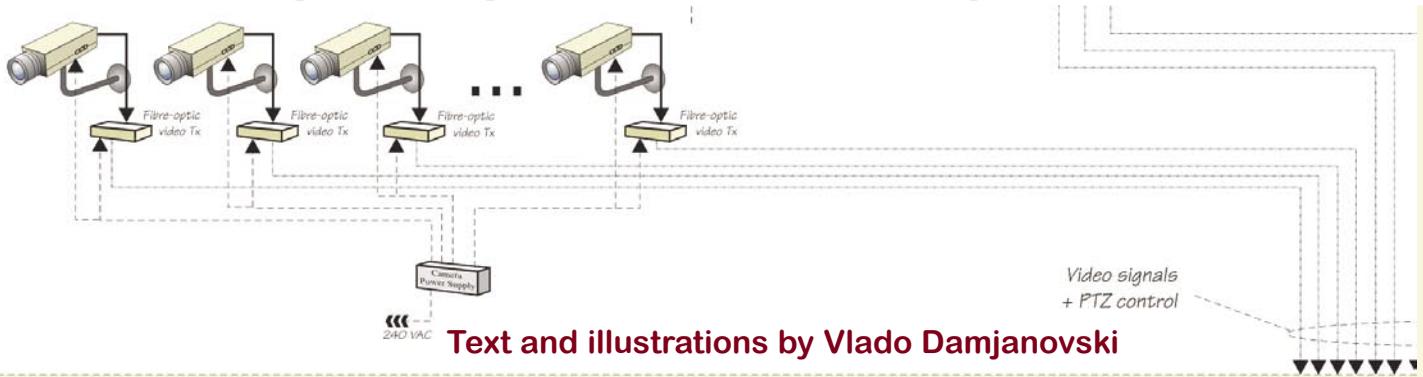
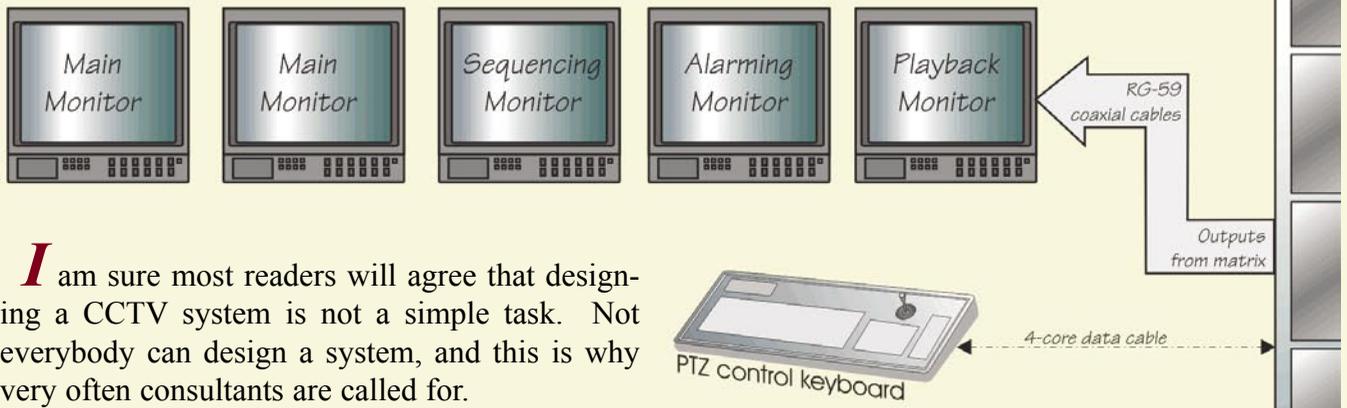


Designing a CCTV System



Main Control Room



I am sure most readers will agree that designing a CCTV system is not a simple task. Not everybody can design a system, and this is why very often consultants are called for.

One has to have at least the basic knowledge of all the CCTV components and stages in a system, understand cameras and their performance, the image display quality, recording, playback, transmission, etc., and be able to put all these together in a functional unity.

But most importantly, prior to designing a CCTV system, we need to know what the customer expects from it. This defines the design approach and components to be used.

The customer could be a technically oriented person and many such customers understand CCTV probably as good as we (the “experts”) do, but most often they would not be aware of the latest technical developments and capabilities of each of the components. Lately, this has become lately, even more pronounced with the introduction of yet another discipline to CCTV - Digital and Information Technology.

So, are there any rules or standards when designing a CCTV system?

There are no written rules or standards. Many experienced consultants and system integrators have developed their own “strategy” and all I can suggest here is from my own experience. I do not insist on that being the only and best method, but will certainly help young and inexperienced CCTV engineers to have a good starting point in their designs, and even, perhaps later on, become consultants themselves.

Unfortunately, as we all know, there are some “consultants” which have no understanding (or creativity), and many of them just simply do a “Copy and Paste” routine from older Tenders. This creates not only confusion among the suppliers, installers and system integrators, but most importantly, do not produce the effect they are intended to have. Certainly, this practice is very damaging to our industry, and we have to condemn it whenever possible.

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So, where do we start?

The most important thing to understand is the general concept of the surveillance the customer wants. Do they want constant monitoring of cameras and activities undertaken by 24-hour security personnel, or perhaps just an unattended operation (usually with constant recording), or maybe a mixture of the two, or even perhaps a remote site monitoring via telephone line, or network?

Once the general requirements are understood, a good suggestion is to analyse what is possible and what not. It is always much easier to avoid or prevent a design that has impossible or impractical requirements, rather than try and do the same after the system has been completed, just to find out that what was originally requested is impossible to achieve in the first place.



Experience shows that it is much easier to modify the general direction of a design in the very early stages of the discussions with the customer, than to try and do this at a more advanced stage. This could refer to, for example, designing a system to work with images transmitted over telephone lines, and accept customer's requirement for "live" viewing at a frame rate of 25 pictures per second. If you know that such a thing can not be done, don't give false hopes to the customer just to get his money. Explain what "live" transmission of images means

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in technical terms and why it is not possible. Maybe you will then discover that the customer actually thinks of getting still images at the actual moment of connection, rather than playback what happened one hour earlier. Perhaps a more realistic scenario would be that the customer will understand what you have just explained and accept the facts. So when the actual system is put in place, he/she will understand why there are only a few images per second (or less). Further more, not only that, he/she will respect your expertise even more because you have told him/her exactly how the system will perform.

Another typical example would be to have a larger site with cable distances exceeding half a kilometre and expecting the whole job to be done with RG-59 coaxial cables, without foreseeing the need for in-line amplifiers, signal losses and most importantly ground loops. It is much better to foresee the potential problems, and instead of fixing them later, suggest a better solution with fibre-optic cable perhaps (or a good quality twisted pair), which although initially may look more



expensive, in the long term will save a lot of trouble in fixing and repairing problems, but most importantly give the best picture quality.

So, there are many questions you could ask your customer in order to clarify your “design vision.”

Amongst the many questions and variables that need to be considered are: What happens if a number of alarms go off simultaneously? Which monitor should display the alarms? Will the alarms be recorded with the same or different recording speed on the DVR(s)? What is

the picture quality going to be? Operators access levels? And so on.

Those are the variables that define the system complexity and like in mathematics, in order to solve a system with more variables, one needs to know more parameters. They can be specified by the customer, but only after the customer has understood the technical capabilities of the equipment.

Understandably, it is imperative for you, as a



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CCTV expert, to know the components, hardware and software you would be offering and achieve what is required in the best possible way.

You would create a favourable impression in the customer's mind, if at the end you give him/her as much as (or even more than what) you have promised. But you would certainly prove unsatisfactory if you don't. Remember that if the customer is fully satisfied the first time, chances are he/she will come back to do business with you again.

To put it simply: Don't claim the system will do this and that, if you are not certain and make sure your system delivers what you say it will.

So, without any doubt, to design a good, functional system, one has to know the components used, their benefits and limitations, how they interconnect and how the customer wants them

to be used.

The first few parts are assumed to be fulfilled, since you wouldn't be doing that job unless you know a few things about CCTV.

The latter one, i.e., what the customer wants, can be determined during the first phone call or meeting.

Usually, the next thing to do is a site inspection. Here is a short list of questions you should ask your customer prior to designing the system and before or during the site inspection:

- **What is the main purpose of the CCTV system?**

If it is a deterrent, you need to plan for cameras and monitors that will be displayed to the public. If it is a "post-event" surveillance, you will need to pay special attention to the quality of recording and easiness of controlling the play-back, searching, extracting images or files, etc.

- **Who will be the operator(s)?**

If a dedicated 24-hr guard is going to use the system, the alarm response needs to be different to when an unattended or a partially attended system operation is expected. This will also dictate the number of operators and monitors in the control room.

- **What are the light levels at areas cameras**

SMS PC, Windows NT
Telephone(s), Radio(s),
Play-back VCR and Video Printer
in the middle part of the console.

Monitors cover (tinted glass):
- Protects monitors from dust
- Improves clarity and visibility
- Easy to clean surface by just one wipe
- When monitors are off => clean, dark and smooth surface
- When monitors come on (alarm) attracts attention





are supposed to survey?

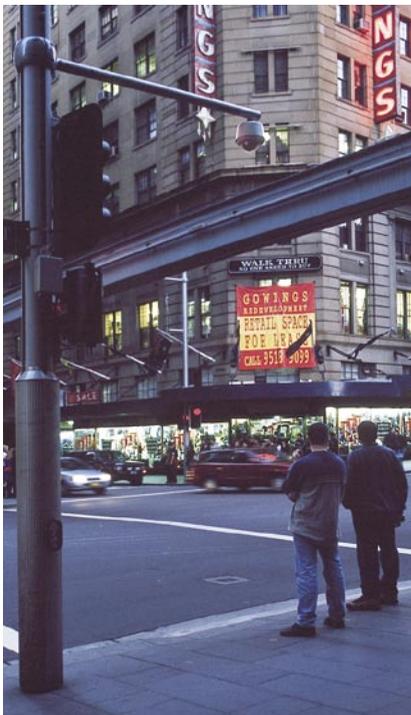
This will dictate the price, as well as the minimum illumination response. Consequently, the lighting in the area needs to be looked at. A colour picture will give more details about the observed events, but if the intention is to see images in very low light levels, or with infrared lights, an alternative system with B/W cameras could be considered (unless the customer is prepared to pay for some of the new cameras available on the market that switch between colour and monochrome operation).

The price of a colour system is dictated not only by the cameras, but also by the monitors, DVRs, compressions, etc.

- How many cameras are to be used?

A small system with up to half a dozen cameras can be easily

handled by a switcher or a DVR, but bigger systems usually need a matrix switcher or a larger number of networked DVRs. CCTV uneducated customers would usually ask for the minimum number of cameras in order to save on costs, but at the same time still expect to see everything around their premises. This could be a point in time to explain that if a camera has a wide angle of view and covers the whole shop, one can not expect same face recognition of a person 1m and 10m away from the camera.



- How many of the cameras will be fixed focal length and how many PTZ?

There is a big difference in price between the two, because if a PTZ camera is used instead of a fixed one, there is extra cost in the zoom lens (as opposed to the fixed one), the pan and tilt head or dome, the site driver and

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the control keyboard to control it. But, the advantages your customer will get having a PTZ camera will be quadrupled. Many modern PTZ camera domes have smart preset positioning, automatic tours scans, auto-focusing, etc. The system flexibility and efficiency will be too great to be compared with the fixed camera system. But it will require some extra software and hardware to control, as well as planning of locations for optimum coverage. A system with only one PTZ camera and half a dozen fixed ones is a choice that may require a dedicated keyboard for PTZ control. If there are more than a few PTZ cameras, perhaps a matrix switcher should be considered. This will increase the price dramatically (compared to a system with only fixed cameras). Alternatively, with the latest DVR technology PTZ camera control can be achieved via DVR's software control, although very often this is a bit more cumbersome and slow, but it should be considered and explained.

- How many monitors and control keyboards are required?

If it is a small system, one monitor and keyboard is the logical proposal, but once you get more operators and/or channels to control and view simultaneously more cameras, it becomes harder to plan a practical and efficient system. When considering monitors, care should be taken regarding the size of the monitoring room, the number of monitors proposed, their size, height, heat and EMF radiation, etc. Certainly, this very much depends on how many cameras are in the system and how many operators are expected there. Care should be taken for the operators' health and the possible strain too many monitors can put on the eyes and brain. This then, has a consequence in the efficiency of the controlling incidents.

- Will the system be used for live monitoring (which will require an instant response to alarms), or perhaps recording of cameras for later reviewing and analysis?

This is the question which will define whether you need to use DVRs, what type and what capacity of recording. If you have a matrix switcher, you will still need a DVR for recording, then con-





sideration should be made for the looping of video signals from one to the other device. The greatest number of questions I have heard in the last couple of years (since the introduction of DVRs) is "how long can I record on the allocated hard drive space?" Make sure you explain to the customer that there are too many parameters which define this length, but the most important parameter is his/her decision of the expected quality of the recorded images and their frequency of recording. This will be the point in time to clarify where the cameras are going and estimate what will be the amount of activity in the camera's field of view, which will define the percentage of movement across 24hrs, which is then used to calculate an estimate of the recording capacity. Another important fact to be raised here is how long should the recording period be, before the DVRs start to recycle. Very often a realistic compromise should be found between cost, hard drive capacity and practicality. There are some special cases where the customer will insist on many months of storage, which can be done if the price is not a problem, but realistically, the most common solutions are with recordings of a few weeks.

- What transmission media can be used on the premises?

Usually a coaxial cable is taken as an unwritten rule and installation should be planned accordingly. Sometimes, however, there is no choice but to use a wireless microwave or even a fibre optics transmission, which will add quite a bit to the total price. If the premises are subject to regular lightning activity, you'd better propose



fibre optics from the beginning and explain to the customer the savings in the long run. So, you have to find out more

about the environment in which the system is going, what is physically possible and what is not and then plan an adequate video and data transmission media.

- **Lastly and probably the most important thing to find out, if possible, is what sort of budget is planned for such a CCTV system.**



The answer to this question will

define and clarify some of the previous queries and will force you to narrow down either the type of equipment, the number of cameras or how the system is expected to work. Although this is one of the most important factors, it should not force you to downgrade the system to something which you know will not operate satisfactorily.

If the budget can not allow for the desired system, it is still good to go back to the customer with a system proposal that you are convinced will work as per his or her requirements (even if it is over budget) and another one designed within the budget with as many features as the budget will allow for. This will usually force you to narrow down the number of cameras, or change some from PTZ to fixed.

The strongest argument we should all use when suggesting a system design is that "a security CCTV system should be a reliable and a secure one." This can only be done if the system is designed properly. Thus by having a well-designed system, the reliability and security should be inherent, thus bigger savings will be made in the long run.

By presenting a fair and detailed explanation of how you think the system should work, the customer will usually accept the proposal.

