ELTEC INSTRUMENTS, INC

ELTEC data #126

Some Notes on Conditional - and Other Factors Relative to the Evaluation of Eltec Passive Infrared Telescopes for Outdoor Intrusion Detection

There are not at present any recognized standards or criteria for evaluating an outdoor intrusion detection system. The main difficulty is that there are too many variables, too many conditions that apply to one situation and not another.

The demands on an outdoor intruder detector are severe. The target might be a thief or terrorist. There are many considerations but unfortunately, few applications can be accurately quantified.

However, as our telescopes, deployed for over 20 years, prove successful in each new application, our confidence grows that they will be appropriate for the next application considered, even though there will be a new combination of conditions (including the actual facility threats).

This paper compares a difficult industrial monitoring application with the task of detecting an intruder outdoors. Since many have industrial/logistical control backgrounds or have dealt with sensor systems, I hope the comparison provides an insight into tasks that have become much more important in the past few years.

We manufacture an industrial sensing device*, our Model 824M2. In one application there are several dozen of our devices on line 24-hrs per day, 7 days a week. These units are in a glassware manufacturing facility. There is a turntable of large metal molds for glass products that produces 2 parts per complete cycle. The turntable indexes 2 steps at a time for mold check, glass glop added, male mold pressing, flame polishing, some other steps, and finally, part ejection. There are 2 of our special sensors, each about 1 meter from each of the ejected glass parts. If each of our sensors does not signal that hot glass has passed in front of it – the machine shuts down. Double-molding would do several thousands dollars damage to the molds and cause line shutdown and loss of production.

Many types of sensors were tried before the Eltec. Either none worked or none would survive the extremely hot environment.

Analysis: Whenever a new Eltec sensor is placed on-line, it is visually watched for many cycles. If it does not operate or falses, it is returned to Eltec. Since the environment is horrible, the initial cycles are exactly like all the cycles to follow. (But walk testing an intruder alarm at 7:00 AM is not like walk testing at noon or midnight or during high wind or rain, thunder, lightning or many other environment influences or combination of variables).

Further: If the Eltec sensor on the glass line alarms during a cycle (falses), the operators on the line now have years of experience with the devices and check to see if some other hot object has been moved through the field of view, or if someone is welding, or if the sensor position has changed due to constant vibration loosening a mounting bolt. If the one false is not explained by the production people, the maintenance people take a more careful examination and may simply replace the unit to see if a "fresh" unit behaves the same.

Please note: This monitoring is so important to the glass company that they would rather have many falses than one miss.

Compare the attitude just described with that behind the "dual technology" indoor intruder alarms that feature both microwave and infrared detection circuitries. The units are judged almost exclusively on a False Alarm Rate basis and the majority of units operate in the AND mode. Thus the intruder only has to defeat one of the technologies to prevent the alarm. Elimination of "falses" is more important than maximization of "catches". A very different attitude!

Which brings us to an extremely important distinction between detecting glass cups and intruders. The glass cups will not try to thwart or frustrate our attempt to detect their presence. The intruder, on the other hand, does not want to

* Note that the industrial application utilizes a sensing system very similar to our "people detecting" thermal telescopes.

be detected and will work actively to prevent detection. Moreover, unlike the children's game of "hide and seek", the situation of our trying to detect an intruder involves dealing with another individual (or individuals) who play by no set of rules. Killing a guard, destroying property, striking when you are most vulnerable – Why not!

And what resources are available to the intruder? Who knows? Maybe it's a poor person who wants to steal some tools to sell for drugs. Or maybe it's someone who can obtain a special aluminum or magnesium ladder-set that can easily bridge a 4 meter width and 3.3 meter height of a double-fence system.

The second distinction between the glass cups and the intruder is that in addition to always behaving in a very predictable manner, the transfer of the cups from the molds to transfer conveyor takes place thousands of times. And this frequency of the "catch" situation allows us to calculate very reliable statistical predictions regarding both "catch" and "miss" of our system. Whereas, there are so few actual intruder attempts that we have no valid basis for projecting our security quotient.

And we never will! Because if the frequency of the intrusion attempts rises sharply, we will place armed guards on duty. There is no choice – especially if we must prevent dangerous materials, life sustaining systems, or strategic locations from falling prey to those who would misuse them to the detriment of the public.

Nevertheless, the fact remains that normally it is cost prohibitive to station a guard every 2 meters for 24 hours per day. And it is reasonable to assume that a security system (double fences, sensing devices, minimum guards, random security checks, etc.) can be provided that is cost effective.

From an instrumentation point of view, that which is to be detected is a human being. That is a biological entity radiating long wave infrared photons to the extent of approximately 80 to 100 watts.

This entity is not a presence within the confines of the area which we wish to protect. So the person will have to move. And in moving, will provide a thermal contrast, positive or negative, to the ambient background.

Attempts at insulation will drive the intruder's ambient temperature far above body temperature in a short period of time and provide a physically untenable situation. Attempts at diffusing radiated energy will involve bulky objects or attire – which will seriously impair the intruder's ability to cut or climb fences. And even if the intruder achieves a surface temperature equal to that of the background – has the intruder maintained the optical emissivity of the background?

Only in a completely closed thermodynamical system will both emissivity and the inverse square law of radiated power cease to have effect on objects within the system which all would be at equal temperatures. The radiant exchange between objects would always be zero net.

It is not that an intruder will never be missed. Rather, he can never have the confidence that he has avoided detection. In fact, since "passive infrared" is indeed passive, it is especially useful in covert applications.

Note: Moving vehicles are actually easier to detect than people. In situations of great potential danger it is advisable to position thermal telescopes so that "actionable" warning is provided.

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