Transforming the Light Curtain:
Using Pattern and Object Recognition for Safer Material Transfer

Industrial safety has evolved considerably since its beginnings in the early 20th century. The number of injuries occurring on an annual basis typically is used to measure workplace safety; over the past century, this metric has improved dramatically. Some of the progress is the result of regulations; but it is also due to advances in safety technology.

Take, for example, the safety light curtain. Light curtains are opto-electronic devices that safeguard personnel in the vicinity of moving machinery that have the potential to cause harm; they are typically used as an alternative to mechanical barriers and other forms of traditional machine guarding. By reducing the need for physical guards and barriers, light curtains can increase the maintainability of the equipment they are protecting. The operability and efficiency of machinery can also be improved by the use of light curtains; for example, they allow easier access for semi-automatic processes.

Light curtains fall into a category of equipment known as presence detection devices. Typically, light curtains are supplied as a pair with a transmitter and receiver. The transmitter projects an array of parallel infrared light beams to a receiver that consists of a number of photoelectric cells. When an object breaks one or more of the beams, a protective stop signal is sent to the guarded equipment.

The light beams emitted from the transmitter are sequenced, one after the other, and pulsed at a specific frequency. The receiver is designed to only accept the specific pulse and frequency from its dedicated transmitter. This enables the rejection of spurious infrared light and thus enhances their suitability as components within a safety system. Light curtains are ordinarily connected to a safety relay that will remove power from the hazard in the event that an object is detected.

New Solution for Material Transfer
In material transfer applications, safety controllers with muting functionality are used. This enables the temporary disabling of the safety function to allow objects to pass through the light curtains without tripping the safety relay. Muting is particularly useful for machinery with semi-automatic processes.

Because of its usage historically, muting is often considered the only option in these applications; but this is no longer true. In 2005, a new technology was introduced commercially that can improve the safety performance and cost efficiency of light curtains in material transfer applications: pattern and object recognition. In fact, light curtains using pattern and object recognition require fewer sensors and less wiring while providing a safety solution that's more secure than muting.

Both methods are Type 4 safety devices, so the difference is not going to show up in a safety assessment; however, it's much easier to defeat muting sensors mounted on a conveyor than it is to fool the beam data that is inputted by recognition technology assessing, say, a pallet or load of goods. Let's take a closer look at this technology to understand this advantage.

Object and Pattern Recognition in Light Curtains

Object recognition (also referred to as goods detection) is used to differentiate between a person walking through the protective field and goods being transported. The size of the goods, along with desired tolerances, can be easily configured via computer software. It is also possible for the safety light curtain to learn new sizes through a teach-in function that does not require a computer. Pattern recognition (also referred to as pallet detection) is used to differentiate between a person walking through the protective field and a pallet. The size of the pallet legs and the distance between them does not need to be configured. When the safety light curtain is in pallet detection mode, it determines that an object is a pallet by looking for two to five objects that are no larger than 240 mm in size. Once it has determined that the number and the size of the objects are consistent with a pallet, it allows the pallet to pass through—as long as the objects do not change in size and they remain a consistent distance apart.

With object and pattern recognition, it is possible to configure the number of objects, object sizes, the distances between objects, and tolerances for applications that use atypical pallets or skids. Safety light curtains using this technology analyze the beam data that is read by the receiver to determine the sizes and distances of objects and pallet legs.

The ability to read beam data makes object and pattern recognition technology particularly valuable in material transfer applications. Depending on the model of light curtain, each unit has a set number of beams that are uniformly spaced along the length of the protective field. The system determines the size of an object by how many beams are blocked. It recognizes and reads the legs of a pallet—it can see that the legs are a certain distance away from each other, or that they are a certain size. Reading pallet legs is the safest process for material transfer applications.

Bottom-Line Advantages

When compared to traditional muting, object and pattern recognition provides an array of advantages in safety light curtains:

- Lower capital costs. Less wiring and fewer sensors help reduce the cost. Traditional muting solutions require one set of safety light curtains, two to four muting sensors, a safety relay, and a module to perform the muting logic. Object and pattern recognition light curtains do not require any external sensors, as all the logic and safeguarding is done with one set of light curtains and a safety relay.
- Lower labor costs. Installation time is also reduced due to less wiring and fewer sensors to mount and configure.
- Better detection. Traditional muting solutions cannot detect a person walking alongside the goods passing through the protective field. For this reason, hard guarding must be used to ensure there is no space for a person to walk alongside the goods. This is also true for goods detection. On the other hand, pattern recognition technology will recognize a person walking alongside the goods. This is because the safety light curtain is looking at only the pallet legs and a person walking will be considered out of standard by the system.
- Ease of configuration and minimized downtime.
  Object and pattern recognition technology offers a host of software-configurable functions that are used to optimize performance and minimize downtime. These include direction detection (i.e., the safety light curtain can be configured to only allow objects to pass through the protected area in one direction), reduced resolution (i.e., so that loose objects up to 60 mm can be ignored to reduce false trips), and object gap detection (i.e., allowing gaps of up to 11 mm between goods to be ignored to reduce false trips).

Typical Applications

Object and pattern recognition-based light curtains are ideal for material transfer applications such as robotic and non-robotic palletizers or de-palletizers, end-of-line packaging, and automated assembly lines in the automotive, food and beverage, and consumer goods industries. They are particularly apt for use in high-paced, high-volume distribution centers.

The technology's ability to configure a large number of objects, the different distances between objects, the size of each individual object, as well as tolerances, is a huge advantage in material transfer applications, especially when the material being transferred is not a normal pallet or solid block of goods. Not surprising, the technology has made tremendous inroads into the automotive sector, where car bodies are being transferred throughout the production process.

Using the Right Tool

A philosopher once noted that anxiety could be attributed in large part to trying to do today's jobs with yesterday's tools. If so, safety engineers should be breathing a sigh of relief. Object and pattern recognition technology is transforming safety light curtains into more effective tools for material transfer applications. As the technology is better understood, we can expect to see increasing utilization in all industrial sectors, since material transfer is a ubiquitous process.

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