

Technology: For increased productivity and improved safety

Thomas R Cutler's emphasis on the benefits of the new technology system are further elaborated on in The Machinist

The TotalTrax system provides complete vehicle and inventory tracking system for the production environment. Since trucks and forklifts represent a major danger, a wide spectrum of technologies can be used to detect trucks. These can be functionally categorised beginning with presence detection.

GENCO supply chain solutions, North America's largest US-based 3PL and a global top 50 logistics provider, adopted the TotalTrax system from Sky-Trax for their 328,000 sq ft reverse logistics facility in Atlanta, Georgia. This new technology system provided complete vehicle and inventory tracking system for the production environment, in this case, consisting of ten forklifts and more than 120 teammates.

According to Wayne Baxter, President of BaxTek Solutions, a leading systems integrator focused on leading technologies impacting quality, traceability and safety, "The value of this new system is the ability to track and verify each and every pallet move from put-away to picking, staging and shipping with 100% accuracy. The technology "mistake proofs" the operational process by removing human interaction completely. No human errors can occur, and the operator does not take time to use a scanning device to acquire load or location ID."

Cary Cameron, Senior Vice President, Strategic Processes and Technologies of GENCO, a Pittsburgh-based company says, "Manually entered data provides the opportunity for inaccuracies, when an operator has to reach for a device to scan or manually enter location and pallet information, they are losing productivity". A solution is required where the operator is allowed to drive the product in and out. GENCO worked on an Active/Passive RFID project to automate the what and where of their operation before installing the dynamic technology in their Atlanta facility. However, after two painful years of working on the project, the company decided that RFID was costly, inaccurate and unreliable. Mr Cameron said, "Our flaw was improper location identification of pallets and we wanted a solution that corrected the root cause of the problem."

Solution and value

In less than three weeks after this new technology was implemented, the value metrics were significant:

- 100% accuracy of the "where" (location)
- 100% accuracy of the "what" (pallet)
- 47% productivity gain
- Reduction in training cost from several hours to ten minutes.

In fact, only two days after Total-Trax was installed, the site was

averaging 18.5 pallet moves per hour, exceeding the goal of 15 pallets per hour, which had never been achieved before.

Mr Baxter used to keep a tab on the implementation of the facilities, documented the capability of reaching upwards of 40 pallet moves per hour—160% over goal. GENCO was able to remove one forklift driver per shift from operations. Twenty weeks after implementation, GENCO was averaging 22 pallets per hour and realising a sustained 47% productivity increase.

After using the new technology for more than 20 weeks

The following results continued to astonish:

- 10% equipment reduction
- 61% labour reduction in three operational areas
- Customer satisfaction improvement
- Enthusiastic teammate acceptance

"It is the grab and go system. All we have to do is drive, and we do not get blamed for putting things in the wrong location," says one operator. Additional features implemented after initial installation have included task interleaving and routing optimisation, which increased forklift use by reducing travel distance. Shipment verification is done by recording each pallet ID as

it is loaded through the correct dock door.

According to Mr Cameron, "The technology is a proved one and can replace manual data collection to truly provide automatic identification. We have determined our baseline without interleaving and routing, and we expect a 50-60% efficiency gain once it is fully tested."

Safety technology for detecting trucks

Mr Baxter insists, "Safety and productivity are compatible and easily cost-justified. Since trucks and forklifts represent a major danger, a wide spectrum of technologies can be used to detect trucks. These can be functionally categorised, starting with presence detection."

Presence detection

Whether the vehicle is in the detection zone or not is being signalled by the detection sensors. There are cases wherein the detection distances are configured. The automotive engineers are familiar with the inductive or capacitive proximity sensors and the photoelectric sensors.

The proximity sensors have a short detection range. They are capable enough to detect large metal masses, for example, a truck that is at a distance of usually less than 1-2 metres. They are applied at chokepoints like dock doors. The photo detector sensor can also be applied for the same. Warehouse safety products like fork-alert and alert safety too are based on the same principles.

The fork-alert vehicle beams infrared light from the top. The receiver on the other side can receive the signals up to a distance of 25 metres and can warn the pedestrians and other drivers through warning lights or audible alarms. One can always see the alert

safety devices fixed on a wall or post with combined features of light source and the detector. The sensor configured vehicles running on the roads can detect those reflective tapes, which are applied on both sides of the forklifts.

The microwave sensors also work on the same grounds. The detection scope is matched with the area of interest like in the case of warehouse intersection warning products—doorman and alert safety products. The microwave sensors aim at all directions as it is fixed with four sensors and the warning light, which is hung above the intersection. If a vehicle is approaching, it detects it and the warning system starts alerting.

Presence and distance detection

The next-gen sensors not only detect the target but also measure the distance of the sensor to the object as well. A note from BaxTek solutions says that the fundamentals are the ultrasonic range sensors and the laser time-of-flight sensors. The ultrasonic sensors emit high frequency sound waves that are too high for the human ear to hear. The sensors can determine distance up to 10 metres, when they are reflected from a solid object.

Laser systems are used in high-end safety systems on automated guided vehicles (AGVs). They have extraordinary features like high accuracy and long range. They calculate the distance by the time-of-flight calculation formulae on the reflected laser beam. The SICK GmbH's commercial safety scanner can be programmed from any area and is configured with warning and emergency stop thresholds.

Presence and identification

The RFID technology is used for tracking inventory in warehouses. The RFID reader reads the tags within less than a metre's distance.

Mr Baxter comments, "The longer read distances of tens of metres are possible with active RFID systems. They identify and detect tagged entities within the read zone of the RFID reader. This capability has been employed widely for security and access control applications."

Location and tracking systems

The next generation of safety systems for warehouse operators would be systems that can track forklifts and the location, and is known as real-time location services (RTLs). The new developments are the radio frequency (RF RTLs) and optical RTLS systems.

The RF RTLs tracking system can track vehicles with RFID tag as they are read by the radio frequency receivers in the detection region. The hi-tech workstation calculates the time and location through triangulation techniques. The leading suppliers of this technology are AeroScout, WhereNet and Ekahau. Moreover, the overall accuracy in the industrial buildings is 2-5 metres.

The most recent advent for tracking down vehicles in warehouses is machine vision for optical RTLs. This concept is widely used in industrial automation for high-speed package sortation, automated product inspection and robotic guidance. Mr Baxter says, "Sky-Trax has adapted this technology for the accurate and reliable tracking of forklifts inside buildings. With the Indoor Position Sensing (IPS) technology, vehicles are tracked in real time to an accuracy of 10-25 cm. Important to many safety applications, IPS systems also know the speed and orientation (direction) of each tracked vehicle."

Small image sensors are planted on each vehicle to look up at the ceiling according to the IPS system. They point towards an array of

low-cost printed tags. The sensor has image processing intelligence that captures and analyses pictures of the ceiling several times per second. It can calculate the exact two-dimensional position along with angular direction of the vehicle. The valued information is then transmitted to a computer wirelessly, which evaluates the location and status of the vehicles in real-time.

Technology for detecting pedestrians

In industrial settings, there are two types of pedestrians. The first is the one who works on foot in an area with the forklift traffic-hand truck operator or an order picker. These workers are required to wear safety costumes. The other type is reckoned to be visitors (vendors, front office staff and contract maintenance workers) as they don't work in that particular area, are less familiar but are well aware of the dangers involved. They are less predictable and controllable and create a high risk level. They don't wear safety devices or a transponder for some tasks, for example, while entering the forklift area. The safety instructors need to be strict enough while dealing with these kinds of pedestrians.

Tracking pedestrians with machine vision

The image processing research over the last ten years has made immense progress in terms of developing methods for detecting, identifying and tracking pedestrians in video images. Mr Baxter suggests, "These technology improvements are driven largely by the need for smart surveillance and security systems... the technology has moved beyond military uses and is now used in commercial applications."

There is a tracking system by Brickstream since 2002, which tracks

and analyses the customer mobility in the commercial buildings. The overhead cameras take a count of the number of people entering a store and the path chosen by them. This following technology is carried out in the retail and banking sector to track down the queues by the customers.

The above technology has so far not been applied to collision-avoidance systems but is expected to be in the near future. The reason being industrial spaces are less diverse and more orderly as compared to streets and stores. The technique holds good in tracking the pedestrians in warehouses. The data includes location, movement and the speed of the pedestrians to stop accidents in the forklift operating area.

Speed control for safety

The major contributor for the collision and stability-induced incidents is speed. According to BaxTek Solutions, "Systems to control speed are in a significant way technology that will improve safety. The best solutions will do this without impacting productivity."

The medium size forklift has the same destruction abilities as that of a small dumping truck as it holds the same mass. The 5000-pound forklift truck with a 4000-pound load when moving at 10 miles per hour offers the same momentum as that of a Cadillac moving at 20 miles per hour. One must control the speed to provide safe halt. The forklifts cannot stop safely on a dime unlike automobiles. A sudden and panicked stop puts an additional endangerment with loss of handling capability and unstable loads.

There are several inputs involved to stop, which include speed, mass, driver reaction time, driving surface conditions and the braking system performance. The key areas that can be controlled by the driver are the

speed and reaction time. The technology also helps in these areas. It can help as a guide by providing advance warning and direction to limit speed. It confirms adequate stopping distance based on location, load, vehicle type and known risks.

The safety systems are applied for safe stopping, the drivers need to obey the speed limits. These rules are often violated on the highways and many of the forklifts are not equipped with a proper speedometer. "Complicating the situation, the safe speed changes as mass changes with loads, and driving surface conditions vary at different locations in the facility. Unfortunately drivers often experience more pressure to be efficient (drive fast) than to be safe," suggests Mr Baxter.

There is a dilemma cited on installing speed limits on trucks for control as the reduced speed are an unnecessary restraint on productivity. BaxTek Solutions concludes, "Allowable speed must vary as the vehicle moves from location to location and as conditions change. This can be accomplished with technology that monitors the conditions, the location, direction and speed of the vehicle and also of all the other vehicles and pedestrians in the area."

Safety must now include an intelligent safety system (ISS), which provides a direct means for alerting drivers and pedestrians when hazards exist and automatically limiting speed. Safety and productivity are possible through advanced technologies. These tools grow, advance and alter the landscape of industrial production daily. ■

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