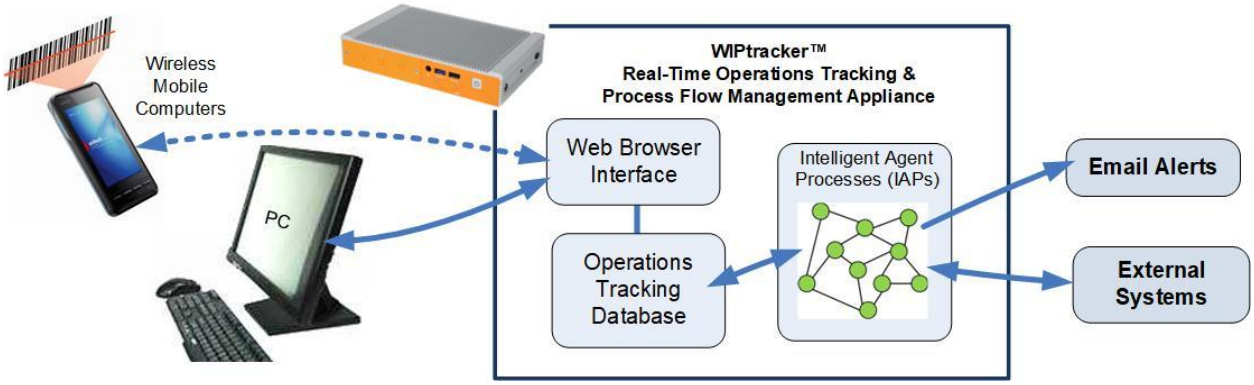
Detecting Employee Theft in Manufacturing Operations

Dr Peter Green

Introduction

Employee theft can be a problem for those organizations that process valuable raw materials, such as copper or silver or manufacture products, such as automobile parts, which have a resale value over the internet or, even worse, for those that make products such as pharmaceuticals, which have a ready black market. This white paper is about using a WIPtracker™ appliance to detect employee theft in manufacturing plants as well as in industrial distribution warehouses that do secondary operations.



WIPtracker is an IOT (Internet of Things) appliance that contains three elements:

1. A barcode tracking system to enable the real-time capture of the flow of materials through each manufacturing plant or warehouse.
2. An operations tracking database in which all the inventory and job tracking transactional data is captured.
3. A set of intelligent agents that periodically evaluate the contents of the tracking database to detect possible theft and send alerting messages to managers and their staff.

A key element in detecting and preventing theft is early detection. It is no good discovering that instead of having 5,200 widgets in stock, according to your ERP system, that you only have 4,300 when you take annual inventory, as by then whoever took the widgets is probably long-gone or has covered his or her tracks. That is, if theft has even taken place at all.

In one incident, the materials manager for a mid-sized manufacturing plant had been a diligent long-term employee, who had not taken a long vacation for years. But one year, his wife persuaded him that it was time to take a longer vacation. As a result, the CFO, to whom the materials manager reported, stepped in and did the materials manager's job for several weeks.

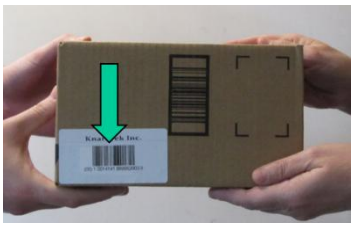
During this time, a shortage of 9 large paper rolls, which were used to make the company's products, was discovered when they went to run a job needing these rolls.

As these rolls of paper cost about $100,000 each, this alarmed the CFO, who immediately blamed and then fired the materials manager upon his return from vacation.

Subsequent investigation revealed that these were “ghost” rolls existing in the ERP system but that did not exist in reality. What happened was that the company purchased these rolls and then processed them into products, which were shipped to customers. When the finished products were shipped, their ERP system “back-flushed” the quantity that was needed to make the products shipped, according to their BOMs (Bill of Materials), to get the estimated inventory of raw materials in stock.

But no-one bothered to take into account the resultant scrap paper in this process. Someone else was diligently collecting, weighing, and recycling the scrap paper but this was never subtracted from the raw materials paper roll inventory. As a result, over time, the ghost inventory grew to over $900,000, which resulted in the materials manager being falsely accused of playing a role in stealing these rolls. I do not know what the outcome of the resultant legal defamation suit was but it probably cost the company well in excess of the value of their 9 ghost rolls.

Detecting Inventory Theft



A key element in detecting theft is to track each container of material or individual item by placing a tracking barcode on it and recording whenever materials are added or subtracted from the container, or the container or item is received, moved, used, or shipped, in real-time. This is similar to the process that FedEx, UPS, and Amazon use to track boxes and other containers of material in their distribution networks.

Rather than trying to check for inventory shortages by counting all the products in the warehouse, which typically requires shutting down the warehouse, possibly for days, we can periodically check the containers and items, in each section of the warehouse.

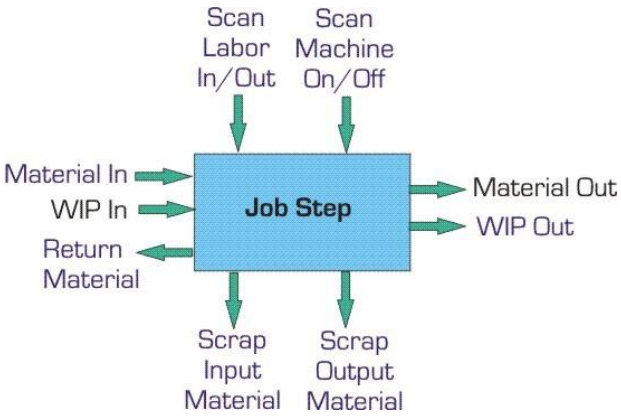
This is made possible by using barcode scanning to record when each container is placed on each shelf and then recording when materials are used from each container for production.

To check each shelf or floor location, we only need to shut down that shelf or floor location for a few minutes to check its contents, without the need to disrupt production by closing the whole warehouse. As a result, it is feasible to spot-check the contents of part of a warehouse, floor area, or production area frequently, on a periodic basis, thus enabling early detection of theft and probably its deterrence.

With WIPtracker, in inventory checking mode, a mobile computer with integral barcode scanner is used to incrementally record what is on each shelf or floor location. Then, on a nightly basis, an intelligent agent can do a check against what was supposed to be there, at the time the check was performed, and alert a manager if there was a meaningful discrepancy. By doing the check nightly, WIPtracker can also compensate for pallets that are temporarily moved to another location by a material handler, who then forgotten to move them back.

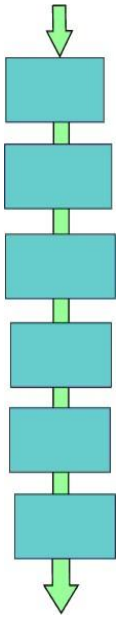
Detecting Work-in-Process Theft

Another powerful method of detecting theft is to record materials consumed and produced in each manufacturing work order step compared with the stored BOM for each step.



Materials are scanned into each manufacturing step by scanning the tracking barcode on each input container and recording the quantity removed. If there is not sufficient quantity in the container then the production worker will record the actual quantity withdrawn. If there is a discrepancy between what is supposed to be in the container and what is actually there, then an intelligent agent will send an alert to the materials manager.

Theft detection is further helped, in make-to-order manufacturing, by the fact that most high-value materials are purchased for specific projects. As a result, all containers except those for common stock (such as nuts, bolts, and washers) are designated for a project. WIPtracker then enforces the rule that only designated materials can be used for making products for the customer project. This makes it even more likely that missing materials will quickly be detected.



WIPtracker also records the work-in-process (hence the name) flowing from one job step and into the next. This enables detection of missing material not recorded into a barcoded WIP tote, such as that shown here, as well as materials stolen between job steps. This is not feasible with ERP systems, for which WIP materials are a black hole.

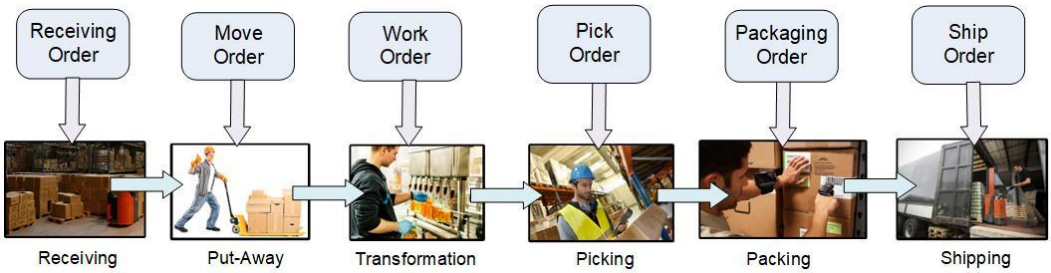
Also, materials are recorded incrementally, as they are consumed on job steps, thus enabling WIPtracker to have an accurate real-time view of the inventory in all the containers and where they are supposed to be. This is in contrast to the ERP backflushing example described in the introduction.

In some cases, whole rolls or other containers of material, have to be loaded onto a machine and then the left-over material returned to stock. In WIPtracker the left-over material returned to stock is recorded, typically by weighing, as is any scrap produced.

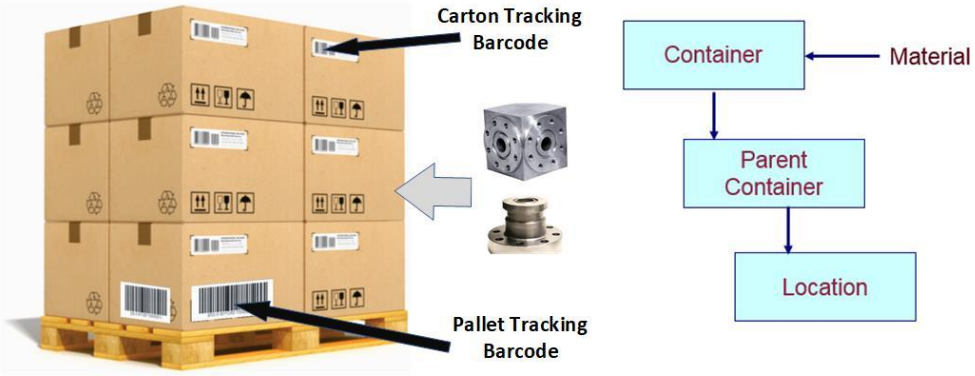
In WIPtracker intelligent agents monitor all these barcode scanning transactions every few minutes and alert managers if there are any discrepancies they should investigate.

Note that data is captured in real-time, analyzed in near real-time, and an alert immediately issued. This enables a supervisor or manager to quickly investigate an issue and determine the facts of the "case" before the trail goes "cold". This saves the manager or supervisor from "walking the floor" looking for problems but can provide a rapid response deterrence for anyone thinking about stealing.

Detecting Theft in the Shipping Department



The container-based tracking theme is carried through into the production and put away of finished products, as well as their picking packing and shipping, where any discrepancies can generate an alert.



This is especially valuable where mixed pallets are made up for shipment, as this is a place where products designated for customer can be misappropriated and their loss blamed on the shipper or the customer themselves.

In this case, barcodes on containers are scanned as they are loaded onto each pallet, which has its own tracking barcode. Then each pallet is scanned as it is loaded onto a truck/trailer for delivery to the customer. Materials handlers are immediately warned if they attempt to ship the wrong materials for each order. Also, intelligent agents can detect whether materials are missing, especially if the pallets are weighed as they are loaded on the shipping truck/trailer, and can alert the shipping supervisor as to missing materials before the dock-door is closed.

This detailed information about what was actually shipped, can also act as a deterrent for customers claiming short or wrong shipments, when this did not actually happen.

Final Thoughts

Despite all of this, clever people can “fudge” the recorded data so that it looks like nothing was stolen until the customer makes a complaint, or an inventory spot check shows up a shortage.

As much of the data entered is based on weight, we can help prevent this by automatically collecting the weights from bench and floor scales rather than having people do manual data entry. But there is always the old “finger-on-the scale” problem – which can somewhat be headed off by having the computer detect this and only use stable weights from the weighing scales.

While some errors, such as attempting to use the wrong materials for a job, can be reported immediately to the production worker, to prevent operational mistakes, cases where potential theft or malfeasance is detected are better handled by an intelligent agent silently sending an alert to a manager or staff member. Then the manager or staff member can quickly determine whether this is a case of potential theft or simply a mistake by the employee.

Commentary

No theft detection system is foolproof, as people are endlessly ingenious. We had one case in a heavily guarded precious metals machining plant where an employee put sticky glue on the soles of their shoes to pick up precious metal dust, which they subsequently removed and resold to a recycler.

Also, Occam's Razor, the principle that "the simplest explanation is usually the correct one," is often applicable when trying to interpret suspicious data from WIPtracker. When it comes to suspicious data, the question of whether the cause is malice (criminal intent) or incompetence (stupidity, negligence, or simple human error) is best left to managers who (hopefully) know the totality of the circumstances.

Systems like WIPtracker can certainly help quickly alert managers and their staff when there are suspicious circumstances which need to be investigated. Also, because all events recorded by WIPtracker are time tagged, these can be coordinated with data from security cameras to determine facts that would otherwise go unrecorded.

Nowhere is this truer than in unmanned stock-rooms and tool-cribs, where people are supposed to scan out barcoded materials or tools before taking them out. Unfortunately, people forget to scan materials and tools out, sometimes deliberately. Fortunately, based on WIPtracker's time tags, it is easy to see who came and went without doing the needed data recording into the tracking system.

Author

This white paper was written by Dr. Peter Green, who serves as the Technical Director of a number of software companies. Dr. Green also consults to manufacturing companies on the application of real-time intelligent systems to improve their manufacturing and supply chain operations.

Dr. Green obtained his BSC (Hons) in Electrical Engineering and his Ph.D. Degrees in Electronics and Computer Science from Leeds University in England. Subsequently Dr. Green was a senior member of technical staff at Massachusetts Institute of Technology and a Professor of Computer Engineering at Worcester Polytechnic Institute.

Dr Green is a Systems Architect who is an expert in using real-time artificial intelligence methods to implementing real-time operations tracking and management systems for industrial organizations. He has led the implementation of over 100 such systems over the past decade. Dr Green also led the team which developed the SmartOps24x7 real-time artificial intelligence software platform and the BellHawk operations tracking software.

For further discussion, or to send comments, please contact Dr-Peter-Green@SmartOpsMgt.com.

For More Information about WIPtracker

Please see www.WIPtracker.com or contact marketing-support@SmartOpsMgt.com.

Copyright