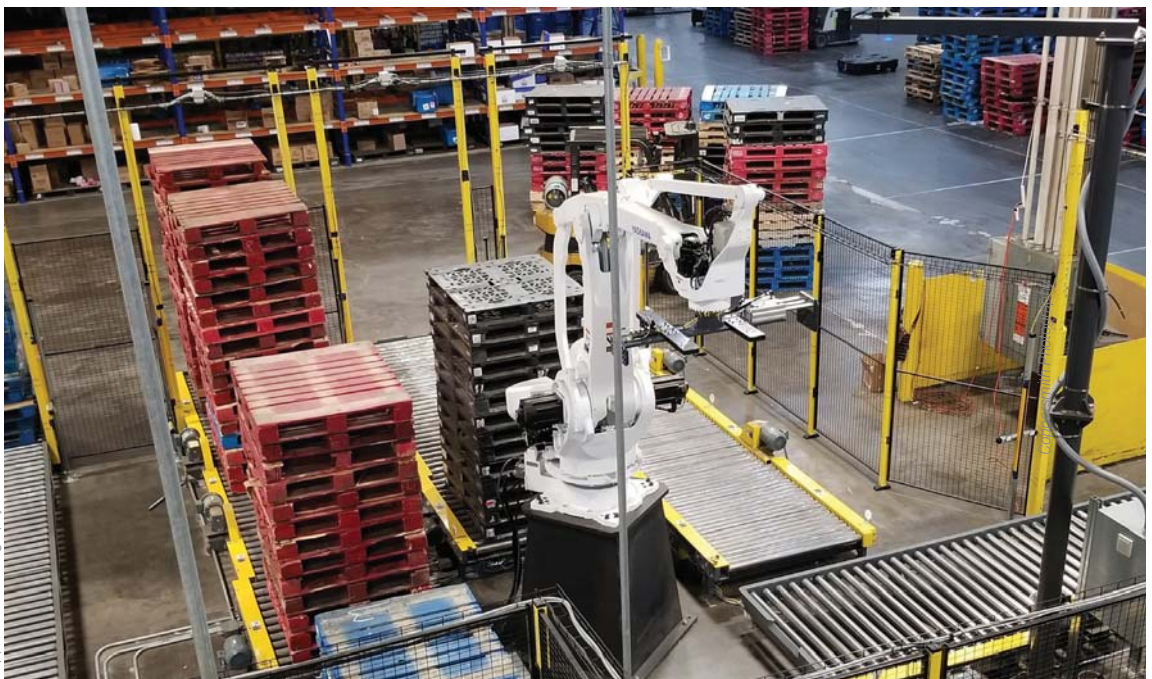


CASE STUDY *By David Peters, CEO Universal Logic*

# LEVERAGING INDUSTRY 4.0 TO IMPROVE SAFETY

A Look at Neocortex Robotic Pallet Sorting.



Coopersmith Photography

In pallet handling, repetitive tasks and the use of dangerous heavy equipment are two concerns that companies must deal with on a daily basis. OSHA and other agencies cast a long shadow of regulations that must be adhered to in order to avoid fines and, ultimately, injuries to workers. As we move into the robotic age, where some of these tasks can be done by machines, it is exciting that Universal Logic, as an Industry 4.0 leader, can provide expert insight and vision for the future.

The distinguishing characteristic of Industry 4.0 is the use of sensor data to provide real-time, reactive control of automated processes. Data is analyzed using artificial intelligence to provide nimble efficiencies critical for today's successful operations. These blended hardware/software silos are known as cyber-physical systems.

Of paramount importance is to provide a cohesive safety protocol for cyber-physical systems that integrate the various technology silos. This ensures there are no gaps in execution, which could lead to adverse outcomes. This overarching concern, coupled with the traditional benefits of automation – saving time, money, and workforce, served as the basis from which Universal Logic created a robotic pallet sorter. As we will see in this case study, the integration of traditional automation with artificial intelligence software demands a wholistic approach to safety for a successful delivery.

Robots have expanded their utility thanks to their general purpose design and seamless integration with sensor-based AI control. Thankfully, robot safety protocols, established by OSHA and the Robotics Industry Association (RIA), provide clear guidance for hardware implementation. Network safety systems are also well understood and their implementation is



straightforward under NIST standards. However, it is far too easy for an Environment, Health & Safety (EHS) manager to miss the implications of the rapid changes underway with Industry 4.0 applications with these siloed disciplines.

As one of the first companies to implement dynamic robot control using sensor information and artificial intelligence algorithms, Universal Logic are experts in AI-based software control, system integration, and cloud based data solutions. The company has seen firsthand what is required to safely implement cyber-physical technology into traditional supply chain solutions. Their proprietary software, called Neocortex, spawned a revolution in AI/sensor/machine control, giving robots the “brain” to automate dynamic supply chain practices at high speed.

### **Customer Problem**

Universal was contracted by a major grocer to automate sorting of pallets, accumulating daily from their various suppliers, at a rate of up to 400 pallets an hour with accuracy up to 99%. The pallets were of every type: CHEP, PICO, plastic and white wood. Their condition was infinitely variable – clean, damaged, debris, wet, tangled with plastic wrap and slip sheets.

The traditional solution was to employ a team of forklift drivers, over multiple shifts, to gather random stacks of pallets from all over the warehouse, or inbound trailer loads. They moved them into a staging area, sorted into homogeneous stacks, then moved them to a shipping dock for loading into outbound trailers. This proved to be an expensive use of labor, equipment, and floor space to execute. The speed with which the operator needed to function further increased the risk of pallet and machine damage, as well as worker injury due to continuous twisting in the seat to maneuver in reverse.

In analyzing the solution, Universal’s AI, software, and integration teams worked closely to deconstruct the problem, and build a system design solving the issues, including: work cell foot print, reduction in labor costs, reduction in forklift use as well as wear and tear, improved work safety, and capturing data metrics for inventory and quality control.

### **Neocortex technology**

Universal spent a decade developing Neocortex – a true cyber-physical Industry 4.0 invention. It is a machine agnostic software “brain” for robots that uses sensor data, artificial intelligence, and machine control to provide real-time dynamic behavior at high speeds. The technology allows robots to replicate the actions of labor on supply chains in both manufacturing and retail. It is machine agnostic, working with all major brands of equipment. Neocortex is part of the enterprise software stack in a budding field known as the Internet of Robotic Things. Neocortex spans the network, residing at the edge, tethered directly to the robot controller and the PLC, in the onsite server room, and in the cloud.

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### **Universal’s Turnkey Solution**

Universal designed the complete software/hardware solution, integrating Neocortex with the robot controller, sensors, PLC, conveyors and safety systems. Handling 60-pound pallets at high speed requires a large industrial robot. In this case a 160KG Yaskawa Motoman. The solution must include safety barriers and light curtains to insure no person is near the robot while it is running. Additionally, with forklift traffic feeding pallet stacks into and out of the sorter, bollard and guardrails must be included to protect the equipment. Safety protocols are dictated by strict RIA and OSHA standards for industrial robot implementation and operation.

Implementing robotic technology into a facility for the first time, requires careful training of operators and EHS managers. This is part of Universal’s deliverable. It is far too easy to become captivated by the awesome power and capability of the robot, and simply think that you bolt it to the floor and turn it on. It is imperative that strict operating protocols be established and maintained. This is particularly important when an operator needs to override the system and enter the work cell. Safety managers need



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to monitor labor behavior around the system until they are confident the operators are following the standards. The Neocortex subscription model means the client always has access to Universal's expertise to assist with any issues, be they mechanical or operator error.

The operation is straightforward. A forklift operator sets random stacks of pallets, eighteen units tall, on an inbound conveyor. Heavy-duty roller conveyors with motor controls every five feet, allow for coordinated pallet movement throughout the cell via the PLC. The stacks move inside the fencing into the robot pick zone. The robot picks one pallet at a time. Using strategically placed vision sensors, Neocortex determines which of the four pallet types the robot has picked. It then directs the robot to place the pallet on the appropriate outbound homogeneous stack. Due to very accurate placement, the robot builds highly uniform stacks. (These, in turn, improve trailer density by 30%.) Once an inbound pallet stack is depleted, Neocortex commands the PLC to move in the next stack. Downstream, up to four homogeneous pallet stacks

can be held in queue for each pallet type until the multi-tasking forklift operator has time to move the stacks into an outbound trailer.

### Benefit to Customer

The tangible benefits to the customer included reassigning four operators to other tasks in the distribution center, the elimination of two forklifts, reduction in repetitive stress twisting injuries, improved outbound trailer density, and management access to real-time data metrics for off-line analysis.

The safety concerns inherent with manual processing were eliminated. To avoid risks associated with powerful automation, teams were trained on strict operating protocols to protect people and equipment. The EHS managers were fully vetted on the cross-functional elements inherent in Industry 4.0 cyber-physical systems, including equipment control, process administration, data analytics, and network security. This provided them the holistic view necessary to avoid any gaps in these historically siloed disciplines which could lead to adverse events. ■



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