P.O. Box 171062
Nashville, TN
37217 United States
615 . 366 . 7281
universallogic.com

Case Study: Retrofitting Pill Fulfillment Modules

By: Clay Wells | Universal Logic

In the ever-evolving landscape of automation, organizations are faced with crucial decisions when it comes to upgrading their existing systems or starting fresh. The challenges posed by retrofitting existing systems are often daunting, requiring careful analysis, innovative solutions, and skilled implementation. This decision between the two methods may be driven by the significant investment, as well as the potential for salvaging the infrastructure.

A new build or greenfield strategy offers the most possibilities because engineers are free to design whatever they choose. These projects are generally going in facilities where there are no existing infrastructure constraints. In contrast, a retrofit involves using the existing machinery and space and redesigning it to serve a new purpose or to improve the current design. This case study dives into the complexities of retrofitting existing pill fulfillment automation and highlights problems within the original design as well as solutions implemented to reconcile those issues.

The Problem

Some time ago, the Department of Veteran's Affairs (VA) decided to automate its prescription fulfillment processes. The VA fulfills thousands of orders a week and millions over a year. To handle this, they entered into an agreement with another prominent American integrator to help construct their vision. This vision consisted of two separate facilities with several lines of modular cells.

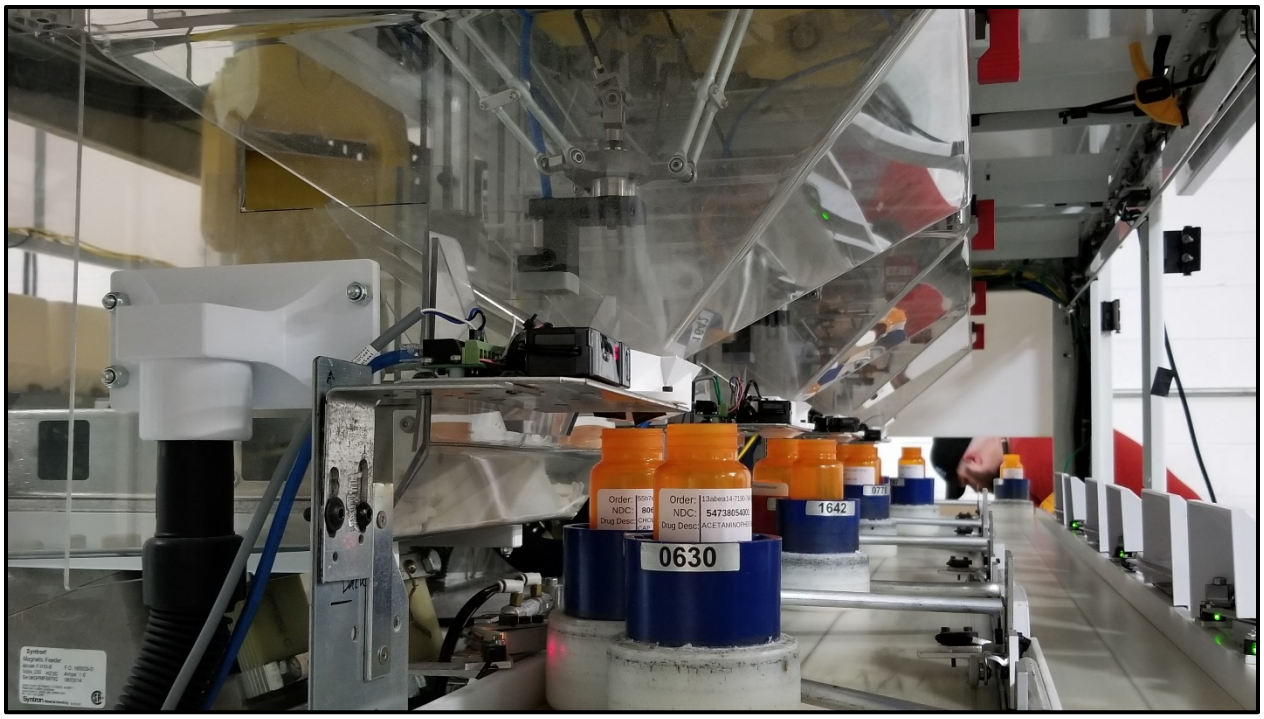
Each module had two halves; the first was for storing and retrieving pill canisters—an external shelf stores large quantities of each medication for later fulfillment. This shelf was a carousel of canisters capable of holding up to 200 medications. A 6-axis robot mounted to the module would oversee the movement of said canisters to and from fulfillment. On the other half, four delta robots worked to fulfill orders. Once a canister was received, they would activate a vibration table and vacuum system to disperse capsules and remove lingering debris; then, the robots would pick and drop into the bottles below one by one. Upon completing an order, a series of conveyors and diverters remove it for further processing, such as labeling and sealing.

These modules would work in tandem to plan and fulfill orders as they come in. However, they were far from reliable, even after seven years of design and testing. They failed on multiple levels. The robot tool could not grip some pill types flinging them around the module. The constant flinging and accumulation led to the rapid degradation of some of the hardware due to the trapped pills and dust. Additionally, the design made basic repairs nightmarish because so many components were trapped behind layer after layer of bulky hardware, leaving maintenance workers with no way to remove the debris.

P.O. Box 171062
Nashville, TN
37217 United States
615 . 366 . 7281
universallogic.com

In short, after seven years, the integrator was never able to finish. Despite the initial investment in automated equipment and support services, a series of automation problems led to the non-renewal of their contract, leaving the infrastructure unused and unsupported. However, with the massive sunk cost, VA opted to retrofit the existing systems to address some issues. Universal Logic was awarded the job and has been working to bring the system online as soon as 2024.

The Solution



To effectively address immediate problems and understand their root causes, it is crucial to clearly understand the customer's pain points. Some issues necessitate complex solutions. Originally, the design aimed for easy production of 20 units, resulting in a modular approach where each piece was designed to perform a specific task. However, when these pieces were assembled, they lacked compatibility, causing numerous issues for VA. This result meant that not only did Universal have to mitigate the problems of the original integrator, but they also had to fundamentally change their approach.

To begin tackle this, Universal's initial priority was pill management. To prevent pills and dust from building up on the conveyors and inside compartments, Universal needed a solution to prevent them from falling in the first place. This change meant redesigning the end-of-arm tool (EOAT) to maintain adequate suction with each medication. Once the new tool was complete, a funnel was installed around the robot in the event of a flying capsule. If one happens to escape the funnel, it will fall into a catch pan below the robot; the catch pans

P.O. Box 171062
Nashville, TN
37217 United States
615 . 366 . 7281
universallogic.com

act as the final defense for medications that may escape. The pan ensures that even if the tool malfunctions, dust, and pills won't accumulate on the other components.

Additionally, to prevent problems with new medications and capsule shapes in the future, Universal designed a state-of-the-art training station that allows new pills to be trained by size and shape with Neocortex, Universal's patented AI, for a seamless transition into production. The training station will also allow future operators to test other settings, such as robot speed and vibratory frequency, for more efficient operations and less downtime. Integrating Neocortex here and on the cell for robot picking and identification gives it a more robust error handling than before. With Neocortex, the robot can identify minor differences between pills if one is in the wrong canister; it can even detect brakes or chips and avoid them for fulfillment.

Foundationally each change made radically improves the process or overall efficiency. After making these improvements, the system's longevity has improved, but it has also become more complex. One of the biggest challenges for the original design was the inability to do regular maintenance. To combat this problem, Universal removed the existing conveyor and hardware that previously handled traffic control. In doing this, they opened access to the robots, the vibratory stands, and other internal components for maintenance. Reducing the number of vibratory stands and pick locations to just one per robot further opened space so that an operator can manually intervene in an emergency. These changes improve the system's efficiency and make maintenance more accessible, allowing for regular upkeep and uninterrupted operations.

Similarly, the theme of simplification persists on the canister side. The original rack was designed to hold almost 200 medication types on an integrated carousel shelf. While this design certainly has more storage, the rack can become misaligned, which prevents the robot from adding new canisters and can create hours of downtime to recalibrate the robot with the shelf. To negate this problem and ensure appropriate alignment, Universal designed a new canister rack with fixed shelves that provide constant alignment and zero variability in the canister locations. This solution effectively addresses the misalignment issue, ensuring seamless operations and eliminating potential downtime caused by recalibration.

The retrofitting of the existing pill fulfillment automation system undertaken by Universal exemplifies the challenges and complexities associated with upgrading and improving established infrastructure. The decision to retrofit was driven by the significant investment already made, along with the potential to salvage the existing equipment. Through a strategic redesign, Universal successfully addressed various issues that plagued the original design, including pill management, maintenance accessibility, and canister misalignment. This case study serves as a testament to Universal's commitment to pushing the boundaries of automation and providing tailored solutions that deliver exceptional results.

If you have automation retrofit needs, contact sales@universallogic.com or call 615-366-7281.