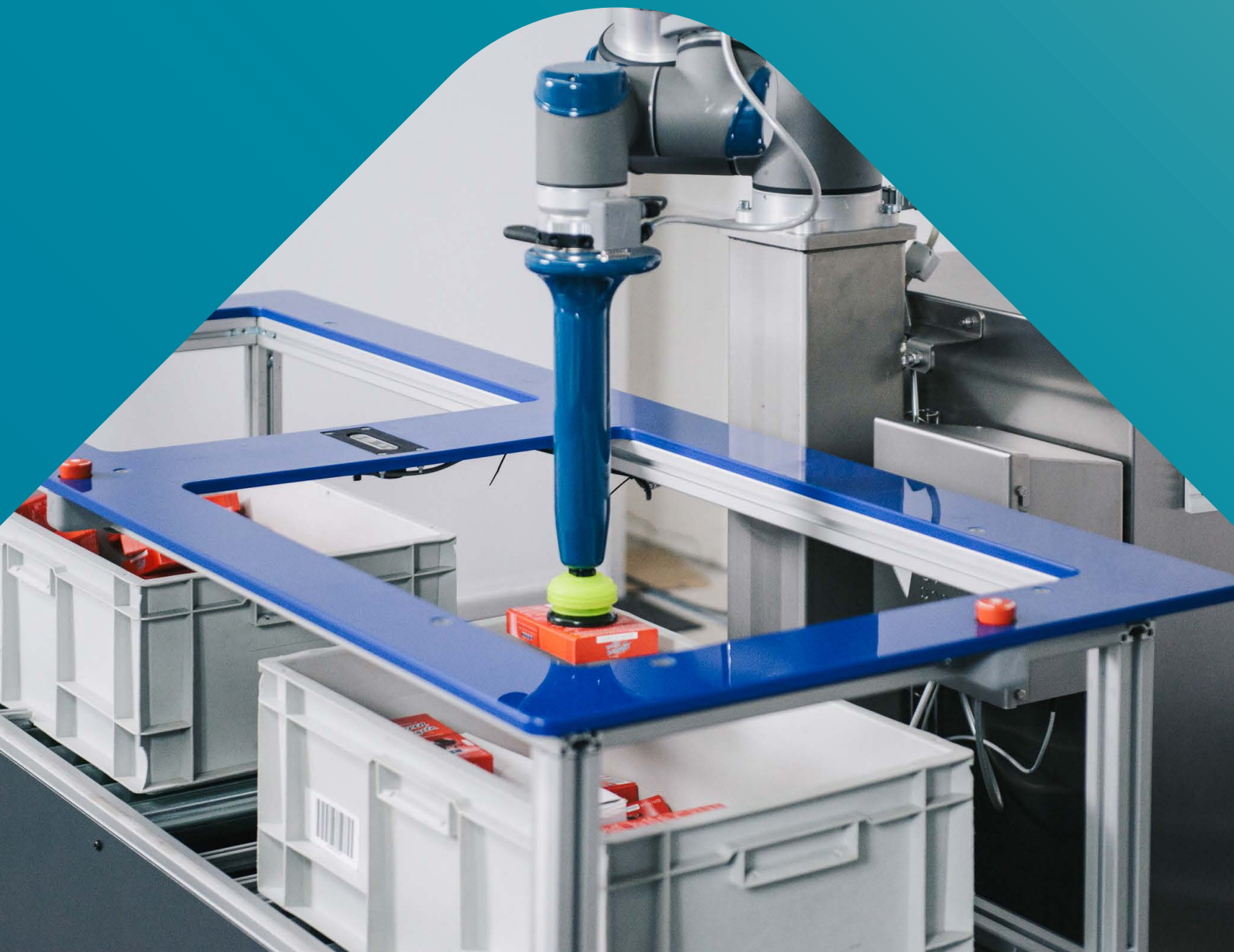


How to implement the ideal **pick & place robot** in your warehouse

A step-by-step guide to ensure the successful implementation of your pick & place robots.





Implement the ideal pick & place robot in your warehouse

For many companies, implementing robots in their warehouse is a new and unfamiliar process. Therefore, good preparation is key. To find and implement the ideal pick and place robot in your warehouse fulfillment process, the following phases should be considered:

1. Exploration
2. Proof of concept
3. Design
4. Implementation & optimization

This whitepaper will discuss the steps you can take to ensure the successful implementation of pick and place robots in your warehouse.

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PHASE 1

Exploration

Why implement pick and place robots in your warehouse?

Nowadays, most warehouse managers are exploring how robotics can be beneficial for their warehouse processes. There are various reasons why the implementation of robots is becoming more popular:

1. **High customer demand:** output needs to increase whilst labor shortages are growing.
2. **Labor costs** rise whilst operating costs need to be reduced to remain competitive.
3. **Health and safety rules** for manual labor are becoming more stringent. Furthermore, companies also want to improve the work conditions for their employees to create a more attractive work environment.

These challenges ask for rigorous adjustments in your warehouse. There are many automation options available, but where do you start? Automating the pick and place tasks in your fulfillment process could be an ideal way to improve your warehouse. But how do you find the perfect pick and place robot, or cobot, that meets your requirements? There are several questions to ask yourself that can help you explore the possibilities and build a solid business case.



How do I start implementing pick and place robots in my warehouse?

First, it is important to map out the manual pick and place processes in your fulfillment process, as that is where you can realize the greatest cost savings. Try to break these manual processes down to all tasks an operator has to execute. The most repetitive tasks are the ones that are easiest to automate with robots. The more repetitive and monotonous the task, the more suitable it is for a robot. That is why pick and place processes are a great place to implement robots.

robot vs cobot

NOTE THAT IN THIS WHITEPAPER,
THE WORD 'ROBOT' CAN REFER TO
BOTH A ROBOT OR A COBOT.

A cobot, or collaborative robot, is a type of robot that is designed to work alongside and together with human operators.



PHASE 1

What parts of my fulfillment process are best suitable for a robot?

Having learned which manual pick and place tasks are most repetitive, take a look at the following topics to discover how befitting these processes are for robotics:

Task variation

The smaller the task variation, the easier it is to automate. Robots are most suitable to execute one specific task, such as palletizing or tote picking and placing.

Product variation

The smaller the product variation, the easier it is to automate. Note that robots are becoming better and better at handling product variation. Hardware and software are continuously improving.

Capacity

Pick and place robots can usually handle a capacity of 300 to 1000 picks per hour, depending on the task.

Reach

Industrial robot arms vary in reach. A cobot arm, very much suited for brown field implementations, can typically handle a reach of 2x2 meters.

Payback

looking at a productivity of 10 hours per day, robots typically have a payback period of about 3 years. Of course, this depends on your business case.



PHASE 1

Should I adjust my fulfillment process for optimal robot functionality?

A pitfall is trying to replace an operator with a robot 1-on-1. Humans and robots have very different skills. To ensure optimal robot functionality, changes in your fulfillment process may be necessary and should be taken into account for your business case. The general rule of thumb is giving the highly repetitive tasks to a robot, and the more varying and creative tasks to an operator. Some examples:



Tote filling rate

Reaching the highest tote filling rate by rearranging products is a task more fitting for a human operator. A solution is to have pick and place robots fill the totes but have the order completion executed by a human operator.

Batching

Some products are harder for a robot to grasp. It can be useful to 'blacklist' products that the robot cannot or should not handle. This way, you can automatically create batches that the robot can pick without problems. The more difficult products can be sent to human operators.

24/7 operation

Manual processes are usually not optimized for 24/7 operation, as night shifts involve high costs. However, a pick and place robot can easily operate 24/7. Improve your business case by facilitating the robot to continue its operation during off peak hours.

How do I build a business case for implementing robots?

During the exploration phase, it is fundamental to gain insight into the costs of pick and place robots versus the costs of manual labour. The following formulas can help you make an estimation of the difference. Though, for a substantiated estimate, it is wise to enlist the help of the pick and place robot suppliers you are considering:

Cost per pick = robot costs / robot capacity

A cycle time analysis is needed in which you determine the expected robot capacity (500 – 1000 picks per hour). Overhead costs should be included, such as maintenance and malfunctions. By dividing the costs of the robot by the capacity, the cost per pick can be determined.

Cost per pick = operator effort per process step X hourly rate

With a MTM analysis the operator effort per process step can be determined. Multiply the operator's effort with the hourly rate. The result shows the cost per pick. Beware that operator costs should also include overhead costs such as lunchtime, absenteeism, sick leave etc.



PHASE 2

Proof of concept

The next step is to get some hands-on, practical experience by testing robots in your warehouse or a test environment. This is one of the most vital steps towards the successful implementation of pick and place robots in your warehouse. During the proof of concept phase, you will learn what is feasible and what not. It will help you to step-by-step build your requirements towards a successful robot implementation. These requirements will be elaborated on in phase 3: design, where you will create a robot implementation plan. To help you get the most out of phase 2: proof of concept, the following steps should be taken:

Step 1: what questions do I still have following exploration?

What parts of your exploration phase are still unclear? What would you like to clear up? Especially think about:

1. **Pickability:** can the robot handle my product assortment? Do we need to request changes from our supply chain? Do we need to blacklist certain products? What exceptions exist that we did not think about before?
2. **Speed:** can the robot meet my KPI's and desired throughput?
3. **Operator interventions:** how often do these occur? What training would my operators need? Will they be able to work easily with the robot?



Step 2: What test environment can get the answers to these questions?

Once you know what questions you still need answers to, think of what type of test environment can help you get the answers you need. It may be sufficient to execute a simple test with a few of your products at the supplier itself. However, if your questions and concerns go further than that, testing the robot in your operation is preferred.

For example, if your warehouse handles millions of different items each day, a simple test at the supplier will not be adequate. Rather, test the pick and place robot in your actual operation to discover what it is able to handle and whether it is a suitable solution for you. But what if you are building a new warehouse? It is still advised to test the robot in an existing warehouse, even if it is not fully optimized for robots. It can help give you an idea of the robot's capabilities and pitfalls.



Step 3: How do we implement the test robot in an easy way?

If you have decided to test the robot in your warehouse, you should think of what is needed to get to a minimal implementation. Above all, you want to test the robot without having to make too many changes in your fulfillment process.

First, you should try to limit the interfacing with surrounding systems. The more interfacing needed, the more time and effort it takes to test the robot. Hence, think of topics such as: does the robot need to link with my WMS? Or can a human operator make a manual translation to the WMS for a few days?

On top of that, consider when to test the robot in your warehouse e.g. seasonal variety may bring important variances in your process that should be added to the tests.



Step 4: set goals and KPI's

To get the most out of your proof of concept phase, it is critical to set goals and KPI's in cooperation with your supplier, as well as how to measure them. What minimal requirements does the pick and place robot need to meet? Think of speed, pickability and operator interventions. Think this through thoroughly, so you can make sure you learn all you need to learn in the proof of concept phase.

Step 5: execute and evaluate test

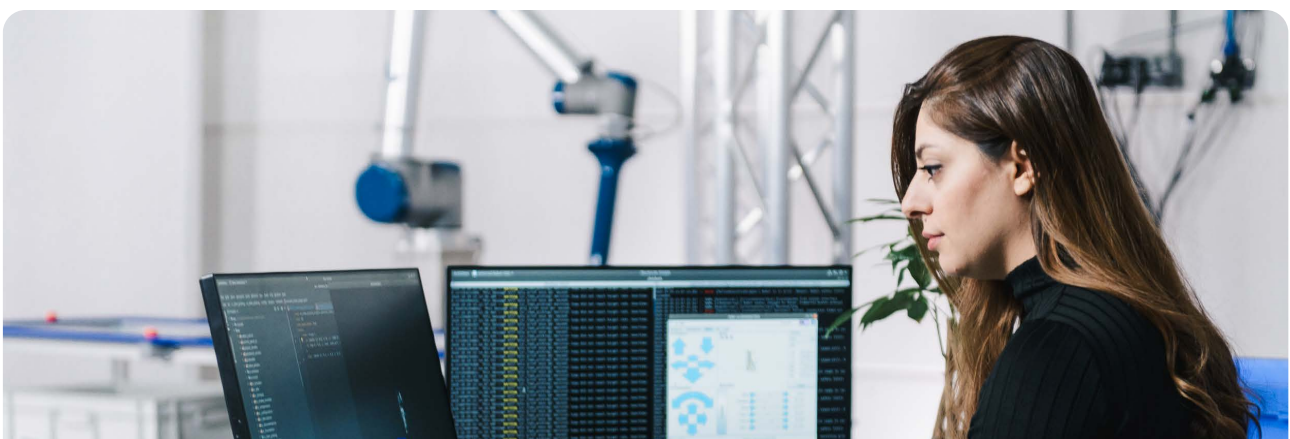
Once you have explored what test environment is suitable, the minimal implementation needed and have set goals and KPI's, it is time to start the actual testing of your pick and place robot. During the test, it is important to:

01

Continuously monitor and analyze the results and adjust the test setup accordingly in close cooperation with your supplier.

02

Communicate intensively with relevant stakeholders so they are up to date on the progress of the test.





PHASE 3

Design

In the proof of concept phase, you have learned what the pick and place robot can do for your warehouse fulfillment process. You know what to expect, what requirements you minimally need and what performance is realistic. This leads to designing the robot implementation plan in detail. There are several subjects that should be included in the design of this plan:

Functional requirements

Task variation

What tasks will the robot execute exactly? For instance, alongside the picking and placing of products, does the robot need to scan product barcodes too? If so, are the barcodes at the correct position of the products? Or will barcodes be scanned by a scanner in a different part of process?

Speed & pickability

In the proof of concept phase, you have learned what is realistic. Subsequently, you should find a match between your production requirements and what the pick and place robot can handle. If 2400 items have to be picked and placed per hour, and the robot can handle 800, then you would need at least 3 robots to meet your requirements. You might want to add redundant capacity, depending on the expected downtime in your process.

Product supply

How will the products be supplied to the pick and place robot? This is crucial to consider, as you want the robot to run continuously. A solution could be to whitelist and blacklist products; making lists of products the robot can and cannot handle. Products that are on the 'blacklist' can then be sent to a picking station with a human operator.

Operator support

Does the robot need support from an operator? And how often would it be required? These are essential questions that can help determine where to position the pick and place robot in your warehouse and how easily accessible it should be. This will help you with your floorplan design.



PHASE 3



Non-functional requirements

Non-functional requirements are all the additional elements the robot might or will need for a seamless integration in your warehouse. Examine requirements such as:

1. **Internet connection:** does the robot need to be connected to the internet – e.g. for monitoring, remote error handling and update purposes? If so, how do you create a secure connection?
2. **Compressed air:** is the compressed air supply available via a central system? Or do you need to generate it locally?
3. **Electricity:** a cobot solution can easily be plugged into your regular electricity grid as it has a very low electricity consumption. However, if you are implementing industrial robots, they will need a separate power group as they consume a higher amount of electricity.

Interfacing

Besides the functional requirements, it is principal to thoroughly think of the interfacing of the robot with surrounding hardware as well as your warehouse control system (WCS). To ensure smooth operation, the robot should be able to communicate with your WCS. In this step, it is key to:

1. **Systems:** make a list of all the systems the robot has to interface with.
2. **Specifications:** decide on the specifications of the interfacing, in close cooperation with your supplier. What data should the robot receive and what should the robot send? At what rate is this data required. What control possibilities are required from the control room (start/stop, resume, etc.)





PHASE 3

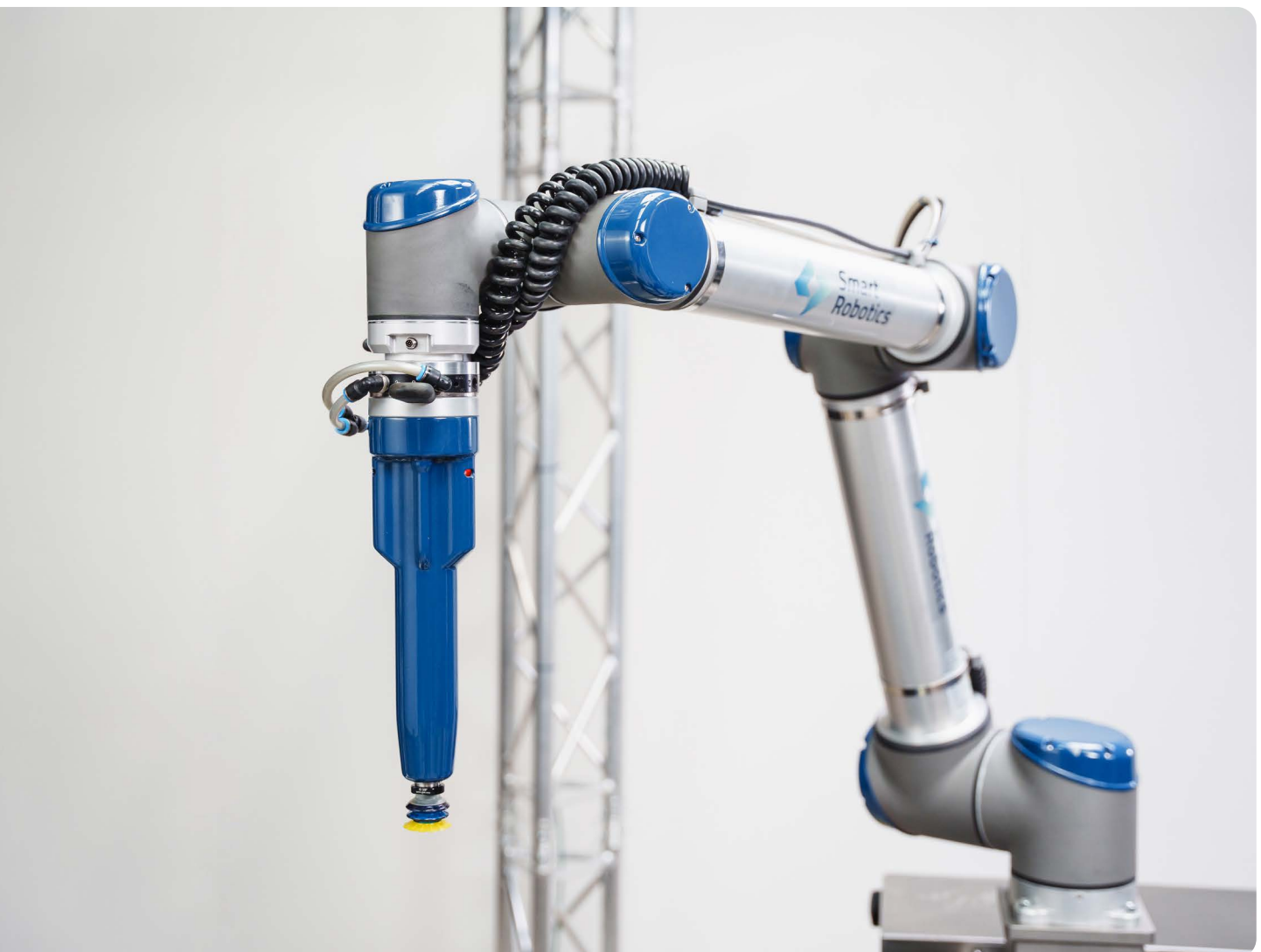
Floorplan

With the information you have gathered on functional requirements, interfacing and non-functional requirements, you can design a floorplan determining where to place the pick and place robot(s) in your new or existing warehouse. When drawing this floorplan, it is essential to think about how the robot is integrated with the surrounding systems. Next to that, the accessibility depending on operator support is an important requirement to find the best layout.

Service plan

Furthermore, think about how you would like to address service of the pick and place robot. As with any machine, it is likely that at some point issues might occur or maintenance is needed. The service you need depends on how critical the robot solution will be in your warehouse fulfillment process. Some questions to ask yourself when thinking about service are:

1. What problems can we solve internally and what problems will we need a service team for?
2. If service by the supplier is needed, how quick should the response time of service be?
3. Can the suppliers' service team access the robot remotely to solve issues?
4. Do we want spare parts in stock on site for quick replacement?
5. Do we want a service contract or pay per service request?





PHASE 3

Safety

Another aspect to consider when designing your robot implementation plan is to inspect safety. How do you ensure the pick and place robot meets the safety requirements of your warehouse? Together with your supplier, you can determine possible risks and how to solve them.



Note that industrial robot solutions require a lot of safety measures by default, including a large safety cage around the solution. This has a severe impact on your floorspace.

Cobots, on the other hand, do not need a safety fence and are easier to implement within an existing line. Nevertheless, cobots may require supplementary safety measures as well. For example, besides the standard safety features of a cobot that already ensure safe cooperation with people, you can add a safety scanner that ensures the robot moves slower while an operator is in close proximity.

Engage your operators

In addition, also consider your operators. Automating manual tasks with a pick and place robot will change the jobs of your operators and warehouse employees significantly. Acceptance is key, as they will have to work together with a robot or cobot. Involve your employees in the process of automation and ensure they feel heard.

Roll-out

After analyzing all key aspects of implementing a robot in your warehouse, it is time to design the roll-out plan. Are you planning to implement multiple pick and place robots in your warehouse or even in multiple warehouses? It could be wise to start small and spread the roll-out over several phases. Even after extensive testing in the proof of concept phase, risks still exist. If you start small, any issues that occur will have less impact and there is still time and opportunity to improve the solution before further roll-out.





PHASE 4

Implement & optimize

Following the extensive research and preparations, the time has come for the actual implementation of your pick and place robot. The installation is the easy part of this phase. What comes after, however, is much more important. Once the pick and place robot is running in your operation, you will learn:

1. How stable is the robot in the long run?
2. Where can I further optimize my process?
3. Do my operators need additional training?

Right away, you should strive for improving the performance of the robot. In an ideal world, your pick and place robot operates completely autonomous at a 100% availability rate. That is a challenge, but it does not mean you should not aim for it. There are always steps that can be executed to improve the performance of your pick and place robot.

Data monitoring to improve robot performance

It is fundamental to continuously monitor the performance of your pick and place robot, based on the KPI's you have determined. This data can then be analyzed to see where improvements can be made, both in the process as well as at the robot. Let us look at some examples of process optimization and robot optimization.

01**The robot has to wait for picking totes to be supplied.**

This affects the items per hour the robot can pick and place. Investigate your goods to robot process and see what causes this delay.

02**The pick and place robot has to wait for an empty space on the sorter belt to place a product.**

Can improvements be made in the sorter process to enable the robot to continue its operation?

03**The robot receives products that are packed in an open plastic bag, causing the product to fall out during the pick and place movement.**

totes to be supplied.
Can the packaging of the product be changed? If not – put the product on a blacklist and send it to a picking station with a human operator.

04**Operators do not use the robot correctly**

For instance, an operator taking a break blocks the robot sensor intentionally so the robot thinks it cannot place a product, instead of pausing the robot correctly via the user interface. This can clutter your robot data as it is shown as an error or waiting time resulting in 'lower' productivity of the robot.

05**The robot accidentally picks two products at the same time.**

this problem may arise when two similar items lie very closely together in the pick tote, resulting in the robot's vision thinking it is one and the same item.

The supplier can solve this issue by improving the deep learning model of the robot.

06**A product is dropped accidentally and blocks a sensor**

A solution could be to build a slide around the sensor so that a dropped product will never block the sensor.



Improve user-friendliness and safety

Along with process and robot optimization, it is valuable to talk to your operators. Ask about their experience with the pick and place robot. They can give useful insights in whether the user-friendliness should or can be improved. Are your operators fully able to work with the pick and place robot? Do they need additional training? Are the user interface and user manuals clear enough for them?

Moreover, acknowledging safety is crucial as well. Is the safety of and around the robot in order? Can improvements be made? Data monitoring can help regulate safety. Especially if you have implemented a cobot solution, data such as collision occurrence can be useful. If camera images are recorded, it is even easier to determine any safety issues.

Besides data monitoring, have your warehouse personnel register any unsafe situations regarding the pick and place robot or cobot. It can enable you to determine what adjustments are needed, either at the robot itself or by creating safety warnings, adjustments in the user manual or by supplying personal protective equipment to your employees.

Predictive maintenance

The hardware of the robot is another element where you can optimize performance and ensure smooth operation. At some point wear and tear will result in having to maintain or replace hardware items. The question is; will you wait till a part is broken and needs to be replaced, resulting in downtime of the robot, or will you replace parts before the hardware malfunctions?

Predictive maintenance is where you use data available to predict when a hardware part needs to be replaced or maintained. For instance, if it is known that the gripper of the robot will show cracks and perhaps break after a certain number of picks, that can be prevented by replacing the gripper before that number of picks is reached. Predictive maintenance can be executed during off peak hours to ensure minimal impact on your warehouse fulfillment process.

Naturally, predictive maintenance is very dependent on the situation. For example, a suction cup of a gripper wears quicker on cardboard than on plastic. Again, a reason why data monitoring is so vital. It allows you to learn the pattern of wear and tear of your hardware items and optimize your predictive maintenance process. Eventually, that will result in a more continuous, efficient and smooth operation.



CONCLUSION

Ready for the warehouse of the future?

Improving your warehouse fulfillment process with pick and place robots is a process that takes time and effort, but in the end it will benefit your company greatly. Pick and place robots are the next step into the future and will help you overcome labor challenges, increasing consumer demand and realize cost savings. Smart Robotics is your Pick & Place partner; we offer various picking solutions to improve your warehouse fulfillment process. We can assist in processes such as order picking, goods to sorter and palletizing. Our pick and place robots are reliable, easy-to-use, adaptable and can handle a large variety of items. This enables you to make your operation much more efficient and to scale up your business.

Click here to book a call with one
of our **pick & place experts**



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