Use Cases Of The Digital Twins Written for Rootstrap, Inc.

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Introduction

Our last whitepaper examined in depth what the Digital Twins are, and examples were provided using Robotic Process Automation, also known as "RPA". In summary, it covered specifically the following topics:

- What Are The Digital Twins?
- The Digital Twins versus Normal Simulations
- The Various Kinds of Digital Twins
- The History of the Digital Twins
- The Characteristics of the Digital Twins
- The Benefits of the Digital Twins.

In this whitepaper, we take a look at some of the use cases, or real-world examples of the use of the Digital Twins.

The Use In Manufacturing

As it was eluded to quite a bit in the last whitepaper, the Digital Twins have found their home in the manufacturing processes of many companies, especially those that are heavily involved in the supply chain and logistics segments. Another good example are car manufacturing and even airplane manufacturing plants. In these scenarios, there are many routine processes that are conducted, and rather than expending human capital on them, robots are used in place.

When Digital Twins are used for these specific purposes, they come known as "Manufacturing Digital Twins". The ultimate goal here is to enhance the value of the product by replicating the physical manufacturing process into the virtual world. For example, if you make use of a Robotic Arm, it can be easily replicated into a Cloud based platform, such as that of the AWS of Microsoft Azure by making use of a Virtual Machine (also known as a "VM").

The idea here is to, by using a virtualized twin, one can get a closer look and feel for the actual robotic arm. Although one can see the latter easily, getting into the granular mechanics of how it actually works can be difficult to witness. But with the virtualized twin, you can segment out certain parts of the actual Robotic Arm, and literally explode that view to see what can be done better to improve the longevity of that component, or even predict when it will collapse, using different kinds of scenarios.

Or you can even see how the Robotic Arm works from beginning to end, in slow motion. From here, even newer ideas can be fostered as to how the components can be made more efficient in subsequent versions.

<u>Why Use Digital Twins</u>?

Apart from the reasons just detailed, there are other key reasons why your manufacturing plant may want to make use of Digital Twins:

1) They never lie:

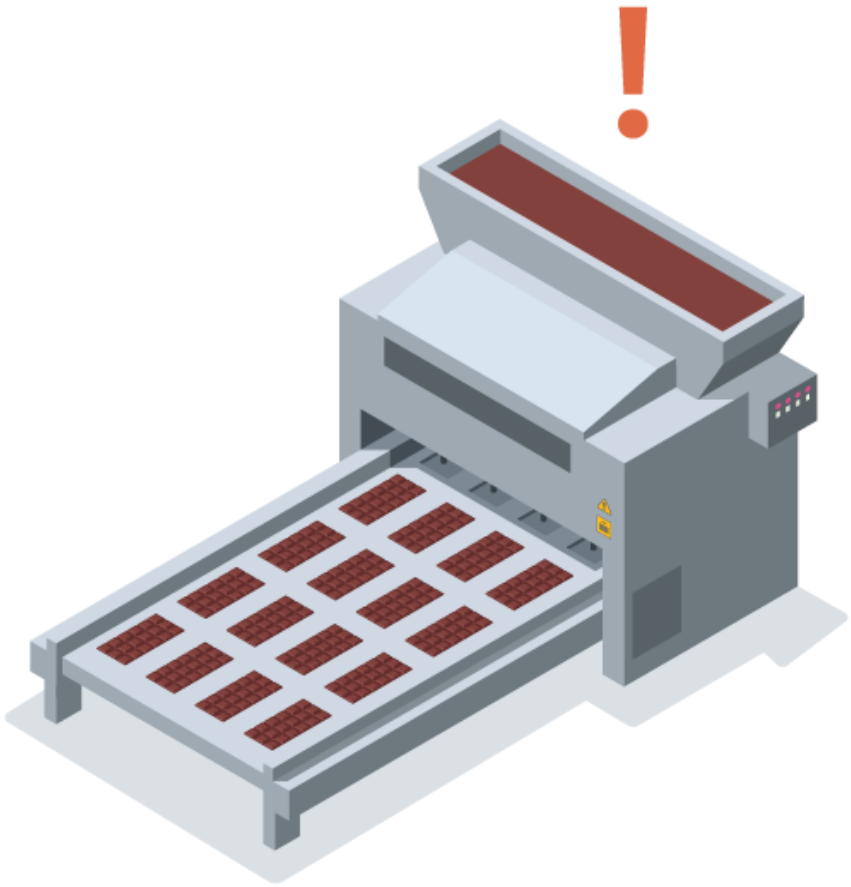
   IF you were to ask a human being to replicate even in part a manufacturing process, there is always a margin of error introduced here, such as not capturing all of the detail that is required, or even a lack of understanding of what is actually involved. This can lead to biasness or some amount of skewing when the final output is produced. But this is not the case with the Digital Twins. What you see with the virtualized version is what you get.

2) Automation is introduced:

   Digital Twins since they are based out of concepts of both Artificial Intelligence (AI) and Machine Learning (ML) can easily harness data from the physical process in a very short and efficient time period. If this did not exist, engineers would be forced to extract the datasets and feed that into the virtual version one piece at a time. This would be of course a very time consuming and laborious process to accomplish.

The Importance of Data In The Digital Twins

As it was mentioned in the last whitepaper, there is usually a level of connectivity between the physical process and the virtual and vice versa. It is through this conduit that data is ingested into the Digital Twin. Thus, it is very important to keep in mind that the type of Digital Twin you want to build will be a direct function of the types and kinds of data that are being fed into it. Very often, this conduit forms as the connection between the two. An example of this is seen below:



(SOURCE: 1).

In fact, it is this data that remains at the heart and soul of the Digital Twin. Without this data, the Digital Twin would be just a graphical version of the physical process (such as the Robotic Arm) and nothing more. It is through these data sets that predictions and the many "what if scenarios" can done with the virtualized version. Therefore, these conduits have become "smart" in their own sense. For example, rather than just simply transferring the datasets over, these devices actually cleanse and optimize the data as much as possible, so that the Digital Twin can start to process it immediately. If this did not happen, a human being would then be required to do this process manually, which would of course take much longer to filter through.

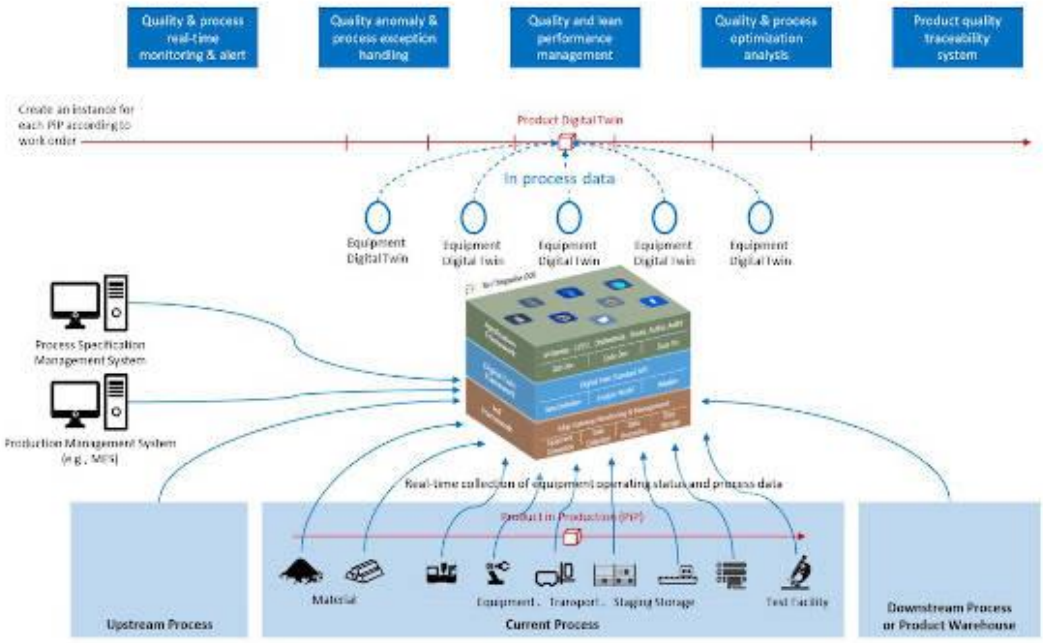
The data can come from just one Robotic Arm, or it can from many of them. Another unique feature of these conduits that are used for Digital Twins is that they can also take into consideration any lag times or effects from the overall manufacturing process. The end product is datasets with all of the statistical outliers removed, and is available into one format for easy infiltration and processing by the Digital Twin.

The Role of IIoT In The Digital Twins

The IIoT is an acronym that stands for the "Industrial Internet of Things". This is actually a subset of what is known as the "Internet of Things", or "IoT" for short. The use of the IIoT is best suited for those operations that make heavy usage of various manufacturing processes, such as those used in creating

different kinds of airplanes, such as Boeing and Airbus. There are separate devices for this, and an IIoT device that is designed specifically designed for the Digital Twin is actually about 10X more powerful than that of a conduit, as previously described. For example, an IIoT device in these circumstances can take data from many other Robotic Arms, hardware and software systems, and sensors and aggregate ti all into one central repository.

From here, all of the data is cleansed and optimized and sent to the Digital Twins. Thus, this can be viewed as a one-to-many mathematical relationship (1:N), versus using the conduit, where a one to one (1:1) relationship was assumed. An example of this can be seen below:



(SOURCE: 2).

- The following are the benefits of using IIoT with the Digital Twins:
- Test our newer manufacturing processes on a real time basis
- Optimize the flow of production
- Find newer ways to lower to manufacturing costs and thus increase the bottom line
- Cut back on energy consumption
- Perform predictive maintenance
- Improve Quality Assurance (QA) processes
- Easily map out the path of production from start to finish

The Use In Healthcare

Although the use of Digital Twins is presently used in the manufacturing sector the most, there are other market segments as well in which it can be applied, and one of those is the healthcare industry. But the key difference here is that rather than replicating a Robotic Arm, the entire human body (or just parts of it) are replicated into the virtual world. It is important to note that the use of Digital Twins is still in its very preliminary stages in healthcare, and there are still many obstacles that need to be overcome.

Probably one of the biggest of these is that of privacy, because not everybody would like to have their physical body replicated into the virtual world, where data leakage issues still abound. But if these impediments can be resolved, using Digital Twins here holds great promise, and could prove to be a great boon for both physician and patient. Consider some of these examples:

1) The creation of medical devices:

   There are many of these existence in today, and one of the best examples of these is the pacemaker, used to adjust the frequency at which the heart beats. Obviously, you want your heart to function properly, and keeping a pace that is optimal for you is very important. Also, many pacemakers have become so advanced that they are now considered to be a part of the Internet of Things (IoT). For example, a medical device can apply firmware updates to your pacemaker without you even knowing anything about it. But this also opens the attack surface for the Cyberattacker to penetrate into. But by using the Digital Twins, Cyber specialists can discover newer remediation techniques so that this will not become an issue.

2) The modeling of diseases:

   A major goal of healthcare is to try to predict what the future could possibly hold for a patient who has been afflicted with a grave medical condition, such as that of cancer. By replicating the cellular structure into the virtual world, doctors can then get a much better idea into the lifespan of the patient, and most importantly, what regimen of drugs or chemotherapy would work best, before trying it on the patient with the side effects being unknown. This also holds true for the modeling of other diseases, such as those of Parkinson's, Alzheimer's, etc.

3) The development of new drugs/vaccines:

   Traditionally, it has taken about 5 years or so (at least here in the United States) for a drug to come to approval by the FDA. But with the COVID-19 pandemic, this changed everything around. For example, it took only abut 7 months or so for Moderna and Pfizer come out with and get FDA approval for their respective vaccines. But by using the Digital Twins, it is hoped that this process could be even quicker, and perhaps even reduce the need for clinical trials, because any testing can then be done on human bodies in the virtual world.

4) A better understanding of the human body:

   Although great advances have been made in this area, and are expected to do so in the future, using Digital Twins can actually help to speed up this process. The primary reason for this is that the human body can be examined in large granular detail at the cellular level. But aside from this, newer surgical techniques could even be possibly developed.

5) Hospital workflows:

   Apart from the medical research and discovery aspects, Digital Twins can also be used to help model both the current and operational workflows in a healthcare organization, in order to drive efficiency and reduce overhead. Examples of this include modeling the current levels of staffing and capacity planning.

As the Digital Twin technology takes further root in the healthcare industry, is expected that this particular market segment will grow as much 40% from now up to 2030.

(SOURCE: 3).

Conclusions

Overall, this whitepaper has examined two use cases of the Digital Twins. The application of this concept is still evolving in other industries. Another area where it is expected to grow is in the "as a Service" business model. For instance, since Digital Twins can be used to unearth hidden trends, this can be used to forecast peak buying times for businesses. Armed with this knowledge, subscription-based services can then be established, as an added revenue stream.

Our next whitepaper will examine the Metaverse, and the Web 3.0

Sources

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