Section A-Research paper

STUDY ON DIGITAL TWIN (DT) AND BOX LIFT MECHANISM USING DT

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***Abstract*-:-** Now a days "digital twin" is a term referred to in many different ways. Some differences vary from region to region, but the meanings between regions can also vary greatly. Within engineering, till now various claims have been made regarding the advantage of using digital twinning over others for design, development, process control, and visual inspection. Nutrition, and a lifetime standard. This technology involves creating visual simulations of processes that mimic the working of real partners. Aim is to observe working in specific contexts in order to improve its effectiveness. It is an upcoming concept that has recently become the center of industries. In this work, control of how to lift the boxes in the simulation using the concept of DT will be possible. The aim is to provide machine flexibility levels. In this work there are the basics of machine automation, the basics of planning, realizing the physical behavior of the machine in real time making it possible to identify the challenges and strengths of development very early in development. In this program the physical behavior of any system can be done in real time before any part of the real system is built. Computer-aid Design (CAD) three-dimensional data is used to create a digital model. Digital Twins dramatically speeds up the process of developing and improving machine design. This not only makes it easier and faster for hardware and software improvements, and also makes it possible to make track tracking visible.

KEYWORDS: Digital Twin, Virtual testing, Product life cycle, Simulation, Box Lifting, CAD.

I.INTRODUCTION

Definition of digital twin by Chen 2017 is given as "It is a programmed model of physical system that provides all functional characteristics and links with the using elements."Digital twin is basically where the physical behavior of any system can be simulated in real time before any part of the system has been constructed. A digital twin is a detailed representation of a real machine. The aim is to show a box lift mechanism using Digital Twin concept i.e on simulation mode. Three-dimensional CAD data is used to create a digital model. Digital Twin focuses on following applications:

1. To simulate the physical behavior of a machine in real time to make it possible.
2. To identify bottlenecks and potential for optimization very early in development.
3. To simplify and accelerate hardware and software development.

Programmable Logic Controller(PLC) is an important part of Digital Twin concept

PLC :- PLC takes input and performs logic on the input in CPU and then turns on or off the system based on the logic. PLC is a computer which monitors inputs and outputs and makes logic based decisions for automated machines.PLC is basically needed to form a digital twin. The developer imports the CAD data for the machine into a modeling tool, like MapleSim, which can be used to assign all the characteristics and functions of the machine being developed – including the materials and sensors used also because of the movements and dynamic properties of the particular machine. To review user friendly programming of machines according to the specified application using Map Technology. To solve various problems, like collisions between robots, various process digital twin concepts are used.

2. LITERATURE SURVEY

1. Aidan fuller, Zhong fan[1]Digital Twin technology is an arising conception that has come the centre of attention for assiduity and, in recent times, academia. The advancements in assiduity4.0 generalities have eased its growth, particularly within the manufacturing assiduity. The Digital Twin is defined considerably but is stylish described as the royal integration of data between a physical and virtual machine in either direction. The challenges, operations, and enabling technologies for Artificial In-telligence, Internet of Effects (IoT) and Digital Halves are presented. A review of publications concerning Digital Twins is performed, producing a categorical review of recent papers. The review has categorized them by exploration areas manufacturing, healthcare and smart metropolises, agitating a spread of papers that reflect these areas and therefore the present state of exploration. The paper provides an assessment of the enabling technologies, challenges and open exploration for Digital Twins.

2. Jos Antonio Marmelejo-Saucedo[2] binary technology consists of creating virtual clones of objects or processes that pretend to be their real counterparts. The ideal is to probe its effectiveness or get in certain cases to support its effectiveness. Applied to products, mama- backbones and indeed complete business ecosystems, the digital binary model can reveal information from the history, optimize this and indeed prognosticate the long run performance of the varied areas anatomized. within the environment of force chains, digital halves are changing the way they are doing business, furnishing a spread of options to grease cooperative surroundings and data- grounded deciding and making business processes more robust. This paper is proposed for the design and development of a digital twin for a case study of a pharmaceutical company. The technology used is Grounded on simulators, solvers and data logical tools that allow these functions to be connected in an interface which is integral for the company.

Summary of Literature survey

From the given survey it can summarize that digital twin technology has been created virtually copy of a object or process that calculate the behavior of the real mechanism. The digital twin is also defining in the large way but can be other good described as the effortless integrated of data between a physical and virtual machine in other direction. This technology is based on simulator, silver and data analytics items that allow all their function that would be connected in an integral interface to company.

3. OBJECTIVES

1. Create and implement Digital twin v

   To create a digital twin, the developer imports the CAD data for the machine into a modeling tool, such as MapleSim, which can be used to assign all the characteristics and functions of the machine being developed – including the materials and sensors used as well as the movements and dynamic properties of the actual machine.
2. To study user friendly programming of machine according to the specified application using Map Technology.
3. To solve potential problems, such as collisions between robots and products, can be identified and avoided, and operators can make targeted adjustments to correct any faults or imprecision’s.

4. METHODOLOGY

For preparation of this work, Mapp Technology, OPC UA were implemented in the work.

The software used are:-

1. Automation Studio 4.7
2. Industrial Physics 2.4
3. VnC server

Two types of data are required in Digital Twin:-

Sensory Data:- It is all data from any sensor on a machine, within a decided time frame. It is designed to monitor something specific, like a vibration, light, sound which might tell the operator that a machine is on vs. off.

Manufacturing Data :- It is all data which is collected along with information, material, and documentation with respect to the manufacturing of specific physical machines. For digital twin to work, we require first any physical machine or any mechanism from which data can be collected and analyzed. Once all the required data is collected i.e sensor data and manufacturing data from physical machines then all the data is monitored. After all the data is monitored then simulation takes place. Simulation can be done using various software like iphysics, VnC viewer etc. After simulation is completed it can be seen on HMI screen. From collecting data from physical machines to viewing on HMI screen.

Automation Studio Software: -Automation Studio is a circuit design, simulation and work documentation software for electrical works conceived by Famic Technologies Inc. It is mainly used by engineers, trainers, maintenance personnel for CAD and training purposes. Automation Studio can be used in the design, training, pneumatics, designing of HMI screen.

Two versions of the software exist:

1. Automation Studio Professional
2. Automation Studio Educational

While comparing both software's, educational version of automation studio is slightly easier than professional version

Figure 1: Automation Studio Software

Industrial Physics :-

Industrial Physics uses CAD data to create the digital twin. In step format data is imported, it utilizes important properties of the CAD design, such as mass and density. Also, it provides additional properties to various components, as well as the degree of freedom and the controller interface. The programmer can immediately start the virtual model on the computer and connect to the controller in a software or hardware loop configuration. Above figure shows how iphysics works. In this iphysics software we actually do the simulation part of the work.

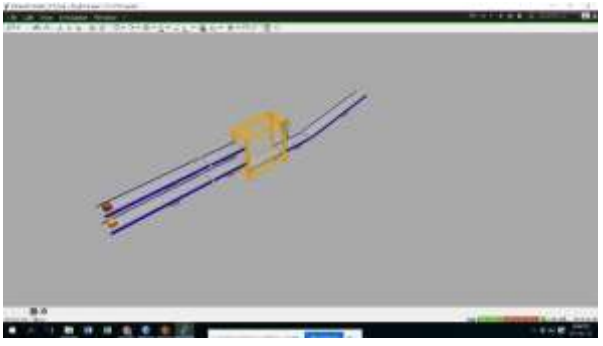

Figure 1: Iphysics software

VnCViewer: -

VnC viewer stands for Virtual Network Computing viewer. It transmits the input coming from keyboard or mouse from one computer to another using graphical .It is used widely now a days. If there's any computer or smart phone and in that if VnC viewer software is installed, then access and control of another computer can be easily taken. In proposed work focused on Ladder logic, ST programming and Automation Studio 4.7 software.

Simulation: -

Using industrial physics software, the box lift mechanism is shown. It is a continuous process; boxes are coming on conveyor belts. When the box reaches the end of the conveyor belt, lift goes up, takes the box and again comes down with the box. Then, from the lift boxes are again moving to the second conveyor belt. This is basically the digital twin of any box lift mechanism process in industries. The simulation is shown on industrial physics software. Then the mapp training showed after that the data recording that is how to record the data of the system. Also alarmx technology is also shown. Here we have added all the screenshots of the work which is done in automation studio software. Here, using industrial physics software, the box lift mechanism is shown. It is a continuous process; boxes are coming on conveyor belt. When box reach at the end of the conveyor belt, lift goes up takes the box and again comes down with box. Then, from the lift boxes are again moving to second conveyor belt. This is basically the digital twin of any box lift mechanism process in industries.

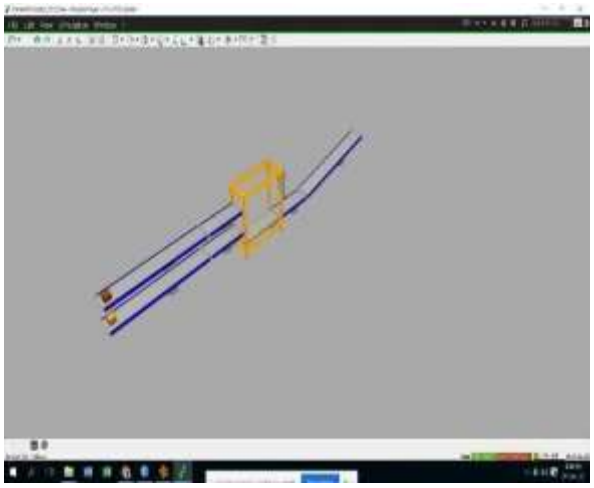

Figure 3 : Simulation of box lift

Map technology Userx login system:-

In Userx login system, basically in work developed HMI using map technology. So in companies there are owners and operators present. So the owner is only responsible to make changes in the system for that proper login system is required. Here, we decide on one user. So this user is basically the owner of that HMI system. We can give one password and then he can have access to all the features. Who is not a user he has only limited access to the system.

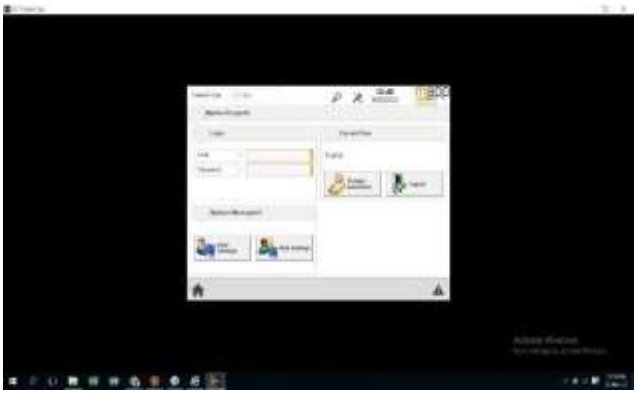

Figure 4: Userx Login System

Map Technology Audit Course:-

Mapp audit is similar to data recording just the difference is that in mapp audit message or any instruction is recorded instead of numbers which are being recorded in c drive of computer.

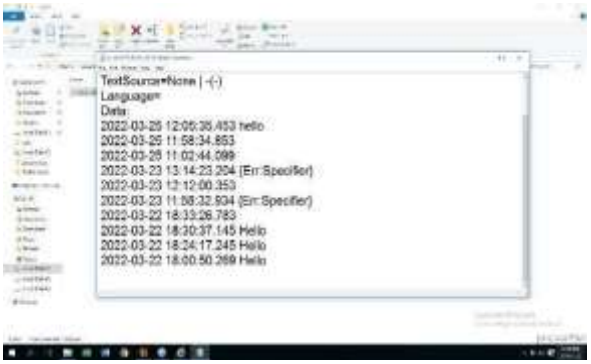

Figure 5: Mapp Audit

OPC UA (Unified Architecture) Expert:-

In figure 6 the OPC UA system in shows run in unified automation that is expert software. Here at the right hand side the output is that system is good and simulation has no problem in running. And if there is some error, the line becomes red. So as per this can find whether there is error in the system or not.

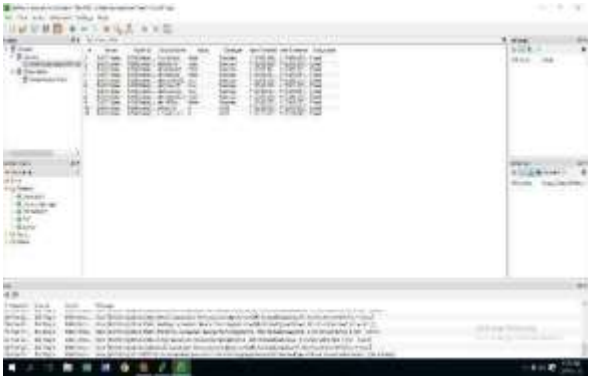

Figure 6: OPC UA

Alarm X and Alarm X list:-

Here if we triggered the alarm then any unidentified user who is trying to login. This alarm x system shows that in the HMI system. That is, unauthorized users can not use this system. It is secured with the login credentials and password.

Alarmxlist:-The history of the unauthorized user who is trying to login shows here. The date and time of the user who is trying to login is shown in this list.

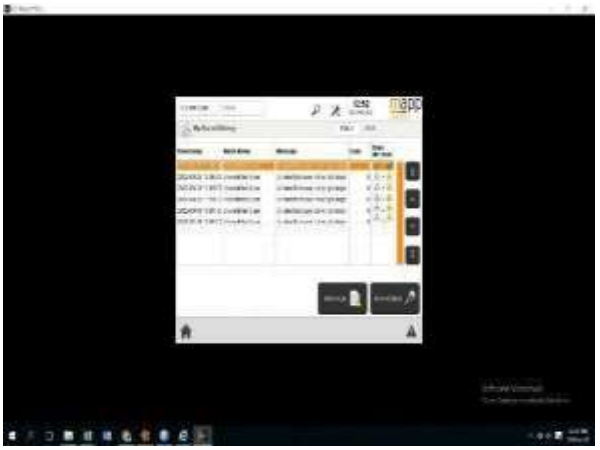

Figure 7: Alarmx list

These are some features which we simulated with the box lift mechanism on automation studio, VnC viewer and OPC UA expert software.

5. BLOCK DIAGRAM:

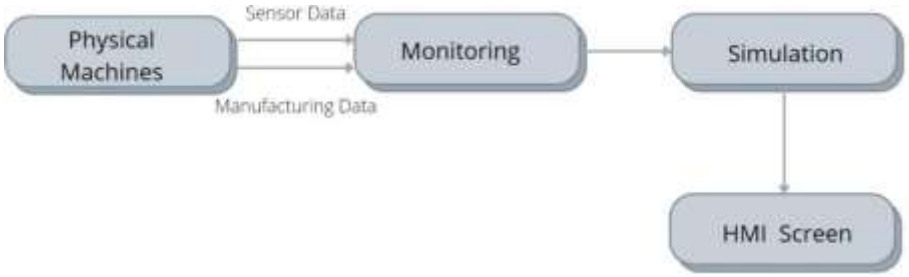

Figure 8: Block diagram

6.RESULT:-

As a result, simulated the box lift mechanism on automation Studio 4.0 software. Also simulated different features related with box lift mechanism.

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