Digital Engineering with Blockchain/ Cybersecurity and Digital Twin

Sreekumar Pillai*

Department of IT Engineering, University of Gujarat, Gandhinagar, India

Corresponding author:
Sreekumar Pillai, Department of IT Engineering, University of Gujarat, Gandhinagar, India.

✉ Pillaisdf@yahoo.fr

Description

The concept of digital transformation with 'Digital Twin's is about creating a digital representation of physical assets of a plant with 3D Intelligent model creation (governed by PDS, PDMS, SP, AUTOCAD, STAD, CAE and CAM software), as well as the enterprise and product lifecycle data management applications (SAP, WRENCH, project lifecycle/data management and other software). This will be supported by AI (Artificial Intelligence) algorithms and adoption of IIoT (Internet of Things), smart sensors, which help in providing an integrated understanding of the production cycle. This operational twin correlates and threads real time streaming IOT data together with all other inputs, which eventually creates a dynamic virtual representation of the entire plant, which will give full visibility of the multi-layered interdependencies among asset, processes and operations. This will give insight into the complete manufacturing analytics and predictive analysis of the asset but also enables in quickly running through the historian data, with the objective of achieving plant safety, reliability and sustainability.

Digital twins are used throughout the asset lifecycle to simulate, predict, and optimize the equipment performance and production system before investing in real physical assets.

The process of engineering, procurement and construction management (EPCM)/project execution uses vast amount of diversified technical information from multiple entities and software applications/ platforms. A means to seamlessly integrate the various sources of data, including licensor data and display this information on a real time basis is envisaged. Intelligent systems enables the business through information and technology with necessary IT infrastructure/ operations technology (OT), makes it easier to separate IT from the rest of the business applications, for successful implementation to drive operational excellence , quality, efficiency, capture all data (Big Data) and hence productivity/business excellence, aligning with Industry 4.0 standard.

Further, Process Industry (and process plants) has a challenging task of monitoring/sustaining productivity; improving plant efficiency/energy, plant reliability and profitability margins; optimizing operational expenditures (OPEX) over capital expenditures (CAPEX); and capturing operational knowledge. The journey of digital transformation needs a holistic approach, to be extended and Integrated from a EPC (Engineering, Procurement,

Construction), to EPCOM (EPC+Operation & Maintenance) for SMART plants, through information and operational technology (IT-OT) convergence, Industrial IoT connected technologies, such as smart sensors, cloud, Big Data and Analytics, with traditional on-premises solution or an off-premises solution, to facilitate real time assessment of the processes, performance of assets and equipment; to improve plant operational efficiency, safety, reliability and sustainability.

A new solution for digital engineering and business transformation with Digital Twin, for process industry with Cloud platform designed to support the 3D Intelligent model, with the objective of implementing DaaS (Data as a service enabler), Software as a Service (SaaS), Platform as a Service (PaaS) and Infrastructure as a Service (IaaS) to drive operational efficiency by innovative and integrated IT technologies (and IIOT), basic web applications shared by small and medium companies. The platform guarantees secure access of multiple users and complete logical separation of computational and data resources related to different projects/ clients. This network distributed data with Block chain technology and edge computing technology approach ensures a high-level of protection of the data stored in the Cloud. The platform supports the Open Stack architecture, while the user authentication is based on an original multimodal biometric approach that easily integrates finger and face recognition modalities. The adoption of Cloud computing, leveraging on the public and hybrid models, involves many advantages in terms of flexibility, scalability and reliability, but also implies new challenges on cyber security, data privacy and protection of personal data. The security specific risks of the cloud are primarily derived from the complexity of

the architecture and its characteristics of multi-user and resource sharing across network/ regional grid.

A solution to the security of data residing on distributed cloud infrastructure is the use of systems for the distribution of data, which allow splitting the data into fragments (blocks and ledgers) and dispersing them on all machines available to the cloud. In this way the recovery and the use of the data is very complex for an unauthorized user. By using these techniques, it is possible to distribute data on platforms of different providers, and to problems arising from the lack of trust in the service provider. However, in order to achieve a proper distribution of the data in the network, it is necessary to develop support tools to ensure the prompt availability and integrity of these data, without increasing the complexity of the system.

Cloud computing services and applications are faced with many challenges, including latency, unreliability, and malicious behavior, mostly related to the public shared environment in which are hosted. Security of outsourced data is still one of the main obstacles to cloud computing adoption in public bodies and enterprises

Biometric authentication is proposed in order to access the system/cloud platform; with a Client desktop application on the user side and a dedicated authentication server connected to the main module. The user interacts with the fingerprint scanner through a desktop client application. Such application produces a model file from the original fingerprints. Recent trends in process plant/production industries are always talking about Energy Efficiency (OEE), reduction in Energy Consumption, Reduction in CO_2 which contribute to global warming, achieving zero downtime and optimize asset utilization. With fourth industrial revolution (4.0), rapid changes in the nature of business over the last decade, use of information technology, extent of automation and customer expectations; the need for incorporation of innovative, efficient and seamlessly integrated technologies has risen drastically. A complete Digital engineering system with Block chain and Edge computing technologies for web applications and data management over the Cloud, coupled with strong biometric authentication, guarantees the identity of the users and makes easy and secure the access to data and services. Moreover, the adoption of a data management solution based on a distributed cloud storage architecture, protection of data residing from the edge computing provider's administrators, and a further improvement of the system with biometric access/ multimodal techniques, including face and face/finger print authentication will be a great leap with overall cyber security solutions.