INSPERIA
THE NEWS BULLETIN

Sakeshwar Gramin Vikas Seva Sanstha's

Adsul's Technical Campus ,

Ahmednagar

Department of Computer Engineering

Shri Aniruddha Adsul

Chairman

Dr. P.M .Patil

Principal

Dr. H.B. Jadhav

Head of Department

Vision of Institute

To be a most preferred Rural Technical Campus in the region by creating competent multifaceted Engineers and Professionals ready to serve the industry and society at large.

Mission of Institute

To establish state-of-the-art facilities and create a conducive environment for transforming the rural minds into competent, skilled, professional, researchers, technically sound, innovative aptitude, and ethics through value-based education to develop the nation for global competitiveness.

Objectives of Institute

- To provide quality education with futuristic trends in engineering and technology
- To ensure continual improvement in quality management system
- To impart innovative teaching and learning

Vision of Department

To strive for excellence in the field of Computer engineering through creative problem solving related to societal needs.

Mission of Department

M1. Establish strong fundamentals, domain knowledge and skills among the students with analytical thinking, conceptual knowledge, social awareness, expertise in the latest tools and awareness to advanced software.

M2. Establish leadership skills, team spirit and high ethical values among the students

M3. Guide students towards research and development, and a willingness to learn by connecting themselves to the global society

M4. Encourage students to become free-lancers.

Silent feature of Department

- **Supportive learning for placement:** Placement learning is immersive and iterative. Support in the form of formative tasks and activities are crucial for student success, whilst being mindful of the need to ensure parity of student workload between modules of the same credit weighting. Placement assistance can offer students professional guidance and support to help them build successful careers. Students who might feel overburdened by the job search process might greatly benefit from placement assistance services.
- **Value added courses:** Value Added courses are career and market oriented, skill-enhancing courses that empower the students beyond their domain of study. The certificate programmes enable them to enrich their capability and enhance their employability. Value added courses are conducted for one week during the semester breaks by department faculty and external trainers.
- **Career oriented Add-On Courses:** Job-oriented courses are training and academic courses that prepare professionals for a particular career field or role. A traditional academic course may provide an overview of a certain topic or area, but a job-oriented course focuses on the knowledge and skills required for a particular job.
- **Teacher as Mentor:** The role of the Mentor Teacher is a complex blend of modelling, coaching, instructing, collaborating, and encouraging as candidates build competency in program standards. Mentor Teachers are expected to support candidates in developing the skills and knowledge to meet these standards.
- **Report writing and Paper Presentation:** A report is a specific form of writing, written concisely and clearly and typically organised around identifying and examining issues, events, or findings from a research investigation. Reports often involve investigating and analysing a problem and coming up with a solution.
- **Professional Development for Industrial Engagement:** There are three types of employee engagement: **cognitive**, **emotional**, and **physical**. When employees are cognitively engaged, they're committed to their job, when they're physically engaged, they're invested in their work, and when they're emotionally engaged, they have an emotional connection to their work.
- **Personality Development and Soft Skill Training:** Personality Development teaches us how to communicate and display ourselves as having caring skills. It also emphasizes personal management, grooming, health, and nutrition, as well as soft skills. This course educates students on the numerous aspects of self-development. Soft skills comprise pleasant and appealing personality traits as self-confidence, positive attitude, emotional intelligence, social grace, flexibility, friendliness and effective communication skills. INTENDED AUDIENCE: Students, Teachers, Professionals, Trainers, Leaders, and Employers.

Program Educational Objectives (PEOs)

PEO1: To prepare globally competent graduates having strong fundamentals, domain knowledge, updated with modern technology to provide the effective solutions for engineering problems.

PEO2: To prepare the graduates to work as a committed professionals with strong professional ethics and values, sense of responsibilities, understanding of legal, safety, health, societal, cultural and environmental issues.

PEO3: To prepare committed and motivated graduates with research attitude, lifelong.

PEO4: To prepare the graduates with strong managerial and communication skills to work effectively as individual as well as in teams.

Program Outcomes (POs)

PO-1: Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering Programs.

PO-2: Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

PO-3: Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

PO-4: Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO-5: Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.

PO-6: The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

PO-7: Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO-8: Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

PO-9: Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO-10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

PO-11: Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO-12: Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Program Specific Outcomes (PSOs)

PSO1: Professional Skills: The ability to apply knowledge of problem solving, algorithmic analysis, software Engineering, Data Structures, Networking, Database with modern recent trends to provide the effective solutions for Computer Engineering Problems.

PSO2: Problem-Solving Skills: The ability to inculcate best practices of software and hardware design for delivering quality products useful for the society.

PSO3: Successful Career: The ability to employ modern computer languages, environments, and platforms in creating innovative career paths.

Events

Farewell Celebration

"We started here together and now here were leaving the same way. The funny thing is you never appreciate what you had yesterday until it is gone Today". College Farewell parties are always an exciting affair and bring alive a lot of happy memories.

ATC, Department of Computer Engineering organized Farewell Party "NEVER SAY GOODBYE" on 27th May 2024 at the college auditorium, where students of B.E 3rd year bid farewell to the outgoing students of B.E final year with great enthusiasm. Function began with a floral welcome of Mr. Dr.P. M. Patil, Principal, Dr. H. B Jadhav, Dean of Academics & Hod of Computer Department, Hods of other Departments by staff and students. This event was coordinated by Assistant Professor Ms. Yogita Suryawanshi and third year students.

Lightning of Lamp was done by Principal, Dean & all HOD"s followed by prayer song. Principal wished good luck to the final year students for their future. He also expressed his hope that students will continue holding best positions in upcoming university exams.

Final years gave inputs to 3rd years to go ahead in building their careers. Most of the placed students shared their experiences in interviews such as GD, Aptitude, Verbal Reasoning and HR sessions, faced during campus selections. They even guided their juniors about the various fields that can be opted once they are in Final years and gave suggestions regarding the Universities providing specific courses based upon the students interest and grades. Juniors even got opportunities to discuss about the doubt full issues regarding their career.

All the seniors and juniors had filled the auditorium with colorful attires which added beauty to the event. Juniors gave a warm welcome with Red Roses followed by very entertaining group dances, solo dances and solo song performances. Students of final year participated in Ramp Walk, judged by Computer Engineering Final year in-charges. It was an incredible day hosted and organized by juniors.

As it was noon and rats were racing in their stomachs, they took a break for the delicious lunch organized by the juniors. Conversations during the meal provided opportunities for the students to bond, plan, connect, and learn from one another. Once they were recharged, they started the fun again.

Different tags were awarded to the students, Mr and Ms. Beauty with Brain, Cute Smile, Mr. and Ms. Popular, Logical thinking, Mr and Ms. Well dressed, etc…Some exciting games were also arranged for the seniors like musical chair, Quiz and Food competition, etc. and were enjoyed by all. Token of love and appreciation was given to the seniors by their juniors. Token of love was presented by Faculties. The day ended by capturing memories with photo sessions. At last the auditorium was geared up with DJ filling high energies and immense pleasure among all, with the stamps of amazing memories and fun.

Yoga Day Celebration

International Yoga Day is observed every year on June 21 to raise awareness about this ancient practice and to celebrate the physical and spiritual prowess that yoga has brought to the world. Yoga is a practice which plays an important role in relaxing the mind and body and boosting people's immune system.

10th International Yoga Day was celebrated by the students and the faculty members of Department of Computer Engineering on 21st June 2024 with great eagerness and enthusiasm. Director Dr. P. M. Patil also joined the International Yoga Day celebration.

The theme for international Yoga Day 2024 is 'Yoga for Self and Society' and revolves around self-enlightenment. This year's theme of international yoga day focuses on Yoga, a transformative practice, representing the harmony of mind and body, the balance between thought and action, and the unity of restraint and fulfillment for self & society.

The function began with a brief introduction of Yoga Day by Mr. Rahul. He explained that regular practice of Yoga helps to achieve better mental and physical health. Mr. Rahul demonstrated Surya Namaskar Asanas and various Yoga Asanas which were performed by the students and the staff members enthusiastically.

The program taught everyone that they should read ancient Indian texts like Patanjali Maharishi's 'Ashtanga Yoga' along with personality development books by international writers. They were encouraged to practice Yoga and meditation on a regular basis for a healthy body and mind.

A special guest of the day Ms. Heena Chawda, A Yoga instructor from Holistic science, Miss Heena started with prayer and explained the importance of Yoga in everyday life. She encouraged all to practice Yoga and meditation on a regular basis for a healthy body and mind. She explained the common Yoga Protocol. She demonstrated various Asanas like Tadasana, Vrikshasana, Pad-Hastasana, Ardha chakrasana, Trikonasana, Vajrasana, Ustrasana, Makarasana Etc. with their benefits & cautions.

The function ended with felicitation of event guest Ms. Heena Chawda & vote of thanks preceded by National anthem. The program concluded with the recitation of Shanti Mantra and the students and teachers carrying home the message that,

"Yoga is not for only one – it's for everyone, Yoga is not for a day- it's for every day."

Articles by Students

Human Augmentation

Human augmentation is the ability to perform actions, whether physical or mental, with the help of tools that practically integrates into our bodies — pushing the limits of our natural capabilities. Here the word "practically" has an ambiguous meaning since not every increment of this type is directly grafted onto the body. And it has not been difficult to see this human performance improvement in our daily lives.

We are already experiencing an increase in our natural abilities thanks to wearable devices, such as smart watches and smartphones. This leads to our ability to communicate "where no man has gone before." Sounds familiar?

When did human augmentation start?

One of the most classic studies on human augmentation is the article written by Douglas Engelbart published by the Stanford Research Institute in 1962. The paper lays the foundations for the concept of the augmentation human intellect.

As the first computer terminals were the object of much expectation, it was natural that they opened the possibility for further discussion and, finally, the emergence of the term human augmentation. However, Engelbart delves deeper and details how human capabilities can be extended from four ways: artifacts, language, methodology, and training; and thus identifies its existence for centuries ago.

What are the types of human augmentation?

The human augmentation market is attracting media because it can let us become "superhumans," or Human 2.0. With advances in brain-computer interfaces, we are approaching augmented human intelligence. But not all forms of human augmentation technology will grant us "superpowers."

Innovations in human augmentation will occur on three action fronts.

Replicating

Perhaps the category that is the most essential is replicating. We now have human augmentation technologies that can replace some part of compromised human ability.

One good example of a tech player that's immensely impacting the market is Naked Prosthetics, which builds finger prosthetics for everyone who has suffered an accident or an amputation.

Certainly, Naked Prosthetics are one of the benchmark companies when we mix technological material and human health. Not to mention the purpose of the business, which attracts many candidates to participate in the transformation of people's lives.

Are humans becoming cyborgs?

Yes, we are and have been for a while. From the moment a human being placed a prosthesis in his body, the contrast between machine and human started to enter a gray area.

And now, everything is even more confusing when we have virtual and real environments coexisting. In this way, even our gadgets begin to be an inseparable part of ourselves.

Supplementing

As it already says, supplementing is an augmentation tech that supplies more potential of an individual capacity. This could include a wide variety of items like ear devices to others capable of enhancing our vocabulary.

Can the human body be augmented?

Imagine a smart glass that shows you a holographic display providing eye-to-eye contact with remote people or places. The good news, it already exists.

Exceeding

The human augmentation market found its most significant challenge when developing products that exceed human potential. As humans, we know our limits and the things we can do naturally, so in this area, some companies allow us to become the heroes who were never born.

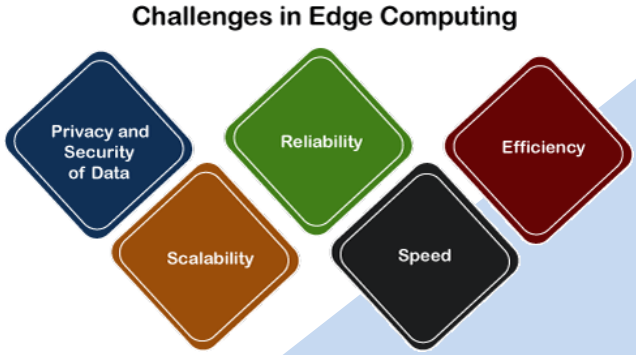
Purushottam Thombare
Second Year 23-24

Edge Computing

Edge computing refers to the exercise of processing information in the direction of its delivery at the edge of a network, in the region of counting on a centralized cloud or data center. In edge computing, statistics are processed and analysed locally on devices or in nearby servers, lowering latency and permitting quicker reaction times. This technique is especially useful in situations in which actual-time or near-real-time processing is crucial, which include the Internet of Things (IoT), autonomous automobiles, and commercial automation.

Edge computing enhances performance, security, and the capability to manipulate and study information at or close to the beginning, making it a treasured addition to the broader cloud computing atmosphere.

Edge Computing is a buzzword such as cloud, IoT, and Artificial Intelligence. Simply saying, Edge Computing brings the decentralization of networks. Edge Computing is the upcoming enhancement and advancement in technology. The literal meaning of the word 'Edge' is the geographic location on the planet to deliver services in a distributed manner. Edge Computing is a distributed computing system that allows to bring computation of data and storage too close to the source (where data is required). It brings computing as much close as possible so as to minimize the bandwidth, improve response time, and use of latency. Instead of locating the data at a centralized place, the concept of edge computing believes in distributing the computing process of the data. However, cloud computing and IoT are faster plus efficient, but edge computing is a more faster computing method. The objective of Edge Computing is to improve the network technology by moving the computation of data close to the edge of the network and away from the data centers. Such a process exploits network gateways or smart objects for performing tasks and provide services on behalf of the cloud. As it is well-known that per day data is produced in a huge amount that makes its computation difficult and complicated to be handled by the data centers. Also, the network bandwidth limit almost gets exhausted, and response time increase highly. So, when moving computation and data services in the hands of edge computing, it is possible to provide efficient service delivery, better data storage, and IoT management that could minimize the response time and transfer rate of data. With the 5G data network, it has enabled to converge 5G data network and edge technologies within reach. Thus, Edge Computing reduces the long-distance processing and slow communication of the data.



Privacy and Security of Data: It is the new change and enhancement in technology, and so there should be change and enhancement in the privacy and security feature also. Securing part devices and the information they generate may be complex. These devices are frequently distributed to diverse locations, putting them at risk of bodily and cyber threats. Security protocols and updates want to be continuously controlled.

Scalability: Scaling edge infrastructure to satisfy the demands of an expanding network or consumer base can be tough. It calls for cautious planning and aid allocation to make certain that processing competencies are allotted successfully. Edge Computing is based on a distributed network, and scalability becomes a challenge for such a distributed network-facing several issues. These issues are:

Heterogeneity of Devices: A focus should be present on the heterogeneity of those devices that have its own different energy and performance constraints.

Devices that have extensively dynamic condition and reliability of the connections in comparison to the robust infrastructure of the cloud data centers. In addition to this, the increase in the security requirements affects and slows down the scaling factor of edge computing as it may bring more latency between the nodes that communicate with each other.

Reliability: Such a feature is a very challenging task for every technology and so for edge computing. For handling service from certain failovers, its management is required, which is very crucial. As edge computing relies on a distributed network, so if a single node fails or unable to reach, still the users must be able to avail the service without any disturbance. Also, the edge computing must be able to alert the user about the failure node and must provide actions to recover from the failure. For this, each device should maintain the network topology of the whole distributed system that will make the detection of errors and its recovery easy to process. Other than this, the connection technology in use may provide different reliability levels and data accuracy produced at the edge that could be unreliable because of the environmental conditions.

Speed: Edge computing should be able to provide speed services to the end-users as it brings analytical, computational resources near to the source (end users), and it leads to fast communication. Such a modern system will automatically outperform the cloud computing system, which is a traditional system. So, maintenance of good speed is also a challenging task for edge computing.

Efficiency: The efficiency of the edge computing becomes better because the availability of the analytical tools is too close to the end-users, and due to this, AI tools and analytical tools which are sophisticated can possibly execute on the edge of the system. Such a platform improves and increases operational efficiency and thus provides several benefits to the system.

Why Edge Computing

Edge Computing is a new type of technology that will not only save time but also save the cost of servicing and other charges too. There are the following reasons that will answer the question:

Through edge computing, it allows smart applications and devices for responding to data very quickly as soon as it is created and thus removing the lag time.

Edge Computing also enables data stream acceleration that includes real-time processing of data without latency use. Data Stream acceleration is, however, critical for self-driving cars type of technologies and provides equal and vital benefits for the businesses.

Efficient processing of data at large scale by allowing processing close to the source, and it saves the use of internet bandwidth also. Thus, it reduces the cost and enables effective accessibility to the applications in remote locations.

The ability of edge computing to provide services and processing data at the furthest distance makes a secured layer for the sensitive data without keeping it into a public cloud.

Applications of Edge Computing

Today, the world relies on the Internet from small to big things, and thus the prices of IoT devices such as sensors and computing cost is reducing too. In this way, more things will remain connected to the Internet. As a result, more connected devices become available, and edge computing will go on demand. There are following sectors that will be potentially benefitted from Edge Computing:

Transportation: It is one of the most potential sectors where edge computing plays a vital role and particularly in autonomous vehicles. It is because autonomous vehicles are full of different sensors types from the camera to the radar system of the car. Such autonomous devices can essentially utilize edge computing for processing data too close to the vehicle through these sensors, and consequently, a good amount of time will be saved. But these autonomous cars are not the mainstream yet, and it is still in preparation. The Automotive Edge Computing Consortium (AECC) in the year 2018 that it would be launching the operations which are focused on the connected car solutions. But not only the self-driving cars, edge computing will be focused upon trains, aeroplanes, and other transportation forms also.

HealthCare: People rely on fitness trackers, smartwatches, stamina measurement watches, etc., and find these health-monitoring wearable comfortable. However, the real-time analysis is essential for capturing the actual benefits of the collected data because many health wearables devices are directly connected to the cloud while others can be operated in an offline mode only. Certain health devices analyze the pulse rate and sleep pattern in an offline mode only, and doctors use to check and evaluate the patients on the spot using the analysis result. Such smart devices are useful for collecting and processing data in treating patients in any pandemic (such as COVID-19).

By the use of edge computing, scientific professionals can acquire and approach facts more quickly, which may motivate higher and faster patient care, which includes a safety layer to PDHD (patient-generated fitness statistics). Through edge computing, hospitals and doctors will be able to use and access more clod applications more quickly, but the security and privacy of data is still a confusion.

Manufacturing: Edge computing in the field of manufacturing will reduce the data that goes to the cloud for applications like predictive maintenance, and it will move the operational technology to the edge computing platforms for running process similarly as processed in the cloud but with more speed and result. However, the maintenance of an on-premise deployment is still reliable on the cloud.

Grid Edge Control and Analytics: These smart grid controls work by creating two-way communication channels via WAN protocols between the power distribution infrastructure, consumers, and the utility head-end. However, edge grid computing is capable of providing advanced real-time monitoring and analytics and also producing actionable insights on distributed energy that generates resources like renewables. Such capability is available in edge computing technologies only. Edge Grid Computing can, however, reduce the overall cost, wastage of energy, avoid out stages and overcompensation if electric vehicles, wind farms and hydroelectric dams that generate a massive amount of useful data can assist the utilities with analytics on requirements, peak usage predictions, availability, and energy production.

Remote monitoring of Oil and Gas: At present, IoT devices are providing modern safety monitoring, sensory devices for controlling, viewing, and sensing the temperature, pressure, moisture, humidity, sound, and radiation of oil and gas. IP cameras and other IoT devices generate massive and continuous amounts of data, and then the data is combined as well as analyzed in order to provide the key insights for evaluating the health of any running system reliably. With edge computing, real-time safety monitoring can be possible for safeguarding critical machinery infrastructure and oil and gas systems from disasters. Also, several edge IoT monitoring devices are being developed, keeping safety and reliability as the main focus points. Edge Computing allows analyzing, processing, and delivery of data to the end-users in real-time. Consequently, it will enable the control centers to access the data instantly as it occurs, preventing the malfunctions in the most optimized manner. Thus, oil and gas services are the critical infrastructures that can be catastrophic in nature if not maintained with safety and precautions.

Traffic Management: Traffic is the worst waste of time and needs to be optimized. The best way to optimize traffic is by maintaining and improving real-time data. For the traffic management process, the smart transportation systems such as self-driving cars, and other sensory systems make extensive use of edge computing devices. Through edge computing, a massive amount of sensory and other data is analyzed, then filtered, and finally compressed before transmitting on the IoT edge gateways to other systems for use. As a result, edge computing reduces network expenses, operating processing, and storage cost for undertaking traffic management solutions.

Edge Video Orchestration: It uses edge computing resources for delivering heavy bandwidth videos by implementing a highly optimized method. It does not deliver the video through a centralized core network to all networks. Instead, it orchestrates, caches, and distributes the video files closely to the device. Through edge computing, it is fast to serve the freshly created video clips and live streams to the paying customers via rich media processing applications that run on mobile edge servers and hotspots in venues. Thus, avoiding certain quality issues that of the mobile networks when delivering heavy videos (terabyte size) and reducing the service costs too. Still, the development of such edge computing is in the process but will boon in the coming years.

Shrushti Pawar
Third Year 23-24

Digital Twin

Have you ever crafted a machine? If so, envision the iterative process it took to achieve flawless functionality. We understand that the journey likely involved numerous attempts, a common challenge faced not only by you but by every manufacturer. Defects in specific fragments can lead to nonfunctionality, prompting dismantling, identification of the faulty part, and starting anew.

Ever wished you could predict a machine's performance before assembly? Imagine simulating it on your desktop, replicating real-world behavior from micro-atomic to macro-geometric levels. This possibility is realized through a "Digital Twin." The future of industrial services revolves around accurately predicting physical assets through their Digital Twins.

What is a Digital Twin?

A Digital Twin of any device/system is a working model of all components (at micro level or macro level or both) integrated and mapped together using physical data, virtual data, and interaction data between them to make a fully functional replica of the device/system and that too on a digital medium.

This digital twin of the physical system is not intended to outplace the physical system but to test its optimality and predict the physical counterparts' performance characteristics.

You can know of the system's operational life course, the implication of design changes, the impact of environmental alters and a lot more variables using this concept. Talking about life course, it invites me to aromatize your awareness of the concept with its origin.

Brief History of Digital Twin

The concept and model of the Digital Twin was officially put forward in 2002 by Dr. Michael Grieves as the conceptual model underlying Product Lifecycle Management (PLM). The concept was being practiced since the 1960s by NASA. They used basic twinning ideas for space programming at that time. They did this by creating physically duplicated systems at ground level to match the systems in space.

Example : When NASA developed a digital twin to assess and simulate conditions on board Apollo 13. The efforts were made keeping in mind only a particular mission and because of that, this concept didn't gain recognition until 2002 after Dr. Grieves presented it with all the elements including real space, virtual space and the spreading of data and information flow between real and virtual space.

The concept of integrating the digital and physical parts as one entity has remained the same since its emergence. Although the terminology has changed over the years till 2010 when it was subsequently called 'Digital Twin' by John Vickers of NASA in a 2010 Roadmap Report.

A Digital Twin consists of three distinct parts:

1. The physical part ,
2. The Digital Part ,
3. The Connection between the Two.

The 'connection here refers to the data that flows from physical products to the digital/virtual product and information that is being available from the digital environment to the physical environment.

Types of Digital Twins:

Digital twins can be categorized based on the scope and complexity of the physical entity they represent, forming a tiered hierarchy of functionality. This section outlines the four main types of digital twins:

1. Component Twins

These twins represent the most granular level, focusing on individual components within a system, such as sensors, actuators, or mechanical parts. They capture intrinsic properties, operational parameters, and behavior characteristics of these components, often relying on sensor data and basic physical models.

For instance, a digital twin of a wind turbine blade might track temperature, vibration, and rotation speed to predict potential wear and tear.

2. Asset Twins

Moving up the scale, asset twins represent complete physical entities like vehicles, machines, or infrastructure elements. They integrate data and behavior from individual components (often derived from component twins) into a cohesive model, providing a holistic view of the asset's performance, health, and potential future states. Asset twins employ more sophisticated models encompassing physics, thermodynamics, and other relevant domains, enabling proactive maintenance and performance optimization.

For example, a digital twin of an airplane might track engine performance, fuel consumption, and flight dynamics to optimize flight paths and predict maintenance needs.

3. System Twins

System twins capture the interactions and dependencies between interconnected assets within a larger system, such as power grids, transportation networks, or manufacturing facilities. They leverage data and insights from asset twins but incorporate additional layers of complexity to account for emergent behavior arising from inter-asset dynamics. A digital twin of a power grid might simulate how the failure of one generator cascades through the system, impacting other components and potentially causing outages.

4. Process Twins

The most comprehensive digital twins, process twins encompass the entirety of a complex operation, including physical assets, human interactions, environmental factors, and logistical considerations. These twins model the entire workflow, enabling comprehensive optimization, scenario simulation, and proactive identification of potential disruptions.

A digital twin of a manufacturing process might encompass everything from raw material procurement to finished product delivery, optimizing resource allocation, predicting bottlenecks, and ensuring on-time production.

How is all this data collected in Digital Twin?

When it comes to discussing about working of a Digital Twin, we can only start by finding an answer to this question. For the creation of a digital twin of any system, the engineers collect and synthesize data from various sources including physical data, manufacturing data, operational data and insights from analytics software. The sensors are connected to the physical product that helps to collect data and send it back to the digital twin, and their interaction helps to optimize the product's performance using a maintenance team.

- Engineers integrate Internet Of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), and Software Analytics with Spatial Network Graphs.
- The integration aims to gather relevant information and map it into a physics-based virtual simulating model.
- Analytics are applied to these models to extract performance characteristics of the physical asset.
- Seamless exchange of data is crucial for devices, including digital twins, to facilitate optimal analysis.
- Digital twins continuously update themselves from multiple sources, representing near real-time status, working condition, or position.
- Learning systems within digital twins use data from various sources, including sensors, human experts, similar machines, and the broader systems/environment.
- Past machine usage data is incorporated into the digital model.
- Analytics, such as environmental conditions and interaction analytics with other devices, are applied to detect anomalies and understand the lifecycle of the physical counterpart.
- Digital twins determine optimal processes to enhance key performance metrics and provide long-term forecasts for business optimization.
- The overall goal is to improve business outcomes by leveraging insights from the digital twin's continuous learning and analysis.

Pankaj Kandekar
Final Year 23-24

Poem on Computer Engineers

I was alone and all was dark
Beneath me and above
My life was full of volts and amps
But not the spark of love

But now that you are here with me
My heart is overjoyed
You turn the square of my heart
Into a sinusoid

You load things from my memory
Onto my system's bus
My life was once assembly code
Now it's C++

I love the way you solder things
My circuits you can fix
The voltage across your diode is
much more then just point six

With your amps and resistors
You have built my integrator
I cannot survive without you
You are my function generator

You have charged my life,
increased my gain And made my math discreet
And now I'll end my poem here
Control, Alt, and Delete

Aditi Wagh
Final Year 23-24

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