



Faculty of Computer Applications & Information Technology
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Message From Dean, FCAIT-UG Programme



It is predicted by many technical experts that within a decade almost every day to day activities will be supported by smart sensors based electronic devices. These predictions can become possible with the help of the edge technology. One may find multiple answers like IoT, smart environment, Cloud Computing or 5G networks etc when asked about edge technology. But edge computing encompasses much more than this.

Edge computing is a distributed computing framework that brings the different enterprise applications and its related data sources closer. Thus this easy availability of the data can deliver stronger business benefits, improve the response time and better bandwidth availability. There are various challenges that are faced while working with edge computing like privacy and reliability of the data, scalability and improving the efficiency of the systems by making different analytical tools available to the end-users.

The application services working over the edge computing technologies allows the reduction of the volume, consequent traffic and distance for data transfers, which leads to lower latency and transmission costs.

The present issue of D-Kosmos will help you to walk through the essential concepts of edge computing. Moreover, the readers will get to know about the different aspects of market trends and challenges faced by the edge computing system.

-- Dr. Tripti Dodiya

From Editorial Desk

Dear Readers,

“The key to edge computing success lies in focusing on the outcome, before looking at implementation” – Rick Vanover

Edge computing is one of the emerging computing paradigms which refers to a range of networks and devices at or near the user. It brings computation and data storage closer to the devices where it's being gathered, rather than relying on a centralized data location which is placed thousands of miles away.

We are glad to present our 20th issue of our half-yearly magazine “D-Kosmos” with the theme “Edge Computing”. The present issue of D-Kosmos focuses on importance, working, challenges and current market trends of Edge Computing. Along With this D-Kosmos also brings out the glimpses of various cultural and technical events organized by FCAIT for the holistic development of students.

Many seminars, workshops and innovative events like Tech-Talk, Code-Express and Cyber-Shadez were conducted to prepare students for industry experience. The cultural event "SHADEZ: gave a platform to the students to showcase their talent of singing, dancing, music, rangoli etc. in the online mode.

We welcome your suggestions and remarks via email, so please get in touch for reviews at dkosmos@glsica.org.

Wishing you all a happy reading of D-kosmos!

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Introduction

Edge computing is a distributed Information Technology (IT) architecture in which client data is processed at the periphery of the network, as close to the originating source as possible. The word edge in this context means literal geographic distribution. In cloud computing, high availability and sub-second response times are nearly impossible, or at least unfeasibly expensive. This drawback has given rise to edge computing, which moves computing resources to the physical location of data creation, or the so-called “edge” of the internet. The touted results are real-time speeds and dramatically increased availability, flexibility, resiliency and consistency of the data. With edge computing, companies gain real-time insights with less latency and lower cloud server bandwidth usage.

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. Following are the reasons why edge computing is widely adopted:

- It allows a faster response to data as soon as it is created and thus removes the lag time.
- It 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.
- 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.

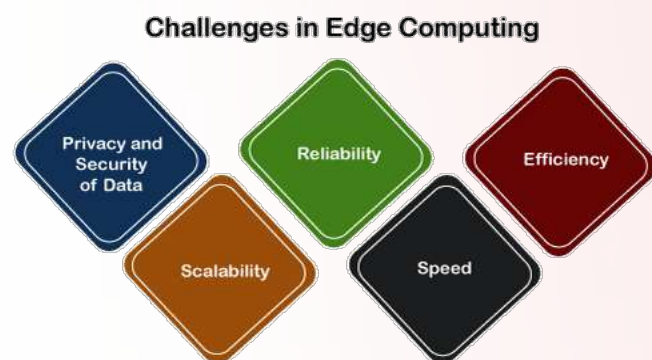
How it Works?

Edge computing works by pushing data, applications and computing power away from the centralized network to its extremes, enabling fragments of information to lie scattered across distributed networks of the server. Its target users use commercial internet application services. Earlier edge computing was available to large-scale organizations, it's now available to small and medium organizations because of the cost reductions in large-scale implementations.

Challenges in Edge Computing

The following are the issues and challenges edge computing poses:

- **Privacy and Security of Data:** New change and enhancement in technology demands regular updation in privacy and security feature in recent time.
- **Scalability:** Edge Computing is based on a distributed network, and scalability becomes a challenge for such a distributed network-facing several issues.
- **Reliability:** Being reliable is a challenging task for every technology as well as for edge computing. 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. So, maintenance of good speed is also 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.



Market towards Edge Computing

Edge computing has increasingly become a priority for a growing number of organizations. According to IDC, worldwide enterprise and service provider spending on edge hardware, software and servers is expected to hit \$176 billion in 2022, representing a 14.8% increase over 2021. That spend is anticipated to approach \$274 billion by 2025, according to the firm. Similarly, the LF Edge arm of the Linux Foundation expects edge spending to jump to \$800 billion by 2028. The edge computing market size is expected to grow from USD 36.5 billion in 2021 to USD 87.3 billion by 2026, at a Compound Annual Growth Rate (CAGR) of 19.0% during the forecast period. The COVID-19 pandemic has boosted field service solution adoption across industry verticals as the users move to leverage field service solutions advantages, such as expansions and less cost. Despite the global economic slowdown, around 50% of subscription companies are expanding at a similar pace without any negative influence due to the COVID-19 pandemic.

Edge computing started out rather modest in its use cases but has quickly expanded across industries and scope. Five years ago an edge network was a few mid-range servers in a ruggedized container. Now Nvidia and Lenovo are deploying GPU-based AI systems. Although only 27% of respondents have already implemented edge computing technologies, 54% find the idea interesting.

Top Edge Computing Companies

The Edge computing industry is one of the largest emerging sectors in technology. The research firm believes that the integration of artificial intelligence into cloud computing will help to drive the growth with industries such as machine control and telecommunication. The best edge computing companies also allow users to harness comprehensive data analysis, with many possible applications like Internet of Things (IoT), Artificial Intelligence (AI), Machine Learning (ML), cybersecurity, and remote workforce support.

AWS

Amazon Web Services (AWS) offers a cloud-edge hybrid model that allows a consistent experience on both the edge and the cloud. AWS includes services and solutions that package IoT, AI, ML, robotics, analytics, and compute and storage capabilities to achieve business outcomes across common industrial workloads.



Amazon Web Services also provides solutions like its Connected Vehicle solution, IoT Device Simulator, and AWS IoT Camera Connector. AWS also sells edge products — including Alexa and Echo devices. AWS edge computing is good for those in the industrial and commercial markets.

Clear Blade

In 2020, ClearBlade released its Edge Native Intelligent Asset Application. This app allows edge maintainers to connect IoT devices, define asset types, and build alert systems without needing any coding ability.



ClearBlade allows a single platform to enable customers to leverage local compute, operationally solve business problems, and artificial intelligence. It also offers real-time location and asset tracking, and its middleware platform helps connect various parts of IoT. ClearBlade will make sense if a company is in the following industries: mining, facilities, oil and gas, rail, logistics, healthcare, and energy.

Dell



Dell has invested heavily in edge computing. Through OpenManage Mobile, Dell EMC offers edge-computing management and orchestration capabilities. Dell EMC divides the company's edge computing hardware into three different categories. These are the Mobile Edge portfolio (which includes cloud-enabled hardware for mobile or remote locations), the Enterprise Edge portfolio and the IoT Edge portfolio, which offers Edge Gateways for manufacturers, retailers, and digital cities.

Mutable



It automatically prioritizes the workloads of the owner while selling the unused compute capacity through its own public cloud to unlock the full revenue potential of existing servers. This handles the increase in internet traffic both effectively and sustainably.

Mutable Public Edge Cloud harnesses the ultra-low latency of 5G networks to provide consistent connectivity between wired and wireless devices on the edge. Mutable also allows developers to deploy their apps to end users without having to maintain their own cloud footprint. Mutable OS is an edge computing software solution designed for container organization and multi-data center server management.

Section



Section is an edge computing platform focused on DevOps — the edge platform fully integrates with application engineers' workloads. Section's newest launch, the patent-pending Adaptive Edge Engine technology, paves the way for complete edge computing.

Users can understand how their edge performs in real-time using Section's traffic visualization console, which provides next-gen observability tooling for DevOps teams.

Edgeconnex

EdgeConnex focuses on positioning data facilities where they're needed the most for better network and IT connectivity. Its thinking is that the edge is an amorphous and non-specific in location, with IoT sensors anywhere and everywhere. In addition, EdgeConnex offers EdgeOS, a self-service management application meant for high observability, with a single universal dashboard to manage it. EdgeConnex's far edge use cases include Artificial Intelligence, AR/VR, IoT, low latency media streaming, connected and automated vehicles, immersive gaming, and machine learning. They work closely with customers to ensure tailored scalability, power, and connectivity. As a result, EdgeConnex is ideal for hyperscale customers. Its main clients include content providers, network and cable operators, and colocation companies.



ADLINK Technology



ADLINK offers users a super-specialized focus on edge computing. With features like IoT hardware and software, AI software, and robotics solutions, ADLINKS would be suitable for those in the military or aeronautics spaces, as well as companies whose focus is healthcare, manufacturing, networking, or communications.

Google Cloud Platform

With its global network and reach, few companies have the technical infrastructure to support edge computing like Google. Many consumers already have a Google device in their home. Google offers a line of connected home products for edge computing. It also provides cloud computing services for managing edge data. Google uses Edge TPU hardware to run analytics and AI at the edge. In addition, Google's other AI cloud services are an excellent complement to its edge computing products.



HPE



Hewlett Packard Enterprise (HPE) offers both wireless and wired networking products that enable edge computing, such as its network security solutions. These include control systems, telecommunications, industrial networks, and IoT data acquisition. HPE allows telcos to deploy

innovative new edge computing services to customers via IT infrastructure located at the edge of networks or on customers' premises. Edge Orchestrator drives new revenue streams, exploring use cases such as AI-powered video analytics, VR retail services, and industrial automation. HPE is well-positioned to serve larger companies, particularly with cloud deployments, and has a long-standing interest in enterprise IT.

IBM

IBM has a strong relationship with large businesses and offers an IoT solution for enterprise asset management, facilities management, and system engineering. IBM's edge computing platform is based on OpenShift technology, and the Watson IoT applies its AI technology there. The company touts an advantage in cloud computing by offering a way for organizations in the telecommunications, retail, and automobile industries to manage the infrastructure at the edge of their networks, using edge computing for servers.



INTEL



Intel is well-known as a chipmaker. Though Intel is one of the leading companies who produces chips, it is also known as one of the top edge computing companies. The Intel IoT Platform products include gateways for IoT, the Intel Secure Device Onboard (SDO) service, Wind River Helix Device Cloud, and Wind River Titanium Edge, in addition to edge computing components featuring Intel processors and storage. Intel also has reference architecture, developer kits, tools, kits, tools, and SDKs for IoT deployments. It chiefly sells products that your company can use to create its IoT products and services.

Vashisht Purani, SYBCA

How will Edge computing power the future of IoT?

Irrespective of the industry, whether it's manufacturing, energy, transportation or any other—IoT will have a big impact on business. Edge computing helps to manage and analyze all of the generated data at an increased speed with reduced load on the internet networks transmitting huge amounts of data. The IoT ecosystem has expanded rapidly in recent years, and with it, an increase in data coming from endpoint devices. But many organizations that spent the past decade moving data out of their own data centers and into the cloud are realizing that it doesn't make sense to send all the data generated by IoT devices to the cloud for processing. One of the main concerns is the sheer volume of IoT data being created. IDC, the tech research and advisory firm, predicts that by 2025 there will be 55.7 billion connected devices worldwide, 75% of which will be connected to an IoT platform. IDC estimates data generated from connected IoT devices to be 73.1 ZB by 2025, growing from 18.3 ZB in 2019.

Most of this data arises from security and video surveillance, but industrial IoT applications will also account for a significant portion of this data. The cost of building the infrastructure and the fees associated with transporting all that data to the cloud would be astronomically high -- much higher than the financial benefits organizations anticipate gaining from many of their uses for gathering endpoint data in the first place. Cost isn't the only issue with moving all that data to the cloud, though. There's also concern over transmission times.

The speed of sending data to the cloud, where analytics engines would process the data and then return actionable insights back to those endpoints would in many use cases take too long. Organizations need near instantaneous results for many of their IoT deployments, where even a one-second delay could be too long.

Edge computing use cases

Cameras, sensors, production line machines, cars and industrial equipment are a few examples of industries where edge computing is expected to play a larger role. Effective applications, enabling computation of data output at the edge would not only help in real-time decision making, mitigating any latency, but also save costs and improve ROI.

A few use cases in various industry verticals are listed below:

- **Oil & Gas:** Edge computing is being deployed in a top-notch oil and gas company to detect faults at the machinery level, before they are found using predictive analysis.
- **Chemical Industries:** It is being used to build smart petroleum refineries where the process is well analyzed to increase productivity and workplace safety.

- **Energy Sector:** It is being used smartly in various energy producing industries to reduce power loss and make energy equipment reliable and efficient.
- **Commuting Sector:** Various transportation companies are making use of edge powered IoT devices and computing services to help find the right parking area and reduce parking downtime. Various AI algorithms work with these edge devices to optimize parking spaces and to collect real-time traffic and navigation data. They use analytics to make well-informed decisions.
- **Industrial Uses:** Leveraging information at the edge, operations like shutting down systems can be carried out easily.

Technologies used to enable computing at the edge of the networks

- **Mobile Edge Computing:** Mobile edge computing or multi-access edge computing is a network architecture that enables the placement of computational and storage resources within the radio access network (RAN) to improve network efficiency and the delivery of content to end users.
- **Fog Computing:** Fog Computing is a decentralized computing infrastructure in which both data, compute, storage and applications are located somewhere between the data source and the cloud.
- **Cloudlets:** These are mobility-enhanced, small-scale cloud data centers located at the edge of a network and represent the second tier in a three-tier hierarchy: Mobile or smart device, Cloudlet and Cloud.
- **Micro Data Centers:** These are smaller, reach-level systems that provide all the essential components of a traditional data center. It is estimated that micro data centers will be most beneficial to SMEs that don't have their own data centers as larger corporations will tend to have more resources and thus not need such solutions.

Key Features of an Edge Computing Platform

Edge computing is beneficial for internet of things (IoT) use cases as IoT devices are typically wireless and situated in remote locations.

An edge computing platform drives edge computing by:

- Enabling real-time data processing away from the central cloud or data center.
- Caching, buffering, and optimizing the data close to the edge device or IoT system.
- Transforming the data received by edge devices and IoT into a format that can be processed for analysis.

The key features of an edge computing platform include the following:

1. Edge application support:

Applications have to be specifically designed to run on the edge. You might want to port existing applications from the cloud to edge environments, or you might want to develop edge native applications. The chosen platform comes with its development suite. It may also integrate with third-party services for app delivery through application programming interfaces (APIs).

2. Analytics insights:

Since edge endpoints are distributed in nature, it can be challenging to maintain control and visibility over time. Therefore, the platform must include an analytics dashboard to monitor all edge devices in your IT environment and use telemetry to collect data from remote locations. Typically, edge computing platforms will have a central hub to maintain the observability of key metrics.

3. Cloud to edge infrastructure:

Most enterprises do not run fully greenfield edge deployment. Instead, the edge environment acts as an extension to the primary cloud and can often unlock cost efficiencies by offloading workloads from the cloud to the edge.

4. Edge security:

Security is a significant concern at the edge as data processing happens in a location far away from the central IT team. That's why your edge computing platform should have built-in security protocols that you can enforce to manage edge network access and govern data flow between edge devices. The platform may also integrate third-party security services and security monitoring tools.

5. IoT enablement:

IoT is the primary use case for edge computing in enterprise environments. Edge platforms allow IoT devices to process data and carry out automated actions locally without losing any latency time. Therefore, it is advisable to look for specific IoT enablement features, such as an IoT marketplace, containerization tools, and prior experience in IoT deployments.

Edge Computing Platforms in 2022

Edge computing platforms help you maximize the power of edge computing to enable data processing at distributed locations and on remote devices. This ensures ultra-low latency, lower cloud costs, and better performance for IoT systems. This article discusses the top 10 platforms you can leverage to achieve these benefits.

1. Alef Private Edge Platform

Overview: Alef is a New York-based edge computing company founded in 2009. It provides edge connectivity products for industrial sectors and healthcare, education, and governments.

Features: The key features of Alef Private Edge Platform include:

- Edge application support: The architecture enables private mobile networks on edge with APIs for a versatile range of applications.
- Analytics insights: You can manage the environment from a centralized platform and view operational analytics.
- Cloud to edge infrastructure: Alef makes it easier to deploy edge infrastructure from the cloud without any knowledge of 3GPP standards.
- Edge security: You can maintain granular network access control to reduce the risk of exposure.
- IoT enablement: Alef powers a combination of 5G and edge network connectivity, ideal for running IoT devices.

2. Azure IoT Edge

Overview: Azure IoT Edge is part of Microsoft's intelligent cloud-to-edge computing solutions suite. It primarily addresses IoT use cases.

Features: The key features of Azure IoT Edge include:

- Edge application support: You can offload workloads to the edge and use AI for edge decision making.
- Analytics insights: The Microsoft Azure Admin Center provides you with detailed insights on Edge operations.
- Cloud to edge infrastructure: You can gain from Azure's IoT Hub, which supports zero-touch device and infrastructure provisioning.
- Edge security: Edge devices can be remotely monitored, and the platform is integrated with Azure Defender for IoT.
- IoT enablement: The platform is purpose-built for IoT applications and can be leveraged alongside Azure Stream Analytics, containers, and certified IoT hardware.

3. ClearBlade

Overview: ClearBlade is an Austin-based company founded in 2007. It provides edge computing software for scalable IoT applications in industrial environments.

Features: The key features of ClearBlade include:

- Edge application support: You can leverage data, messaging, code, triggers, portals, and other connectors to run applications on edge.
- Analytics insights: You can easily filter and stream data at the edge and obtain insights from the centralized edge platform.
- Cloud to edge infrastructure: ClearBlade supports code portability, which can be developed in the cloud and pushed to the edge or implemented at the edge itself.
- Edge security: Edge access is secured through multiple encryption, authentication, and authorization layers.
- IoT enablement: ClearBlade is compatible with most IoT systems, devices, and protocols.

4. Eclipse ioFog

Overview: Eclipse is an integrated development environment built by the Eclipse Foundation, backed by IBM. Eclipse ioFog is the organization's open-source edge computing platform.

Features: The key features of Eclipse ioFog include:

- Edge application support: It runs an agent on each edge device so you can execute applications through a microservices architecture.
- Analytics insights: The Controller hub provides you with remote visibility and analytics insights.
- Cloud to edge infrastructure: You can link cloud infrastructure to the edge through built-in connectors.
- Edge security: Eclipse ioFog has an open architecture, which means you can connect it with third-party security services.
- IoT enablement: Eclipse ioFog can be adapted to various use cases, including IoT, through Kubernetes development.

5. Google Distributed Cloud Edge

Overview: Google Distributed Cloud Edge was launched in October 2021, as part of the Google Distributed Cloud suite of hardware and software solutions. It equips enterprises and communication service providers to deliver edge-enabled apps.

Features: The key features of Google Distributed Cloud Edge include:

- Edge application support: You can use the cloud-backed control plane powered by Anthos to manage application experiences.
- Analytics insights: Google's AI, data analytics, and databases solutions enable edge observability and help gather data insights.
- Cloud to edge infrastructure: You can easily migrate from on-premise to cloud and the edge using Google Cloud infrastructure services.
- Edge security: It is compliant with security and privacy requirements and can further integrate with third-party security providers.
- IoT enablement: You can leverage containers and serverless architecture to run IoT applications.

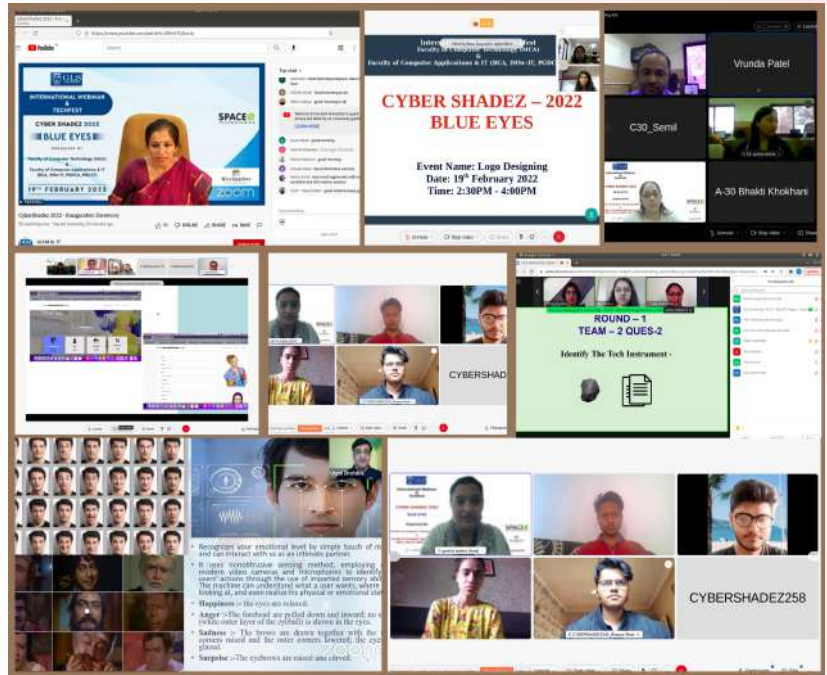
Harish Kumawat, SYBCA

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CYBER SHADEZ 2022-23

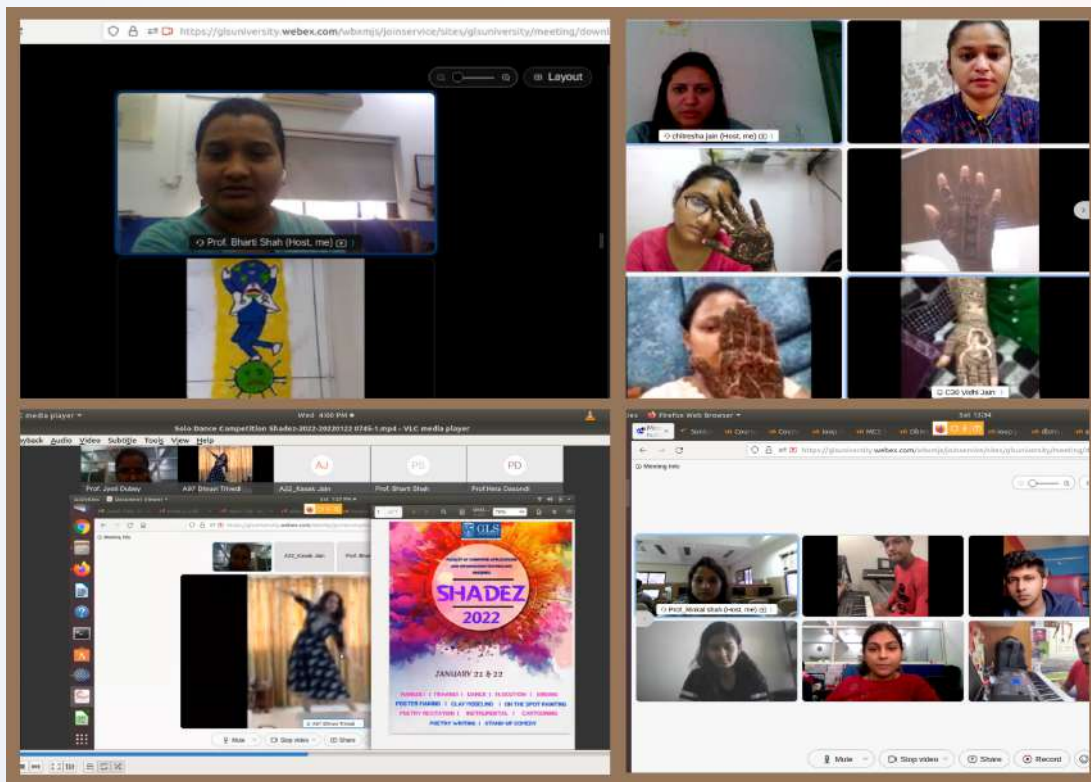
“To see an opportunity we must be open to all thoughts”, adhering these words, Faculty of Computer Applications & IT (Msc-IT, BCA, PGDCA, iMsc-IT) and Faculty of Computer Technology (MCA) jointly hosted the 16th edition of a Three-Day International Webinar and Techfest “Cyber Shadex” with the theme of “Blue Eyes” from 17th to 19th February 2022. Embracing the new normal the programme was conducted online through the Zoom platform. The objective of Techfest was to provide a platform to young students to gain an insight into Blue Eyes technology. Various competitions like Techathon, Tech Teaser (IT Quiz), Tickle Your Mind (Idea Presentation), Brain Digger (Programming),



Logo Design, IT Treasure Hunt, Webholic (Web Designing) were organized for UG, PG students and Higher secondary school students. Students from more than 16+ universities from the states of Maharashtra, Rajasthan, Haryana, Gujarat and Madhya Pradesh actively participated in Cyber Shadex 2022. International Webinar - “Aggregation of Data in Blue Eyes” by Mr. Utpal Dholakia, Tech Lead, EverestRE Incorporation, USA added much to the glory of Cyber Shadex 2022.

SHADEZ -Cultural Festival

Cultural events play a vital role in the holistic development of an individual. College level cultural events help students boost emotional, cognitive and social development; and cultural events strengthen the unity of the group members. They develop the skills of cooperation and dialogue. SHADEZ – 2022 - the annual cultural festival was organized on January 21st-22nd, 2022 in virtual mode due to pandemic. Students showcased their talents participated in various events such as cartooning, clay modelling, instrumental and solo singing, mehndi, on the spot painting, poetry recitation, poster making and Solo dance.



Tech Talk

Tech Talks are futuristic technology-oriented talks wherein students explore various contemporary techniques and technologies and present the same to other students through talk shows. Tech Talk ‘Machine Vision’ was organized on 4th January, 2022. The talk explored the field of artificial intelligence and its applications in the context of Machine Vision. Moreover the components of Machine Vision, its types, applications and the different aspects of Human Vision vs. Machine Vision were discussed in depth. The future and the scope of Machine Vision and its impact on Human Life were explored during the talk. The tech talk was organized in the hybrid mode to provide students an opportunity to attend the event across the cities. The glimpse of the event in both modes can be seen in photographs.



Webinars & Expert Lectures

FCAIT organizes various workshops and seminars on upcoming technologies and current IT trends every year. Due to the pandemic this year various webinars were conducted online. Webinars on recent trends and technologies conducted are listed below:

1. Webinar on "Block Chain" was conducted by Prof. Vidhi Thakkar on 8th January, 2022.
2. Webinar on "AR vs VR" was conducted by Prof. Bharti Shah and Jainin Vakil on 29th January, 2022.
3. Workshop on "jQuery" was conducted by Prof. Jainin Vakil on 09th-10th February, 2022.

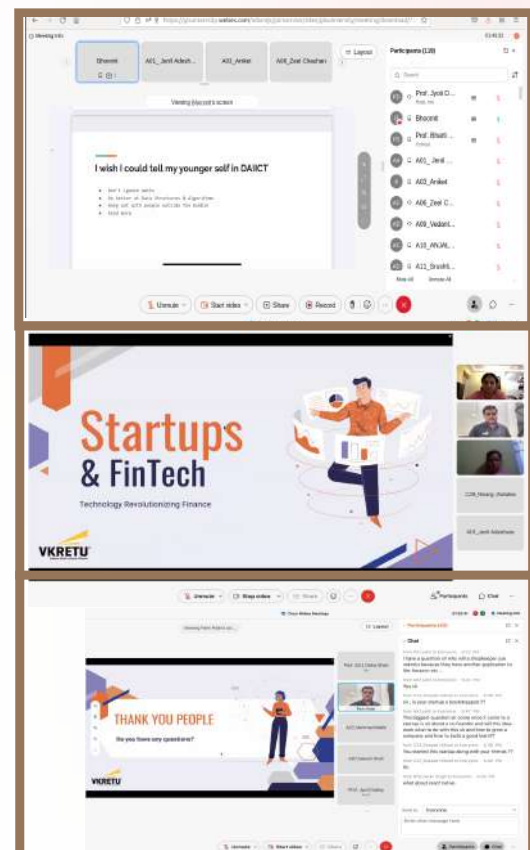
Alumni Talk

The institute is keen on being in touch with its alumni across the world. Sessions are arranged for Student-Alumni interaction. It provides students an exposure to alumni's work profile and culture. Moreover, students acquire knowledge about the recent trends and technologies of respective countries where alumni's have settled.

This semester we got connected to two of our alumni:

Mr. Parin Patel, Director of IT, VKRETU INDIA PVT. LTD. talk primarily focused on how financial technology is helpful in developing new startup. He shared his experience of working as director at his company which was an initiative started by him. He emphasized students for taking a chance in exploring new technology and also threw light on how to think on establishing new business. Students who are interested in startups were delighted to interact and ask questions. Mr. Parin gave a new insight to the student to become an entrepreneur in future.

Mr. Bhoomit Vasani, Sr. Software Engineer @ Alexa Amazon, California, USA enlighten students regarding his journey right from BCA till now. Bhoomit's talk primarily focused on “Big company and Startups”. He talked about various emerging trends in the area of Machine learning and AI. Bhoomit also shared his experience of working on virtual assistant technology, -Alexa. He emphasized students for higher education either in India or Foreign countries for better exposure and learning. He conveyed his thoughts to learn new technological trends deeply and try to master in what you learn.

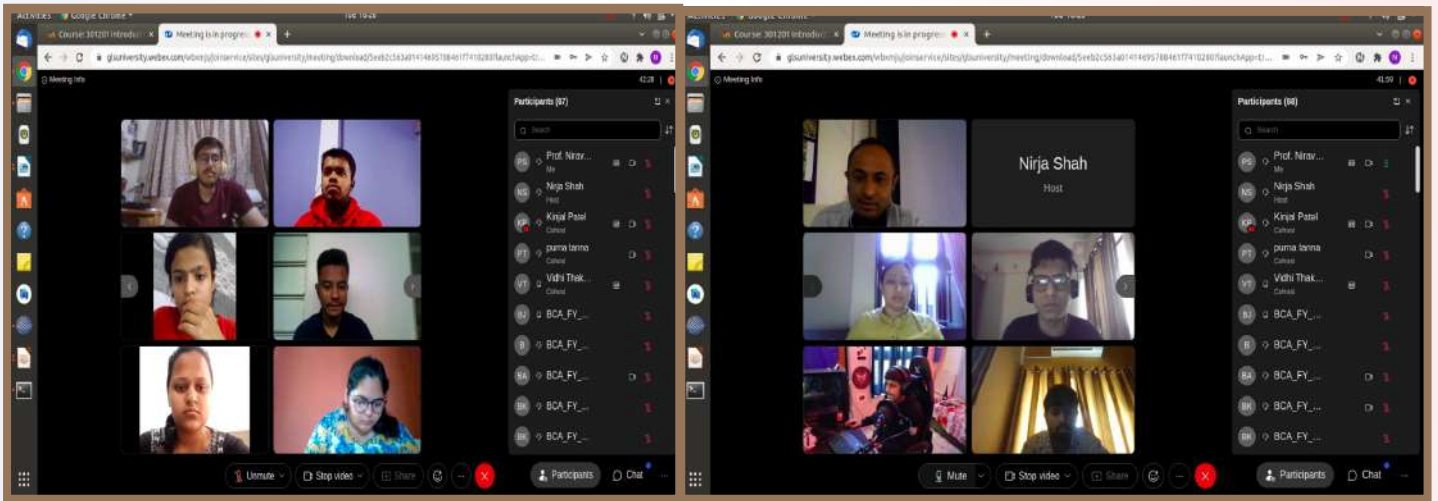


Code Express

Faculty of Computer Applications and Information Technology (FCAIT) initiated "CODE EXPRESS" event to develop coding skills among the students. Under its mandate, students explore various innovative programs based on trending programming languages. This results in students' participation which gives them an opportunity to showcase their expertise in a friendly yet spirited environment to develop their coding skills.

Code Express#-12 was organized on Mongo DB, in which students were inspired to discover new opportunities according to the latest demands and trends in the database of Mongo DB and faculties were enlightened by the vast knowledge of students.

Anurag Sharma and Shivam Brahmshatriya(BCA) and Aarti Bodani and Harshil Prajapati(iMSc-IT) won the event.



External Achievements

Students of FCAIT won prizes in various technical festivals organized by other institutions at state and national level.

Name of Students	College Name	Event Name	Position Secured
Anshi, Diya, Bhavika, Vanshika	IBS, Mumbai	Konflex- Treasure Hunt	1 st
Vishwa Ketan Shah, Divy Mayank Parekh, Mahmood Furkan Topiwala	L. J. University	Science Mela	1 st
Vishwa Ketan Shah, Divy Mayank Parekh, Mahmood Furkan Topiwala	Charusat University Science and Technology	Ignite 2022	2 nd
Deepak Shivnath Nishad, Anas Aarif Mirza, Harsh Shah	Charusat University Science and Technology	Ignite 2022	3 rd
Manav Adwani	Rao Information Technology	Codefest V1.0	2 nd

