Group 1 Emerging Technologies

1a. What is assistive technology, and how does the application of artificial intelligence (AI) make it an emerging technology?

Assistive technology refers to devices, systems, or software designed to help individuals with disabilities perform tasks more independently. These include screen readers, speech-to-text applications, and mobility aids.

The application of AI makes assistive technology an emerging field by enhancing adaptability, personalization, and automation. AI enables real-time language translation, smart prosthetics, and predictive text generation, making these technologies more effective and user-friendly.

1b. What are three advantages of applying AI in assistive technology?

a. Improved Accessibility: AI-powered assistive tools, such as speech recognition and text-to-speech systems, enhance access for people with visual, auditory, or mobility impairments.

b. Enhanced Personalization: AI adapts to users' preferences and behaviors, improving their experience with devices such as smart wheelchairs and voice assistants.

c. Real-Time Adaptability: AI enables real-time responses, such as object recognition for visually impaired individuals and live captioning for hearing-impaired users.

1c. In which areas of assistive technology is AI applied? Provide two specific examples.

AI is applied in various areas of assistive technology, including:

a. Vision Assistance: AI-driven tools like Microsoft Seeing AI help visually impaired users identify objects, read text, and recognize faces.

b. Speech and Communication: AI-powered speech synthesis and recognition tools, such as Google's Project Euphonia, assist individuals with speech impairments by improving communication.

Group2

Question 1a. What is Quantum Computing?

solution:

Quantum computing is a new paradigm for computing that uses the principles of quantum mechanics to perform calculations. Unlike classical computers, which use bits to represent information, quantum computers use quantum bits or qubits, which can exist in multiple

states simultaneously. This property allows quantum computers to process vast amounts of information in parallel, making them potentially much faster than classical computers for certain types of calculations.

1b. What is the relationship between Quantum Computing and Artificial Intelligence?

Solution:

Quantum computing and artificial intelligence (AI) are two rapidly evolving fields that are increasingly intersecting. Quantum computing can be used to speed up certain machine learning algorithms, which are a key component of AI. Additionally, quantum computing can be used to optimize complex systems, which is a key challenge in many AI applications. The integration of quantum computing and AI has the potential to revolutionize many fields, including image recognition, natural language processing, and predictive analytics.

1c. What are the areas of application of Quantum Computing in Artificial Intelligence?

Solution:

Some of the areas of application of quantum computing in artificial intelligence include:

- Machine Learning: Quantum computing can be used to speed up certain machine learning algorithms, such as k-means clustering and support vector machines.

- Optimization: Quantum computing can be used to optimize complex systems, which is a key challenge in many AI applications.

- Image Recognition: Quantum computing can be used to speed up image recognition algorithms, which are a key component of many AI applications.

- Natural Language Processing: Quantum computing can be used to speed up natural language processing algorithms, which are a key component of many AI applications.

1d. What are the advantages of using Quantum Computing in Artificial Intelligence?

Solution:

Some of the advantages of using quantum computing in artificial intelligence include:

- Speedup: Quantum computing can be used to speed up certain machine learning algorithms, which can lead to significant improvements in performance.

- Improved Optimization: Quantum computing can be used to optimize complex systems, which can lead to significant improvements in performance.

- Increased Accuracy: Quantum computing can be used to improve the accuracy of certain machine learning algorithms, which can lead to significant improvements in performance.

- New Applications: Quantum computing can be used to enable new AI applications that are not possible with classical computers.

Group 3

(a) What is the role of IoT in education?

Answer: IoT in education enhances learning experiences by enabling smart classrooms, real-time student performance tracking, and personalized learning. It connects devices like smart boards, tablets, and sensors to improve interaction and engagement.

(b) How can IoT improve student safety in schools?

Answer: IoT can enhance student safety through smart ID cards, real-time location tracking, and automated emergency response systems. Security cameras and biometric attendance systems also ensure a secure learning environment.

(c) What challenges does IoT face in the education sector?

Answer: Some challenges include data privacy concerns, high implementation costs, network security risks, and the need for proper training for educators to effectively use IoT-based tools.

Group4

1. List 4 challenges Gen AI faces while integrating it into the traditional educational system.

Answer:

a. Accuracy and bias

b. Lack of human interaction

c. Data privacy concern

d. High cost

Group5

1. a. What is Zero-Knowledge Proof (ZKP), and how does it enhance privacy in blockchain?

   b. What are the key differences between ZK-SNARKs, ZK-STARKs, and Bulletproofs?

   c. How do financial institutions use ZKPs to maintain data privacy?

Group6

Questions and Answers

1a. Describe the key advantages of using cryptocurrencies for cross-border payments compared to traditional banking systems.

Answer

Cryptocurrencies offer several advantages over traditional banking systems for cross-border payments, including:

- Lower Transaction Costs: Traditional systems like SWIFT involve multiple intermediaries, each charging processing fees. Cryptocurrencies reduce these intermediaries, significantly lowering costs.
- Faster Settlement Times: SWIFT transactions can take several days, whereas cryptocurrency transactions settle within minutes or hours.
- Financial Inclusion: Cryptocurrencies provide a decentralized alternative for unbanked populations, allowing them to engage in international trade and remittances.
- Transparency and Security: Blockchain technology ensures that all transactions are recorded on an immutable ledger, reducing fraud risks.
- Elimination of Third-Party Restrictions: Cryptocurrencies bypass capital controls and government restrictions on international transfers, allowing direct transactions without regulatory limitations.

1b. Explain the role of Central Bank Digital Currencies (CBDCs) in cross-border transactions and how they address some of the limitations of cryptocurrencies.

Answer:

Central Bank Digital Currencies (CBDCs) play a crucial role in improving cross-border payments by combining the benefits of cryptocurrencies with regulatory oversight.

- Efficiency and Cost Reduction: Unlike traditional banking, which relies on intermediaries, CBDCs enable direct transactions between central banks and financial institutions.
- Reduced Volatility: Unlike Bitcoin and other cryptocurrencies, CBDCs are government-backed and maintain a stable value, making them a reliable payment medium.
- Regulatory Compliance: CBDCs operate within legal frameworks, addressing anti-money laundering (AML) and tax compliance issues that challenge decentralized cryptocurrencies.
- Examples: The Eastern Caribbean Central Bank (ECCB) launched DCash, a digital currency improving cross-border transactions in the Caribbean region. The mBridge project, involving China, Hong Kong, Thailand, and the UAE, is another initiative aimed at improving cross-border settlements.

1c. Discuss the major risks associated with cryptocurrency-based cross-border payments, including security threats and regulatory concerns.

Answer

Cryptocurrency-based cross-border payments face several risks and challenges, including:

- Regulatory Uncertainty: Different jurisdictions have conflicting regulations, making compliance difficult. Countries like China have banned cryptocurrency transactions, while others, like the U.S. and EU, are still developing clear frameworks.
- Security Threats and Fraud Risks: While blockchain itself is secure, hacks and scams in the crypto industry remain prevalent. For example, the $600 million Ronin Network hack in 2022 highlighted vulnerabilities in smart contracts and digital wallets.
- Volatility and Price Instability: Cryptocurrencies like Bitcoin experience frequent price swings, making them unreliable for businesses. Although stablecoins address this issue, they still face regulatory scrutiny.
- Scalability and High Transaction Costs: Network congestion, especially on blockchains like Ethereum, has led to high gas fees, reducing the cost-effectiveness of cryptocurrency transactions.
- Sanctions and Compliance Issues: Countries like North Korea and Russia have used cryptocurrencies to bypass economic sanctions, leading to increased regulatory crackdowns and stricter AML requirements.

1d. How does blockchain technology contribute to the security of cryptocurrency payments?

Answer

Cryptocurrency transactions are stored on a publicly-visible distributed ledger as blocks. Each block is validated by millions of connected computers before being added to the ledger. This approach greatly reduces the risk of hacks and manipulation

Group7

1a. Define virtual reality.

1b. With respect to your definition in 1a above, explain how virtual reality is integrated in real Estate?

1c. What are the challenges involved in implementing virtual reality in real estate?

Answers.

1a. Virtual reality is a computer-generated simulation that immerses users in a 3D environment, enabling interactive experiences that mimic real world physical interactions.

1b. Virtual Staging: This is the use of computer-generated images to furnish and decorate empty spaces. It is a cost effective and affordable property enhancement technique that allows property buyers to customize the properties to suit their preference.

1c. High cost of implementation.

Tech expertise is required.

Preference for physical visits.

Group 8

1a. Explain the role of Artificial Intelligence (AI) in greenhouse automation and describe two key AI technologies used in this field.

1b. Discuss two major challenges in adopting AI-driven greenhouse farming and propose possible solutions to overcome them.

1c. A smart greenhouse utilizes an AI-powered irrigation system that reduces water usage by 40% compared to traditional irrigation. A farmer using traditional irrigation consumes 500,000 liters of water per month. With AI-driven automation:

i. Calculate the new monthly water consumption after AI implementation.

ii. Determine the total water savings per year due to AI automation.

iii. Discuss how AI-based irrigation improves sustainability and cost efficiency in greenhouse farming.

1d. An AI system predicts crop yields with 95% accuracy, compared to traditional methods with 75% accuracy. Considering this improvement:

i. Calculate the difference in yield prediction accuracy between AI and traditional methods.

ii. If a farmer expects to harvest 20,000 kg of tomatoes, estimate the potential error in yield prediction using both AI and traditional methods.

iii. Evaluate how AI-driven predictive analytics can enhance food security and economic growth in agriculture.

GROUP 9

Questions and Answer

1a. Question:

Explain how smart contracts contribute to the efficiency and accessibility of Decentralized Finance (DeFi) systems.

Answer:

Smart contracts are self-executing programs stored on the blockchain that automate financial transactions based on predefined conditions. They eliminate the need for intermediaries, reducing transaction costs and delays. By ensuring transparency and trust, smart contracts make financial services accessible to anyone with an internet connection, especially in regions lacking traditional banking infrastructure.

b. Question:

Describe the role of blockchain in ensuring the transparency and security of DeFi platforms.

Answer:

Blockchain acts as the foundational technology for DeFi platforms, providing a distributed ledger that records all transactions transparently and immutably. Each transaction is verified by a network of nodes using consensus algorithms, ensuring data integrity and resistance to tampering. This decentralization reduces single points of failure and enhances the security of the system, while the transparency allows users to audit operations in real-time.

c. Question:

Identify and explain any two major risks associated with the adoption of DeFi.

Answer:

i. Security Vulnerabilities: Smart contract exploits and hacking incidents are common, leading to significant financial losses
ii. Regulatory Challenges: The decentralized nature of DeFi complicates compliance with existing financial regulations, creating uncertainty for both users and developers

d. Question:

What are the primary challenges facing the adoption of DeFi, and how do they affect its implementation?

Answer:

i. Scalability: Blockchain networks like Ethereum face congestion and high transaction fees, limiting their efficiency during peak usage.
ii. Interoperability: Lack of standardized protocols prevents seamless interaction between DeFi platforms.
iii. Digital Divide: Limited internet access and low digital literacy in developing regions restrict access to DeFi solutions.
iv. Over-Collateralization: DeFi lending requires collateral exceeding loan values, making it inaccessible to financially constrained users.

GROUP 10

IoT in industrial safety: Advanced Tracking and Emergency Systems in the Mining Industry

QUESTIONS

1. What is IoT (Internet of Things)?
   b) Why should IoT be considered as an essential addition to industrial safety?
   c) What are the challenges of integrating IoT into industrial safety?
   d) What other Technologies can be integrated with IoT. List 5 of them.
   e) What the Fundamental concepts to be prioritized when integrating IoT in the Mining Industry?

ANSWERS

1. IoT is network of physical devices embedded with sensors, software and connectivity features to enable data exchange and autonomous decision-making.

   b) IoT should be considered for the following reasons:
   - Ease of Integration of other Technologies like Machine Learning and Artificial Intelligence
   - Automation and Real-time Application to IoT devices
   - Predictive maintenance of Miners Health
   - Predictive maintenance of Industrial Equipment
   - Ease of Integration of Data Analysis and Data Management platforms

   c) The challenges and their causes are:

   - Lack of Data privacy and security
   - Cybersecurity risks within the IoT Networks
   - Scalability issues
   - Energy constraints

   d) other technologies include:

   - Artificial Intelligence
   - Robotics and Automation
   - Blockchain
   - Data Analysis
   - Machine Learning

   e) Fundamental concepts to be prioritized

   - IoT sensors
   - Reliable communication
   - Monitoring systems
   - Emergency and alert systems
   - Artificial Intelligence
   - Energy conservation

Group 11

A) How does AI contribute to Cybersecurity?

AI enhances cybersecurity by automating threat detection, analyzing large datasets for anomalies, and responding to attacks in real time. AI-powered systems can recognize patterns in cyber threats, identify vulnerabilities, and improve security protocols without human intervention. Machine learning (ML) models help in predicting attacks based on historical data, while AI-driven automation speeds up incident response, reducing damage from cyber threats.

B) How will AI evolve in Cybersecurity in the future?

In the future, AI in cybersecurity will become more autonomous and predictive. Advanced AI models will detect zero-day vulnerabilities before exploitation, automate security patching, and improve adaptive defense mechanisms. AI-driven deception technologies, such as honeypots, will mislead attackers, while AI-enhanced threat intelligence will help organizations anticipate cyber threats. However, as AI strengthens defenses, cybercriminals will also use AI to develop more sophisticated attacks, leading to an ongoing AI-driven cyber arms race.

C) i What are three common cyber threats?

1. Phishing
2. Ransomware
3. Distributed Denial of Service (DDoS) Attacks

Explanation of Phishing:

Phishing is a cyberattack where attackers deceive individuals into providing sensitive information, such as passwords or financial details, by posing as legitimate entities. Attackers often use emails, fake websites, or messages that appear trustworthy. These attacks can lead to identity theft, financial loss, and unauthorized access to critical systems.

ii List three areas where AI is used in Cybersecurity

1. Threat Detection and Response
2. Fraud Prevention
3. Behavioural Analysis

Explanation of Threat Detection and Response:

AI-powered systems analyze vast amounts of network traffic and user behavior to detect anomalies that may indicate a cyberattack. These systems use machine learning models to

identify patterns associated with malware, phishing attempts, or insider threats. Once a potential attack is detected, AI can automatically respond by blocking malicious activity, isolating affected systems, and alerting security teams. This reduces response time and minimizes the impact of cyber threats.

Group12

1a. Define IoT in the context of water management.

IoT in water management involves using connected devices and technologies to monitor and control water systems more efficiently.

b. List three reasons why water management is critical in today's world.

- Urbanization
- Climate change
- Resource depletion

c. Explain how IoT technologies contribute to sustainable water management.

IoT technologies enhance efficiency, reduce water wastage, and provide real-time monitoring and control, leading to more sustainable water management practices.

GROUP 13

EMERGING TECHNOLOGY

a) Explain IoT and its importance in logistics

Answer

The Internet of Things (IoT) connects physical devices like sensors, GPS trackers, and smart systems to the internet for real-time data exchange. In logistics, IoT enhances supply chain visibility, enabling real-time tracking of shipments, vehicles, and inventory. It improves efficiency through route optimization, predictive maintenance, and automated warehousing. IoT also ensures security and quality control by monitoring environmental conditions and preventing theft. This technology reduces costs, enhances delivery speed, and improves overall logistics management.

b) Explain the concept of digital twin technology

Answer

Digital Twin Technology is a virtual representation of a physical object, system, or process that is continuously updated with real-time data. It uses IoT sensors, AI, and analytics to simulate, monitor, and optimize performance. Digital twins help in predictive maintenance, process optimization, and risk assessment across industries like manufacturing, healthcare, and smart cities. By creating a digital replica, businesses can test scenarios, detect issues, and improve decision-making. This technology enhances efficiency, reduces costs, and supports innovation in various fields.

c) List 3 challenges and 3 benefits of adoption of IoT in logistics

Answer

Challenges: Scalability Issues

High Implementation Cost

Interoperability (Synergy)

Security vulnerabilities

Benefits: Enhanced Visibility

Improved Efficiency

Increased Security

Sustainability

Group14

1. Explain the history of IoT in agriculture.

The history of IoT in agriculture dates back to the early 2000s when farmers started using sensors and automated systems to monitor soil conditions, weather, and crop health. Before IoT, precision farming relied on GPS technology and remote sensing to improve productivity. As internet connectivity improved, devices such as smart irrigation systems, soil moisture sensors, and drones became more common, allowing farmers to collect real-time data and make better decisions.

In the 2010s, the adoption of cloud computing and artificial intelligence further advanced IoT in agriculture. Smart farming systems began integrating AI-driven analytics, automated machinery, and connected devices to optimize resource use and reduce waste. Today, IoT helps farmers with precision agriculture, livestock monitoring, and supply chain management, improving efficiency and sustainability in the industry.

2. List and explain three sensors used in agriculture.

1. NPK Sensor: used for detecting the fertility of soil.

2. Moisture Sensor: used for detecting the moisture level of soil.

3. pH sensor: used for knowing the acidic or alkalinity of a soil.

4. Rainfall Sensor: used for detecting the availability of rainfall and the speed at which it falls.

5. Temperature Sensor: used to know the wind or soil temperature.

6. Humidity Sensor.

3. Explain IOT system:

An IoT (Internet of Things) system is a network of physical devices, vehicles, home appliances, and other items embedded with sensors, software, and connectivity, allowing them to collect and exchange data with other devices and systems over the internet.

Components in IOt system includes:Devices,sensors, Actuators, communication protocols Data processing and Analytics and cloud infrastructure

GROUP 15

(VR in Football Training: Opportunities and Challenges)

QUESTION

1. a)

i) State the differences by defining the terms Virtual Reality (VR), Augmented Reality (AR), and Mixed Reality (MR).

ii) List the three (3) basic types of VR and explain any two (2).

b)

i) Mention two (2) common VR devices used in football training.

ii) Explain the role of Motion Tracking Systems and Machine Learning in VR-based training.

ANSWER

1 a)

i) Definitions:

- ✓ Virtual Reality (VR): A fully immersive digital environment where users interact with a computer-generated world, typically using headsets and motion sensors.
- ✓ Augmented Reality (AR): An interactive experience where digital elements like images or information are overlaid onto the real-world environment using devices like smartphones or AR glasses.
- ✓ Mixed Reality (MR): A blend of VR and AR where real and virtual environments coexist, allowing physical and digital objects to interact in real-time.

ii) Two (2) Basic Types of VR (Select any two)

- ✓ Non-Immersive VR: Provides a limited interactive experience through a computer screen without a headset. Such as video games.
- ✓ Semi-Immersive VR: Offers partial immersion through larger displays or projection systems, often used in flight simulators.
- ✓ Fully Immersive VR: Provides a highly realistic, interactive experience using VR headsets, motion sensors, and sound systems, commonly used in training and gaming.

1 b)

i) Select any two (2) VR Devices Used in Football Training:

1. Oculus Quest 2
2. HTC Vive
3. PlayStation VR
4. Meta Quest Pro

5. Google Cardboard

ii) Role of Motion Tracking Systems and Machine Learning in VR-based Training:

- ✓ Motion Tracking Systems: Capture athletes' movements in real-time, enabling accurate analysis and interaction with virtual environments, which helps improve technique and performance.
- ✓ Machine Learning: Analyses motion data to identify patterns, predict outcomes, and provide personalised feedback, enhancing the effectiveness of VR-based training sessions.

Group16

TOPIC: EXPLORING THE POTENTIAL OF AI IN HEALTH CARE DIAGNOSTIC.

Q1a: What are the main challenges in implementing AI in healthcare diagnostics?

Answer:

The main challenges include:

- Data Quality and Bias: Poor-quality or biased training data can lead to inaccurate predictions, especially for underrepresented populations.

- Ethical Concerns: Issues like patient privacy, consent, and the potential misuse of genetic information need to be addressed.

- Regulatory Frameworks: There is a lack of standardized guidelines for validating and deploying AI tools in clinical settings.

- Human Oversight: Over-reliance on AI could undermine clinical judgment, so maintaining a balance between automation and human expertise is crucial.

- Hallucinations: Some AI models generate incorrect or fabricated information, which poses risks if not properly validated.

B) Question: How do you envision the future of AI in healthcare diagnostics?

Answer:

The future of AI in healthcare diagnostics is promising but requires careful integration. I envision:

- Personalized Medicine: AI will enable more precise and tailored treatments by analyzing individual genetic profiles and clinical data.

- Real-Time Decision Support: AI tools will provide real-time insights during consultations, improving diagnostic speed and accuracy.

- Enhanced Accessibility: AI-powered chatbots and diagnostic tools will expand access to specialized care, especially in underserved areas.

- Collaboration Between Humans and Machines: AI will complement human expertise, allowing clinicians to focus on complex cases while automating routine tasks.

- Improved Training and Validation: Advances in explainable AI (XAI) and regulatory frameworks will ensure safer and more reliable AI applications.

C) Question: What steps should be taken to ensure the responsible deployment of AI in healthcare?

Answer:

To ensure responsible deployment:

- Develop Strong Ethical Guidelines: Establish clear standards for data usage, transparency, and accountability.

- Promote Interdisciplinary Collaboration: Involve clinicians, ethicists, regulators, and AI developers in the design and implementation process.

- Conduct Rigorous Testing: Validate AI tools in diverse clinical settings to ensure they perform reliably across different populations and scenarios.

- Educate Stakeholders: Train healthcare professionals and patients on the capabilities and limitations of AI tools to foster trust and effective use.

- Monitor and Update Regularly: Continuously monitor AI systems for biases, errors, and evolving needs, updating them as necessary to maintain safety and efficacy.

Group17

RESEARCH QUESTION ON AI IN AUTONOMOUS VEHICLES: ADDRESSING OPPORTUNITIIES AND CHALLENGES IN AFRICA

QUESTION:

How can AI-powered autonomous vehicles help reduce road accidents in Africa, given its high accident rates and poor road conditions?

AI-powered Autonomous Vehicles (AVs) can enhance road safety in Africa by:

- Reducing human error: which is responsible for a majority of road accidents. AI-driven AVs follow traffic rules strictly, avoiding reckless driving, speeding, and distracted driving.
- Collision Avoidance Systems: which use AI-based sensors (LiDAR, radar, cameras) to detect potential hazards and apply automatic emergency braking.
- Driver Monitoring & Assistance: where AI detects driver fatigue or distraction and provides alerts or takes over driving when necessary.
- Predictive Analytics: which anticipates accident-prone situations and takes preventive actions, such as slowing down before potential danger spots.

GROUP 18

EMERGING TECHNOLOGY QUESTIONS

1a. What is the impact of IoT-based traffic management on fuel consumption and carbon emission?

1b. How do smart traffic lights function in an IoT-based traffic system?

1c. What are the major factors affecting the accuracy of IoT traffic sensors?

ANSWERS

1a. By reducing idle times, optimizing traffic flow, and enabling eco-friendly driving routes, IoT minimizes fuel consumption and carbon emissions, contributing to environmental sustainability.

1b. Smart traffic lights dynamically adjusts signal timings based on real-time traffic data from sensors, optimizing the flow of vehicles and reducing unnecessary stops.

1c. Weather conditions (rain, fog) can reduce sensor accuracy.

Sensor calibration issues can lead to incorrect traffic flow measurements

Group 19 questions

1. What is IoT-based smart lighting?

- It is a lighting system that uses the Internet of Things (IoT) to control and monitor lights automatically, improving energy efficiency and smart city functions.

a. How does IoT improve lighting systems?

- IoT allows lights to adjust brightness based on usage, detects movement for security, and integrates with other smart city technologies like traffic monitoring.

b. What are the main benefits of IoT-based smart lighting?

- Energy savings, cost reduction, real-time monitoring, improved security, and smart city integration

c. What are the main cybersecurity risks in IoT-based smart lighting?

- Hackers can access IoT networks, manipulate lighting controls, or steal data, so strong encryption and security measures are needed.