SNS COLLEGE OF TECHNOLOGY

Coimbatore-35

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DEPARTMENT OF CIVIL ENGINEERING

19CET308- AR/VR in Civil Engineering

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AP/CIVIL

UNIT - V   AR/VR APPLICATIONS

1. Introduction

Augmented Reality (AR) and Virtual Reality (VR) are immersive technologies revolutionizing industries by providing interactive and realistic environments.

- AR overlays digital content (images, models, data) onto the real world.
- VR creates a completely simulated digital environment, replacing the real world.

Both are increasingly used in Architecture, Engineering, and Construction (AEC) sectors for design, visualization, collaboration, and training purposes.

AR/VR in Architecture, Engineering, and Construction (AEC)

- **Architecture:**
  - Create immersive walkthroughs of buildings before construction.
  - Visualize design modifications instantly.
  - Assist clients in experiencing spaces, lighting, and aesthetics.
- **Engineering:**
  - Simulate structural behavior under different conditions.
  - Visualize mechanical, electrical, and plumbing (MEP) systems in 3D.
  - Error detection early in the design phase.
- **Construction:**
  - Site planning using AR to visualize underground utilities.
  - VR-based training modules for site safety practices.
  - Simulate construction sequencing and project phasing.

Benefits of AR/VR in Construction Industry

Benefits	Description
Enhanced Visualization	3D models provide realistic representations of projects before construction begins.
Improved Collaboration	Stakeholders can experience the project together and provide feedback in real time.
Error Reduction	Early detection of design errors, clashes (e.g., between HVAC and structural elements).
Cost and Time Savings	Reducing the number of changes during construction saves time and money.
Training and Safety	VR simulations can train workers in hazardous situations without real-world risk.
Client Engagement	Clients can 'walk through' the design, leading to higher satisfaction and better decision-making.
Remote Accessibility	VR and AR allow remote site inspections and project updates without physical presence.

Limitations of AR/VR in Construction Industry

Limitations	Description
High Initial Cost	Hardware and software setup (like VR headsets, AR glasses) can be expensive.
Technological Expertise Required	Specialized skills are needed to develop, use, and maintain AR/VR systems.
Hardware Limitations	Devices can be heavy, battery-limited, or require frequent updates.
Data Security Issues	Project data shown through AR/VR must be protected from cyber threats.
Resistance to Adoption	Traditional stakeholders might be reluctant to trust new technology.
Limited Real-World Testing	Simulations may not fully replicate complex on-site variables like weather, human error, etc.
Integration Challenges	Difficulties in integrating AR/VR with existing BIM (Building Information Modeling) and CAD systems.

Applications in AEC Sectors

Sector	Applications
Architecture	- Virtual walkthroughs for client presentations - Visualize renovations and restorations - Urban planning simulations
Engineering	- Structural analysis and visualization - MEP clash detection using AR overlays - Material behavior simulations
Construction	- Safety training using VR simulations - AR-guided installation of components (e.g., piping, wiring) - Project progress tracking through AR visualization
Facility Management	- AR for real-time maintenance assistance - VR for staff training and operation protocols
Surveying and Inspection	- AR for real-time site measurement and surveying - Drones with AR/VR integration for remote inspections

Challenges

Challenges	Description
Cost and Budget Constraints	Not all companies can afford AR/VR implementation, especially SMEs.
Skill Gaps	Lack of trained professionals proficient in AR/VR application development and use.
Integration with Existing Tools	Compatibility issues with traditional CAD and BIM software.
Device Limitations	Some VR headsets cause motion sickness; AR glasses may not have sufficient field of view.
Change Management	Overcoming reluctance among workers and management to shift from traditional practices.
Data Management	Managing large volumes of 3D models and real-time simulation data is complex.
Legal and Ethical Issues	Liability in cases of AR/VR-induced errors needs legal clarity.

Thankyou

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