# ROLE OF IOT IN CIVIL ENGINEERING

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Agriculture

# INTRODUCTION

#### Anytime Any Context

Anyone Anybody

- \* Advancements in sensing and IoT technologies are revolutionizing civil infrastructure.
- The usage of smart devices and IoT is paving the way towards smart and sustainable infrastructure.
- Enhances the efficiency of the construction sector throughout the entire value chain: Production of construction materials, Design, Construction, Operation, Maintenance phases
- IoT aims to improve: Efficient operation of building systems, Reduction in energy consumption, Reduced operating and maintenance costs, Increased security, Remote access, Improved life cycle of equipment and related utilities
- Existing buildings can be converted into smart buildings by installing smart devices and sensors connected to a network and adaptable software.
  Anywhere



#### Anytime Any Context

#### Anyone Anybody

- A smart building or an intelligent building uses automation through the Internet of Things to control operations such as: HVAC (Heating, Ventilation, and Air Conditioning), Lighting, Security, Energy optimization
- Smart buildings employ sensors, actuators, and microchips to collect and process data according to the building's functional requirements.
- Benefits of smart infrastructure include: Improved asset reliability and performance, Energy efficiency, Space optimization, Temperature control, Minimized environmental impact
- Examples of smart infrastructure: Smart office buildings, Health care facilities, Hospitals, Smart transportation facilities, Educational facilities

Any Place Anywhere

#### Any Service Any Business

## ARCHITECTURE OF IOT

Streaming

processor



Machine

Data

analytics

Sensors, actuators

Gateway

- learning \* The architecture of an IoT system can be described as a four-stage process: Data flows from sensors attached to "things", Data passes through a network, Data is processed, analyzed, and stored in the cloud, Analyzed data is transmitted back to associated devices for taking appropriate actions
  - In the Internet of Things, a "thing" could be: A machine, A building, A person \*\*
  - **\*** IoT architecture also sends data in the form of instructions or commands to: Actuators, Other physically connected devices
  - \* Instructions or commands tell these devices to take action to control a physical process
  - \* Examples of actions an actuator could perform: Turning on a light, Shutting down an assembly line if impending failure is detected



## APPLICATIONS OF IOT IN CIVIL ENGINEERING Structural Health Monitoring (SHM)

- Involves monitoring and assessing the condition of a structure under working conditions
- Tracks parameters like stress, strain, vibrations, etc.
- Emergence of IoT simplifies manual, laborious data collection
- Real-time data collection is done by installing sensors and actuators to improve overall performance



#### **Smart** Cities

- Use IoT devices such as connected sensors, lights, and meters to collect and analyze data
- Data is used to improve infrastructure, public utilities, and services

#### **Smart Homes**

Equipped with interconnected smart devices forming a network
Enables remote operation of the smart home system
Examples include Google Home, Amazon Echo Dot, Apple's Siri forming a smart home hub





## **Intelligent Transportation Systems (ITS)**

- Apply technologies to monitor, evaluate, and manage transportation systems for efficiency and safety
- Use smart sensors and GPS-based tracking systems to improve performance
- Real-time data on locations, expected time of arrivals, delays, etc., improves traffic efficiency

### **Project Safety Platform**

- IoT-enabled sensors and wearables improve safety and efficiency on construction sites
- Collects real-time data on harsh working environments, diagnosing and predicting failures, accidents, and mishaps
- Facilitates immediate emergency evacuation, preventive measures, or rescue activities in case of threats or incidents

## Damage Detection of Structures

Smart sensors installed in structures or underground mines predict parameters like stress, strain, settlements, or seismic activities

Timely detection and continuous monitoring help prevent or minimize asset failures

### **Real-Time Construction Management Solution**

IoT provides solutions like remote operative equipment to ensure workforce safety

 Reduces project costs through applications like Building Information Modelling (BIM) for resource efficiency

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# PROS OF IOT IN CIVIL ENGINEERING

- Automation: Increases productivity and reduces production costs, leading to better profit margins for industries, Enhances uniformity and quality of products and services due to higher accuracy in automation
- Efficiency: Utilization of IoT-enabled devices minimizes human intervention, Increases machine-to-machine interactions, resulting in more free time, Provides better transparency in the entire process
- Economy: Initial cost for installation of smart devices is higher, Proven to be economic and cost-saving in the long run
- Faster Communication: Machine-to-machine interaction simplifies tasks and allows user control without difficulty, Smart home devices like Amazon's Echo Dot, Google Home, and Apple's Siri simplify day-to-day activities
- Data Accessibility: IoT allows data to be easily accessed at any time, Facilitates the decision-making process

## CONS OF IOT IN CIVIL ENGINEERING

- Security Concerns: Usage of smart devices requires internet connectivity and large data transfer to the cloud, Storage and availability of large amounts of data on remote servers pose risks of unauthorized access and hacking
- Lag in Real-Time Data Acquisition: Smart devices require strong internet connectivity to perform tasks, Fluctuations in connectivity and internet speed result in time lags, making real-time data acquisition difficult
- Availability of Networks and Services: Network connectivity and services for smart devices are not guaranteed round the clock, Issues such as device mobility and weather conditions can affect connectivity
- Compatibility: IoT is still emerging, and many existing devices may not be compatible with smart devices, Need to replace or upgrade existing devices to ensure IoT connectivity, Variations in device manufacturing can cause compatibility issues
- Complexity: Technology appears simple but is vast and diverse with multiple functioning layers and a large network of devices, Minute errors at a single node can adversely impact the overall output

## CONCLUSION

DATA

- The advent of IoT provides better insights into the construction industry.
- **IOT** can be applied in various domains of civil engineering.
- Sensors can monitor parameters such as: Settlements, Stresses, Strains, Consolidation issues
- Monitoring these parameters helps in avoiding or minimizing accidents and property loss.
- IoT can be efficiently employed in: Health and safety issues of the workforce, Structural health monitoring
- **BIM** application can be effectively used in construction management practices.
- IoT technology works with minimal human intervention but requires human supervision for efficient decision-making.
- IoT is already being employed in various fields of civil engineering.
- There is a huge scope for improving the efficiency of IoT-enabled smart technologies.

# THANKS