SRI SIVASUBRAMANIYA NADAR COLLEGE OF ENGINEERING

(An Autonomous Institution-Affiliated to Anna University,Chennai)

KALAVAKKAM - 603110

DEPARTMENT OF CIVIL ENGINEERING

proudly presents

CIVHACK 360

Number of rounds: 2

- **Round1: Abstract Submission**
  Last Date for submission: 14.3.25
  Result: 20.3.25
- **Link for submission:https://forms.gle/DxySq1cZzXidUQ6H8**
- **Round2: Power Point Presentation**
  Date: 24.3.25
- **Maximum number of members per team: Three**

Abstract Template

Domain

- Structurals
- Materials
- Environmental
- Transportation
- Water resource
- Geotechnical

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PROBLEM 1

STATEMENT:

Smart AI Monitoring for Earthquake-Resistant Buildings.
Earthquakes pose a significant threat to buildings and infrastructure, leading to catastrophic losses in terms of human lives and economic damage. Despite advancements in engineering and seismic-resistant construction, there is a lack of continuous and real-time structural health monitoring (SHM) systems that can assess a building's resilience and predict possible failures. This gap in monitoring technology can significantly hinder timely responses to seismic events and ultimately impact safety and recovery efforts. Developing effective SHM systems is crucial for enhancing the preparedness and resilience of structures in earthquake-prone areas.
Suggest a system that leverages IoT sensors, AI algorithms, and predictive analytics to assess the structural integrity of buildings before, during, and after seismic activity.

EXPECTED OUTCOMES:

The challenge is to develop an AI-powered monitoring system from building structures that work as Real-time Structural Health Monitoring, AI-based Anomaly Detection, Earthquake Impact Prediction, and Emergency Alert System using any one or combination of technologies like Artificial Intelligence & Machine Learning, IoT Sensors, Cloud Computing & Edge AI, Data Analytics & Visualization to analyze real-time data.

PROBLEM 2

STATEMENT:

AI-Powered Damage Detection and Maintenance Optimization for Heritage Monuments

Heritage monuments are extraordinary cultural treasures that powerfully embody the history, architecture, and traditions of civilizations. However, these structures face ongoing threats from environmental factors, aging, pollution, natural disasters, and human activities, all of which contribute to their deterioration. Traditional methods of inspection and maintenance tend to be costly, time-consuming, and reactive, often failing to detect early signs of damage. To effectively safeguard these invaluable assets, we must adopt more proactive approaches that ensure their preservation for future generations.

Suggest a solution that integrates AI-powered monitoring and predictive maintenance which will revolutionize heritage conservation, ensuring that historical monuments are preserved for future generations.

EXPECTED OUTCOMES:

The developed system should leverage computer vision, deep learning, IoT-based sensors, Cloud & Edge Computing, 3D Modelling & Digital Twin Technology and predictive analytics to monitor, detect, and predict cracks, erosion, material decay, and other structural vulnerabilities of heritage monuments in real-time with Automated Damage Detection, Predictive Maintenance Optimization, Environmental Impact Assessment. Additionally, it should provide data-driven insights to prioritize maintenance and restoration strategies efficiently.

PROBLEM 3

STATEMENT:

Flood forecasting technologies using AI & ML techniques
Floods are one of the most devastating natural disasters, affecting millions of people worldwide. Traditional flood forecasting techniques often rely on manual processes, weather data, and physical models, which may not always offer real-time predictions or accurate forecasts. With the advent of Artificial Intelligence (AI) and Machine Learning (ML), there is a significant opportunity to improve flood forecasting by integrating dynamic, data-driven models that can predict floods with higher accuracy and in real-time.
Develop an AI/ML-based flood forecasting system that can predict floods based on various environmental and meteorological data. This system should analyse and process historical data, weather patterns, and river levels to provide early warnings and accurate flood predictions.

EXPECTED OUTCOMES:

The developed system should predict the likelihood and severity of floods in a given region. The system should leverage historical data, weather information, and real-time data to provide timely predictions and recommendations. Additionally, the model should provide confidence intervals for its predictions to help emergency management and flood mitigation authorities make informed decisions.

PROBLEM 4

STATEMENT:

Stabilization of contaminated soil using innovative materials and techniques.
Soil contamination typically arises from pollutants like heavy metals, organic compounds, and industrial waste, which can adversely affect both human health and the environment. Stabilization techniques aim to reduce the mobility and bioavailability of contaminants, render them harmless, or improve soil properties to make the land suitable for development.
Suggest some suitable non- conventional techniques like bioremediation, electrokinetic remediation etc to stabilise contaminated soil depending on the pollutant selected.

EXPECTED OUTCOMES:

The suggested approaches and materials should aim to provide effective, sustainable, and cost-efficient methods to remediate contaminated lands and restore their ecological function.

PROBLEM 5

STATEMENT:

The Water Economy – A Dystopian Future
In a future world where water scarcity has reached critical levels, governments and corporations have taken control of all water resources. Water is no longer freely available—it is now a regulated currency. Every individual is assigned a personal water credit that determines their daily allocation for drinking, sanitation, and other needs. These credits can be earned, traded, or transferred, but overconsumption comes at a steep cost. The challenge is to design a system that governs the allocation, consumption, and management of water as a currency, integrating technology, policy, and engineering solutions.
Therefore, develop innovative solutions that addresses aspects of
(i) Water credit system – technology and monitoring
(ii) sustainable engineering solutions through proper governance and management.

EXPECTED OUTCOMES:

Solutions can be in the form of (i) Tech prototypes (apps, AI models, IoT devices) (ii) Algorithms or simulations for water credit management (iii) Business models & governance frameworks (iv) Infrastructure or engineering blueprints.

PROBLEM 6

STATEMENT:

Application of IoT and AI Techniques in Non-infrastructure Solutions to Traffic Engineering Problems.
India's rapid urbanization has led to severe traffic congestion, causing significant economic losses, increased pollution, and reduced quality of life. With millions of vehicles on the road and limited space for infrastructure expansion, traditional solutions like road widening or flyovers are often impractical and costly. An IoT and AI-based smart traffic management system offers an innovative, scalable, and cost-effective approach to tackling congestion. For a country like India, where unpredictable traffic behavior, encroachments, and limited enforcement further complicate mobility, such a system can bring significant improvements. It helps reduce delays, minimize fuel consumption, lower emissions, and improve overall urban mobility without requiring extensive infrastructure upgrades.
Therefore, design and prototype an AI and IoT-based smart traffic management solution that can analyze real-time traffic data, predict congestion, and optimize traffic flow, demonstrating its feasibility through simulations or a working model within the hackathon timeframe.

EXPECTED OUTCOMES:

The design is expected to address traffic congestion and improve traffic flow in urban areas without relying on major infrastructure changes. The solution should aim to reduce traffic delays, enhance road safety, and minimize environmental impact, all while being scalable and cost-effective for cities with limited infrastructure capabilities.

PROBLEM 7

STATEMENT:

Non-conventional industrial waste as pozzolanic material in recycled concrete.
With rapid urbanization and infrastructure development, the demand for concrete has increased significantly, leading to excessive consumption of natural resources like sand, gravel, and limestone. This has raised concerns about environmental sustainability, especially due to high carbon emissions from cement production and the generation of construction and demolition (C&D) waste. Additionally, industries produce large amounts of non-conventional waste materials, which often end up in landfills, causing pollution.
Suggest a solution that has the potential to transform the construction industry by promoting greener alternatives, reducing industrial waste, and creating a more sustainable and resilient built environment.

EXPECTED OUTCOMES:

The challenge is to identify and process an innovative and sustainable solution to utilize non-conventional industrial waste as pozzolanic material to integrate them into recycled concrete while ensuring structural integrity, cost-effectiveness, and compliance with construction standards.
Elaborate in detail on Material Selection & Processing, Strength & Durability Assessment, Concrete Mix Optimization, Structural Testing & Compliance, Carbon Footprint Reduction, Sustainability & Lifecycle Assessment, Cost-Effective Construction Solutions, Standardization & Implementation.