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VIGYAAN

DEPARTMENT OF CIVIL ENGINEERING

PROBLEM STATEMENTS

CIV01: Digital Marketplace for Surplus Construction Materials

Design an integrated digital platform that facilitates the sustainable redistribution of surplus construction materials, minimizing landfill disposal, reducing project costs and support sustainable resource utilization. The platform should enable users to upload material details with images and geospatial tagging, incorporate an intuitive map-based search system with advanced filtering options and include a secure communication interface to ensure seamless and reliable interaction between suppliers and prospective buyers.

CIV02: GIS-Based Landslide Risk Prediction Model

Develop an advanced GIS-integrated landslide hazard prediction system that overcomes the limitations of conventional static risk maps by incorporating real-time environmental triggers and geospatial datasets. The platform should integrate analytical or machine-learning models to assess terrain vulnerability. The system must provide accurate and intuitive visual risk zonation through an interactive mapping interface, enabling proactive disaster preparedness, timely mitigation planning and informed decision-making for disaster management.

CIV03: Low-Cost, IoT-Enabled Concrete Strength Estimator

Build a low-cost, IoT-enabled handheld device for rapid on-site estimation of concrete strength, addressing the limitations of conventional laboratory-based testing and the high cost of existing digital solutions. The system should incorporate a spring-impact mechanism with an integrated accelerometer to capture rebound

characteristics, utilize an embedded microcontroller to evaluate compressive strength from the acquired data and provide real-time results.

CIV04: <u>Solar Environmental Monitoring Station for Construction Sites</u>

Build a compact, solar-powered environmental monitoring station for construction sites, addressing the limitations of conventional pollution monitoring systems that are expensive, bulky and impractical for temporary deployment. The system should be housed in a durable enclosure, integrate sensors to monitor dust and noise levels and upload real-time environmental information to a cloud platform, enabling continuous monitoring without dependence on grid power.

CIV05: <u>Smart Formwork with Embedded Concrete Curing Sensors</u>

Develop a reusable and rugged smart formwork system with embedded sensor technology to accurately monitor concrete curing conditions. The solution should incorporate a durable, waterproof sensor pod capable of measuring temperature and humidity, support wireless data transmission through an onboard microcontroller and ensure simple installation and retrieval, so it can be reliably reused across multiple construction applications.

CIV06: <u>Digital Crack Measurement & Logging Tool</u>

Develop a digital crack measurement and logging system that automates the assessment of structural cracks, eliminating subjective visual estimation and improving the consistency of inspection records. The solution should accurately determine crack width through image-based analysis and maintain securely logged visual data with measurement details, enabling reliable tracking of crack progression for structural health monitoring.

CIV07: <u>Smart Floating Sensor for Drainage Flow Monitoring</u>

Develop a low-cost, floating sensing device for proactive monitoring of underground drainage networks, addressing the challenges of hazardous manual inspections and reactive maintenance. The system should assess drainage flow conditions by tracking its movement within pipelines and generate early alerts when abnormal flow patterns or

potential blockages are detected. The device must ensure reliable operation in harsh submerged environments and support periodic status reporting to assist timely decision-making for urban flood prevention.

CIV08: Safety Harness for Construction Workers

Create an ergonomic safety harness that helps construction workers lift safely by monitoring their posture in real time. The harness should detect unsafe back positions during lifting and provide instant haptic feedback to remind the worker to correct their posture, reducing the risk of injury while remaining comfortable and practical for daily use on-site.

CIV09: Low-Cost Digital Levelling System for Automated Surveying

Develop a low-cost digital levelling system to support accessible and automated elevation measurement in small-scale surveying. The solution should utilize two communicating units to automatically detect level alignment, determine height differences with accuracy and present the results clearly, enabling efficient and reliable surveying in construction applications.

CIV10: Permeable Concrete Footpaths

Develop modular permeable concrete footpath slabs that allow rainwater to infiltrate into the ground, helping reduce urban flooding caused by conventional impermeable pavements. The solution should incorporate sustainable or locally sourced materials and its performance must be validated through testing of water infiltration and durability to demonstrate its practicality and cost-effectiveness compared to conventional pavement alternatives.

CIV11: Low-Cost Rainwater Harvesting Models

Develop an affordable rainwater harvesting model that effectively channels rooftop runoff into a storage system, helping reduce water wastage in urban environments. The solution should be simple to implement using commonly available materials and must demonstrate effective filtration, storage capability and potential water savings through a functional tabletop prototype.

CIV12: <u>Earthquake-Resistant Building Frames</u>

Develop small-scale earthquake-resistant building frame models using accessible materials to improve structural stability in low-rise rural structures that are prone to collapse due to inadequate reinforcement. The solution should demonstrate enhanced performance through vibration-based testing and provide comparative evidence of improved resistance and reduced collapse risk relative to conventional frame designs.