AAVARTAN 24-25

VIGYAAN
DEPARTMENT OF CIVIL ENGINEERING

PROBLEM STATEMENTS

CIV01. Investigating Structural Integrity and Accessibility Challenges in Urban Skywalk Projects:

Develop a comprehensive framework to address structural integrity and accessibility challenges in urban skywalk projects across Indian cities. Analyze past failures such as the Raipur Skywalk, examining root causes including design flaws, foundation issues, and inadequate accessibility features. Propose strategies to enhance structural stability, optimize material usage, and improve accessibility for all pedestrians, including those with disabilities.

Description:
Skywalks serve as critical pedestrian infrastructure, yet failures like the Raipur incident underscore the need for a robust framework. This project aims to rectify past shortcomings by addressing structural integrity and accessibility challenges, ensuring safer and more inclusive urban mobility.

Current issues and limitations:

- Recent skywalk projects, exemplified by the failed Raipur skywalk, highlight safety hazards and incomplete infrastructure.
- Existing skywalks often lack proper design and integration, leading to underutilization and safety concerns.
- Challenges include low pedestrian usage, inadequate accessibility, and inefficient material usage, hindering practicality and sustainability.

Future Scope:

- The project seeks to create safe, accessible skywalks that enhance urban mobility while minimizing environmental impact.
- Environmentally conscious design principles will guide construction, fostering improved pedestrian connectivity and reduced traffic congestion.

Expectations from the team:

- Conduct a thorough analysis of past skywalk projects, identifying structural flaws and accessibility barriers.
- Address critical issues such as structural instability, inadequate accessibility for disabled individuals, and maintenance challenges.
- Propose strategies to enhance structural integrity, optimize material usage, and ensure compliance with safety regulations, fostering safer and more inclusive urban pedestrian infrastructure.

CIV02. Low-carbon Cement alternatives

Description:

CalMag cement, a magnesium-based alternative derived from waste brine that is manufactured at significantly lower temperatures, and absorbs CO_2 during the hardening process, making it a carbon-negative material, reducing its environmental impact. This aims to address the drawbacks of conventional concrete, offering a more sustainable and environmentally friendly solution. In the pursuit of low-carbon concrete alternatives, concrete production harnesses waste brine from desalination processes to create a sustainable magnesium-based cement.

Current Challenge:

● Cement, used in conventional concrete blocks, contributes significantly to environmental concerns due to its large carbon footprint arising from the high-temperature burning of limestones, clay, and shale.
● The conventional manufacturing process results in substantial carbon emissions, exacerbating climate change and sustainability challenges, emphasizing the imperative to explore low-carbon alternatives and sustainable practices in concrete production.
● Furthermore, the disposal of byproducts from desalination processes, such as brine, into oceans contributes to marine ecosystem destruction, increasing environmental concerns.

Future Scope:

● The successful implementation of this is anticipated to yield low-carbon concrete alternatives, mitigating the environmental impact associated with traditional concrete production.
● This exploration of CalMag cement could lead to a transformative shift in the construction industry, promoting the adoption of eco-friendly materials and practices.
● The outcomes could significantly contribute to the broader goal of achieving sustainable and low-carbon solutions in the field of construction and infrastructure development.

Expectations from the team:

Investigate the environmental impact of traditional concrete production. Explore potential solutions and methodologies for reducing the carbon footprint in the concrete industry, with a focus on innovative alternatives like magnesium-based cement from desalination waste. Explore the manufacturing process and properties of CalMag cement, emphasizing its lower temperature requirements and carbon-negative attributes. Investigate the potential scalability, feasibility and effectiveness of CalMag cement derived from waste brine as a low-carbon sustainable alternative to conventional cement. Assess the potential benefits of integrating calcium into this process.

CIV03. Sustainable Solutions for the Effective Disposal and Recycling of Plastic Waste through Innovative Composite Tiles

Description:
Innovate a transformative solution by designing composite tiles from waste plastic bags (LDPE). The proposed solution should take the form of paver tiles made from LDPE (low-density polyethene) plastic. The goal is to create tiles with enhanced mechanical strength, reduced flammability, and resistance against acids, bases, and organic solvents. Moreover, the incorporation of industrial waste, such as fly ash, and a flame retardant should be explored to create a versatile and sustainable material suitable for usage in constructing structures like paver tiles, ensuring they meet construction standards and address environmental concerns.

Current issues and limitations:

● The escalating use of plastics, particularly thermoplastics such as low-density polyethylene (LDPE), has led to a surge in plastic waste, posing a significant challenge for effective disposal.

● The non-biodegradable nature of plastic bags exacerbates this issue, demanding an immediate, sustainable and scalable solution.

● The prevalent disposal methods for plastic waste, including burying or burning, contribute to environmental degradation and are unsustainable.

● Existing plastic recycling practices face limitations, creating a need for innovative solutions that can simultaneously address environmental concerns and provide materials suitable for construction.

Future Scope:

● The successful implementation of this solution is anticipated to result in the creation of composite tiles, providing a sustainable and economically viable alternative for waste plastic disposal.

● This could lead to the development of construction materials boasting enhanced mechanical properties, minimized environmental impact, and versatile societal applications.

● The incorporation of fly ash as a filler material is directed towards effectively addressing the disposal challenges posed by both waste plastic bags and fly ash. This innovative solution holds the potential to revolutionize waste plastic management, transforming it into a valuable resource for the benefit of society.

● The anticipated outcomes could lead to a transformative shift in construction practices, contributing to a reduction in the environmental footprint associated with traditional building materials.

Expectations from the team:

Explore a solution involving the unique combination of LDPE plastic, fly ash, and a flame retardant to create composite tiles. The proposed solution should address the limitations of current plastic recycling practices and provide a multi-faceted approach, providing a scalable solution for waste plastic disposal, considering material properties, environmental impact, and societal applications. This aims to mitigate plastic waste accumulation by converting it into a constructive and valuable resource.

CIV04. Real-time In-situ Concrete Strength Assessment

Develop a non-invasive technology-driven solution that enables real-time determination of concrete strength directly at the construction site, that reduces reliance on specialized instruments, ensuring practicality and accessibility in diverse construction settings.

Description:

Ensuring the structural integrity of concrete is crucial for safety and longevity in construction. Compressive strength is a crucial parameter in assessing the quality and durability of concrete structures. The conventional approach can be time-consuming and may not provide real-time insights into the in-situ concrete strength.

Current issues and limitations:

● The current method of casting representative cubes, curing them under controlled conditions, and testing them in a laboratory, is time-intensive and often suffers from delays, limited sampling, and potential inaccuracies due to site-specific factors. Additionally, variations in curing conditions, material properties, and mixing procedures contribute to uncertainties in predicting the actual in situ strength.

● Standard methods fail to capture the actual strength development of concrete under specific curing conditions at the construction site.

● Existing non-destructive testing (NDT) tools are often expensive, limited in their applicability, and provide only estimates of strength.

● Destructive testing requires core samples, weakening the structure and generating waste.

● Specialized instruments are often expensive, and bulky, and require trained personnel, hindering widespread adoption.

● Laboratory testing may not always accurately represent the in-situ conditions, environmental factors and curing variations can lead to discrepancies between lab and in-situ strength.

● Lack of real-time strength assessment hinders the ability to make decisions related to construction progress and quality control.

● The challenge lies in developing a non-invasive method using technology to instantly ascertain the in-situ strength of concrete, eliminating the need for laboratory testing and providing a more accurate and immediate assessment.

Existing Solutions:

The current industry norm involves casting concrete cubes on-site, curing them, and subsequently testing them in a laboratory environment.

Non-destructive testing (NDT) methods offer rapid in-situ assessments, but can be expensive, require specialized instruments and may be inaccurate for certain concrete types.

Future Scope :

● A Successful solution will not only enhance the efficiency of in situ concrete strength determination but also contribute to more informed decision-making during the construction phase, ultimately leading to improved structural performance and durability of concrete structures.

● The implementation of a non-invasive and real-time concrete strength assessment method will significantly reduce the time required for laboratory testing, allowing construction projects to proceed without unnecessary delays.

● By eliminating the need for specialized instruments and minimizing the reliance on traditional testing methods, construction costs can be reduced, making projects more economically viable.

● With instant strength assessment, site engineers can make informed decisions in real-time. This optimization leads to a more efficient and responsive construction workflow.

● The continuous monitoring of concrete strength on-site ensures that the constructed elements meet design specifications, enhancing overall quality control in construction projects.

● A successful solution will be adaptable to different construction materials, curing conditions, and project scales, making it a versatile tool applicable in diverse construction scenarios.

● Accurate and real-time strength assessment allows for better optimization of material usage, minimizing waste and contributing to more sustainable construction practices.

Expectations from the team:

The proposed solution should provide real-time, accurate results enabling on-site engineers to instantly assess the strength of concrete during and after construction, ensure a high level of accuracy in determining concrete strength, consider variations in curing conditions and material properties, and ensure compatibility and ease of integration with diverse construction practices. Demonstrate the effectiveness of your method through experimental testing on diverse concrete samples and compare results with existing testing methods.

CIV05. Designing a Responsive Suspension Bridge

Description:

Develop a suspension bridge model that incorporates dynamically adaptive technologies to adjust its shape and distribute loads in real-time, optimizing performance and ensuring safety under varying external forces. This project aims to address the limitations of static bridge structures by implementing responsive mechanisms that intelligently respond to dynamic environmental conditions.

Current issues and limitations:

Conventional suspension bridges, designed with static configurations, often lack the flexibility to adapt to fluctuating loads and environmental changes, leading to inefficiencies and safety concerns. Fixed bridge structures may experience heightened stress levels during unexpected events, jeopardizing their performance and structural integrity. Additionally, the limited capability for real-time adjustments further exacerbates these challenges, hindering optimal performance and safety.

Explanation of the 'Dynamically Adaptive Shape' concept:

The concept of dynamically adaptive shape refers to the ability of the bridge structure to modify its configuration in response to external forces and environmental conditions. By employing advanced technologies such as sensors, actuators, and control systems, the bridge can autonomously adjust its shape and load distribution to optimize performance and enhance safety. This adaptive nature allows the bridge to effectively mitigate the effects of varying forces, ensuring structural stability and resilience under dynamic conditions.

Future Scope:

Successful implementation of dynamically adaptive suspension bridges holds the potential to revolutionize bridge design practices, ushering in a new era of adaptive and resilient infrastructure. By integrating responsive technologies, these bridges can minimize maintenance costs and enhance long-term structural safety, thereby promoting sustainable development and resilience in the face of evolving environmental challenges.

Expectations from the team:

The team is expected to design a suspension bridge model that leverages responsive technologies to dynamically adapt its shape and distribute loads in real time. Emphasis should be placed on innovation, structural efficiency, and safety considerations, to achieve optimal performance and resilience in dynamic environmental conditions. Additionally, the project should demonstrate intelligent responsiveness to varying forces, promoting efficiency and safety in bridge operations.

CIV06. Engineering a Resilient and Adaptable Shelter for Disaster Relief

Design and develop a prototype for a portable, rapidly deployable, and highly adaptable shelter system that overcomes the limitations of existing solutions and addresses the unique challenges of disaster relief in diverse conditions.

Description:

Disaster zones often face a critical shortage of temporary shelters, leaving survivors exposed to the elements and vulnerable to further harm. Conventional shelters, like tents, often lack durability, struggle to withstand extreme weather conditions, and require significant time and resources to deploy. Basic shelters often lack proper sanitation, water purification, and energy generation capabilities. These limitations present a major hurdle in providing immediate and effective protection for displaced populations.

Current issues and limitations:

- Tents are prone to damage from strong winds, heavy rain, and extreme temperatures, leaving occupants exposed and vulnerable.
- Production and disposal of plastic tents can generate significant waste and contribute to environmental pollution.
- Many prefabricated shelters are difficult to transport, requiring specialized vehicles and equipment, hindering rapid deployment to remote or hard-to-reach areas.
- Assembly of traditional shelters often involves skilled labour and extended setup times, delaying critical response efforts.
- Most shelters often lack essential services like sanitation, water purification, and energy generation.
- Many shelters are vulnerable to harsh weather conditions, repeated use, and potential vandalism, compromising their longevity and effectiveness over time.
- Some materials used in shelters can have negative environmental footprints, raising concerns about sustainability.

Future Scope :

● The development of a portable, rapidly deployable, and adaptable shelter system will significantly improve the efficiency of disaster relief efforts.

● Rapid construction with minimal assembly time and labour will enable quicker response times, facilitating the timely provision of shelter to affected populations.

● The designed shelter system's ability to withstand harsh weather conditions and minor earthquakes will provide a higher level of safety and security for occupants during disaster situations.

● Prioritizing reusable, recyclable, or locally sourced materials and minimizing waste generation will contribute to environmental sustainability.

● This optimization can lead to more efficient resource utilization, making the shelter system more accessible and affordable for widespread deployment in disaster-stricken areas.

● Providing safe, adaptable, and sustainable shelter contributes to the overall well-being and resilience of disaster survivors.

Expectations from the team:

The design should withstand harsh weather conditions like strong winds, heavy rain, and even minor earthquakes, providing safe and secure refuge for occupants. The system should be flexible and configurable to accommodate different terrains, population sizes, and specific requirements like accessibility for people with disabilities.Analyze the structural integrity and performance of your design through calculations, simulations, or testing, demonstrating its ability to withstand expected loads and environmental stresses.

CIV07.Predicting and Mitigating Rockfall Hazards on Transportation Infrastructure

Develop an innovative and integrated system that can predict, prevent, and mitigate rockfall hazards on transportation infrastructure in mountainous regions.

Description:

Building and maintaining transportation infrastructure in mountainous regions is a constant battle against the forces of nature. One of the most significant threats is rockfall, where large boulders or entire sections of cliffs can suddenly detach and tumble down onto roads, bridges, and tunnels, causing catastrophic damage and loss of life.

Current issues and limitations:

● Passive Mitigation: Traditional methods like rockfall barriers and netting are often reactive, offering limited protection and requiring significant maintenance.

● Inaccurate Prediction: Predicting the timing and location of rockfalls remains a challenge, leading to reactive responses and increased risk.

● Limited Monitoring: Current monitoring systems often rely on visual inspections or basic sensors, lacking real-time data and a comprehensive understanding of rock movement.

Expectations from the team:
Design a network of advanced sensors and data acquisition systems to continuously monitor rock movement, environmental factors, and potential triggers for rockfall. Develop advanced algorithms and machine learning models to analyze the collected data and predict the likelihood and location of rockfall events with high accuracy. Utilize artificial intelligence for advanced data analysis and autonomous robots for remote rockfall monitoring and mitigation. Design your system with adaptability in mind, allowing for effective implementation in diverse geological and environmental conditions.

CIV08. Designing an Integrated Traffic Management Strategy for Sustainable Urban Mobility

Create a comprehensive traffic management plan for a growing city to minimize congestion, optimize traffic flow, and improve overall transportation efficiency, considering the integration of smart technologies and sustainable practices.

Description:

The increasing urbanization and population growth in City X have led to a surge in vehicular traffic, resulting in severe congestion, suboptimal traffic flow, and a decline in overall transportation efficiency. To address these challenges, there is a need for a comprehensive traffic management plan that leverages smart technologies and incorporates sustainable practices.

Current issues and limitations:

- City X is grappling with escalating traffic congestion, particularly during peak hours, leading to increased travel times, fuel consumption, and environmental pollution.
- The current traffic management system lacks the adaptability and efficiency required to handle the growing volume of vehicles, negatively impacting the quality of life for residents and hindering economic activities.

Past Research:
Previous studies have explored various traffic management strategies, including signal synchronization, dynamic lane assignments, and intelligent transportation systems. However, these approaches often fall short of addressing the unique challenges posed by the dynamic growth of City X. Past research has also highlighted the potential benefits of integrating smart technologies and sustainable practices, but a holistic and customized model for City X is yet to be developed.

Future Scope :

The model aims to transform the City's traffic management into a dynamic, responsive, and sustainable system that not only addresses the current challenges but also prepares the city for future growth and urban development.

Expectations from the team :

The proposed traffic management plan for City X will be a comprehensive and adaptive model that combines cutting-edge smart technologies with sustainable practices. This model will involve the integration of real-time traffic data, machine learning algorithms, and advanced traffic signal control systems to dynamically optimize signal timings based on traffic conditions. Sustainable practices will be incorporated to reduce dependency on private vehicles and minimize the city's carbon footprint.

CIV09.Transportation system for a coastal city prone to rising sea levels

Design a resilient and energy-efficient transportation system for a coastal city prone to rising sea levels and extreme weather events, considering the potential impacts of climate change on infrastructure.

Description:

The challenge is to design a transportation system that is both resilient and energy-efficient for a coastal city facing the imminent threats of rising sea levels and increased frequency of extreme weather events. The transportation infrastructure must be capable of withstanding the impacts of climate change, ensuring the uninterrupted flow of people and goods while minimizing environmental repercussions.

Current issues and limitations:

● The current transportation system in the coastal city is vulnerable to the effects of rising sea levels and extreme weather events, leading to disruptions, damage to infrastructure, and increased risks to the safety and functionality of the entire network.
● Conventional systems are ill-prepared for the challenges posed by climate change, necessitating the development of a more adaptive and sustainable solution.

Past Research:

Past research has explored various aspects of climate-resilient transportation systems, including studies on flood-resistant infrastructure, sustainable mobility options, and adaptive urban planning. However, there is a need for a comprehensive approach that integrates these findings.

● The future scope of a transportation system for a coastal city prone to rising sea levels involves a holistic and forward-thinking approach that integrates resilience, sustainability, technology, and community engagement.

●Into a unified model specifically tailored to the unique challenges faced by coastal cities.

Future Scope :
Collaboration with various stakeholders and a focus on adaptive strategies will be key to ensuring the long-term viability of the transportation infrastructure in the face of climate change.

Expectations from the team :
The model will incorporate state-of-the-art engineering solutions, such as elevated roadways, flood-resistant infrastructure, and the use of environmentally friendly and energy-efficient modes of transportation. The model will also integrate real-time monitoring and adaptive management systems to respond swiftly to changing conditions and ensure the long-term sustainability of the transportation network in the face of climate change. The goal is to create a blueprint that not only addresses the immediate challenges but also sets a precedent for resilient urban infrastructure in coastal regions globally.

CIV10. Urban planning strategy to address the challenges of urbanization

Develop an urban planning strategy that promotes mixed-use development, green spaces, and sustainable infrastructure to address the challenges of urbanization while maintaining a high quality of life for residents.

Description:
Urbanization is rapidly transforming cities, leading to increased population density and challenges in maintaining a high quality of life for residents. To address these issues, there is a need to develop a comprehensive urban planning strategy that fosters mixed-use development, incorporates green spaces, and integrates sustainable infrastructure.

Current issues and limitations:
- Many cities are grappling with the negative consequences of unplanned urbanization, including traffic congestion, pollution, loss of green spaces, and inadequate infrastructure.
- The lack of a holistic urban planning approach contributes to a decline in the overall well-being of residents and compromises the sustainability of urban environments.

Past Research:
Previous research has explored aspects of urban planning, including mixed-use development, green urban spaces, and sustainable infrastructure. However, there is a gap in integrating these elements into a cohesive strategy that addresses the multifaceted challenges of urbanization. Past studies have often focused on individual components without providing a comprehensive and integrated solution.

Future Scope :
The future of urban planning involves a holistic and integrated approach that incorporates technology, sustainability, resilience, community engagement, and innovative solutions to address the complex challenges of urbanization.

● Smart cities and technology Integration: Implementing smart infrastructure, including smart transportation, energy-efficient buildings, and intelligent waste management systems.
● Resilient Urban Planning: Planning for climate change impacts, such as rising sea levels, extreme weather events, and increased temperatures

Expectations from the team :
The model will leverage data-driven approaches, community engagement, and best practices from successful urban planning projects. It will consider factors such as population growth, economic development, and environmental sustainability to ensure a high quality of life for residents. The model will provide specific guidelines for zoning regulations, land use policies, and infrastructure investments. It will prioritize the creation of walkable neighbourhoods and the preservation of natural areas. Additionally, the model will integrate smart city technologies to enhance urban efficiency and resilience.

CIV11. Create an energy-efficient and sustainable bridge design that incorporates innovative materials and construction methods, ensuring durability, reduced maintenance costs, and minimal environmental impact over the bridge's lifecycle.

Description:
This project aims to create an energy-efficient and sustainable bridge design by utilizing innovative materials and construction methods. The primary objectives include enhancing durability, minimizing maintenance costs, and reducing the environmental impact throughout the bridge's lifecycle. The focus will be on integrating sustainable practices from inception to completion.

Current issues and limitations:
Traditional bridge designs often overlook energy efficiency and sustainability, leading to increased maintenance costs and significant environmental footprints. Existing infrastructure faces challenges such as material degradation, heightened maintenance needs, and insufficient consideration for eco-friendly approaches.

Explanation of key concepts:
The project will explore advanced sustainable materials like recycled composites and self-healing concrete to improve the bridge's structural integrity. Additionally, it will incorporate a life cycle assessment to evaluate environmental impact factors such as carbon emissions, resource consumption, and recyclability. Moreover, energy-efficient features such as smart lighting systems and renewable energy integration will be explored to further reduce the bridge's operational environmental footprint.

Future Scope:
The future of energy-efficient and sustainable bridge design is promising, with continual advancements expected in technology, materials, and environmental awareness. Potential future developments include the integration of smart materials capable of monitoring and

adapting to environmental conditions, the adoption of green construction practices like prefabrication and modular construction, and the incorporation of renewable energy sources such as solar panels or kinetic energy harvesting systems.

Expectations from the team:

The team is expected to propose a bridge design that leverages state-of-the-art sustainable materials and construction techniques. The model should undergo a comprehensive life cycle assessment to evaluate its environmental impact, considering factors such as carbon emissions, resource consumption, and recyclability. Furthermore, the team should explore energy-efficient features like smart lighting systems and renewable energy integration to minimize the bridge's operational environmental footprint. The emphasis will be on innovative solutions that prioritize structural integrity, cost-effectiveness, and environmental sustainability.

CIV12. Implement Sustainable Urban Drainage Systems to manage stormwater runoff

Design and Implement Sustainable Urban Drainage Systems (SUDS) for a rapidly growing city to manage stormwater runoff and mitigate the impact of urbanization on local water bodies, considering climate change and increasing impervious surfaces.

Description:

With the rapid urbanization of City X, there has been a significant increase in impervious surfaces, leading to heightened stormwater runoff and subsequent negative impacts on local water bodies. The conventional drainage systems are proving insufficient to handle this surge, resulting in urban flooding, water pollution, and degradation of aquatic ecosystems. The need for an advanced and sustainable Urban Drainage System (SUDS) is crucial to address these challenges.

Current Issue:

● The existing drainage infrastructure in City X is unable to cope with the escalating stormwater runoff caused by urban expansion. This has led to frequent flooding, property damage, and compromised water quality in local rivers and lakes.

● Traditional drainage systems are not equipped to handle the changing climate patterns, exacerbating the problem. The inadequacy of the current system poses a threat to both urban infrastructure and the ecological balance of water bodies.

Past Research:

Previous studies on urban drainage systems have primarily focused on technical aspects, such as pipe capacity and water flow modelling. Some research has explored sustainable solutions, but implementation has been limited. Past models often overlooked the dynamic nature of urbanization and climate change, leading to inadequate system designs. A few pilot projects have attempted to incorporate sustainable elements, but comprehensive integration is yet to be achieved.

Future Scope:
Implementing SUDS as a standard practice in urban planning can contribute significantly to creating more resilient, sustainable, and livable cities in the future. The combination of technological advancements, policy support, community involvement, and a global perspective will likely shape the evolution of SUDS in the years to come.

Expectations from the team :
The model will incorporate green infrastructure elements, such as permeable pavements, green roofs, and bio-retention areas, to reduce runoff and promote natural infiltration. Advanced hydraulic modelling and data analytics will be employed to optimize the system's performance under various scenarios.

CIV13. Optimizing Hospital Layout for Efficient Patient Flow

In the realm of civil engineering applied to the medical field, a significant challenge lies in designing hospital layouts that enhance patient flow, reduce congestion, and improve overall operational efficiency. Design an optimal hospital layout that minimizes patient travel distances, reduces wait times, and enhances overall operational efficiency within the given constraints of the existing infrastructure.

Description:
Hospitals are complex facilities with diverse functional areas, including patient wards, diagnostic labs, operating rooms, and support services. Efficient patient flow is crucial for timely medical care, resource utilization, and staff productivity.

Current Issues:
- Existing Infrastructure Constraints: Work within the limitations of the current hospital building, considering structural, spatial, and regulatory constraints.
- Patient Diversity: Account for the diverse needs of patients, including those with mobility issues, different medical conditions, and varying levels of urgency.
- Infection Control: Implement measures to minimize the risk of infection transmission, especially in the wake of global health concerns.

Future Scope :
By integrating the above given advanced technologies and methodologies, the future implementation of a hospital layout optimization model can significantly enhance patient flow, resource allocation, and overall operational efficiency in healthcare facilities.

Expectations from the team :
A detailed hospital layout plan that optimizes patient flow and enhances operational efficiency. Improved patient satisfaction scores and reduced wait times. Enhanced emergency response

capabilities.Recommendations for implementing the proposed layout within the existing infrastructure. This problem statement challenges civil engineers to apply their expertise in spatial planning, traffic engineering, and infrastructure design to contribute to the optimization of healthcare facilities, ultimately improving patient care and overall hospital performance.

CIV14. Problem Statement: Structural Health Monitoring of Aging Infrastructure

Description:

Ageing infrastructure, including bridges, dams, and buildings, poses a significant challenge in terms of structural integrity and safety. The deterioration of these structures over time is influenced by various factors such as environmental conditions, material degradation, and increasing loads. To ensure public safety and prevent catastrophic failures, there is a critical need for the development of an efficient and cost-effective system for monitoring the structural health of ageing infrastructure.

Current Issue:

● Current methods of structural health monitoring often rely on periodic inspections, which may not provide real-time insights into the evolving condition of the infrastructure.

● This lack of real-time monitoring can lead to delayed detection of structural issues, increasing the risk of accidents and necessitating costly emergency repairs.

Past Research:

Past research has explored various sensor technologies, including accelerometers, strain gauges, and acoustic emission sensors, for structural health monitoring. However, integrating these technologies into a comprehensive and cost-effective system that provides real-time data and predictive analytics remains a challenge.

Future Scope:

By addressing these challenges, the proposed model aims to revolutionize the field of structural health monitoring, ensuring the safety and longevity of ageing infrastructure while minimizing the economic and social impacts associated with unexpected failures.

Expectations from the team :

The proposed solution aims to develop a state-of-the-art Structural Health Monitoring (SHM) system that seamlessly integrates advanced sensor technologies, data analytics, and real-time monitoring. The system should be capable of continuously collecting data on structural parameters such as vibrations, strains, and material conditions. Machine learning algorithms can be employed to analyze the data and detect anomalies, providing early warnings for potential structural issues.