CEC201 – App Development: Geospatial Solutions for Civil Engineering

Contents

Description

Similarly to how we discussed in the lectures, identify a real-world civil engineering problem in the Roorkee/Uttarakhand region and design a geospatial solution in the form of an application (app) or interactive dashboard. The goal is to demonstrate the crucial role of geospatial engineering in solving various civil engineering challenges, while fostering skills in data-driven decision-making and technology-enabled impact creation. The themes are mentioned later.

You are free to use any tool for this purpose, however it suggested that you may begin with Google Earth Engine (GEE) or Leafmap given their rich data catalog and cloud processing. Irrespective of the tool, your app/dashboard should demonstrate integrating datasets, analytics, and visualization for practical and societal benefit. In order to identify a solution that works, you are suggested to read at least two relevant research papers.

You should clearly identify at least one United Nations Sustainable Development Goal (SDG) supported by your solution. Further you should justify the significance of your product by providing quantified justifications of the value-addition in measurable terms (e.g., possible lives impacted, monetary savings, reduced carbon footprint, faster processing time, environmental gains etc.).

Your app/ dashboard should clearly answer questions like 'whose problem will be solved with my prototype?" or 'your app provides solution to exactly what engineering problem?'. To further support your claim, demonstrate the utility of your prototype through a case-study. E.g. if the app is focused on floods, then you may demonstrate the utility of your app through the case-study of the 2023 Uttarakhand floods. Finally also provide also test your prototype with your targeted users , and share their feedbacks.

Domains of Interest

Your selected problem should belong to the following areas:

1. Agriculture (e.g. monitoring & crop health)

2. Forest fire (e.g. detection and risk assessment)

3. Flood (e.g. prediction and inundation mapping)

4. Renewable energy (e.g. site suitability (solar, wind, hydropower)

5. Water quality (e.g. monitoring and pollution tracking, wetlands)

6. Air quality (e.g. pollution trends, hotspots, mapping and emission spots)

7. Urbanization (e.g. urban heat, expanding pockets, land encroachment detection)

8. Road construction (e.g. monitoring & progress tracking)

9. Landslide (e.g. hazard mapping and risk prediction)

10. Deforestation (e.g. loss of urban forests)

11. Height estimation (e.g. from smartphone images (photogrammetry)

12. Real-time road health status (e.g. during floods, street lighting status)

13. Socio-economic (e.g. health, electrification, poverty mapping)

You are encouraged to propose **novel domains or interdisciplinary ideas** if they align with civil engineering and geospatial applications within the above topics.

Requirements & Process

1. **Team Formation:**

   o Up to **3 members per team**.

   o Your team performance may benefit if the members have similar interest and complementary skills.

2. **Problem Selection & Justification:**

   o Choose a relevant civil engineering challenge.

   o Select a problem that is specific, measurable, and relevant to the Roorkee/Uttarakhand context.

   o Clearly state why the problem matters in civil engineering terms (e.g., infrastructure resilience, water resource management, environmental safety).

   o Read and cite at least two peer-reviewed research papers to justify your choice and ensure technical feasibility.

   o Answer clearly the question, "**your app provides solution to exactly what engineering problem?**"

3. **Solution Design:**

   o Clearly define the scope of your solution.

   o Ensure it incorporates **geospatial datasets, analytical processing, and visualization**.

   o You may use **GEE or any other tool** for computation, visualization and app development. Alternative platforms (QGIS, ArcGIS Online, Python APIs, etc.) are also acceptable.

4. **Impact Quantification:**

   o Identify **specific, measurable value addition**:
   e.g., cost savings, environmental protection metrics, population reached, hazard reduction time.

   o Map your solution to **at least one SDG** and explain the connection.

5. **Implementation & Demonstration**

   o Build a working prototype of your app/dashboard.

   o Ensure **ease of use, reliability, and actionable outputs** for your target audience (e.g., engineers, policymakers, citizens).

6. **Case-study demonstration:**

   o Demonstrate the utility of your app through a case-study. E.g. if the app is focused on floods, then you may demonstrate the utility of your app through 2023 Uttarakhand floods.

   o You should include feedback from at least 2 users outside of your team group.

7. **Final Deliverables:**

   o **Shark Tank–style Pitch:**

      ▪ Max 7 slides, 8–10 minutes.

      ▪ Focus on **problem relevance, innovation, feasibility, and measurable impact**.

      ▪ The scale & urgency of the problem

      ▪ The value & measurable impact of your app

      ▪ The innovation & feasibility of your approach

   o **Report (max 10 pages):**

      ▪ Problem definition, background, and literature review

      ▪ Methodology and datasets used

      ▪ App design and implementation

      ▪ Impact assessment and SDG alignment

      ▪ Result demonstration through case-study, and user feedback.

      ▪ Future scope and limitations

Evaluation matrix

Evaluation will have total marks (100)

Component	Criteria	Points
Problem	Relevance, importance & scale of the civil engineering problem in the chosen area of interest	10
Solution	Feasibility (5), Value addition (5)	10
App/Dashboard	Completeness (5), Effective use of geospatial technologies (20), Usability/ User feedback (5)	30
Report & Presentation	Report: SDG alignment (10), Case-study through app (20) Presentation: Clarity, depth, team-work and professionalism (20)	50

Total marks (100)

Timeline (implementation and submission)

Final evaluation will begin in October end. Timelines in weeks:

Activity	Timeline	Duration
Team formation and theme selection	2nd –3rd week, Aug	2 weeks
Problem formulation and solution ideation	3rd week, Aug – 2nd week, Sep	4 weeks
Necessary skill development	2nd –4th week, Sep	3 weeks
Interim status report (1 page summary of the task status from each team)	1st week, Oct	
App/Dashboard development	2nd week, Sep – 3rd week, Oct	8 weeks
Report and presentation preparation	2nd –3rd week, Oct	2 weeks
Deadline **submission of code, dataset, AI tool log, demo video 60sec, report, presentation** Will not be extended.	**23:59, 23rd October (Thursday)**	
Evaluation (app demonstration, report, presentation)	27th Oct onwards	

AI tool usage policy *(App Development & Dashboard Project)*

Purpose

AI tools can support creativity, efficiency, and problem-solving. This policy ensures their use **enhances learning** rather than replacing it.

You may use AI for

- Brainstorming problem statements & solution ideas.
- Getting coding hints, syntax fixes, or debugging help.
- Improving grammar, structure, or clarity of reports.
- Finding relevant datasets or APIs (must be verified).
- Suggestions for dashboard layouts or data visualizations.

You shall NOT use AI for

- Submitting AI-generated code/reports without **understanding** them.
- Fabricating data, results, or references.
- Copy-pasting outputs without adapting to your project.
- Using AI to bypass your own learning or problem-solving.

AI Use Log (Mandatory)

Include an appendix in your final report with:

1. **Tool name & version** (e.g., ChatGPT v4, GitHub Copilot).
2. **Date accessed**.
3. **Purpose of use**.
4. **Prompts**
5. **Exact AI output used** (or a paraphrase) + **how you modified it**.

Academic Integrity

- The jury may question you on **any AI-assisted content**.
- If you cannot explain it, **0/100 marks may be awarded**.

- Cite AI as a digital resource:
  Example: "OpenAI ChatGPT, version 4, accessed on 13 Aug 2025."

Ethics & Impact

- Check AI outputs for accuracy.

- Ensure data use is ethical, legal, and relevant to **civil engineering & geospatial problem-solving**.

- Consider sustainability and societal benefit in all AI-supported work.

Remember: AI is your assistant, not your substitute. Use it to learn better, not to do the learning for you.