Semester Project Proposal:

Mobile-Based Campus Navigation Assistant

Objective

This project aims to develop a **mobile-based navigation assistant** that estimates a user's location on campus **without using GPS**. Instead, the system will rely on **image-based landmark recognition and distance estimation**. The final deliverable will be a **mobile application** that identifies campus buildings and determines the user's position based on captured images.

General Guidelines

- **Group Size:** 8 students (2 per phase).
- **Pretrained Models:** Must be used for landmark recognition due to the small dataset size.
- **Annotation:** Images must be properly labeled for training.
- **No GPS:** Distance and localization should be based on **visual cues and mathematical models**.
- **Try to do things in parallel it'll save your time and help you complete project.**

Project Phases and Tools

Phase 1: Image Collection & Dataset Preparation

📌 **Goal:** Build a dataset of **campus landmarks** (exterior images of buildings only).

✅ **Tasks:**

- Capture **5-15 images per building** from different angles.
- Annotate images with **building names** (manual or semi-automated).
- Store images systematically in a structured dataset.

🛠 **Recommended Tools:**

- **Mobile Cameras** (for image collection).
- **LabelImg** (for annotation).
- **Python + Pandas** (for dataset structuring).

✅ **Deliverables:**

- Images must be stored in the images/ folder.
- All images should be in **JPEG (.jpg) or PNG (.png)** format.
- Students should provide annotations in a **CSV file** named annotations.csv inside the annotations/ folder.
- Students should include a dataset_description.txt file containing:
  - ✅ **Total number of images collected**
  - ✅ **List of landmarks/buildings covered**
  - ✅ **Description of annotation format**
  - ✅ **Challenges faced (e.g., lighting conditions, obstructions)**
- **Submit as a `.zip` file** named: `Campus_Landmarks_Dataset_GroupX.zip`

Phase 2: Landmark Recognition Model

📌 **Goal:** Train a **pretrained model** to recognize buildings from images.

✅ **Tasks:**

- Preprocess images (resize, enhance, augment).
- Use a **CNN-based model** like **MobileNet, ResNet, or VGG16**.
- Train and evaluate the model for accurate landmark recognition.

🛠 **Recommended Tools:**

- **TensorFlow/Keras or PyTorch** (for model training).
- **OpenCV** (for image preprocessing).
- **Google Colab** (for training with GPUs).

✅ **Deliverables:**

- Trained model (`.h5`, `.pth`, or `.tflite`)
- Preprocessing, training, and inference code (`.ipynb`)
- Evaluation results (metrics & confusion matrix)
- Report (PDF) summarizing model details
- ReadMe file explaining how to run the model

Phase 3: Distance Estimation

📌 **Goal:** Estimate distance from the user's position to a detected landmark.

✅ **Tasks:**

- Use **object size comparison** or **triangulation** to estimate distances.
- Incorporate a **known reference object** (e.g., door height, signboard width).
- Capture images from **two different positions** for better accuracy.

🛠 **Recommended Tools:**

- **OpenCV** (for landmark detection).
- **NumPy & SciPy** (for mathematical calculations).
- **Matplotlib** (for visualization).

Phase 4: Localization on Campus Map & Mobile App Development

📌 **Goal:** Display the user's estimated location on a **digital campus map** within the mobile app.

✅ **Tasks:**

- Use **trilateration** to estimate the user's position based on distances to detected landmarks.
- Develop a **mobile app** for capturing images and estimating location.
- Display user location dynamically on the campus map.

🛠 **Recommended Tools:**

- **Flask/Django (Backend API)** (for serving model predictions).
- **React Native/Kivy (Mobile App)** (for user interface).
- **Matplotlib/Leaflet.js** (for mapping user location).

✅ **Deliverables:**

- It'll be final submission so there should be everything in it
- Mobile app, codes, Jupyter notebooks, trained models
- You are supposed to submit a report of your project
- Also make presentation slides 10-12 containing info about the dataset annotations, model training evaluation matrices, and final results.

Evaluation Criteria

Each phase will be evaluated based on the following:

- ✅ **Dataset Completeness & Annotation Accuracy** (Phase 1).
- ✅ **Recognition Model Performance** (Phase 2).
- ✅ **Distance Estimation Accuracy** (Phase 3).
- ✅ **Localization Accuracy & Usability of Mobile App** (Phase 4).

Expected Outcome

By the end of the project, you will have developed a **fully functional navigation system** that:

- **Recognizes campus buildings** from images.
- **Estimates distances** to known landmarks.
- **Determines the user's location** and displays it on a mobile app.

Project Timeline (8 Weeks)

Phase	Tasks	Responsible Group (2 Students Each)	Duration	Submission DeadLines
Phase 1: Image Collection & Annotation	📸 Capture 5–15 images per building, annotate, and organize dataset	**Group 1**	**1 Week**	**16th March**
Phase 2: Landmark Recognition Model	🔄 Preprocess images & train a **pretrained model** (e.g., MobileNet, ResNet)	**Group 2**	**2.5 Weeks**	**9th April**
Final submission: Distance Estimation and mobile app	📏 Implement size-based & triangulation-based distance estimation 📱 Build a basic mobile app & integrate recognition & distance estimation	**Group 3 & 4**	**2.5 Weeks**	**26th April**