MMWave Radar AI Project – Official Assignment (Time Limit: 24 Hours)

Objective:

To identify capable students for the mmWave Radar AI Research & Development team by evaluating their skills in signal processing, computer vision, machine learning, and real-time AI pipeline design.

PART 1 — Synthetic Radar Signal Processing (Mandatory)

Task:

• Generate synthetic radar-like 1D and 2D signals mimicking range-Doppler readings.

• Create empty-room, metal-object, and clutter scenarios.

• Apply FFT-based transformations.

• Visualize range, doppler, and heatmaps.

Deliverables:

• radar_simulation.ipynb

• Heatmap visualizations

PART 2 — Metal vs Non-Metal Classification (Mandatory)

Task:

• Build a dataset of at least 300 samples using synthetic heatmaps.

• Train a classification model (CNN or SVM).

• Evaluate accuracy, confusion matrix, predictions.

Deliverables:

• classification_model.ipynb

• Model file + results

PART 3 — Hidden Object Detection Challenge

Task:

• Simulate cluttered scenes (metal hidden behind objects).

• Apply noise filtering and background subtraction.

• Test model performance on cluttered samples.

Deliverables:

• hidden_object_detection.ipynb

PART 4 — Deployment Logic (Short PDF)

Describe:

• Real-time radar pipeline

• Preprocessing

• Model flow

• Limitations and improvements

Deliverable:

• deployment_design.pdf

PART 5 — Demo Video (2 Minutes)

• Show heatmaps

• Show predictions

• Explain approach

Deliverable:

• demo_video.mp4 (Drive/YouTube link allowed)

FINAL SUBMISSION ITEMS:

1. GitHub Repository Link

2. All Jupyter Notebooks

3. deployment_design.pdf

4. Demo Video Link

SELECTION CRITERIA:

• Radar simulation accuracy – 30%

• AI model performance – 25%

• Noise/clutter handling – 20%

• Code quality – 15%

• Video explanation – 10%

Time Allocation: STRICT DEADLINE — 24 HOURS

Good luck!