# Project Report - Deep Space Vision

Team Name: Code Offenders  
Project Name: Deep Space Vision  
Tagline: Synthetic Vision, Real Precision in Space  
  
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Methodology  
  
1. Data Collection:  
 - The dataset was sourced from Falcon and uploaded to Google Drive for training on Google Colab using the provided scripts.  
  
2. Model Training:  
 - Initially, the training was attempted locally, but due to hardware limitations, the process was migrated to Google Colab using a T4 GPU.  
  
3. Fine-Tuning:  
 - Fine-tuning was conducted by swapping the training and validation folders for further training.  
 - 50 epochs were utilized during fine-tuning with Albumentations enabled by default in YOLO.  
  
Integration:  
 - The trained model was exported as model.pt and integrated with the frontend and backend using Flask API for inference.  
  
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Results & Performance Metrics  
  
1. mAP Scores:  
 - mAP50: 0.94 (Best achieved at epoch 42)  
 - mAP50-95: 0.85 (Final epoch result)  
  
2. Confusion Matrix:  
 - FireExtinguisher: 374 TP, 13 FP  
 - Toolbox: 369 TP, 10 FP  
 - OxygenTank: 361 TP, 25 FP  
 - Background: 11, 12, and 10 misclassifications across the respective classes.  
  
3. Accuracy Analysis:  
 - No additional accuracy comparisons or benchmarks were conducted.  
  
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Challenges & Solutions  
  
1. Limited Hardware:  
 - Initially, the model was trained locally but encountered significant hardware limitations.  
 - Solution: Switched to Google Colab with T4 GPU for effective training.  
  
2. Overlapping Boxes & Class IDs:  
 - Overlapping bounding boxes and class ID mismatches were observed during inference.  
 - Solution: Adjusted Non-Maximum Suppression (NMS) parameters to mitigate overlapping and ensure correct class assignment.  
  
3. Colab Runtime Limitations:  
 - Colab runtime disconnects and limitations hindered training continuity.  
 - Solution: Implemented checkpoint saving to resume training without loss of progress.  
  
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Conclusion & Future Work  
  
1. Conclusion:  
 - The primary objective was to detect objects using a model trained on synthetic data. Despite hardware and runtime limitations, the model achieved satisfactory accuracy and mAP scores.  
  
2. Future Work:  
 - The next phase will focus on deploying the model using ONNX for cross-platform flexibility.  
 - Further training will incorporate new classes and additional synthetic data to improve generalization.