APP Section - Autonomous Payload Perception Systems: A Technical Feasibility Exploration
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1. INTRODUCTION & PROBLEM STATEMENT:
- Addressing Long Loads (Pipes/Bars, etc.) in Racking for Autonomous Forklifts: An Assessment Report.

**RQ** What are the best Sensors/Algorithms for payload perception that can be used as the perfect solution for Long Load handling needs?

**Goals**
- Develop suitable vehicle perception systems (sensors and algorithms) for high-fidelity perception of forklift loads including pallets and other non-uniform loads.
- Provide a real-time load detection method/model that performs long-range and high accuracy object detection.

**Challenges**
- Shiny surfaces and metal edges pose some challenges with 3D camera technology.

Camera Sensor Kit Used
![ToF/RGB sensor kit]

2. METHODS, TECHNIQUES, & SOLUTIONS:
- State-of-the-art ToF sensor system evaluated for: range, field of view, accuracy and frame rates. Helios2+ Triton 3.2MP sensor kit selected for use in this project as the best solution for the target application.
- Comparison of Deep Learning Models for load detection such as YOLO v.8 and Faster-RCNN algorithms and object detections for different types of loads.
  - Identifying the load length, height and depth.
  - Identifying the gap between two loads.
  - Identifying the distance between the camera sensor and the load.

**Research Area**
- Machine Vision/Object Detection

![Segmentation Example of a Load in a Warehouse.]

3. SOME RESULTS DURING TRIALS/EXPERIMENTS:
- Training Custom Data via YOLOv8 snapshots
- Precision - Recall Curve / Running YOLOv8
- Confusion Matrix Produced by YOLOv8 for Our Model

4. LABELLING EXAMPLE OF A LOAD IN A WAREHOUSE:

**Potential Publications**
- Target to Publish in early 2024
  - An Autonomous Forklift for Different Types of Long Loads: Comparison of Implementation of Deep Learning Models Yolo.v8 and Faster-RCNN.