

Project: **S.I.M.P.A.T.I.A**

A photograph of a diverse group of construction workers. They are wearing various types of protective headgear, including hard hats and safety helmets. Many are wearing high-visibility safety vests over dark uniforms. They are standing close together, some with their hands on each other's shoulders, suggesting a team or group photo.

System for Identification and Monitoring for Assured Protection of Workers using AI

Roadmap

- Project Objective
- Technologies Used
- Module Timeline (Sprint Summary)
- MVP Features
- Pipeline in Action
- Strategic Analysis Summary
- Lessons Learned
- Next Steps



Project Partners



- One of Brazil's largest producers of ethanol and clean energy, with 8 agro-industrial units across 4 states and over 10 thousand employees;
- Investments in technology to enhance operational safety and efficiency - SIMPATIA.
- Working as a Data Analytics Intern in the Data area of Atvos, directly reporting to Diego Antonio Freire Dias.

Project Objective

Objective:

Automate the identification and monitoring of Personal Protective Equipment (PPE) usage through computer vision and real-time video processing.

Expected Benefits::

- Enhance operational safety
- Reduce manual supervision efforts
- Provide structured and traceable compliance reports





Technologies Used

- YOLOv8 / YOLOv12 – Object and PPE detection
- OpenCV – Real-time video processing
- FastAPI + WebSockets – Backend for video streaming
- win11toast – Local desktop notifications
- OneDrive + SharePoint – Automatic image storage
- Power BI – Data visualization and analysis

Project Project Timeline (Sprint Summary)

Sprint	<u>Main Focus</u>
Sprint 1	Planning and roadmap definition
Sprint 2	Strategic analysis (PESTEL, Porter, financial)
Sprint 3	Dataset expansion, data augmentation, model benchmarks
Sprint 4	YOLOv12 training, error resolution, and notebook translation
Sprint 5	Final YOLOv12 training and preparation for MVP integration

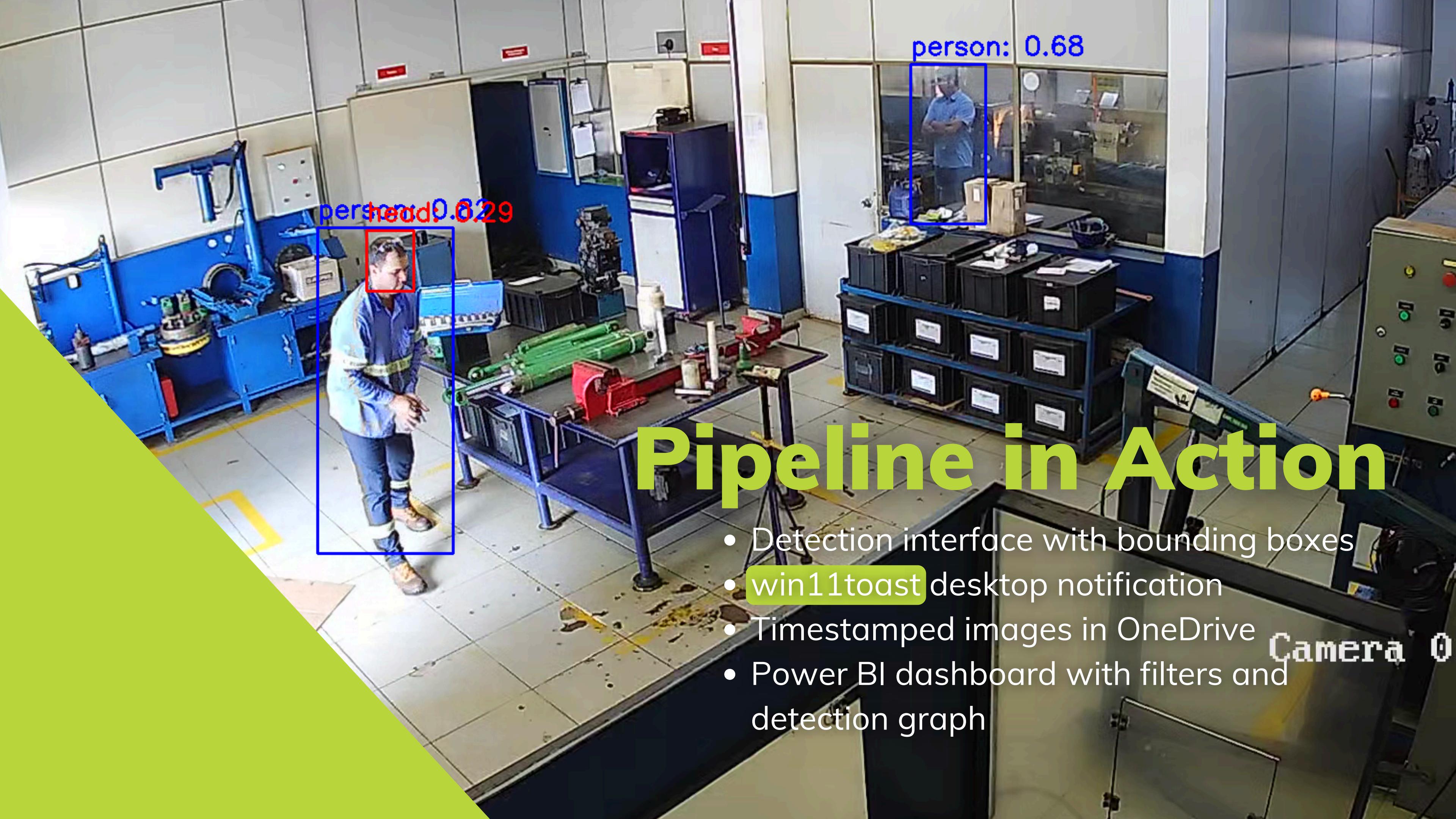
MVP Features

Key Functionalities (Already Implemented):

- ✓ Real-time detection of PPE violations
- ✓ Multi-threaded processing for multiple camera feeds
- ✓ Automatic image capture with timestamp
- ✓ Cloud storage via OneDrive
- ✓ Desktop notifications with direct image access
- ✓ Power BI dashboard with detection reports

Current Status:

The YOLOv12 model has been successfully trained and is ready to be integrated into the existing MVP, replacing YOLOv8 and enhancing detection accuracy and performance.



Pipeline in Action

- Detection interface with bounding boxes
- win11toast desktop notification
- Timestamped images in OneDrive
- Power BI dashboard with filters and detection graph

Strategic Analysis Summary

Comparison with Market Solutions:

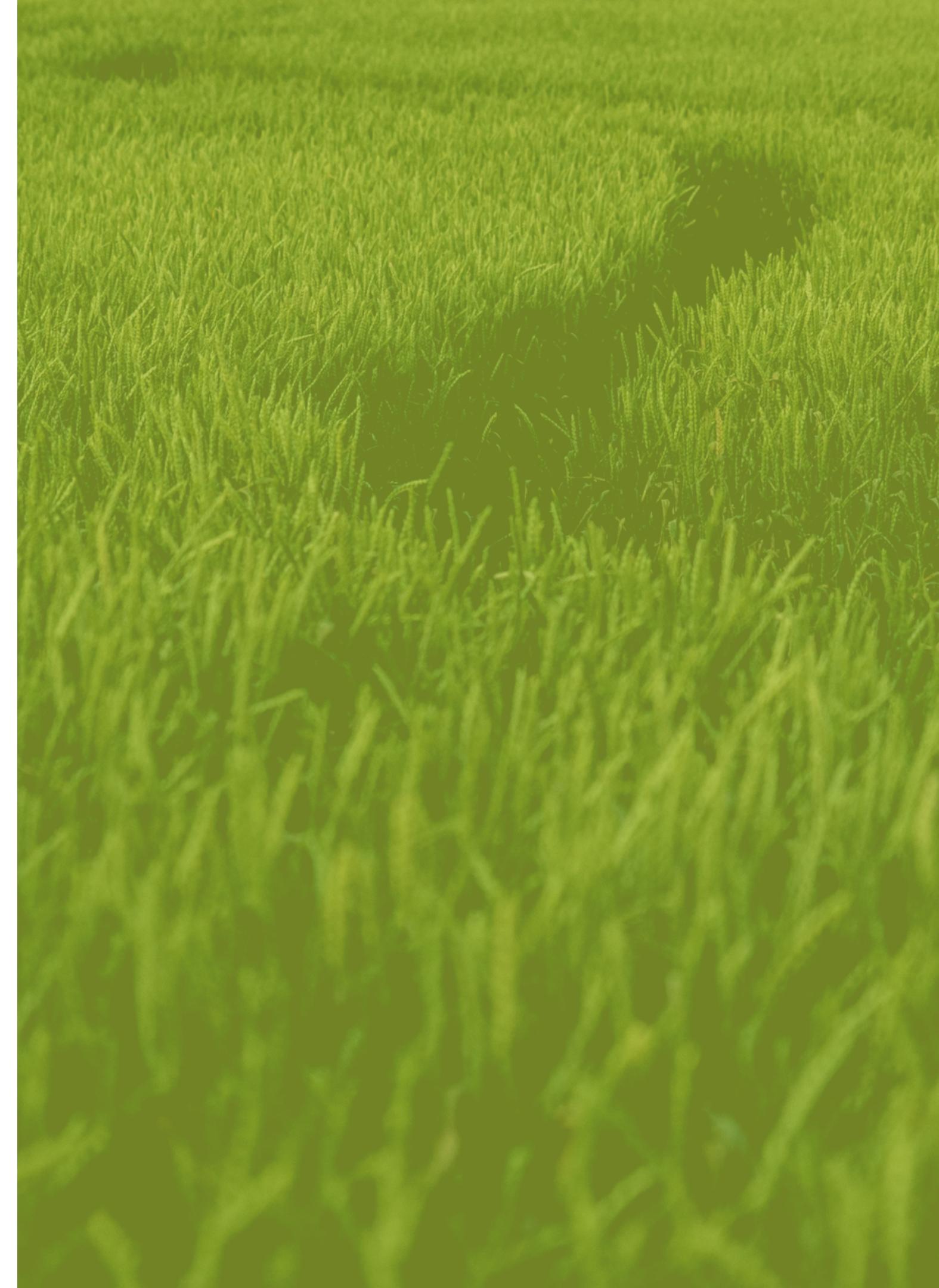
Criteria	SIMPATIA	Minsait	Mob Condua
Initial Cost	<input checked="" type="checkbox"/> Low	<input checked="" type="checkbox"/> High	<input checked="" type="checkbox"/> Medium
Flexibility	<input checked="" type="checkbox"/> High	<input checked="" type="checkbox"/> High	<input checked="" type="checkbox"/> Low
Maintenance	 Complex	<input checked="" type="checkbox"/> Included support	<input checked="" type="checkbox"/> Included support
Ready to Use	 Requires integration	<input checked="" type="checkbox"/> Yes	<input checked="" type="checkbox"/> Yes

Strategic Decision:

Prioritize the adoption of a market-ready solution in the short term, using SIMPATIA as a technical benchmark and internal alternative for future customization.

Strategic Analysis Summary

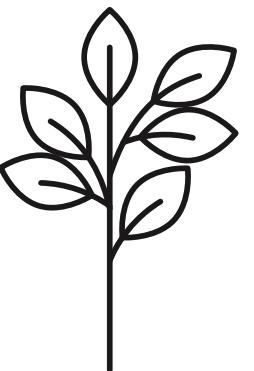
- Model robustness depends on realistic and balanced datasets
- Technical documentation is essential for scalability and maintenance
- Market solution benchmarking guides strategic decisions
- Balancing internship demands with academic project work requires focus and time management



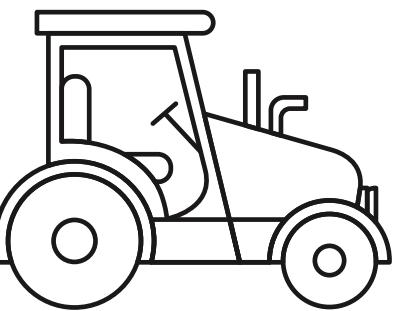


Lessons Learned

- Model robustness depends on realistic and balanced datasets
- Technical documentation is essential for scalability and maintenance
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- Balancing internship demands with academic project work requires focus and time management



Next Steps



- Integrate YOLOv12 into the existing MVP
- Evaluate commercial options (Minsait or Mob Conduta) for immediate production use
- Expand model to detect additional PPE types (glasses, boots, vests)
- Test the full pipeline with real cameras through HikVision integration



Thank you!!

Se o Implementarmos, Melhorará a Proteção e Aumentará a Tolerância com IA!!!