

The Integration of a Vision Based In-process Inspection System within the CassaMobile Project

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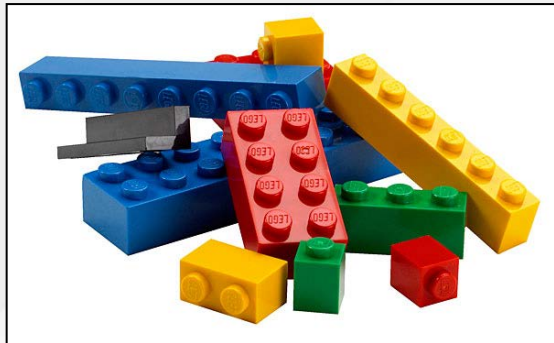
24th January, 2017, MTC QCAM

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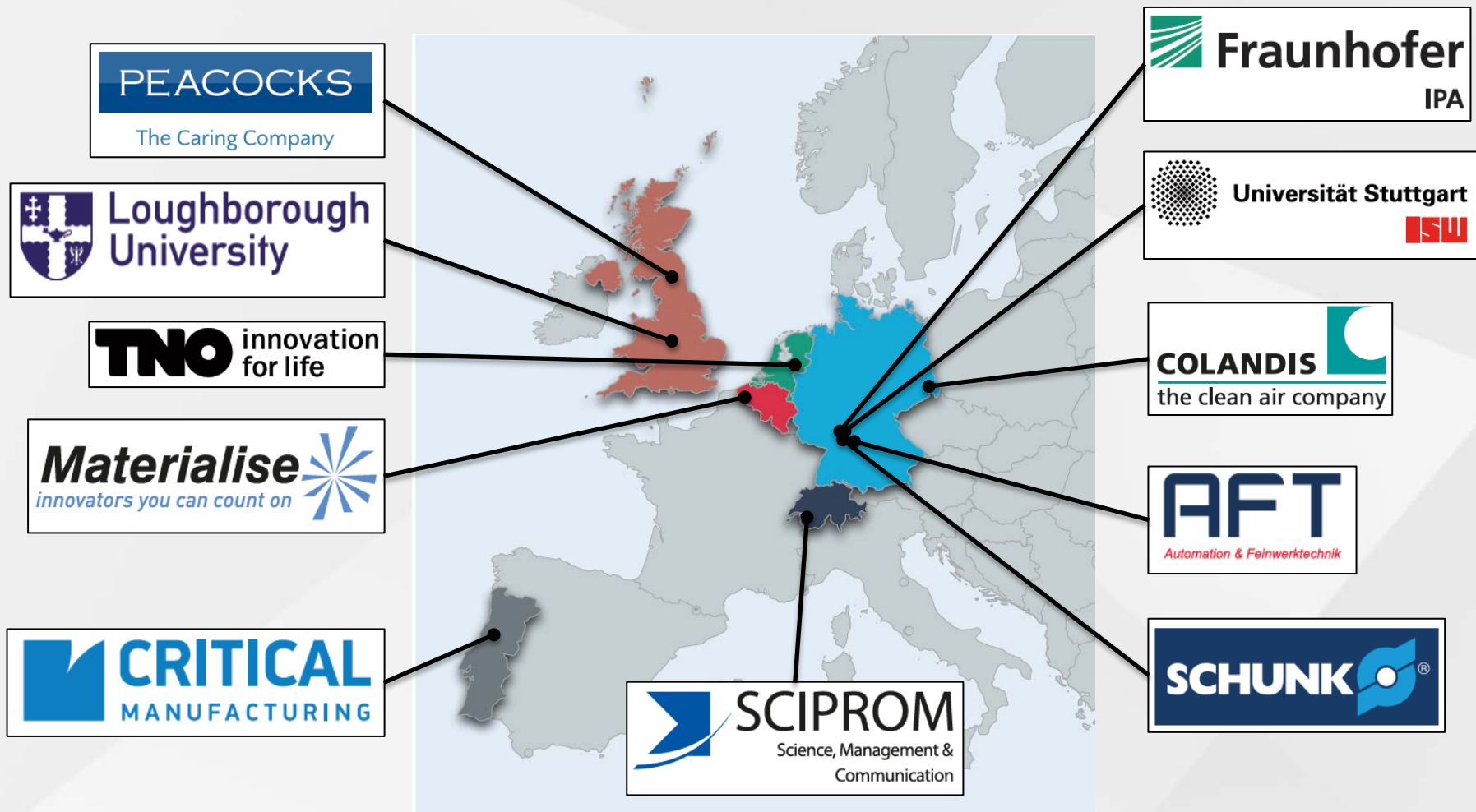
- Introduction to CassaMobile project
- Introduction to the Additive Manufacturing (AM) Module
- The integration of the inspection system
- Conclusion

Introduction to CassaMobile

- €5.6 million, 11 partners
- <http://www.cassamobile.eu/>
- 36 months; September 2013 – August 2016
- Keywords: Mobile, flexible, modular



Introduction to CassaMobile

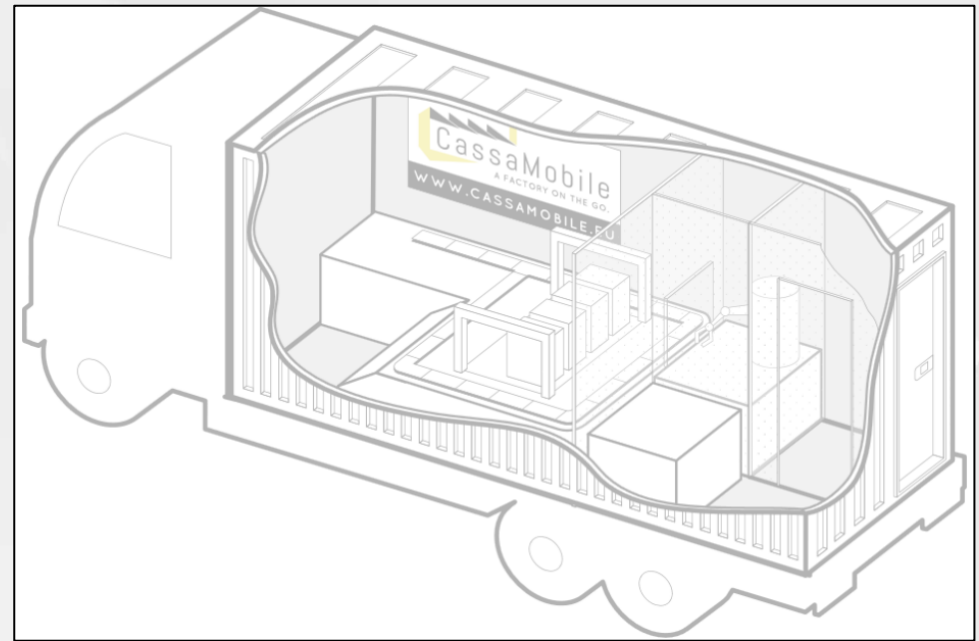


Introduction to CassaMobile

The General Concept

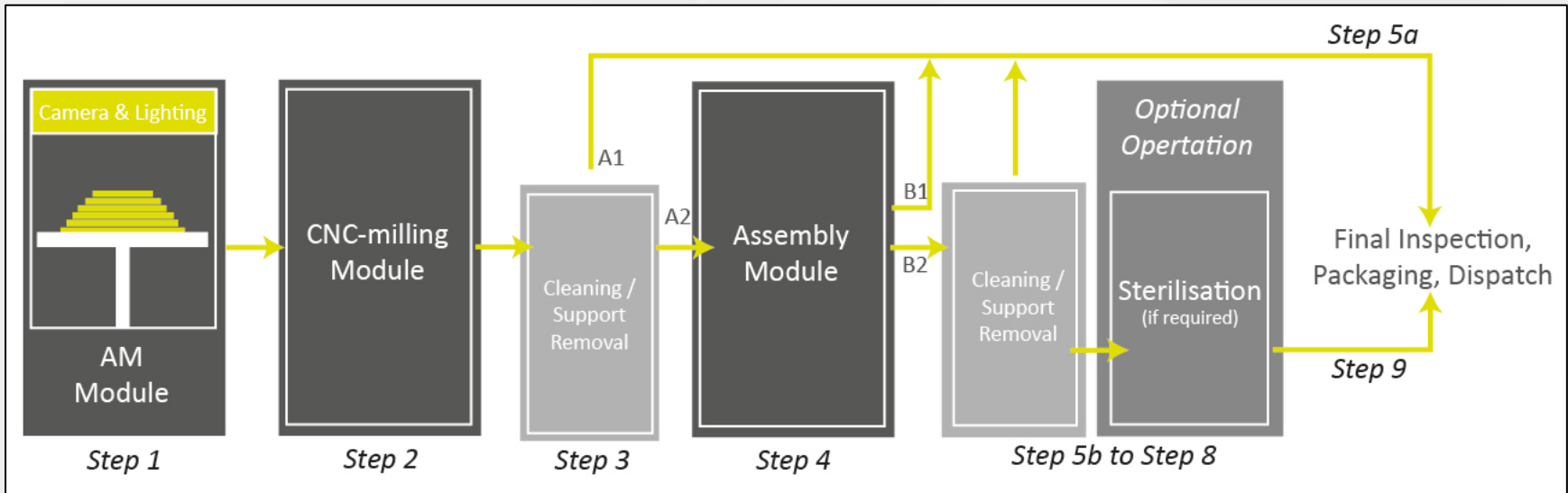
Mobile, flexible, modular, small-footprint manufacturing system in a transportable container that can be easily configured for different products and processes

On-site manufacturing anywhere, enabling the benefits of localised service delivery without duplication of equipment at multiple locations



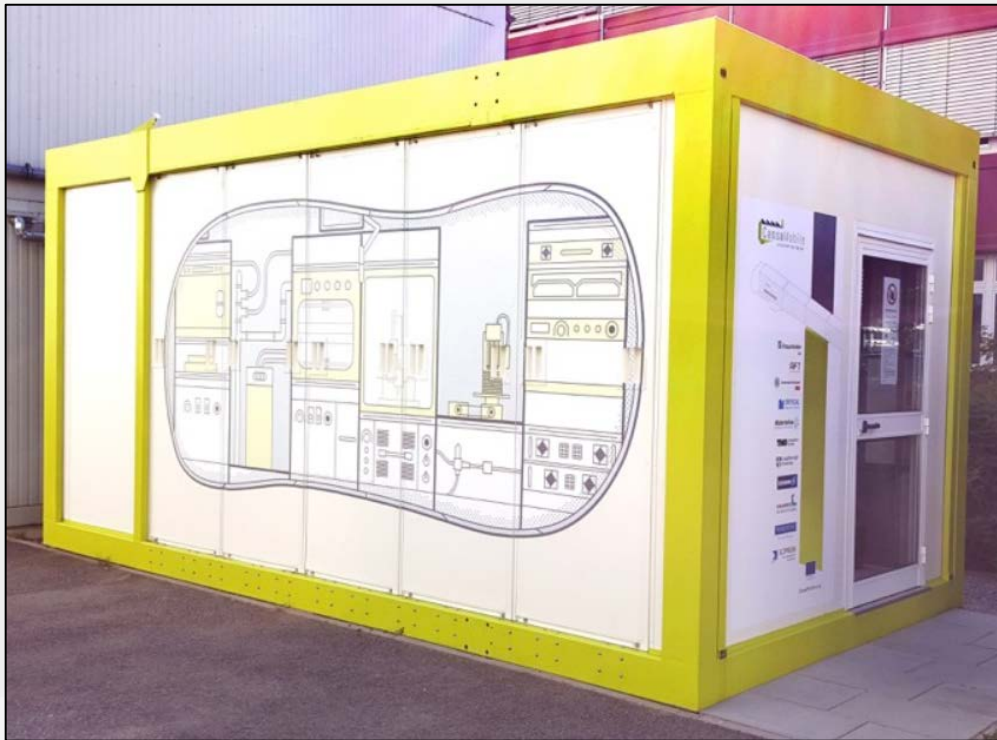
Introduction to CassaMobile

The Process Flow



Introduction to CassaMobile

The CassaMobile Container



Introduction to the AM module



CAD model

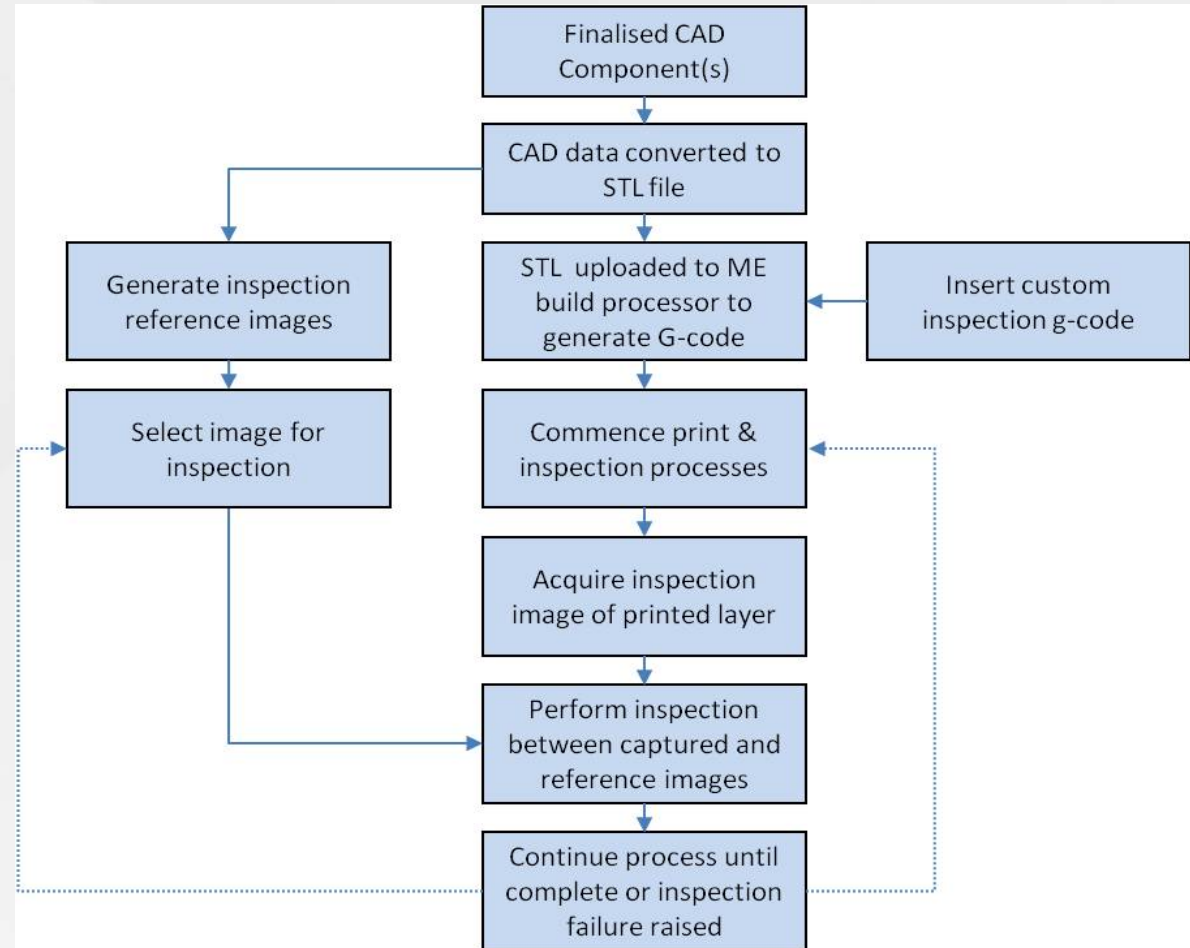


Basic specification

- Material Extrusion
- Dual Nozzles with water cooling
- Print speed: 600mm/min
- Minimal layer thickness:0.15mm
- Discrete control cabinets
- Integrated inspection camera and lighting

The Integration of the inspection system

The Concept Overview



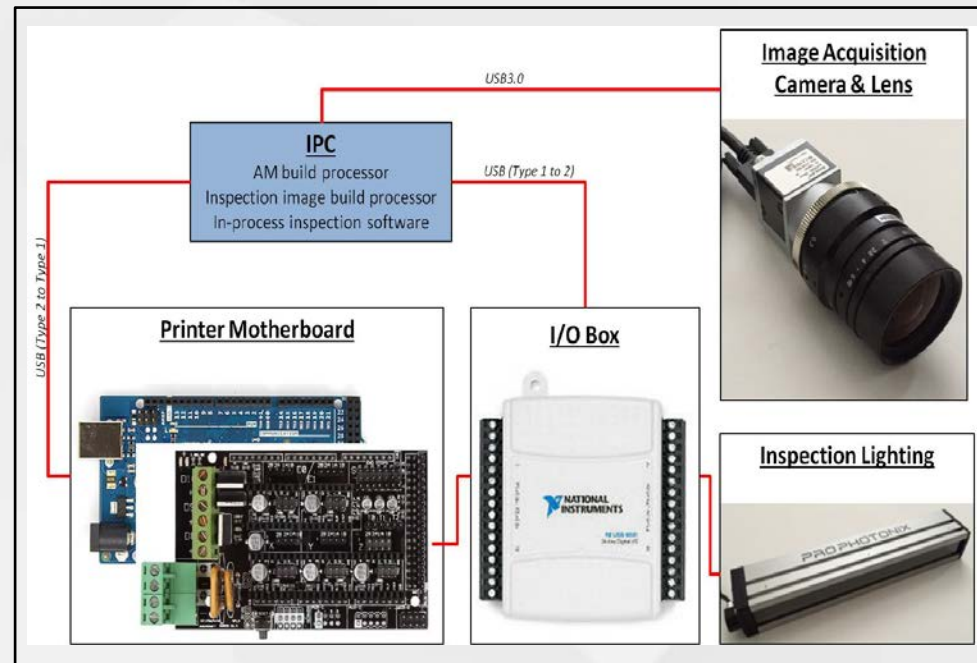
The Integration of the inspection system

Hardware

- A high specification camera and lens
- Inspection lighting and power supply units
- An appropriate I/O box
- An industrial personal computer (IPC)

Specification

- Basler acA2040-90um camera
- Kowa LM12HC lens
- 300mm long ProPhotonix line light - Qty 4
- National Instruments USB-6501 I/O box
- 24v power supply unit



Hardware components connections

The Integration of the inspection system

Software

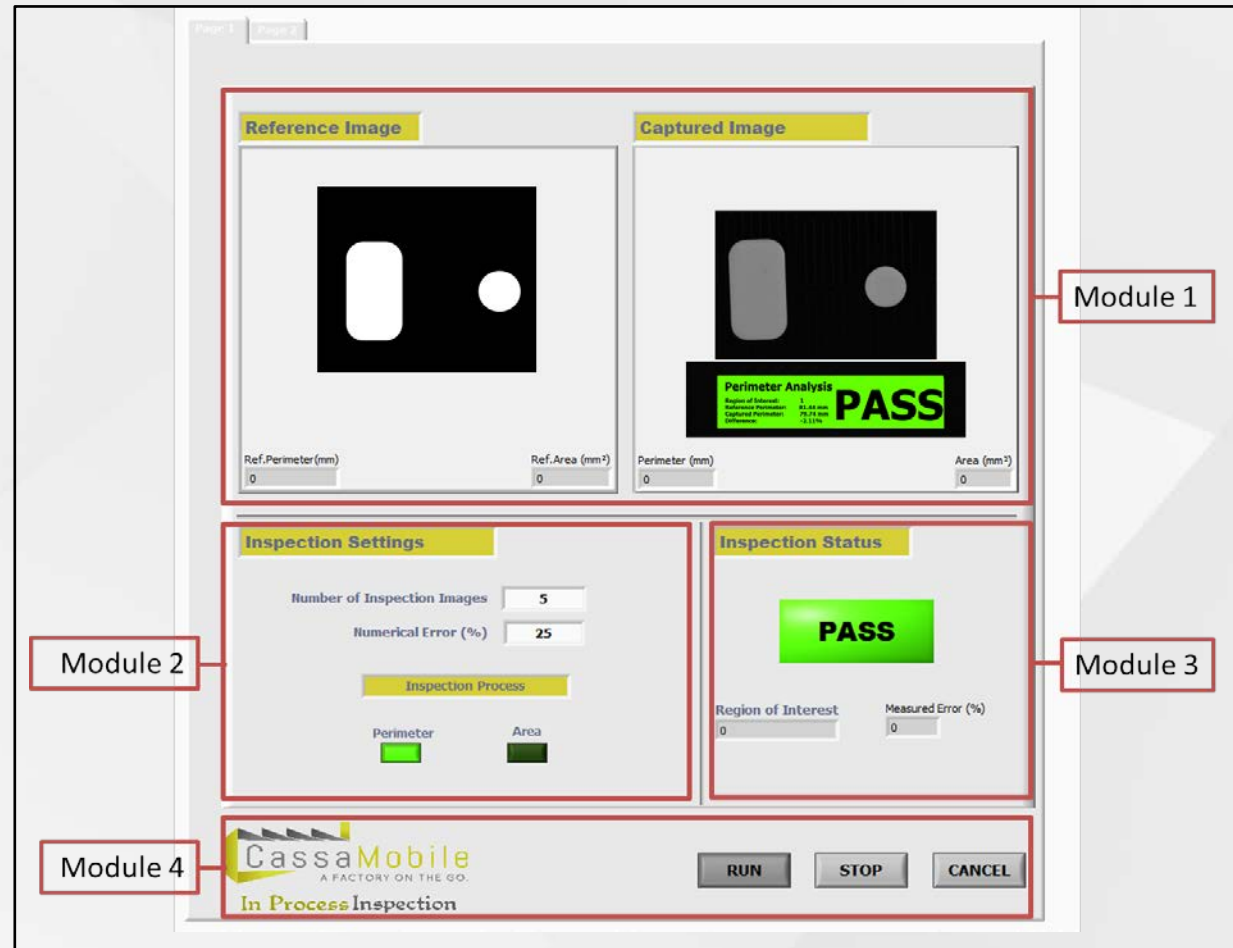
To facilitate the realisation of the proposed in-process inspection concept, a number of software requirements need to be satisfied, including:

- Generating reference image data
- Appropriately preparing/coding the I/O box
- Establishing the custom G-code to trigger the inspection system
- Designing and implementing an appropriate in-process software inspection system

The Integration of the inspection system

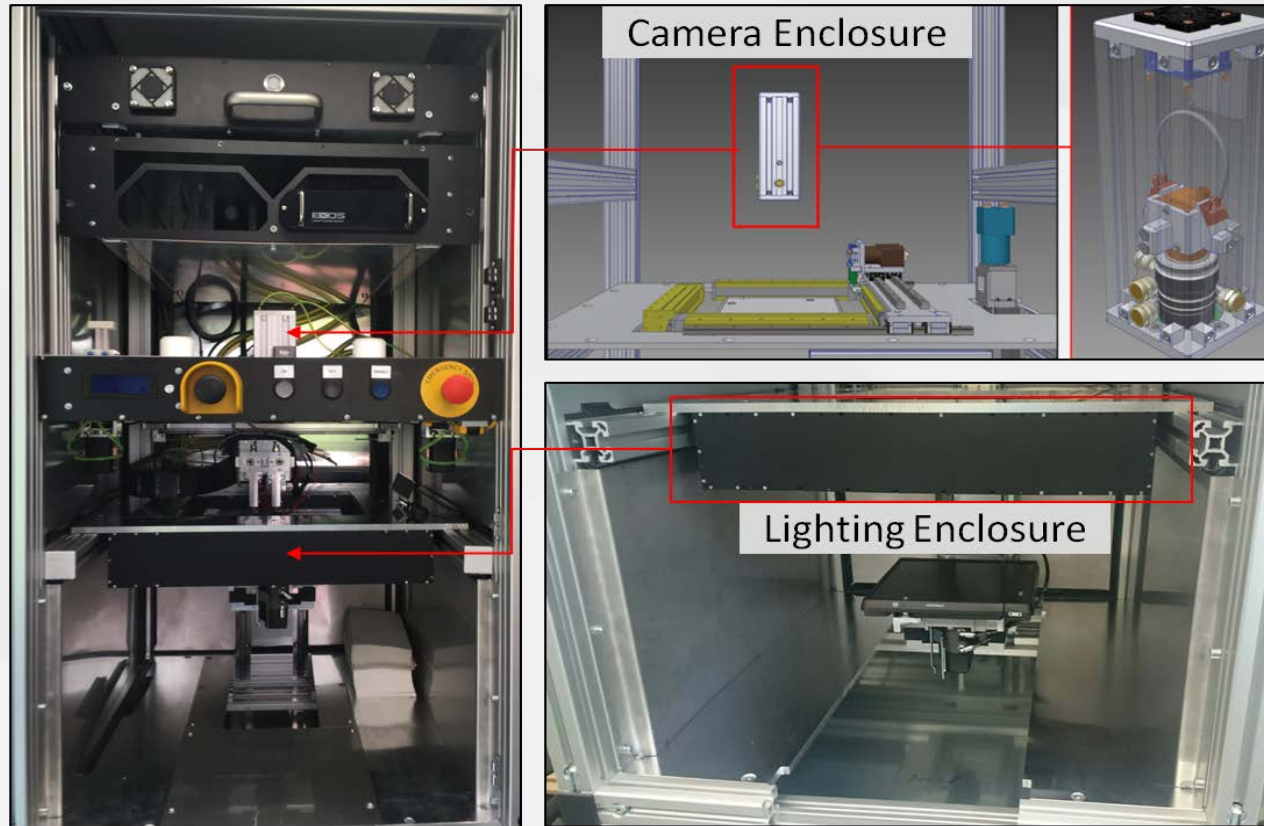
UI (User Interface)

- **Module one** - Displays images of the both the reference slice image as attained from the raw CAD data, and an image of the capture printed layer.
- **Module two** - Enables the operator to set the number of required inspections, an acceptable calculated percentage difference between the reference and built images, and whether a perimeter or area inspection is to be performed.
- **Module three** - Provides a clear indication to the operator as to the inspection status of the system
- **Module four** - Allows the operator to commence or abort the inspection cycle.



The Integration of the inspection system

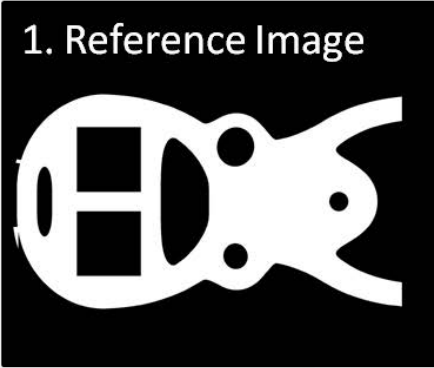
Inspection system housing within the AM module



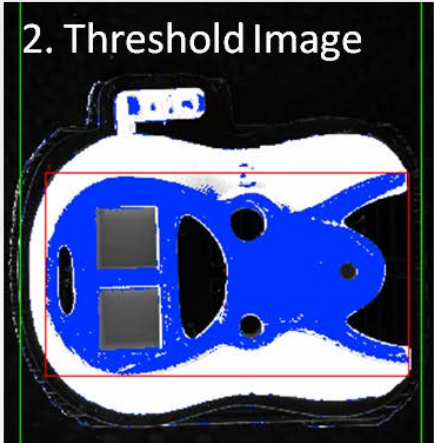
The Integration of the inspection system

Inspection system initial testing


1. Reference Image



2. Threshold Image



3. Inspected Image



Perimeter Analysis

Region of Interest:	1
Reference Perimeter:	207.63 mm
Captured Perimeter:	231.46 mm
Difference:	10.85%

PASS

Future study

- Establishing a mean to automate the thresh-holding of captured images to optimise inspection performance.
- Determining an intelligent lighting protocol to minimise shadows within the inspection area of highly complex parts.
- Enhancing the storage and visibility of inspection results/data using 3D graphic solutions.

Conclusion

- A vision based in process inspection system has been established
- It has been integrated in the AM module
- The system has been tested within the AM module in the container

CassaMobile Video

<https://www.youtube.com/watch?v=PoyVWlaEHaA>

Thank you for your attention.
Any questions?

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