VLAIO TETRA

Machine Vision for Quality Control

(MV4QC)

Demonstrators

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Demonstrator 1

- Variety of vendors: Omron, IDS, Cognex, Intel
- Variety of applications: 3D, measuring, color, classification
- 50% classical machine vision and 50% data-driven
- 50% open source and 50% commercial software

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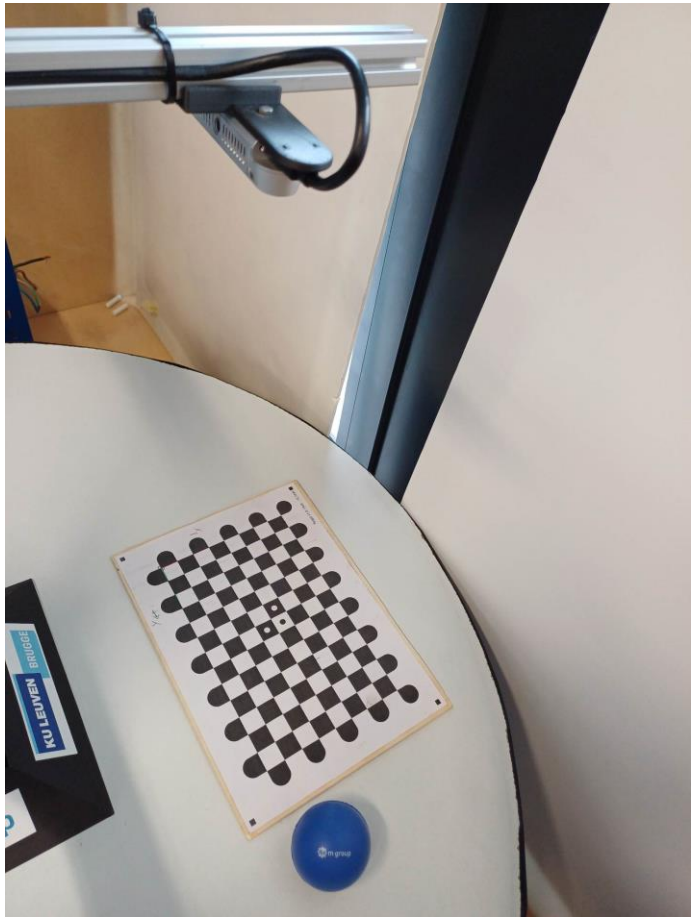
Demo 1 – Detection of a ball in 3D

- Camera: Intel RealSense D415 color + depth camera 1920 x 1080 (2MP) USB3.0
- Lens: /
- Light: /



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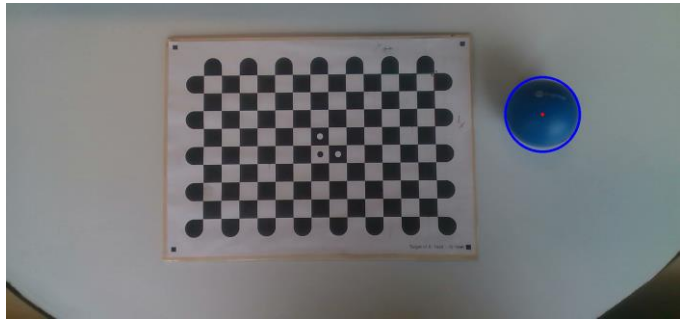
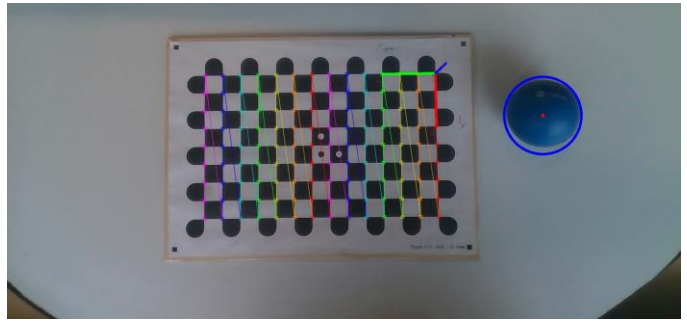
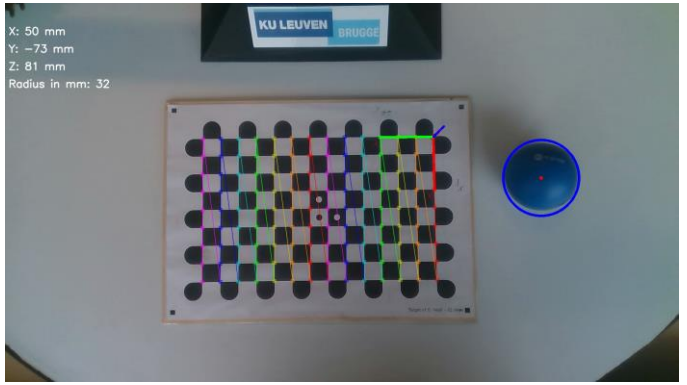
Demo 1 – Detection of a ball in 3D

The 3D coordinate of a ball with respect to a user-defined coordinate frame is obtained using classical machine vision techniques.







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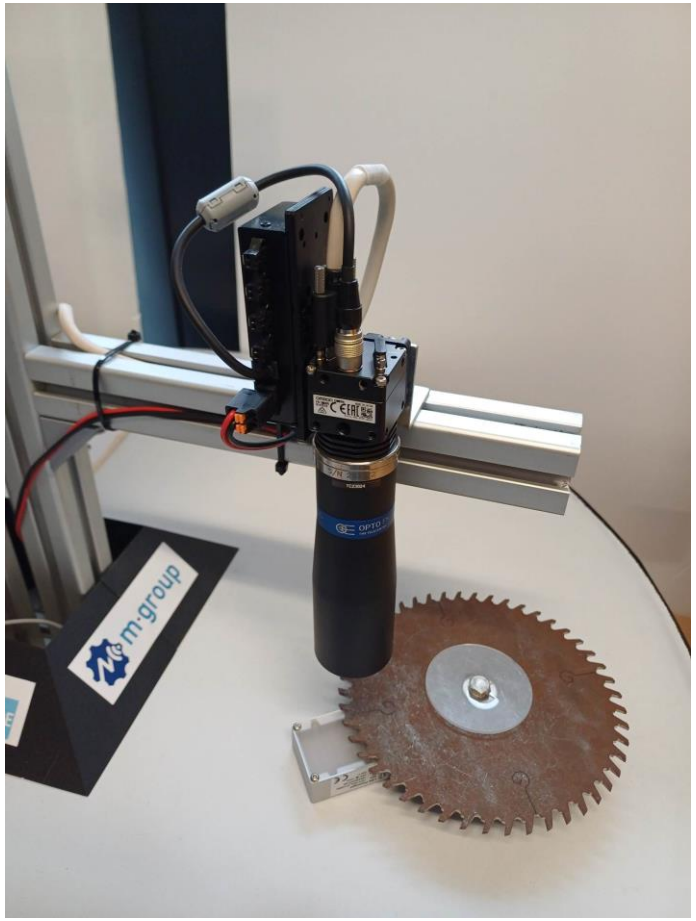
Demo 2 – Measuring the saw angle of a sawblade

- Camera: OMRON FH-SMX05 monochrome camera 2448 x 2048 (5MP) USB3.0
- Lens: Telecentric lens with 0.35 magnification
- Light: A red backlight



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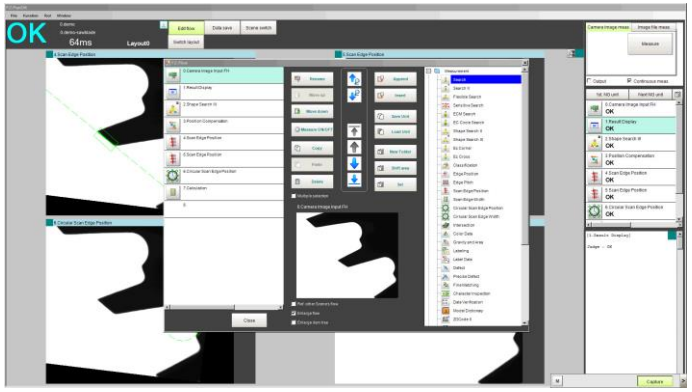
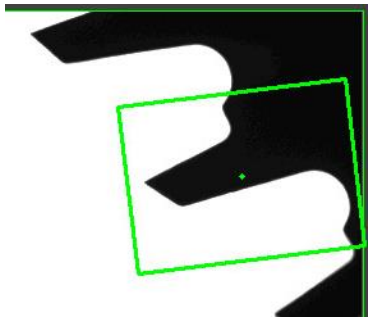
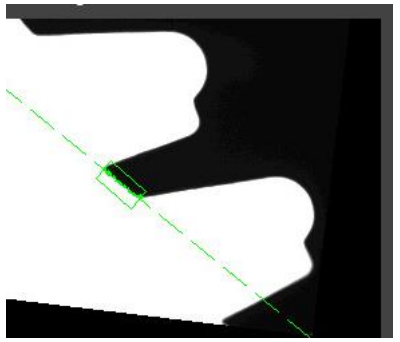
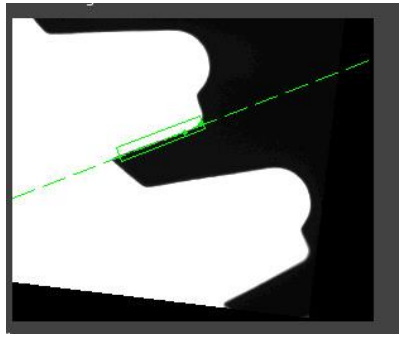
Demo 2 – Measuring the saw angle of a sawblade

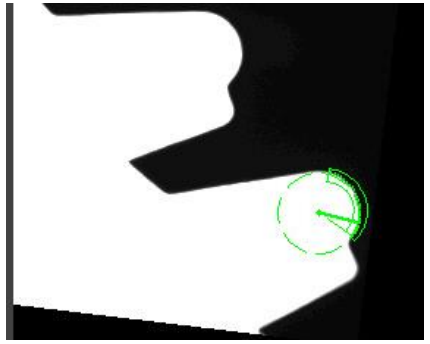
The angle of a sawblade is obtained via classical machine vision and using a backlight and telecentric lens.

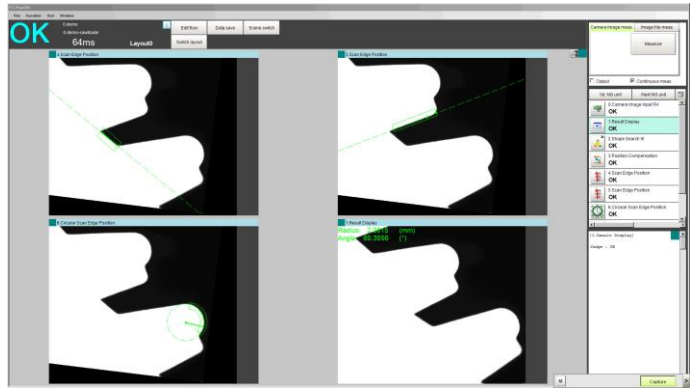












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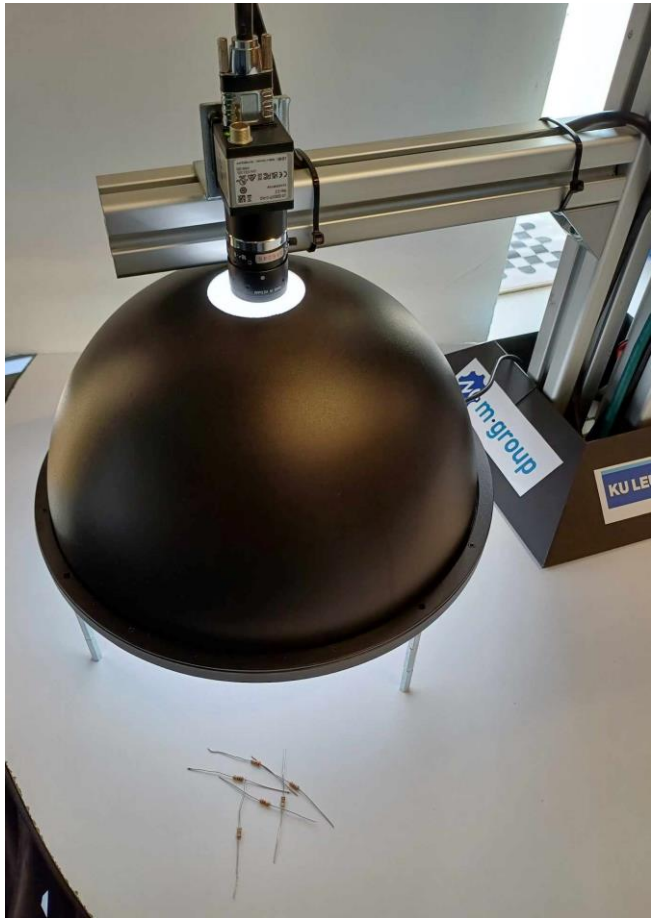
Demo 3 – Determination of the value of a resistor

- Camera: IDS U3-3280CP-C-HQ Rev 2.2 color camera 2448 x 2048 (5MP) USB3.0
- Lens: Ricoh FL-CC1614-5M 16mm
- Light: IDS5-00-250-1-W-24V white dome light



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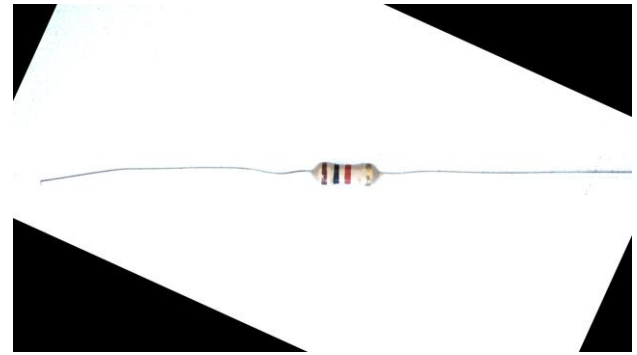
Demo 3 – Determination of the value of a resistor

The value of a resistor is obtained using classical machine vision techniques and Machine Learning.



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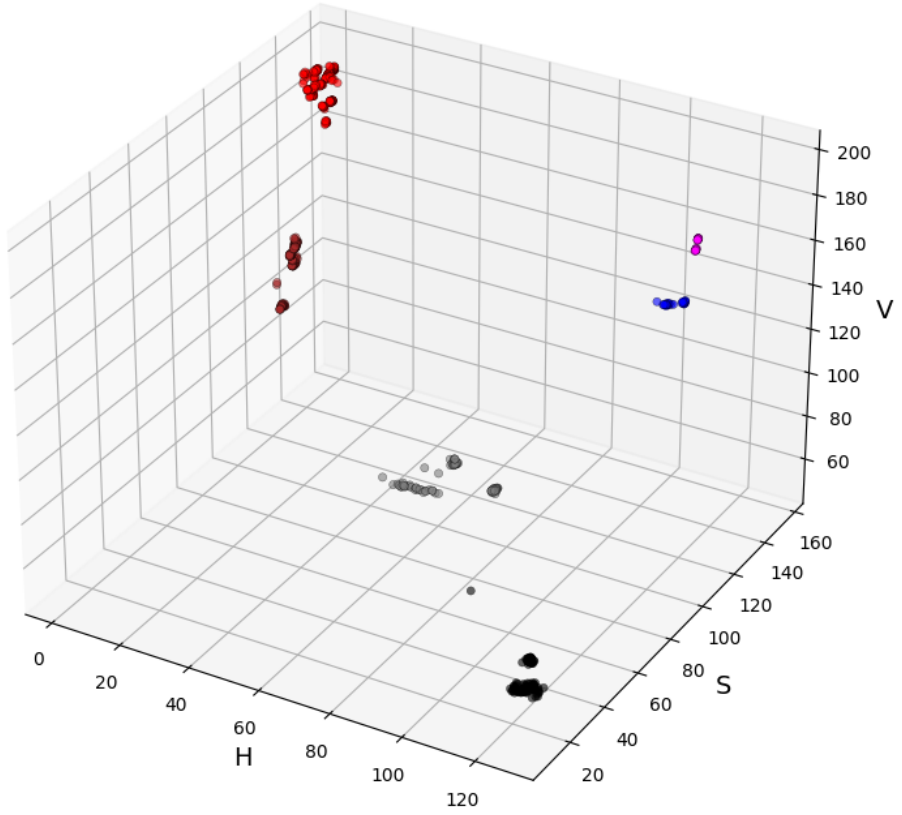
Demo 3 – Determination of the value of a resistor

The mean HSV-values of all color bands represent a point in the dataset together with their label. An SVM is used to classify the colors.



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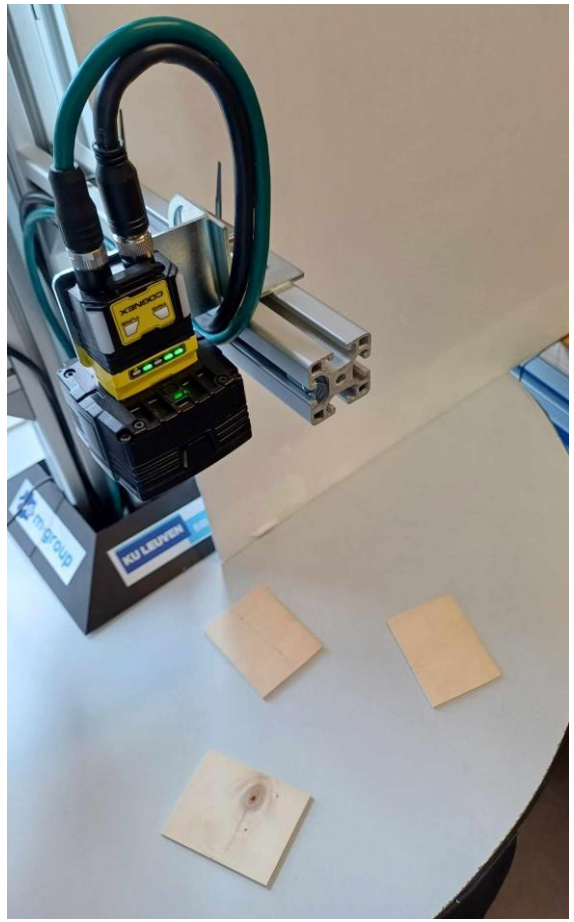
Demo 4 – Classification of surface defects on wooden sheets

- Camera: Cognex in-sight 2800 color camera 1440 x 1080 (1.6MP) USB3.0
- Lens: 12 mm
- Light: Multi-torch RGBW



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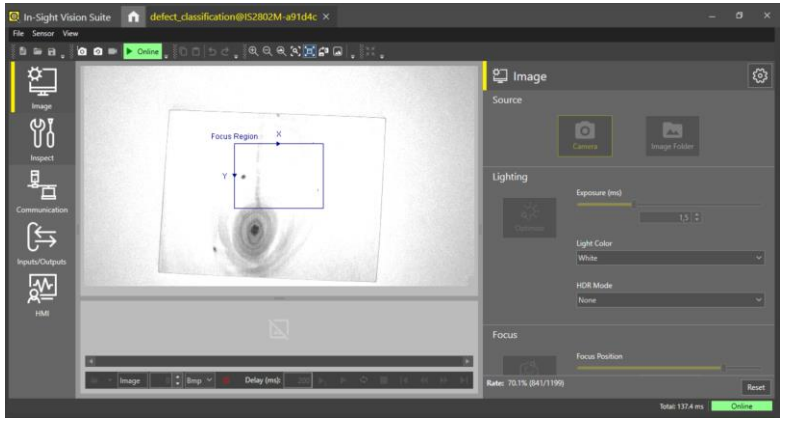
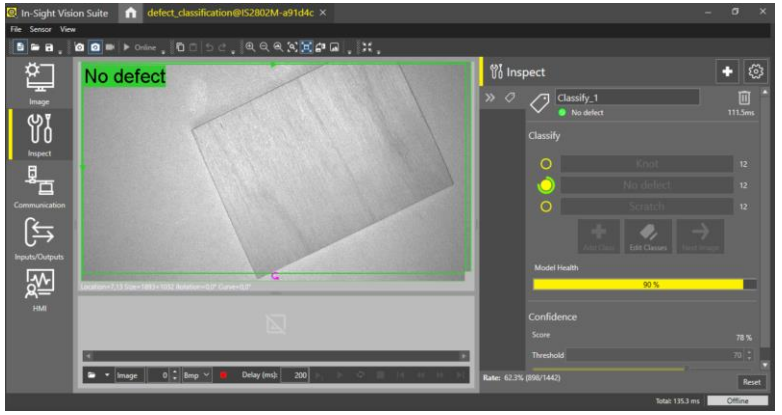
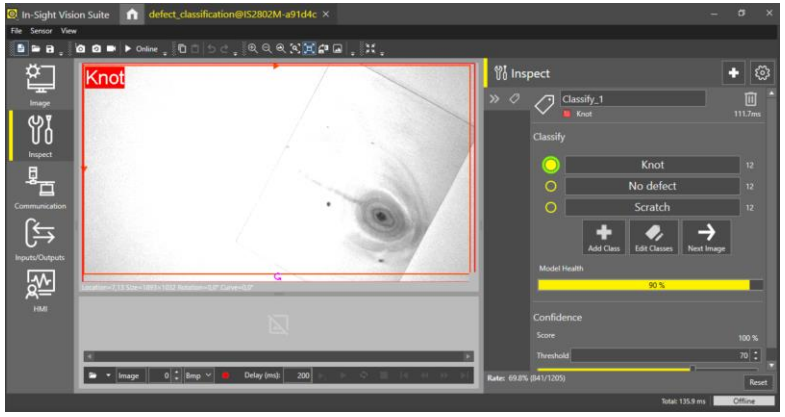
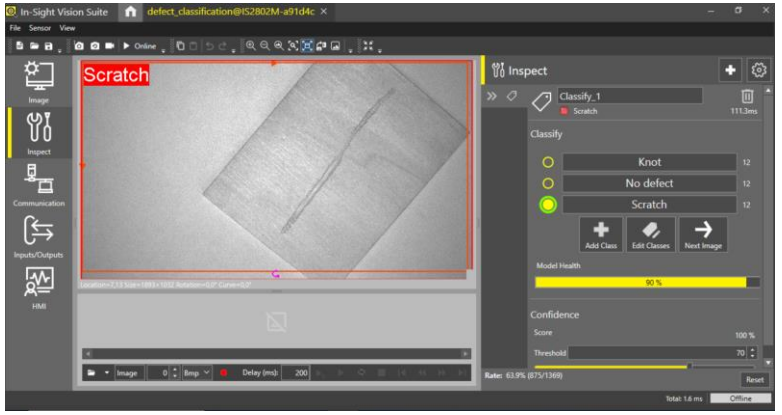
Demo 4 – Classification of surface defects on wooden sheets

Wooden sheets are classified in ‘Knot’, ‘Scratch’, and ‘No defect’ using transfer learning on a Cognex in-sight 2800 smart camera.









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Demonstrator 1 summary

	Demo 1	Demo 2
Description	Detection of a ball in 3D	Measuring the saw angle of a sawblade
Application	3D application	Measuring application
Technique	Stereo vision	Line / circle detection
Camera	RealSense D415	Omron Monochrome
Light	/	Back light
Lens	Fixed focus	Telecentric

	Demo 3	Demo 4
Description	Determination of the value of a resistor	Classification of surface defects on wooden sheets
Application	Color application	Classification
Technique	Machine Learning	Deep Learning
Camera	IDS Color	Cognex in-sight 2800
Light	Dome light	Ring light
Lens	Fixed focus	Liquid lens

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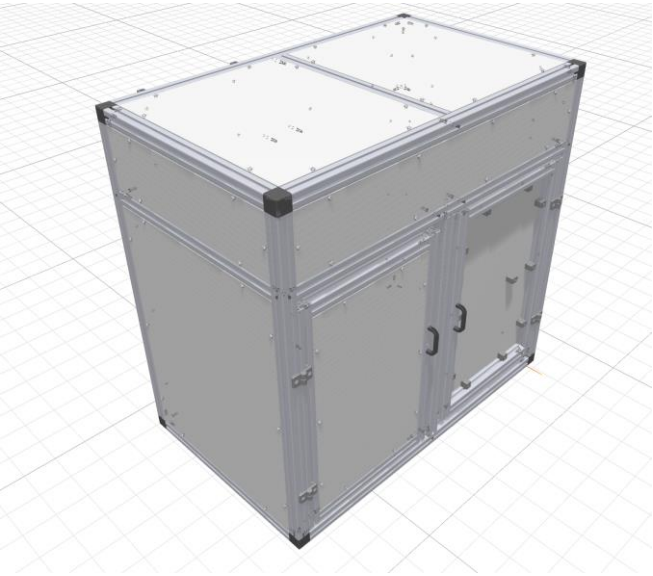
Demonstrator 2

- Focus on the industrial implementation using commerically available solutions
- Showing the following demonstrators
    1. Basic lighting test table: Fast validation
    2. Automated demonstrator table: Showcases
    3. High speed demo: trigger based activation
    4. Interactive electronics test: machine and vision linking
    5. Transfer learning demonstration



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Demonstrator 2: Part1

Goal: Basic setup intended for specific tests and validations

- Exchangeable components
  - Movable camera mount : (between 0 and 700 mm)
    - Cameras available
      - Low res black and white : Baumer Veg *
      - Hig res. Color : IDS *
      - High speed Ethercat controlled (planned) : Beckhoff
      - Cognex camera with integrated logic (IS2802 series) *
  - Lighting
    - Backlight
    - 2 lightbars with optional polarising filters *
    - Ringlight
  - Lenses
    - High resolution *
    - Matched to camera (Beckhoff)
    - Small field of view *
    - General purpose *

* Component available

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Demonstrator 2: Part1

- Example use:
  - Lighting test:

Polarised lens

Sideways lighting

Overhead lighting

  - Camera validation for the application

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Demonstrator 2: Part1

- Status:
  - Frame: designed and assembled
    - Validation needed
  - Camera systems
    - 3 out of 4 planned available
  - Electrical cabinet
    - Temporary model available (24 vDC)
    - Final version with 48 VDC and connectors: under construction

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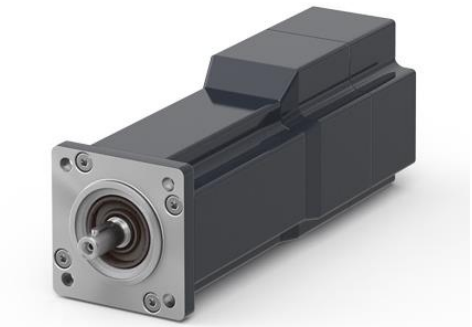
Demonstrator 2: part 2

- Goal: Continuous demonstration with variable examples. Intended for fairs and specific demonstrations
- Main components: link between motion control and vision. Liquid lens design.
- Demonstration plans:
  - Continuous loop showing impact of evaluated products
  - Automatic positioning of specific components
    - Rotate positions and Indicate where the desired components is
  - Impact of height difference and depth of field



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Demonstrator 2: part 2

Technology:

- Motion control based triggering
  - Same controller for both the vision system and the servo control
  - Link
- Shape matching
- Liquid lens for different focus ranges (Cognex camera)

Hardware:

- Controller: Beckhoff
- Servo motor (AMI81xx series)
- Rotating table
- Cameras
  - Cognex for

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Demonstrator 2: part 3

- Goal: High speed demonstrator
- Main components: High speed camera, safety lock, pulsed lighting
- Demonstration plans:
  - Position based trigger
  - Pulsed lighting
  - Speed optimisation techniques
    - Both logic and hardware

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Demonstrator 2: part 3

Technology:

Hardware:

- Controller: Beckhoff CX2043-0175 (Quad core Ryzen)
- Servo motor (AMI81xx series)
- Rotating table
- Cameras
  - VCS2000-0200 167 FPS, monochrome, 2.3 MP
  - 10020 captures / min, => 417 RPM full measurement (or 1200 RPM with partial measurement of 1/3 of the teeth)

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Demonstrator 2: part 4

- Goal: Interactive test of a Display system
- Main components: Colour camera, stand in for display system
- Demonstration plans:
  - Line detection
  - OCR (optical character recognition)
  - Interfacing Display⇔ controller

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Demonstrator 2: part 4

Technology:

Hardware:

- Controller: Beckhoff CX2043-0175 (Quad core Ryzen)
- Servo motor (AMI81xx series)
- Rotating table
- Cameras
  - IDS colour camera

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Demonstrator 2: part 5

- Goal: Transfer learning
- Main components: In Sight vision suite
- Demonstration plans:
  - Transfer learning
  - Interface to PLC

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Demonstrator 2: part 5

Technology:

Hardware:

- Controller: Beckhoff CX2043-0175 (Quad core Ryzen)
- Servo motor (AMI81xx series)
- Rotating table
- Cameras
  - VCS2000-0200 167 FPS, monochrome, 2.3 MP
  - 10020 captures / min, => 417 RPM full measurement (or 1200 RPM with partial measurement of 1/3 of the teeth)

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