Integrated project Engineering Technology

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Automation of foam sheet perforation for the composite industry

Pieter Ooms and Kas Henderickx

Electromechanical Engineering Technology

Situation

This design project was commissioned by Cuthings and U Plastics, who partnered in 2024. U Plastics, based in Dilsen-Stokkem, specializes in plastics and recycling. Cuthings, located in Hasselt, focuses on advanced machining and material processing. One of their activities is processing foam **sheets made from 100% recycled PET** for use in the composite industry. These sheets are used in applications like wind turbine blades and boat hulls. They also vary in size and density. Currently these sheets are processed by drilling precise **hole patterns of 32×32 mm or 16×16 mm** with **holes 3 mm in diameter**. These holes are used to create 3D connections between 2 outside layers. However, the existing machine used for this task has issues regarding both the efficiency and functionality.

Figure 1: Existing machine

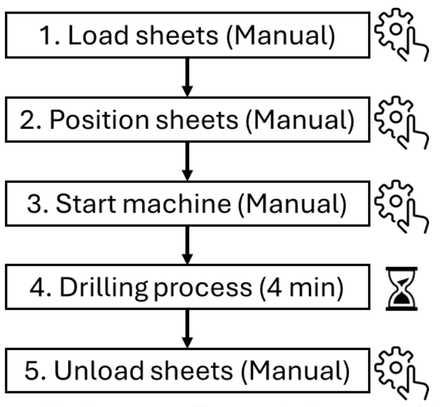


Figure 2: Process flow existing machine

Problem

The current machine requires **extensive manual handling** (Figure 2), which increases cycle time and adds up significantly over a full pallet.

Goal

The goal is to design a machine that requires the operator only for startup, pallet changeovers, and maintenance. It should **autonomously process an entire pallet** and provide a signal upon completion.

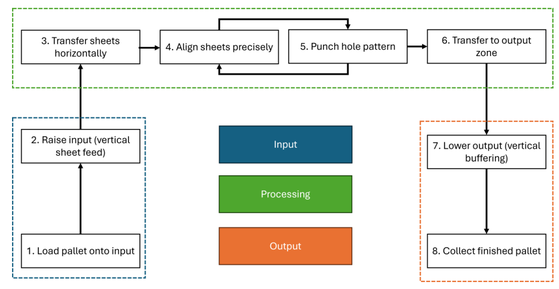


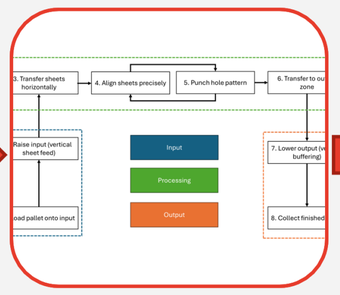
Figure 3: Function block Diagram

Method

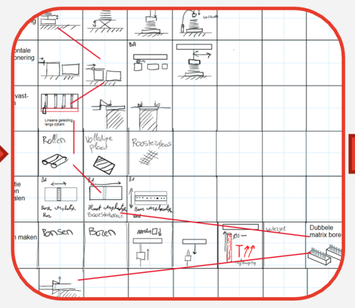
Requirements

	Variabele eisen	Wensen	
X			Cyclustijd van één plaat (of stapel tot 60 mm dik) is min minuten.
X			Platen van 2448 x 1008 en platen van 1220 x 1008 kunne met in acht nemen van alternatieve breedte: 1220
X			Perforaties moeten worden uitgevoerd volgens een vast 32 x 32 mm. Tolerantie +/- 1mm op de afstand +/- 0,2mm diameter
X			Machine moet toegankelijk zijn voor onderhoud en eenvo vervanging van onderdelen.
X			Maximale hoogte van de machine mag niet hoger zijn da
X			Machine moet kunnen werken met schuimplaten van GR GR100, en FR100.
X			Operator nodig alleen voor opstarten, verwisselen van pa onderhoud.
X			Machine moet zelfstandig een volledige pallet verwerken geven bij voltooiing.
X			Machine moet boorbreuken detecteren en hierop reagere
	X		Maximale grondoppervlakte van machine: circa 2,5 x 1
	X		Budget van €60.000 - €80.000 (lager is gewenst

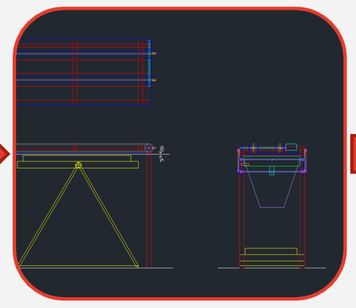
Function block Diagram



Morphological overview



Concept



3D design and 2D drawings

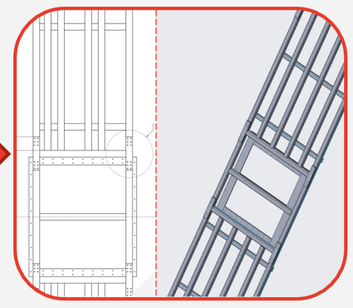


Figure 4: Project methodology following Kroonenberg's model

Result

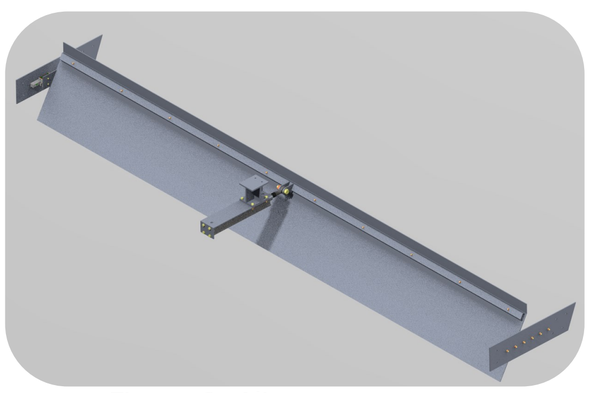


Figure 6: Alignment press

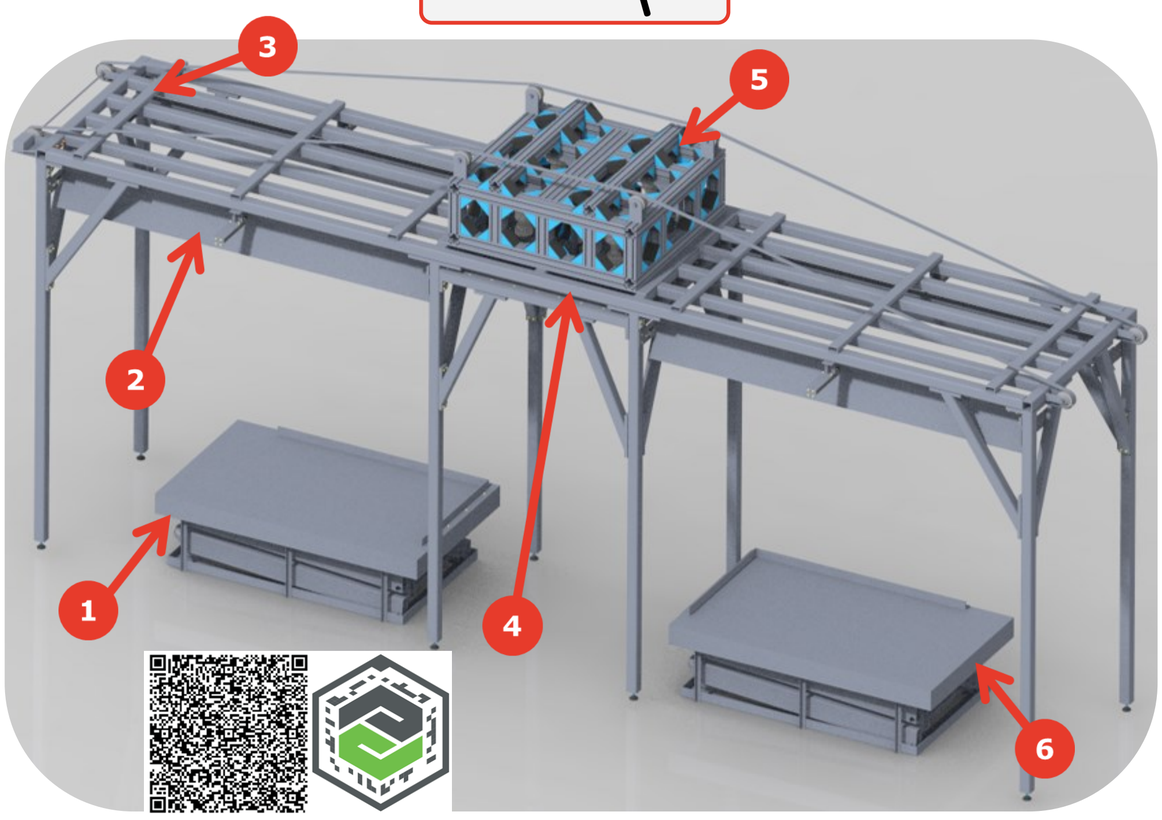


Figure 5: Complete assembly with QR code for the AR app and AR marker

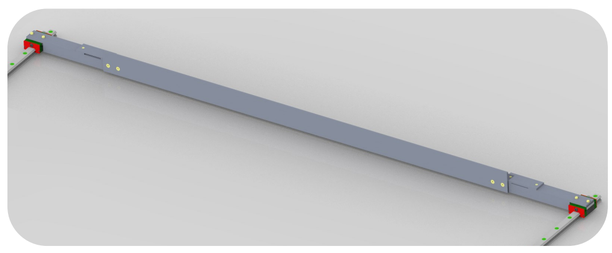


Figure 7: Pushing unit

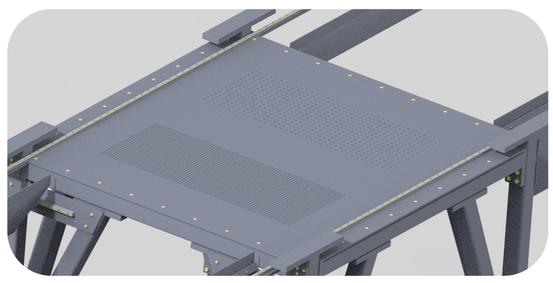


Figure 8: Punching zone (no punching units)

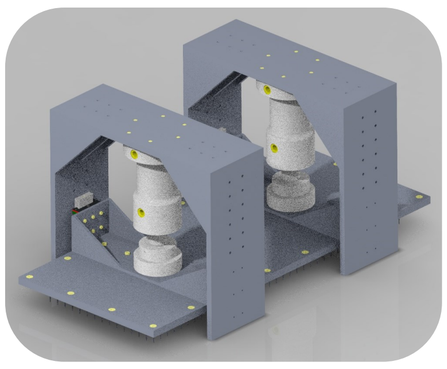


Figure 9: Punching unit

1. The operator places a pallet of sheets onto the **input lift** (Figure 5), which is positioned using mechanical stops.
2. The lift raises the stack to the correct height, where the **alignment press** (Figure 6) aligns the sheets from both sides.
3. The **pushing unit** (Figure 7) then moves a batch of sheets (up to 60 mm thick) into the **punching zone** (Figure 8).
4. There, the **punching unit** (Figure 9) **creates the hole pattern**. Since one stroke doesn't cover the full sheet, the pushing unit advances step by step until the pattern is complete.
5. Ultimately, the perforated sheets are pushed onto the output lift, where they are realigned. Then the lift lowers to make space for the next batch, while the input lift rises again. The cycle continues until the entire pallet has been processed and a full pallet of perforated sheets is ready for removal.

Supervisors / Co-supervisors / Advisors:

Prof. dr. Ing. Karel Kellens
Prof. dr. Ir. Michaël Daenen
Prof. dr. Jeroen Lievens
dr. Ing. John Bijnens
Kristof Weckx
Wouter Frederix

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