

Automation of the supply and mixing process of brick slips

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Bridging programme for Master of Electromechanical Engineering Technology



View the model in 3D with AR

- 1) Scan the QR code to download the Vuforia View app
- 2) Open the app
- 3) Scan the ThingMark and explore in 3D



Fig. 1: Manual production line

Original production line



Fig. 2: Manual production line



Fig. 3: Rack with brick slips

Automated production line

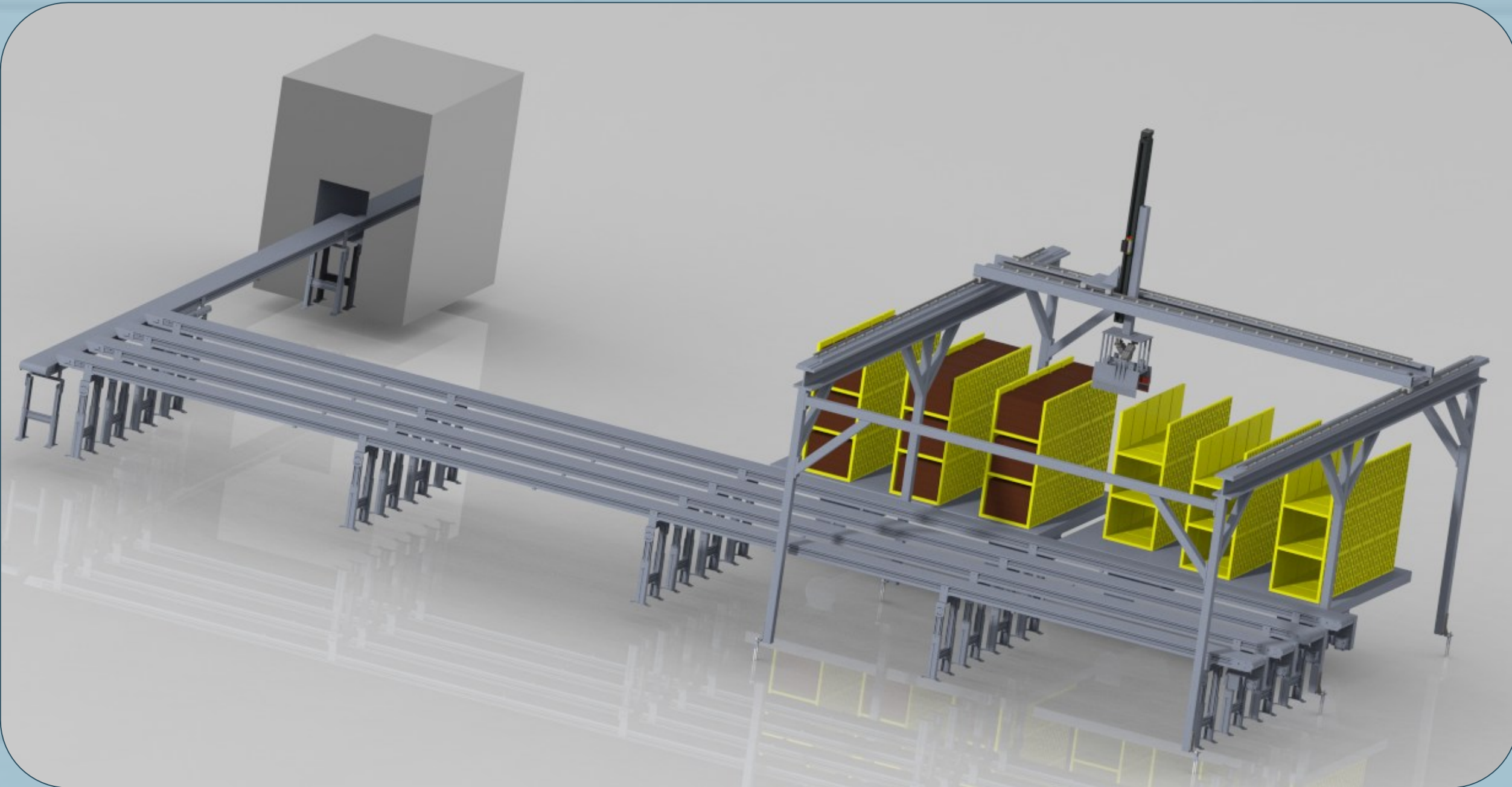


Fig. 4: Gantry system with gripper and conveyor belts

Requirements and solutions:

The topic of this bachelor's thesis was designing the **mechanical concept** for a partial automation of Vandersanden's **production line for brick slips**. In their original production process, yellow cassettes on train carts containing the recently baked brick slips were emptied by a 6-DoF robot into **large steel racks**. Next, factory workers had to manually take the slips out of these racks, place and sort them on a **conveyor belt** before the final production stages. Vandersanden experienced workplace accidents due to workers constantly having to bend over, using this method, which forced them to stop using the bottom level of the racks. The primary focus of this project was to **safeguard the initial processing speed and maximize the throughput** of the brick slips.

Additionally, there was the requirement to be able to **mix the brick slips** coming from four different prior production lines. Each level of brick slips in the cassettes comes from a different production line with **slightly different production characteristics**. This to ensure that no off-colour patches can occur.

To swiftly and securely process the brick slips it was decided to make use of a **gantry system**, together with a **specialized gripper**. This gripper was fitted with **two levels of 'fingers'** to both sufficiently process enough brick slips and limit the required moving speeds. This makes sure the gantry frame isn't overdimensioned which would result in increased costs. Empty cassettes are picked up by the lower-level 'fingers' and stacked on top of one another (three on the previous train cart and the rest on the same cart).

To solve the mixing problem of the brick slips, **four different conveyor belts** were used with each receiving its own set of slips (grouping the brick slips from the previous four different production lines). This way the conveyor belts can be programmed to mix the slightly different slips.

Some other crucial criteria:

- Ability to process the **two different sizes of brick slips** Vandersanden produces.
- **Buffering** the slips before the mixing step.
- Designing the system to operate in an **extremely dusty environment**.

A closer look at some fine details:

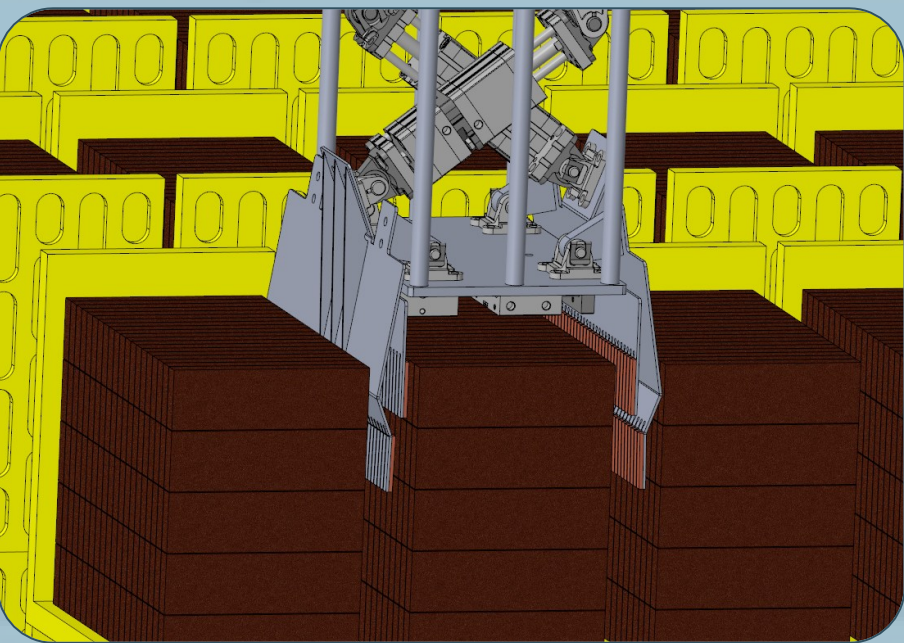


Fig. 5: Section view of gripper grabbing two levels of brick slips

Gripper:

To prevent the slips from being dropped and to avoid hindering the movement of the conveyor belts, the lower-level fingers were equipped with a **swing-out mechanism**. Because of the proximity of the cassettes to each other, the mechanism was also equipped with a middle position. Both these constraints were satisfied by using **two cylinders connected end to end**, one with a stroke of 40 mm and the other 10 mm. This way it is possible for the gripper to lower itself between the cassettes and grab either the brick slips or the cassettes.

Dusty environment:

Because the production of these brick slips generates a **lot of dust**, the construction had to be resistant to this dust. This is why Iglur polymer bearings were used. This material fills in irregularities in the metal rail and so prevents debris from negatively affecting the movement of the axes.

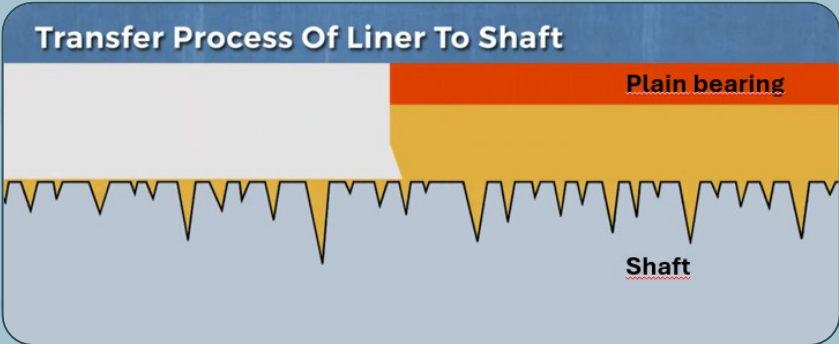


Fig. 6: self lubricating linear guide

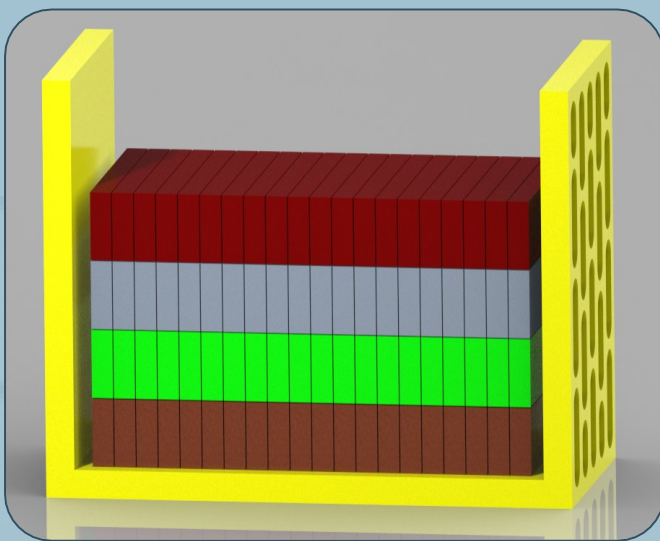


Fig. 7: Visualization of difference between levels

Necessity of mixing the bricks:

Since the cassettes are filled with brick slips from **multiple previous production lines**, differences in sanding, shape, colour, and other properties can occur. Failing to mix the bricks or slips can result in **differently coloured patches**. By mixing during the production process, this **step is eliminated** for the builder or a prefab robot.

Use of slits in 'fingers':

Because of the irregular shape of the brick slips, slits were cut in the 'fingers'. This way each brick slip is allowed to slightly differ in size and **still get picked up by the gripper**.

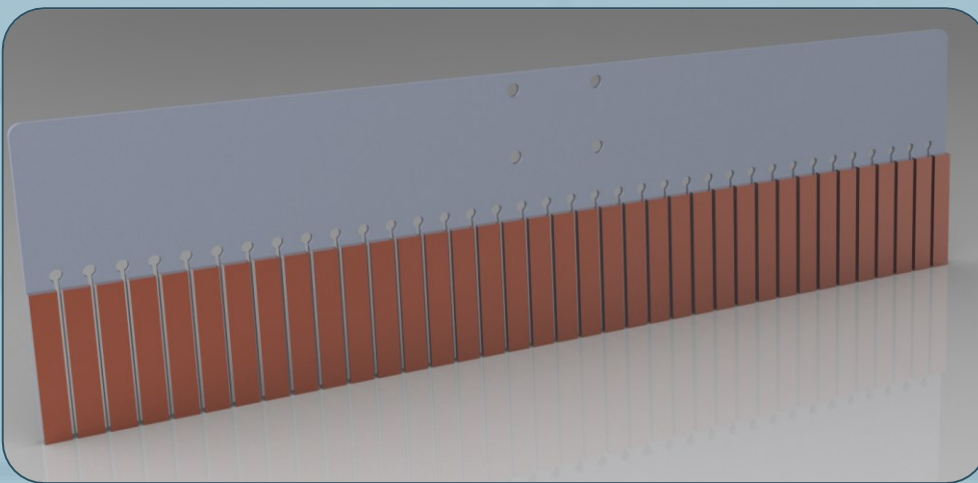


Fig. 8: Gripper grabbing two levels of brick slips

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