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MARS

Tomorrow starts today

Gum Optimization YRV-GNV

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GUM OPTIMIZATION

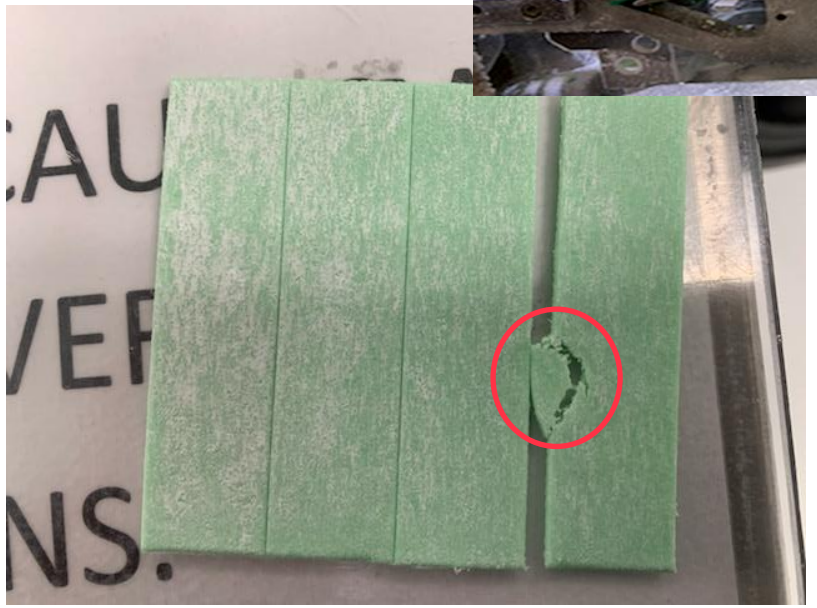
USING VISION SYSTEM TO IMPROVE GUM QUALITY

THE CHALLENGES ADDRESSED

Gum defects or gum measurements being out of thresholds are detected very late in the manufacturing process. This translates into:

- **Production line stoppages**
- **Waste of kgs of material produced**
- **Delays in production schedule, amongst other disruptions.**

By leveraging data and analytics capabilities and improving the visibility of gum processing we can mitigate these challenges and reduce losses



POTENTIAL USE CASES

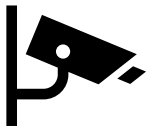
WE IDENTIFIED THREE POTENTIAL USE CASES THAT COULD BE APPLICABLE TO YORKVILLE AND GAINESVILLE SITES

1	BATCH MANAGEMENT	Automated batch reporting system for visibility of unknown issues resulting in higher quality and more consistent gum.	**Out of scope**
2	GUM MEASUREMENTS	Use visual inspection to measure circular LAND settings that eliminates operator subjectivity **to improve the regularity of gum measurements**, **score depths** and **reduce short stops downstream** in the wrapping process.	**YRV + GNV**
3	GUM DEFECTS	Use visual inspection to **identify holes/spots & trim abnormalities** to improve gum quality and **reduce short stops** further downstream in the wrapping process.	**GNV**

2 GUM MEASUREMENTS

Objective: Accurate way to measure circular LAND settings across multiple lines that eliminates subjectivity to improve the regularity of gum measurements and reduce short stops further down in the wrapping process.

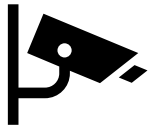
Cold Scoring Line



Laser Profiler
Laser continuously measuring width and land score depth of gum sticks

1

Images processed by respective Keyence software on device's controller.



Line Scan Camera + Strobe Light
Camera measuring length of gum sticks through image capture.

2

Images processed by respective Keyence software on device's controller.

3 Sizing Rollers applied to sheet before scoring (thickness → Circular Scoring Rollers (x26) → Cross-Scoring Rollers (x6) → Last Roller → LTO → Cooling & Packaging

Rotational encoder to synchronise camera shutter with belt movement.

1 The laser profiler continuously measures the width of the gum sticks as well as circular land score depth. The camera is placed after the Circular Scoring Rollers **above and centre of the cards.**

Scanning Area = 39mm (2 Circular Land Scores)

Width : Distance between score lines
Land score Depth: Roller balance and knife + scraper settings

2 The line scanner is placed above and perpendicular to the moving belt. The camera's shutter is synchronized to the belt movement by using a rotational encoder. When a signal from the encoder is received, the camera takes a picture.

A strobe light illuminates the back of the cards.

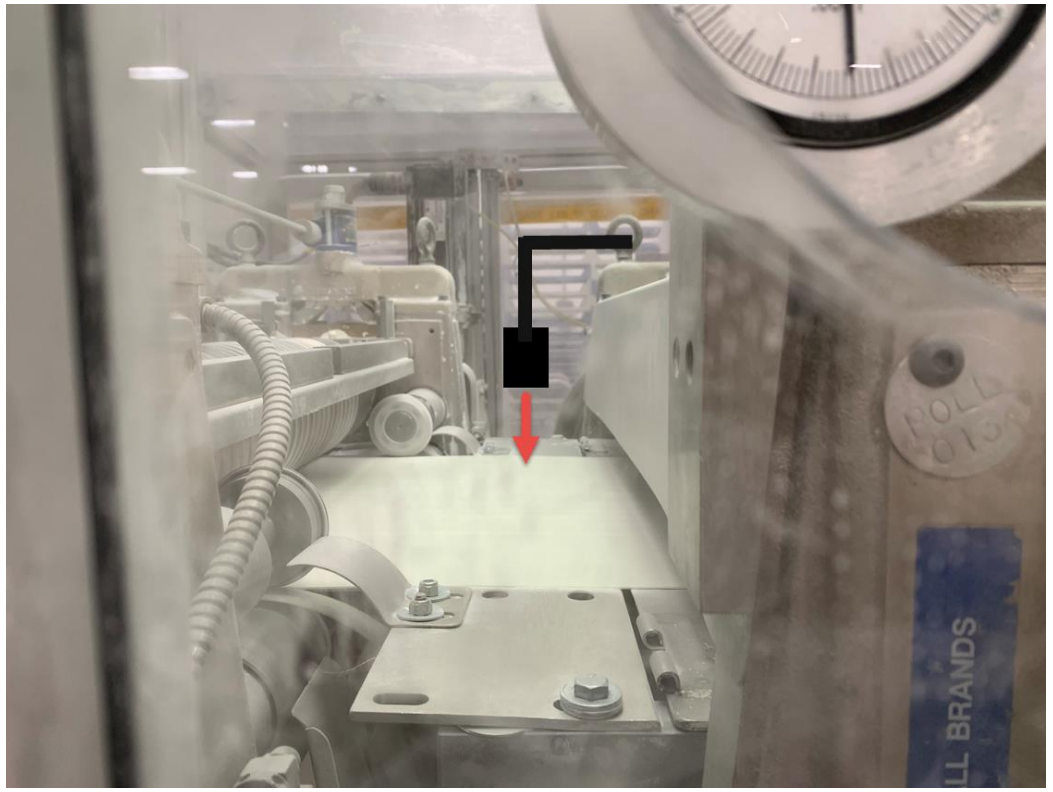
2 GUM MEASUREMENTS

Objective: Accurate way to measure circular LAND settings across multiple lines that eliminates subjectivity to improve the regularity of gum measurements and reduce short stops further down in the wrapping process.

Cold Scoring line - YRV

Line Scanner located after rollers

Laser Profiler located in between rollers



2 GUM MEASUREMENTS

Hardware used

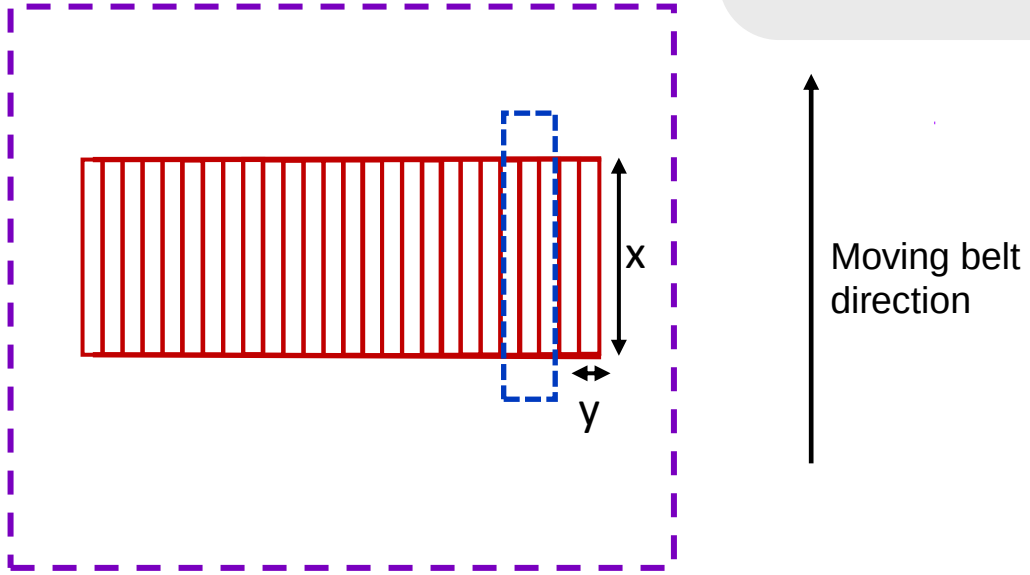
Line Scan Camera Set-up

- **Keyence CA-HL02MX**
- Captures the **length,** output the measurements
- The resolution of the **scan line is 2000px**. The resolution in the direction perpendicular to the scan line depends on the resolution and setting of the digital encoder. The settings will be adjusted so that the final resolution is identical to the scan line resolution.
- The size of the FoV in the direction parallel to the scan line is 0.7'' – 1.41''; in the direction perpendicular to the scan line it can be unlimited

Laser Profiler Set-up

- **Laser profiler: LJ-X8080**
- **T**he width of the scanning area is 39mm (1.54'') which allows a scan of ~2 circular land scores at a time. Captures cross land score.
- A **laser profiler** provides the **circular land score** and **width of a gum stick**
- **Profiler controller and Signal converter** will be used to transfer data

- Each card consists of 26 gum sticks
- **x = length of gum stick (2.86 in)**
- **y = width of gum stick (0.74 in)**



Hardware	Use
Line Scanning System	Image scans measures **length** of the gum stick.
2D Laser Profiler	Measurement of the **Circular land scores and width** of the gum stick
Light source	Light source (back)

2 GUM MEASUREMENTS

Analytics Solution

Descriptive analysis:

- **Display measurement** results and report if they are within thresholds
- **Send alert via Teams** to operator when values are out of threshold

Predictive analysis:

- Check the **tendency** of the values
- **Predict** when the values will be out of threshold
- **Send alert via Teams** to operator when necessary

Visualization:

- Users are able to see if the length, width and land score depth of the gum stick is within thresholds
  - **Real-time:** across the past 30 minute time period
  - **Historically:** measurements are displayed for the production runs of the last 2 weeks
- Historical KPIs per production run are also available to track production success.

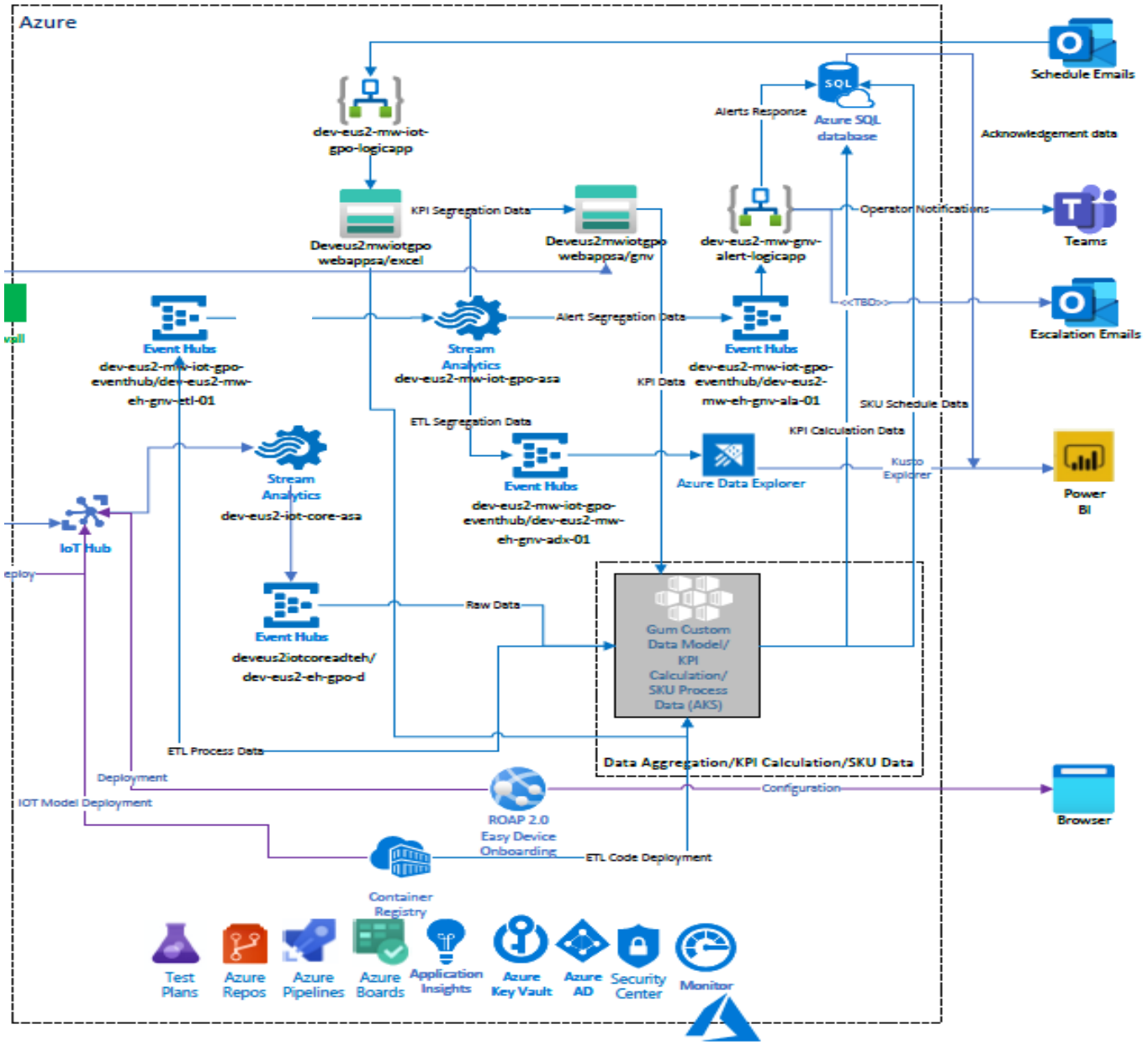
2 GUM MEASUREMENTS

Architecture Overview

- The ETL is triggered by an event (a new payload arriving)

- **Real-time analysis:**
  - Cleaning and analysis of the data, calculates if measurements are within or outside thresholds
  - If they are outside thresholds and alert is sent to Teams channel
  - The information is then ingested in powerBI

- **Historical KPI calculation:**
  - Every 2 hours and also when a production run is finished a process is launched to calculate main KPIs (number of errors, operator responses…)
  - This information is stored in sql tables
  - These tables are ingested in powerBI



GUM MEASUREMENTS
SCALED VALUE CASE

	% OF GLOBAL PRODUCTION	REDUCTION IN WASTE	REDUCTION IN SHORT STOPS	SCALING OPPORTUNITY
		Assumption of reducing waste by 48%	*TBD*	
YRV	13%	$171k	TBC	$171k
GNV	42%	$530k	TBC	$530k
GNZ	9%	$118k	TBC	$118k
YNG	15%	$186k	TBC	$186k
DOE	14%	$177k	TBC	$177k
		$1.2m	TBC	Scaled Opportunity: $1.2m+

GUM OPTIMIZATION – WHAT'S NEXT?

GNV MVP PLANNING

1 - GUM MEASUREMENTS DEPLOYMENT:

- Refactor solution and go live in **4 weeks**

2- GUM DEFECTS DETECTION: (10 weeks)

- Camera takes synchronized pictures of every gum sheet in the conveyor belt.
- An accurate computer vision model is developed to detect defects on real-time
- Alerts are sent via teams so that operators can take corrective actions

Types of defects: holes, rigged edges, ingredient spots

Large amount of pictures are needed to develop a CV model

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Thank you!

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