



# Besting shortfalls in production with AI Vision

Learn how we made a multi-billion dollar tyre manufacturing company find irregularities in production to eliminate shortfalls in meeting daily targets.



## Looking at AI in the manufacturing industry

In 2019, the global AI in manufacturing market size was USD 1.82 Billion and this is projected to reach USD 9.89 Billion by 2027, exhibiting a CAGR of 24.2% during the forecast period.

A multi-billion legacy tyre manufacturing company with products used internationally in 65+ countries along with a presence in paints & coats, toys, motorsports and cricket training approached Cogniphi. According to their catalog, they produce tires for passenger cars, two-wheelers, trucks, buses, tractors, and light commercial vehicles.

The renowned tyre manufacturer is committed to ensuring improved quality and customer satisfaction at every level. To optimize their manufacturing throughput and fix the bottlenecks in the system they planned to engage with automation.

Manufacturers are driven towards automation in operations for precision, greater operational efficiency and consistency. According to research conducted, McKinsey Institute estimates automation in different tasks of manufacturing can raise productivity growth by 1.4% annually.



# Identifying the Problem

The company wished to optimize its production processes and improve productivity through automation. They sought the help of Cogniphi's AI expert team to resolve this issue.

To begin with, the expert team of Cogniphi scrutinized the video visuals of the manufacturing process using already existing CCTV cameras and identified multiple causes for the problems in the production shortfall. They identified that one of the major challenges is a frequent delay rooted in the 'component change over' process.

## Impact on business



Loss of productive hours and revenue



Underutilization of manpower



Decrease in efficiency and throughput

## What is the 'Component Change Over' process?

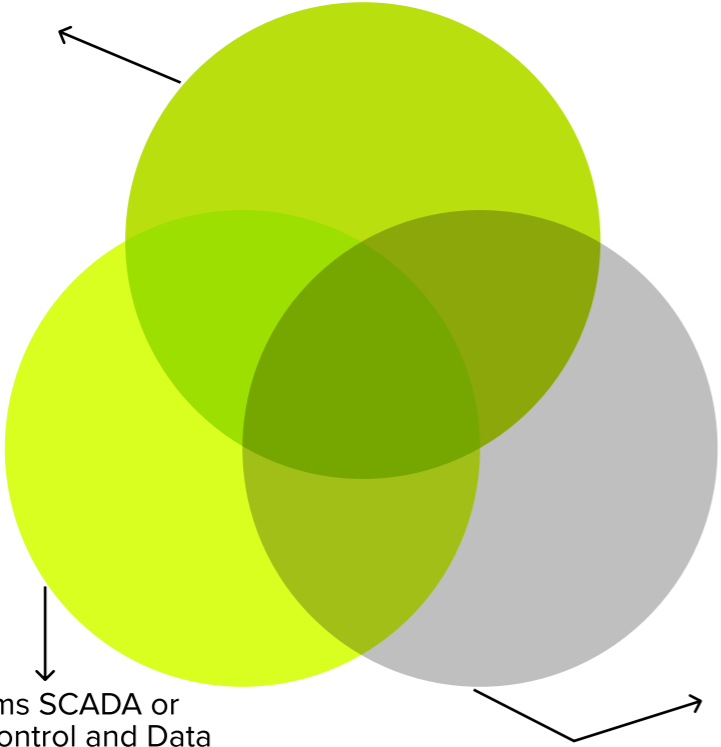
There are 2 plants spread across 300 acres, having 1000+ machines. At zone 1, the components are manufactured from raw materials. From here, it has to be taken to pre-allocated slots next to each tyre manufacturing machine in Zone 2, of the plants. The components trolley near the machine needs to be filled with required components in advance before the current component gets empty so that the operator can continuously load the machines and production can continue smoothly.

Targets for production are set a month in advance considering the demand. The demand for production was identified and daily targets were met in three shifts. The irregularities were brought under notice when the company faced production shortfalls in meeting daily targets due to unplanned machine downtime.

It took up to 10 minutes to solve the issue by the floor supervisors, whenever there were delays due to 'component change over'. During that time, the machine was stopped, and the operator was idle as the required component did not arrive.

# Finding the Solution

The machine operators followed the traditional communication system using walkie talkies or intercom to convey the unavailability of components to floor supervisors to rectify the issue. It was a reactive process in which issues were settled after the intervention of supervisors.



Existing systems SCADA or Supervisory Control and Data Acquisition and PLC systems were not efficient to ensure the availability of components at the required times

There was no real-time system to monitor the inventory and 'component change over' of machines.

The second step was to capture data from the existing CCTV, sensors, reference data and SCADA to create the AI models. The images from the video feeds were used to train AI models for object detection, texture identification, action recognition and real-time alerting.

Cogniphi's team integrated AI Vision with the existing SCADA system along with sensors to monitor and collect information about real-time processes. Cogniphi uses the existing CCTV camera infrastructure of the factory floor to integrate it with the AI Vision platform.

Out of the cameras integrated, a camera is dedicated to monitoring the activities of the operator and another is dedicated to tracing the components. The camera visuals are then converted as data in the local server and stored in the cloud. This method provides local processing of data, ensuring privacy for data.

The visual data of the factory floor was to aid in resolving the 'Component change over' problem effectively.

# Here is how Cogniphi solved the problem

- A threshold time is fixed to ensure that the components are available in the annotated area. Whenever the component is loaded into the machine, the switch is pushed by the operator to start the countdown of leftover minutes (LOM) for the respective component. LOM indicates the 'time left' to load the component into the machine for the next turn.
  - Cameras equipped with object detection capabilities of AI Vision, track and trace availability of component carriages in the predesignated slots where the carriages with the components were kept next to the machine.
- AI Vision's action recognition capability combined with object detection enables identification of objects such as



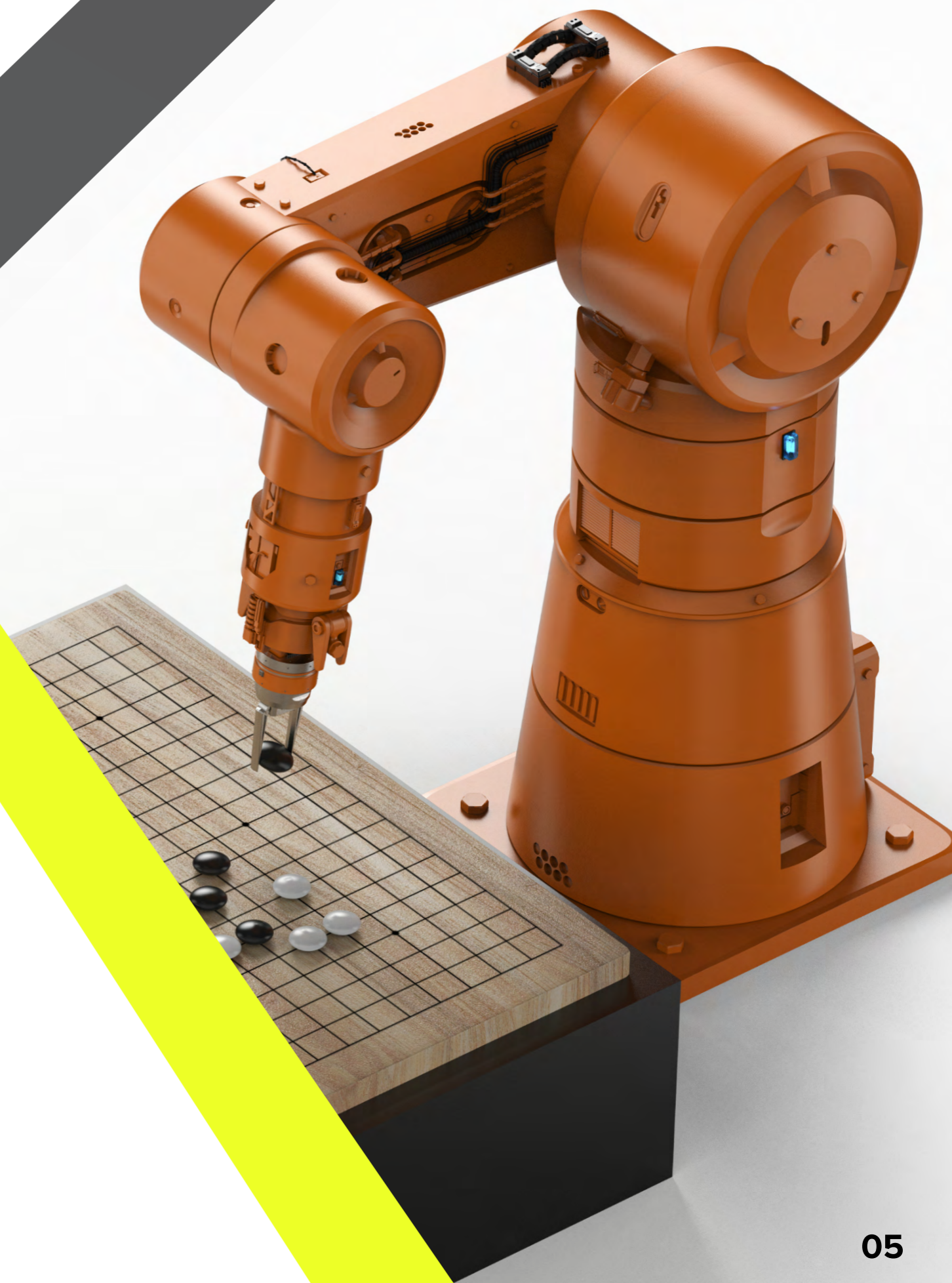
Machine operators



Factory workers



Carriages

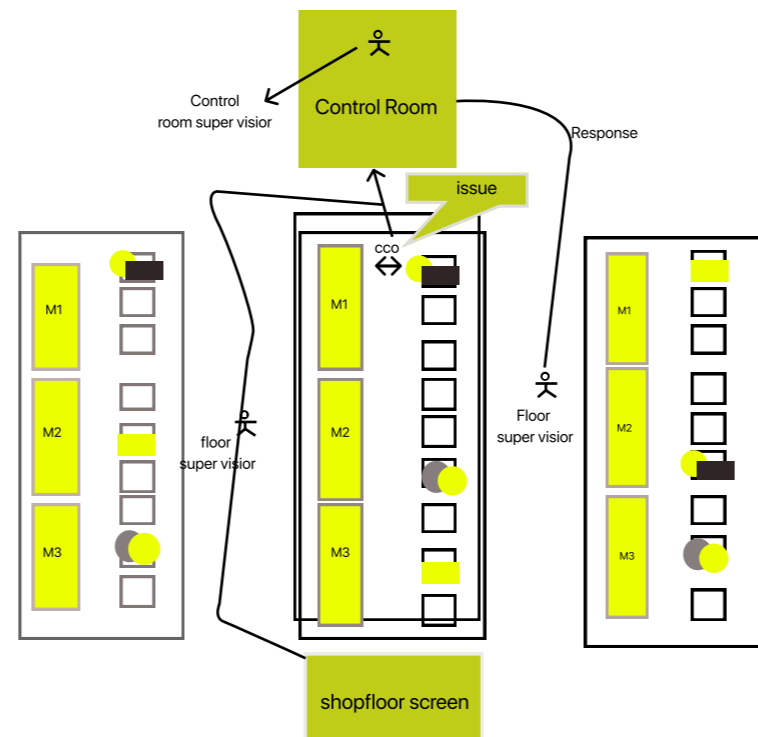


To gauge their actions such as factory workers bringing the carriages and placing them in designated slots, machine operators loading the components into machines, removing carriages from near machines, clearing empty carriages, operator non-availability, etc.

- If AI Vision doesn't detect a filled component within 45-60 minutes of the LOM, then it would enable **an alert** to supervisors to attend to the issue.
- Still, if the component hasn't yet arrived within 45 minutes, then AI Vision will generate **an anomaly** to warn the supervisors for immediate attention.
- Excluding the real-time alerts, the AI Vision equipped cameras track inventory across multiple locations of a plant in a dashboard.

Material Loss Hotspot		09:22:18		
Machine	Comp.	Leftover	Qty.	Inventory Location
LMC 103	PLY 1	00.26	8	PLY 1 IS available in zone 1 Buffer
	TREAD	00.00	9	TREAD is available in zone 1 Buffer
LMC 104	TREAD	01.10	15	TREAD is available in zone 1 Buffer

The AI Expert Cogniphi team developed a 'shop floor screen' in the factory floor displaying the dashboards. A screen to help the workers, operators, and floor supervisors know the updates in the production process and also so that the control room supervisors could monitor and coordinate with floor supervisors to rectify issues effectively.



# The successful outcome

## AI Vision capabilities used for this case study

### Context relevant object detection:

Different machines produce different types of tyres from light motor vehicle tyres to heavy truck tires requiring different types of materials and components. AI Vision identifies that the right material is placed next to the right machine as per the schedule. Multiple objects such as different types of carriages referred to as creels, leaf trucks and cassettes, different components, operators were identified and correlated with machine and production schedule

### Body skeleton and Action Recognition:

Vision models are trained to identify actions such as factory workers bringing the carriages, placing carriages in designated slots, removing empty carriages, machine operators loading the components into machines, to correlate with machine status and identify LOM as well as delays in component changeover.

### Texture detection and object counting:

For identifying components and materials used for tyre production AI Vision accompanies cameras for raw material quality check. In case of any anomaly, the results are sent for the supervisor's intervention. Object counting is used to track the quantity of inventory as shown in the inventory dashboard.



**Video tracking:**

The material movement across multiple zones inside the factory movement was tracked and traced by relating data from different camera feeds.

**Face recognition:**

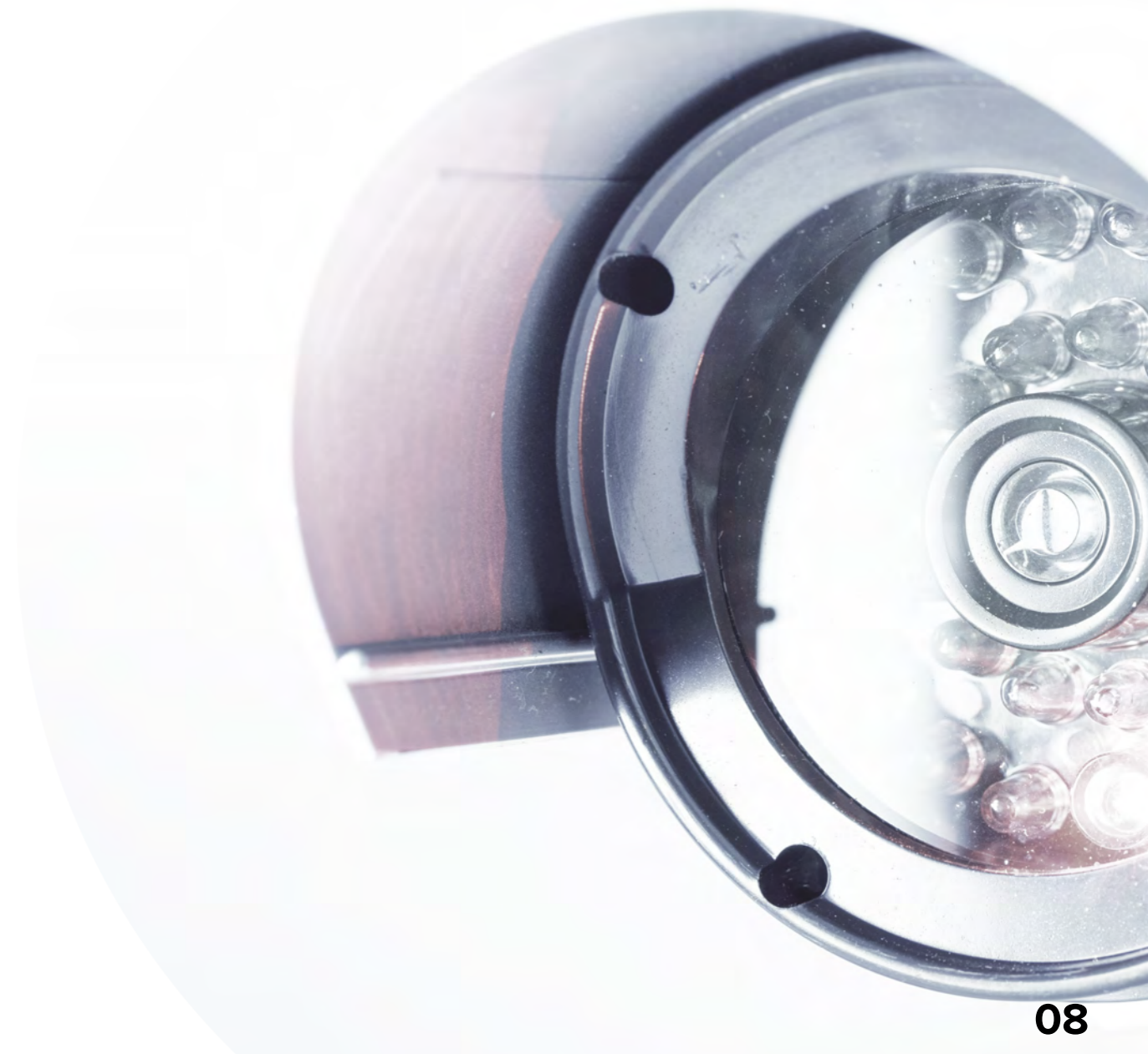
Identifying facial emotions of machine operators and factory operators determined the efficiency and alertness of labour.

**Flagging Outliers:**

Any failings in the routine such as identifying wrong material placement, identifying whether empty trolleys/ carriage are full or empty, wrong carriage/ material placed near a machine are flagged to the responsible authority for swift action.

# Project Highlights

- Firstly, we should highlight the fact that the entire project was up and running within 4 months and has been functional for over 4 years. This includes-
- Integration of 1100 Active Sensors & 500 legacy cameras for detecting/predicting instances that can cause productivity loss, wastage, inappropriate handling of inventory, missed inventory, NCM movement, and operator availability across plant floors spanning an area of 300 acres with over 800+ machines
- Dispense vision data, inferences, prediction, productivity and live view to the plant team supervisor in a simple and effective dashboard.




- Firstly, we should highlight the fact that the entire project was up and running within 4 months and has been functional for over 4 years. This includes-
- Integration of 1100 Active Sensors & 500 legacy cameras for detecting/predicting instances that can cause productivity loss, wastage, inappropriate handling of inventory, missed inventory, NCM movement, and operator availability across plant floors spanning an area of 300 acres with over 800+ machines
- Dispense vision data, inferences, prediction, productivity and live view to the plant team supervisor in a simple and effective dashboard.
- 500 cameras processing roughly 30 GB of data per second used to create a functioning setup.
- Server setup within the factory premises, leading to all data being processed locally and company information staying protected through internal firewalls.  
>99% accuracy achieved in visual detection models.
- Real-time and non-intrusive solutions are designed for all problems encountered during the manufacturing process.
- Reduce the need for training data with custom data generation through Vision AI engines.
- Processes were built on existing infrastructure and fortified, instead of a complete overhaul.

# About Cogniphi

Cogniphi is a technology company that enables customers to achieve transformational outcomes through cognitive digital solutions. Cogniphi's AI Vision is a proprietary technology framework that's built to provide organizations with actionable alerts on the go along with insights into productivity and operational inefficiencies



 [connect@cogniphi.com](mailto:connect@cogniphi.com)

 +61 3 8679 2213

## INDIA

5th Floor, Bhavani Building,  
Technopark, Trivandrum, Kerala

## AUSTRALIA

11 Wilson St, South  
Yarra, VIC 3141



All rights reserved © 2022 cogniphi.com