



Project Overview

Objective: Development of an IoT-based framework for energy optimization in industrial assembly lines.

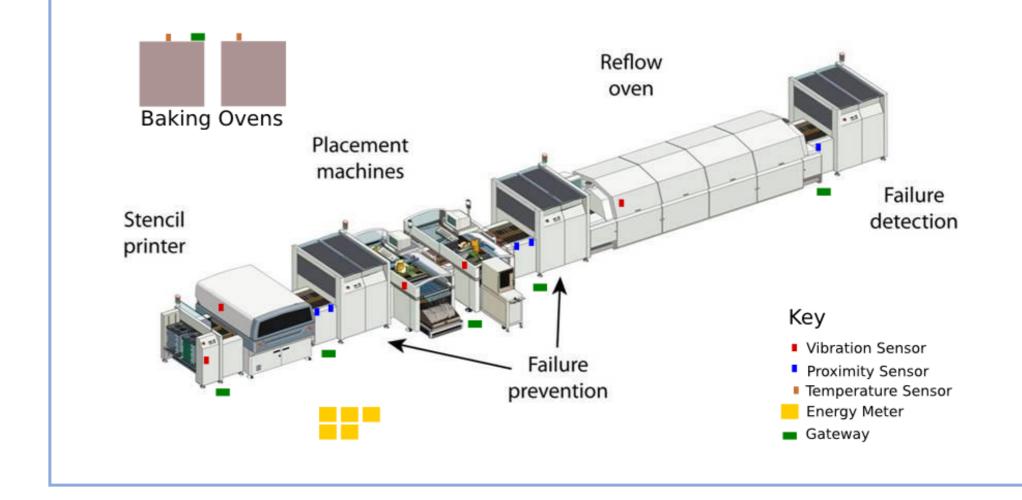
Case study: An SMT PCB Assembly Line

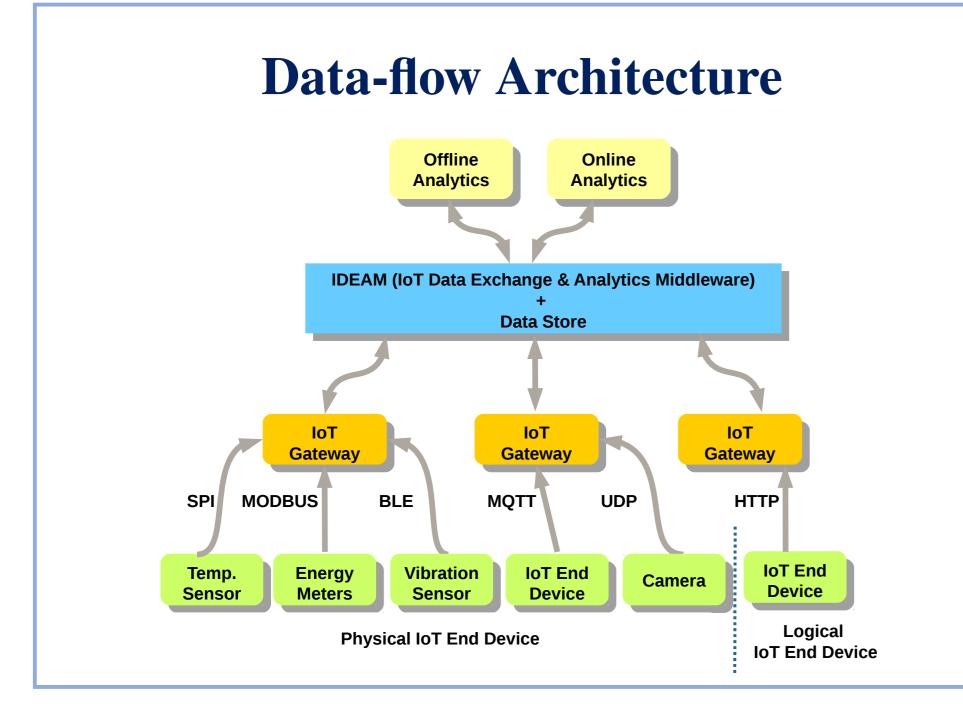
Components:

- Data Aggregation Platform
- Data Analysis Engine and KPI displays
- Simulation Model for Prediction and Process Optimization

Sensor Deployment

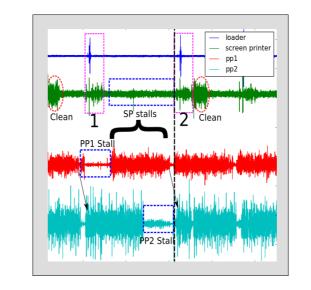
An SMT-PCB Assembly Line





Key Performance Indicators and Insights from Data

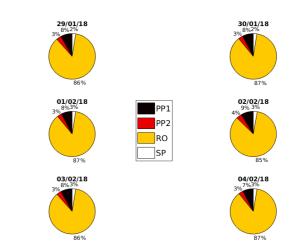
A Snapshot of Vibration Sensor Data



Performance Metrics Tracked:

- Machine-wise idle-times, latencies and energy consumption
- System Throughput
- Machine Breakdowns, Shifts.

Machine-wise break-up of energy over a week



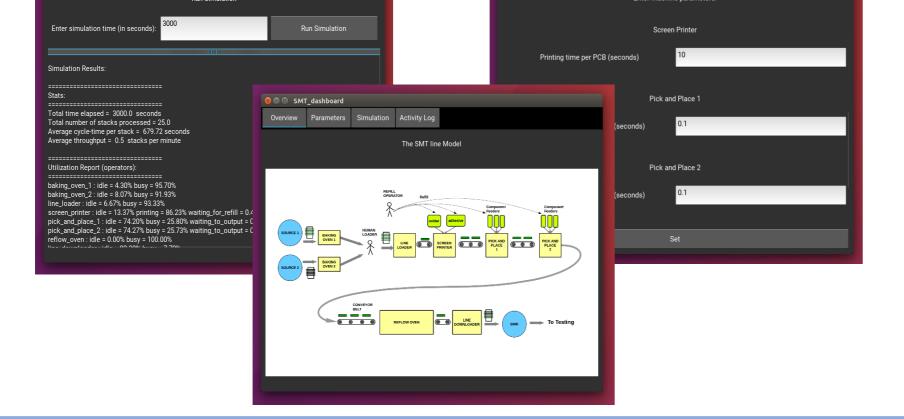
Insights: The Re-flow oven accounts for more than 85% of the total energy consumption on average, whereas the Pick and Place machines are often the throughput bottlenecks.

Parameterized Simulation Model with GUI support

😣 🖻 🗊 SMT_dashboard						😣 🖻 🗉 SMT_dashboard			
rview Paramete	rs Simulation	Activity Log				Overview	Parameters	Simulation	Activity Log
		Run Simul:	ation					F	Enter machine na

Energy Optimization and Ongoing Study Items

• Impact of buffering between the Pick and Place and Re-flow



operations (preliminary results based on simulation indicate that up-to 2X reduction in energy is possible via buffer insertion.)

- Design space exploration of line configuration
- Optimal inspection and re-calibration policies
- Human-in-the-loop modelling
- Dashboard for real-time operational support

Dr. Ashish Joglekar, Dr. Neha Karanjkar, Dr. S. Sridhar, Dr. Alexandre Reiffers-Masson, Sampad Mohanty, Venkatesh Prabhu, D. Raghunath, Prof Rajesh Sundaresan, Prof Bharadwaj Amrutur, Prof Chiranjib Bhattacharya Robert Bosch Centre for Cyber-physical Systems, Indian Institute of Science, Bangalore and Dr. Devadutta Kulkarni, Dr.Rajeev Shorey, TCS Innovations Lab