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Intelligent Services for the Connected Worker 4.0

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Do you see AI in general more as an opportunity or more as a risk ?

Artificial Intelligence: opportunities and risks

Source: Bitcom Research on AI (Basis N=1006) 15.11.2017

Agenda

- What are the needs of connected workers?
- Typical uses cases for intelligent services
- Deep Dive: Demo Fault Diagnosis Bot
- Deep Dive: Demo Image Recognition
- Summary

Hands-free working and assisted reality is not sufficient ...

How to make the **Connected Worker 4.0** more **efficient** and **intelligent**?

In times of digitalization and interconnected production several key areas need to be addressed…

Top challenges in the area of production in the coming 12 months

Digitalization / Industry 4.0

- IOT
- Automation
- Human machine collaboration

QA & Process Optimization

- Extension of capacities
- Cost efficiency / pressure /reduction
- Agile development and production
- Increasing quality requirements
- Lean management

Workforce 4.0

- Skill shortages
- Human resources / know-how
- Cultural change & adoption of new technologies
- Shop-floor management

IT & IT-Security

- Extension/integration MES
- Analytics
- Security problems

Market Challenges

- Globalization
- Raw material evolution (price/availability)
- Competition
- Volatility

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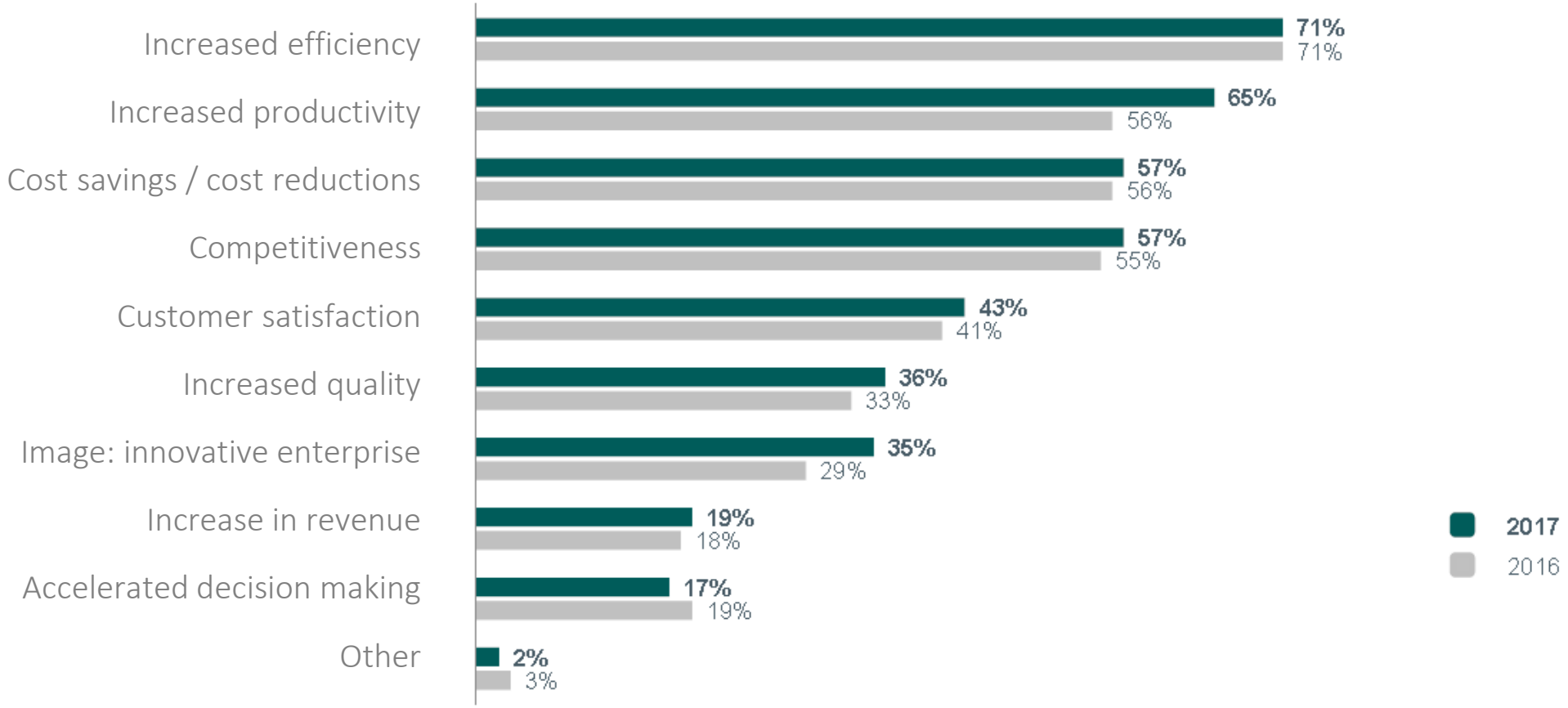
Source: "Digitalized and interconnected Production 2017/2018" Survey, 6/2017, DACH

… in order to leverage benefits of Industry 4.0

Expected benefits and optimizations of Industry 4.0 for the enterprise

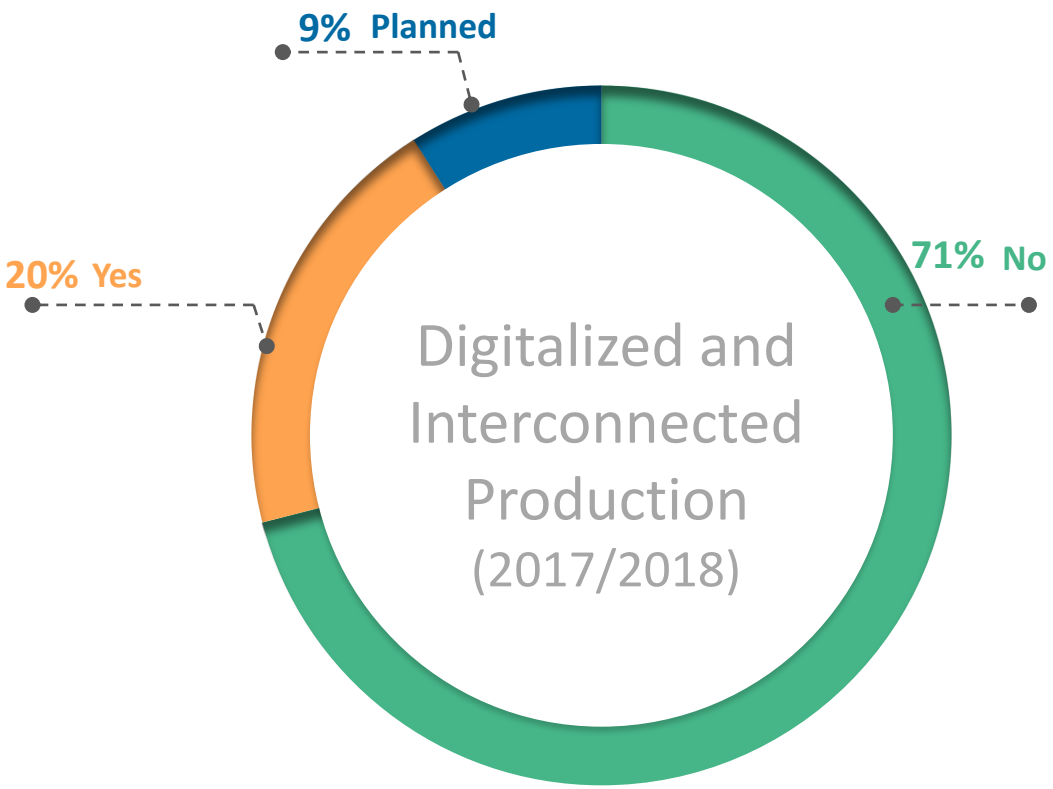


(*) multiple responses allowed

Source: "Digitalized and interconnected Production 2017/2018" Survey, 6/2017, DACH

Artificial Intelligence starts to be perceived as an important factor

Is Artificial Intelligence relevant to your enterprise and where?



Source: "Digitalized and interconnected Production 2017/2018" Survey, 6/2017, DACH

Production process
Production planning, Production control, Self-optimizing processes, and Automatic control of processes

System control
Factory and process efficiency, Factory automation, Robots at machines, Collaborative production

Plant floor IT
Data interconnection, Big data – analytics and Software development

Supervision / maintenance / quality assurance
Demand monitoring, Optical inspection of products, Analysis and repair, Product inspection, Product quality prediction, Machine maintenance

Products
Products for autonomous driving

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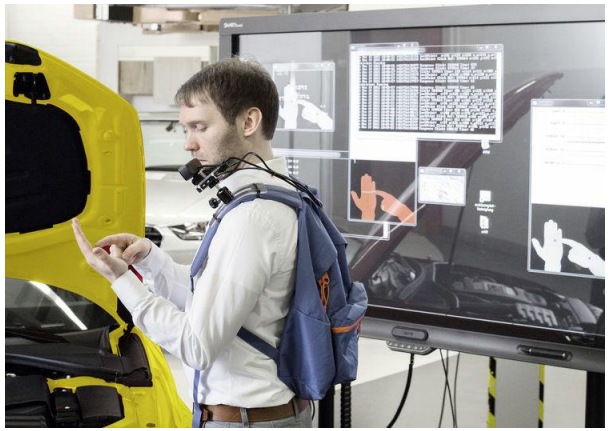
Manufacturing Industry is experimenting with new types of devices and user interfaces

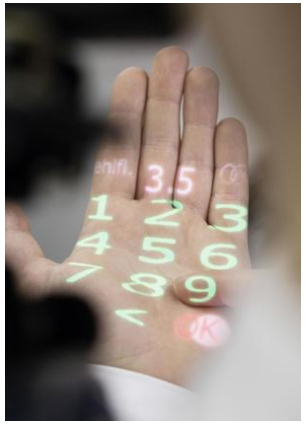
Early pilot projects in automotive industry

Audi Production Lab: Journey to the future [2015]

Tablets, smart glasses, hand projection

Moving towards **smart glass** integration





BMW Spartanburg: visual testing with memory in final inspection [2014]

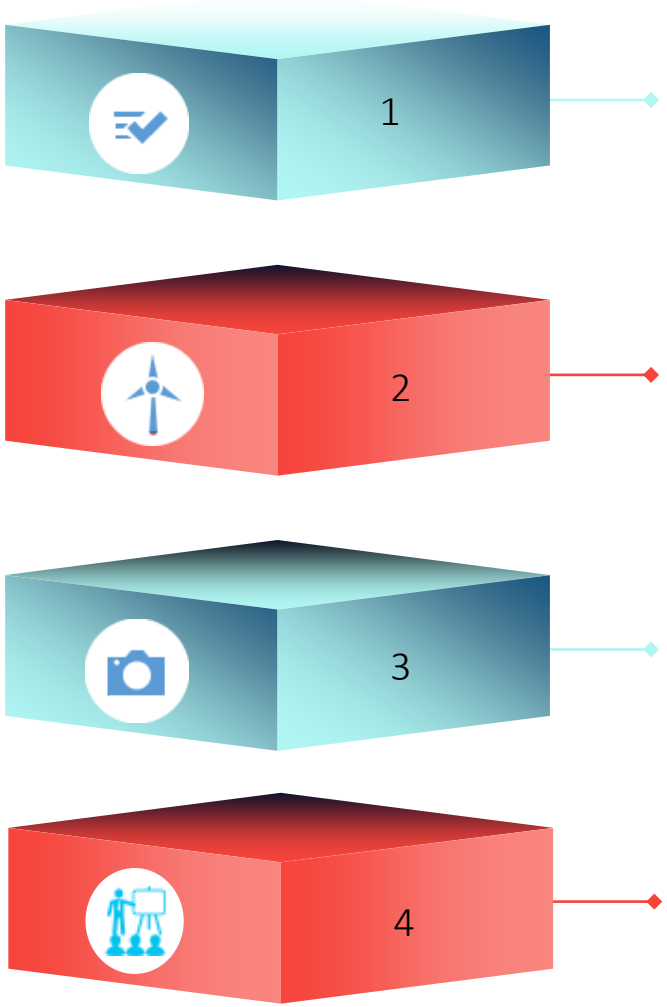
Google Glass: **document defects** by photo/video, **remote video assistance**

BMW's "logistics of future": from smart glasses to electric trucks [2016]

Smart glasses support logistic workers to **find the correct component** and to perform **visual quality inspection** backed by Artificial Intelligence for detecting various types of fault

How could a connected worker benefit from intelligent cloud services?

Typical uses cases for a connected worker where artificial intelligence could help



Service & Inspection

- Document maintenance or service activities by speech, transform to text, extract semantic/intent
- Identification of equipment/parts by image recognition
- Identification of defects by image recognition
- Failure diagnosis by conversational bots
- Failure diagnosis by machine learning
- Validation of work result by image recognition

Manufacturing / Complex Assembly

- Real-time analytics to detect anomalies using machine learning, alert the connected worker and visualize
- Failure diagnosis (see above)

Quality Control / Process Documentation / Security

- Detecting quality issues by image recognition (using machine learning)
- Worker security in safety areas: biometric and environmental sensors detect stress/fatigue levels

Training

- Evaluation of training work using video intelligence

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We have developed a demo use case to explore the Artificial Intelligence capabilities of the Google Cloud Platform integrated with Google Glass

Industry 4.0 Cookie Production

Demo **Smart Cookie House Factory**

COOKIES HOUSE
FOR DELICIOUS COOKIES

Manufacturing Agility

- Variable market demand
- High level of customer fulfilment
- Capability & capacity

Customized Products

- Command platform, configurable option
- Profitable proximity sourcing
- Suppliers, distributors & retailers

Workforce Agility

- Better decision making
- More fully engaged with businesses
- Sharing knowledge, collaboration of stakeholders

Simulation of data coming from production

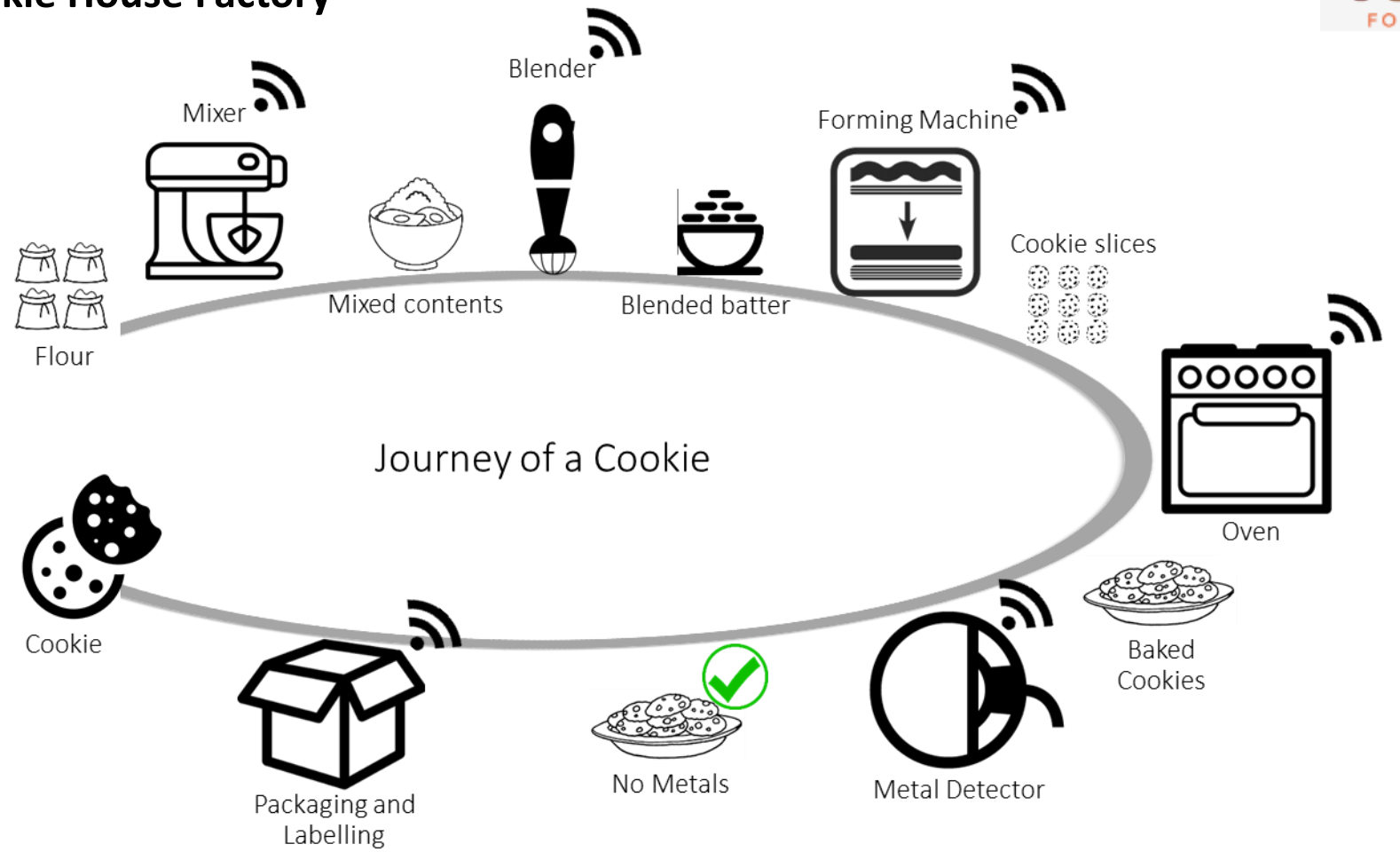
Based on a real customer project/product: **Statistical Process Control System** for manufacturing customers

- SaaS/Cloud solution
- Multi-tenant
- Capable of handling high data volumes
  - Potentially 20.000 packets/sec. for large customer
  - Potentially > 100 GB/day or large customer

A typical cookie manufacturing flow

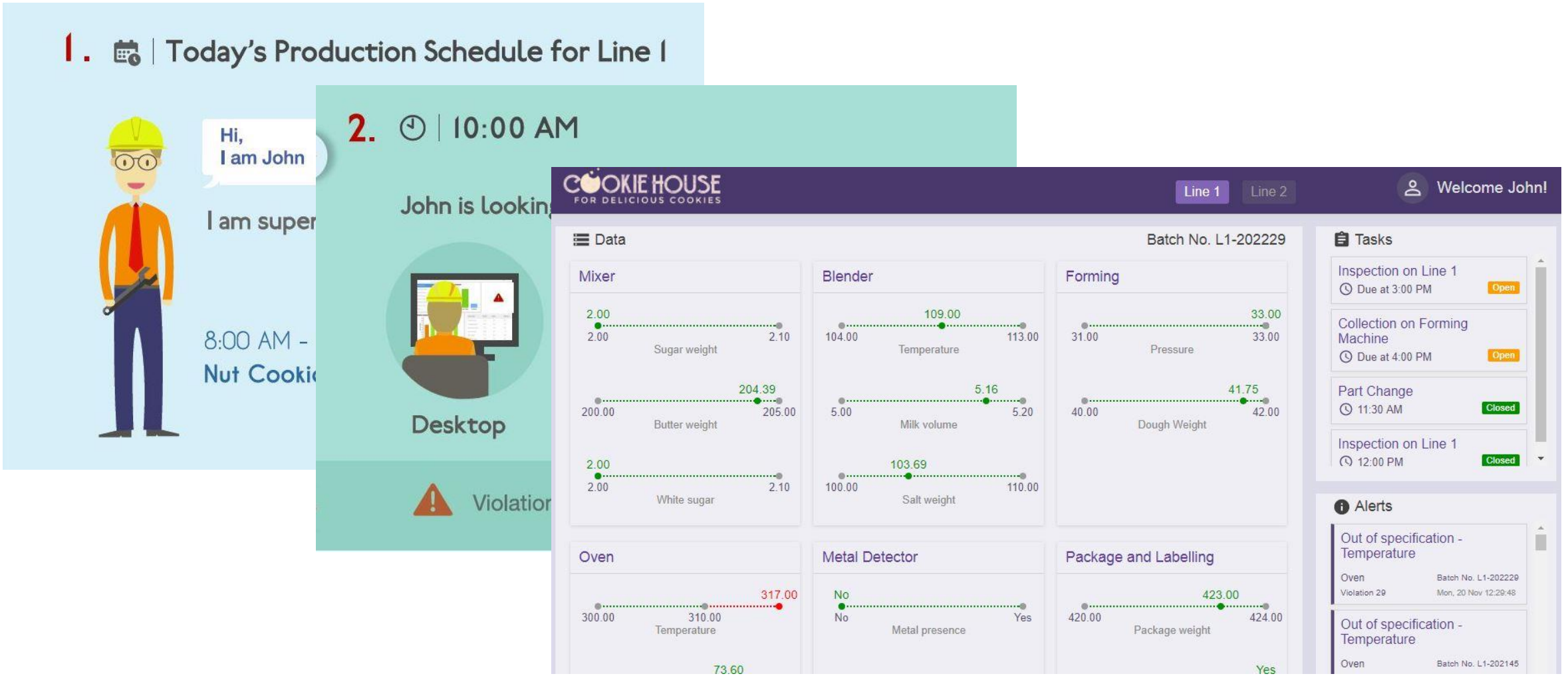
Industry 4.0 Cookie Production

Demo **Smart Cookie House Factory**



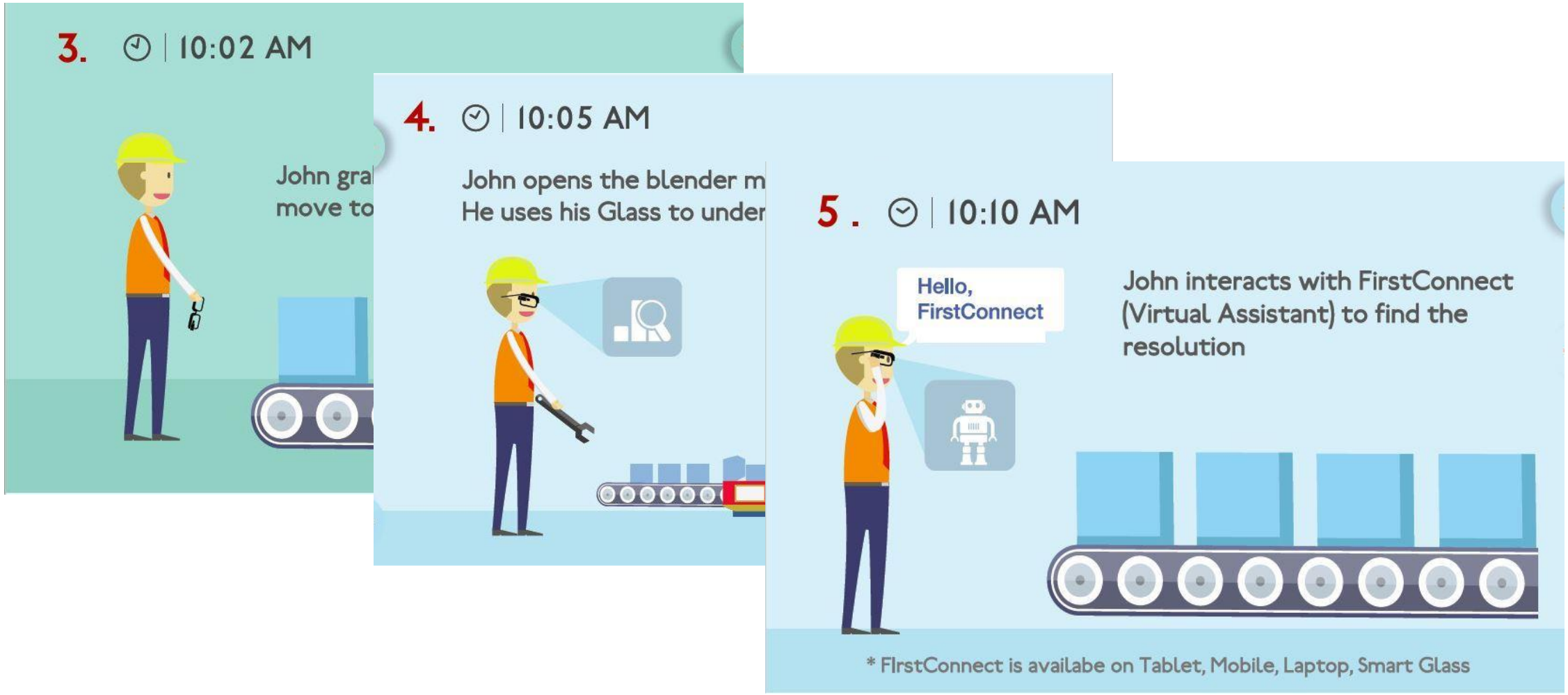
The Connected Worker is monitoring production lines…

Connected Worker Journey (1)



… and will use his smart glasses to assess an irregular situation on a machine …

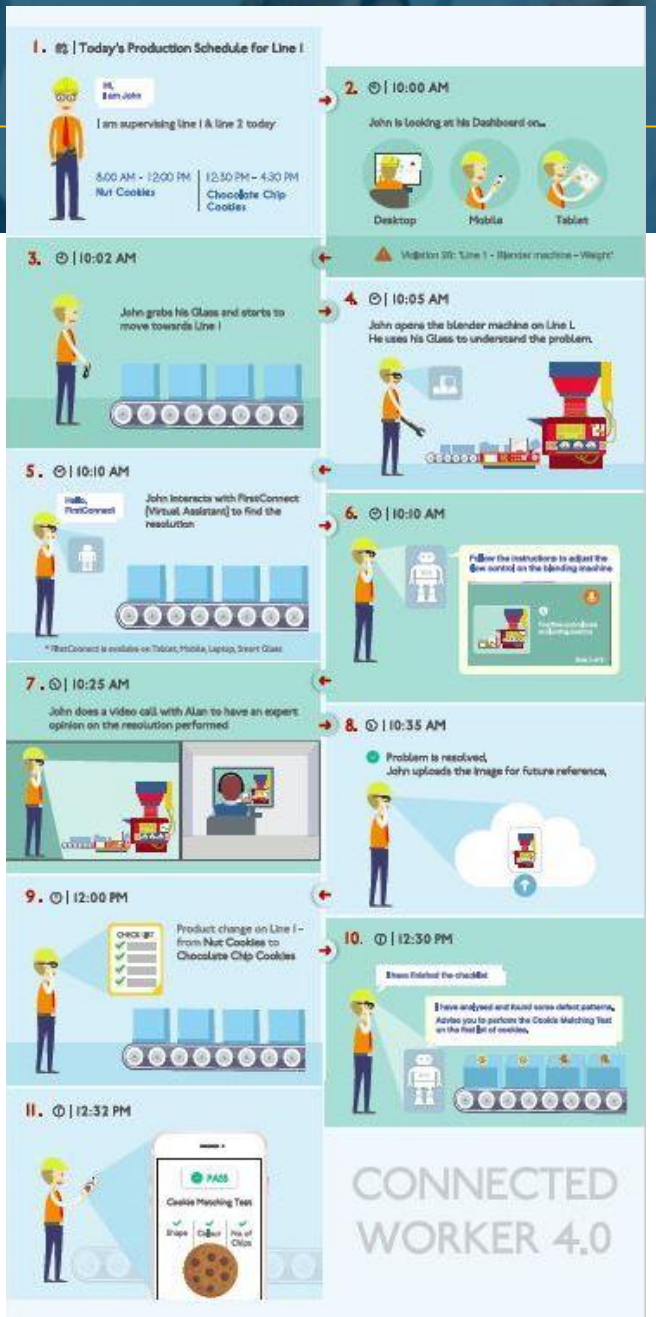
Connected Worker Journey (2)



… and will invoke “FirstConnect” – a diagnosis bot …

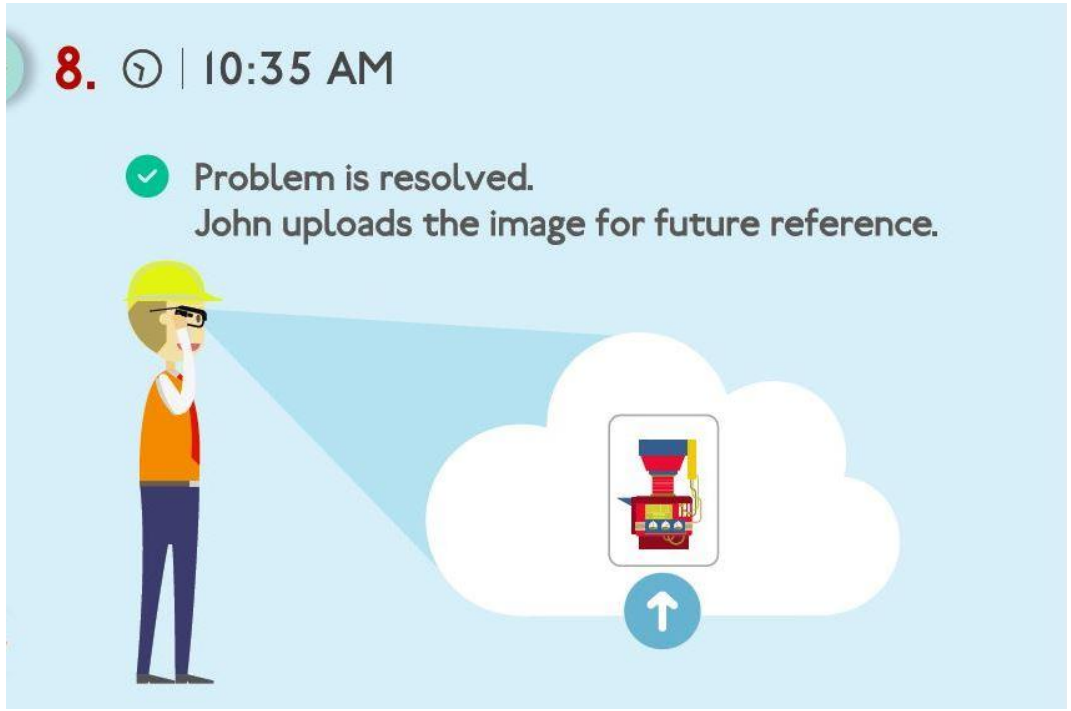
Connected Worker Journey (3)

“First Connect” is the **fault diagnosis bot** with a conversational user interface



… and will proceed with next tasks

Connected Worker Journey (4)

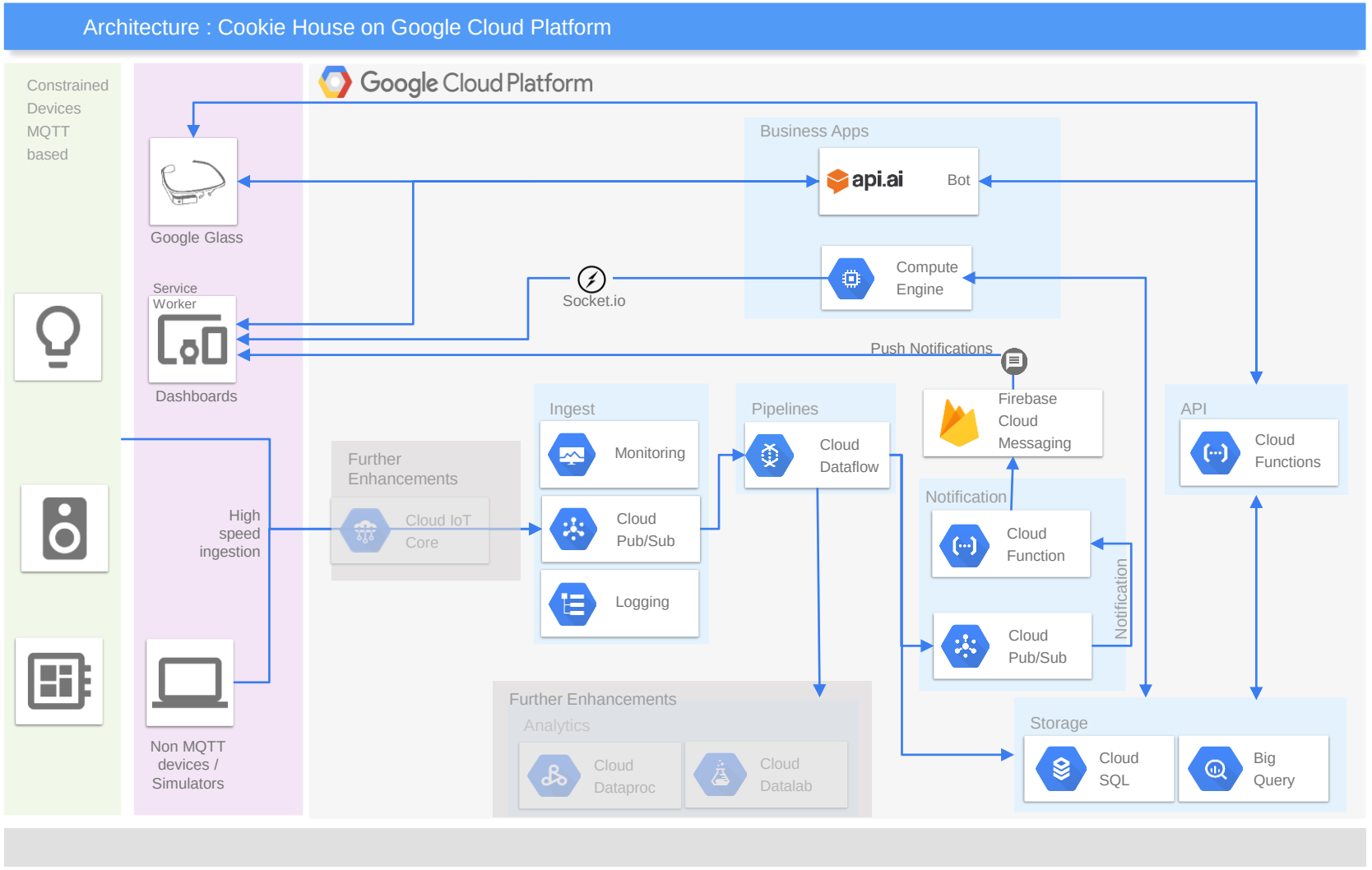


Cookie House Production

Cookie House Architecture

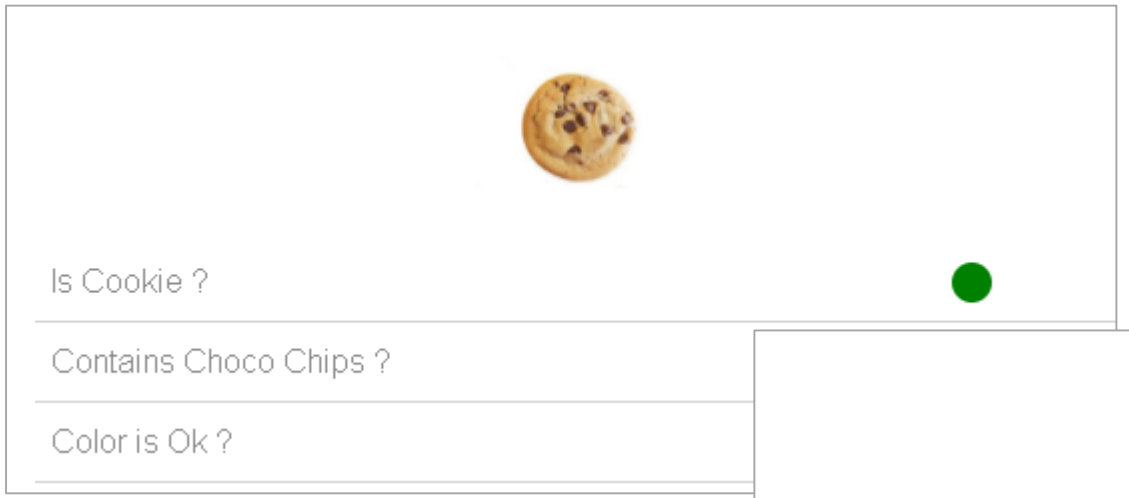
Relevant Cloud Components

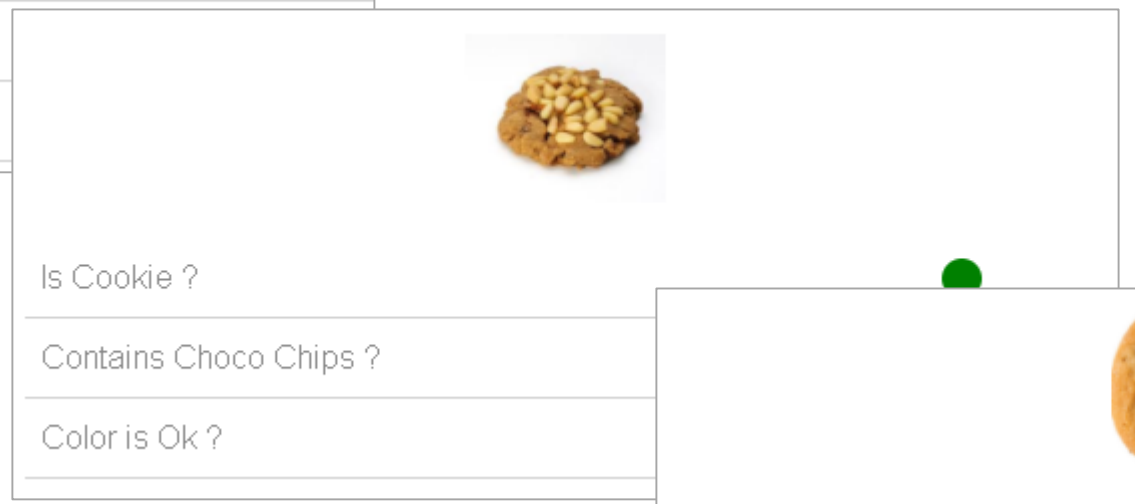
- Google **API.AI** to implement fault diagnosis in production with advanced conversational user experience (bot)
- Google **Cloud Pub/Sub, Dataflow, Cloud Functions, Cloud Messaging, Compute Engine, WebHooks** to implement real-time data analytics, monitoring and alerting

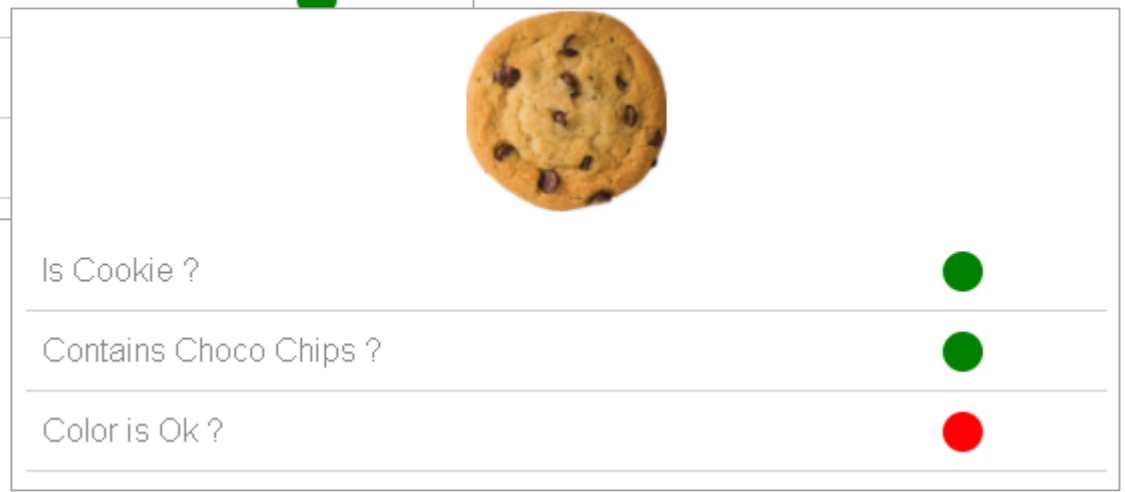


Cookie House Production

Vision App Architecture

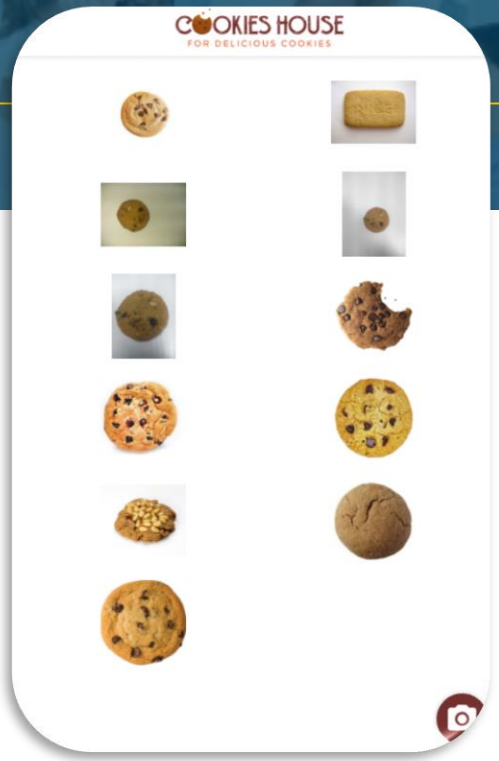






Relevant Cloud Components

- Google **Vision API**
  to implement quality control of produced cookies



Cookie House Production

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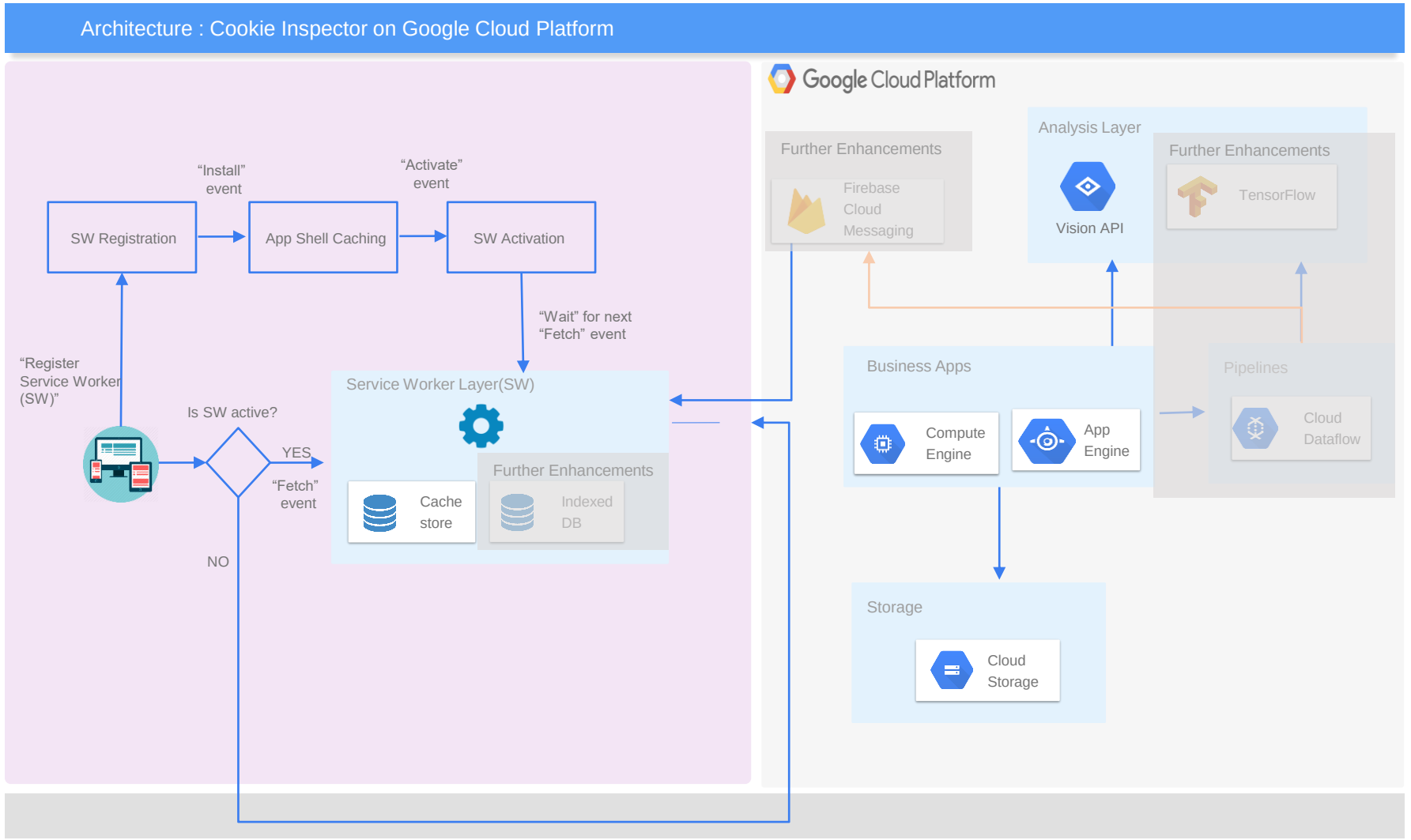

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How difficult is it to leverage intelligent services?

Effort involved in building these demos / proof of concepts

Conversational fault diagnosis bot
- Artificial intelligence part

5
Person Days

Image Recognition
- Artificial intelligence part

2
Person Days

Complete Effort
- Cloud IoT platform

<80
Person Days

Complete Task Details

- Cloud platform
- Integration with API.AI and GCM
- Simulation of production real-time data
- Real-time data/event processing and alerting
- Dashboards
- Glass App with fault diagnosis bot
- Mobile App with image recognition

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Involving experts from our Center of Excellence “Cloud”, “Mobile” and “Internet of Things”

How to make the Connected Worker 4.0 more efficient and intelligent?

Use the right platforms and advanced APIs
Use of industry proof wearables
Leverage the right skills

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