IoT Lifts Elevator Maintenance to the Cloud

Our Journey to Digitizing and Digitalizing our Service Business

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thyssenkrupp Profile

• Diversified industrial conglomerate - $45B in sales
  • 155,000 employees worldwide

• Elevator Business Area - $9B in sales
  • 50,000 employees
  • 20,000 service technicians
  • x.x M elevators & escalators under service

• Elevator Business Unit Americas - $3.7B in sales
  • 15,500 employees
  • 230 Branch locations
  • 5,000 service technicians
  • xxx,000 elevators and escalators maintained in 16 countries
IoT Can Change the Game in Different Ways

• Improve Customer Service & Satisfaction
  • Improve service efficiency
  • Reduce down time
  • Improve margins

• Add Value While Disrupting
  • Increase revenue through different offerings
  • Decrease product variability
  • Improve margins
thyssenkrupp’s Challenge

- **Aging workforce** includes implications for the highest paid blue collar worker in the U.S.
  - 30% of skilled technicians will retire in the next 5 years
  - New technicians lack “how it works” knowledge and expect to be connected 24/7 (millennials)

- **Elevator Technology** has evolved to microprocessors generating massive amounts of data instead of electronics and relays of the past

- **No infrastructure** existed to intelligently harvest data to make technicians more effective and efficient

- **Service route management** has become a challenge - balancing routine maintenance with calls for elevator service

- **Remote Monitoring** and knowledge based systems to improve on first time fixes was a good start

- Needed a **leap frog** approach to the service business to re-invent how elevator maintenance is performed
Disrupting the industry maintenance model

- **CORRECTIVE MAINTENANCE**
  - Immediate maintenance after failure, aka. repair
  - Usually unplanned and by customer demand (e.g., complaint or callback)

- **PREVENTIVE MAINTENANCE**
  - Usually based on expected lifetime of components
  - Performing periodic inspections and tests to prevent failure
  - "Unnecessary" maintenance visit unavoidable

- **PREDICTIVE MAINTENANCE**
  - Condition based maintenance (condition monitoring)
  - Performing maintenance / replacing components if failure, deterioration of working conditions is seen as imminent based on indicators
  - Reduction of "unnecessary" maintenance visits
  - Better planning & scheduling of maintenance visit
  - Optimization of spare-part handling

- **PRESCRIPTIVE MAINTENANCE**
  - Farsighted prediction of failure and planning of maintenance
  - Knowledge/Recognition of long-range (time) failure patterns
  - Predictions based decision making and effect anticipating maintenance actions
  - "Strategic maintenance" to actively optimize operational profits
MAX – leverage what you have and partner for the rest
MAX - The Intelligent Service Model

Precise Diagnosis (step 1)
- Malfunction Dial-out
  - Intelligent identification & root cause information
  - Delivered to the Technician to guide them through a logical sequence

Predictive Intervention (step 2)
- Routine Download of events
  - Intelligent accumulation & escalation analytics
  - Delivered to the Technician to point them to the right place to prevent a callback

Life Cycle Management (step 3)
- Routine download of cycle counters
  - Product lifecycle knowledge in backend
  - Replace component just prior to creating a deteriorating condition

#IoTMan
The thyssenkrupp Elevator Journey

- Communication infrastructure
- Organizational structure and fit
- Data models and sensors
- Security
- Status of the program
Communications Infrastructure Considerations

• Connectivity for remote locations
  • LoRa, 3G, 4G, LTE, Ethernet
  • How long will the technology be available and what will the replacement costs be?

• Cost – Hardware, lifecycle, remote maintenance
  • Mature vs emerging markets

• Data cost
  • How much data will you send and at what frequency?
  • Global contracts (cloud services, transmission costs)
  • Country-specific data privacy laws

• Viability of reliable connectivity (where is the equipment located)

• Make or Buy
Organizational Structure

• IoT requires a constant strategy
  • You don’t know what you don’t know

• Whatever you think you’ll need for resources, triple it!

• No matter what - don’t make it part of daily operations

• Make sure all business functions buy in and understand their role to make IoT part of the fabric of your business

• Find good data scientists and keep them interested
Data Models and Sensors

• Processed vs. raw data
  • Processed data limits your ability to apply analytic algorithms broadly across products
  • Raw data is big and expensive!

• Sensor technology is amazing and continues to expand
  • Data validity must be extremely high

• Need to balance opportunity cost against moving forward with processed data and sensor installation costs

• Go-forward product development decisions
  • Any new product or component in a system must be capable of sending deep data

- 8x accelerometers
- Temperature & Humidity,
- Barometric Pressure,
- Altitude sensor
- Self calibration and certification
Security Concerns

• Remote command and control
  • Can a hacker take control of your product / the building / the city?

• What is the impact of a hack to you or your customer?
  • Would you want that on the front page of the newspaper?
  • How visible would it be?

• Cloud security at a minimum
  • Is the connection to your ERP safe from business espionage (e.g. intellectual property)

• Embedded device security
  • Minimize hacks from proliferating throughout
Status of MAX today

• Project development (mostly hardware) 2 years

• Press release 10/28/15 at CTBUH (Council on Tall Buildings and Urban Habitat)

• Rollout in the U.S. began October 2015
  • 60,000 elevators sending 1MB of data/day today
  • 100,000 elevators & escalators by June 2017
  • Global target of 80% of 1.1 million elevators on MAX ultimately

• Successes
  • 98% of the time, the alert is accurate of equipment outage which reduces dispatch time and down time for customers
  • 70% of the time the coach application correctly identifies first-time fix
  • We can accurately predict when an elevator will fail due to a door related problem (highest industry callback issue) within a 10 day window
  • The journey proves that we can achieve both dramatic service efficiency improvements and reduced down time for our customers
Thank you!

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