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Stevepb, CCO, www.pixabay.com

Case File

Tokencube Pharma Logistics Monitoring System

10.10.2018, created by Klaus Starnberger, Tokencube

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Summary

This document includes an application description for transportation monitoring of pharmaceutical goods using the "***Tokencube* Pharma Logistics Monitoring System**". For example, 200 vehicles of a pharmacy delivery service can be equipped with a mobile surveillance system in order to proof the transport conditions are fine at any point of time. In this document, special use cases are selected and described in more detail. They can be varied in many ways and yet can be realized with one and the same technology.

The "***Tokencube* Pharma Logistics Monitoring System**" consists of battery-powered wireless sensors ("**Tokencube** sensors") that measure temperature, humidity, shocks and movements permanently. They are mounted in the delivery vehicle or on the goods packages. Furthermore, it consists of radio modules ("**Tokencube** Gateways"), which transmit the collected data via the LTE mobile network to the Internet on a server where the data is managed in a database. These can be mounted in the delivery vehicle easily.

The ***Tokencube* Pharma Logistics Monitoring System** offers the following advantages:

- Proof of shipment conditions of pharmaceuticals
- Auditing of shipment quality
- Tracking and Tracing of pharmaceutical shipments, always online
  - Localization of goods online in real time
  - Determining the state of goods in real time
- Real-time alerts
  - by email
  - on smartphone
  - on cloud platform
- No data loss
  - Data buffering in the sensor, in the logger and in the cloud
- Administration Web Interface for
  - Sensor and system configuration
  - data visualization, various data views
  - Alarm settings
- Live data via smartphone, web interface

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Use Cases

Basic Requirements of a Standard Environment

Temperature Monitoring in the Vehicle Hold

One use case is to proof the shipment is done in a defined quality range. Therefore the temperature in the cargo space of each vehicle or each goods package is being monitored in real time and data are stored in a secure database. Live alarms are triggered in case the permitted temperature range of the corresponding temperature class (e.g. 15 ° C to 25 ° C) is exceeded. The corresponding temperature classes for temperature-controlled delivery are flexibly adjustable (cooled goods, frozen goods, ultra-frozen goods). For installation the vehicle is equipped with 2-3 temperature sensors. All temperature data are stored to prove that the cool chain was not interrupted.

Furthermore tilt angle or mechanical shock applied to the shipment can be monitored.

Monitoring the Opening State of the Doors

Another 2 door contact sensors can be mounted in the access to the loading space of the delivery van, which are read out the opening state of the doors via the *Pharma Logistics Monitoring System*.

Tracking and Tracing

All position data (geo-coordinates / length, width, height) are available online along with the sensor data at any point of time during the monitored delivery. In case the mobile radio link has failed, all necessary data are stored locally and reloaded when the connection is available again.

Stationary Refrigerators

The *Pharma Logistics Monitoring System* can also be used for unsupervised stationary refrigerators to ensure gapless cooling. In case of an incident, alarm messages allow appropriate action.

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Basic Architecture

The system consists of the following elements:

- Sensors (**Tokencube** sensors)
  - Temperature sensors
  - Humidity sensors
  - Door contact sensors

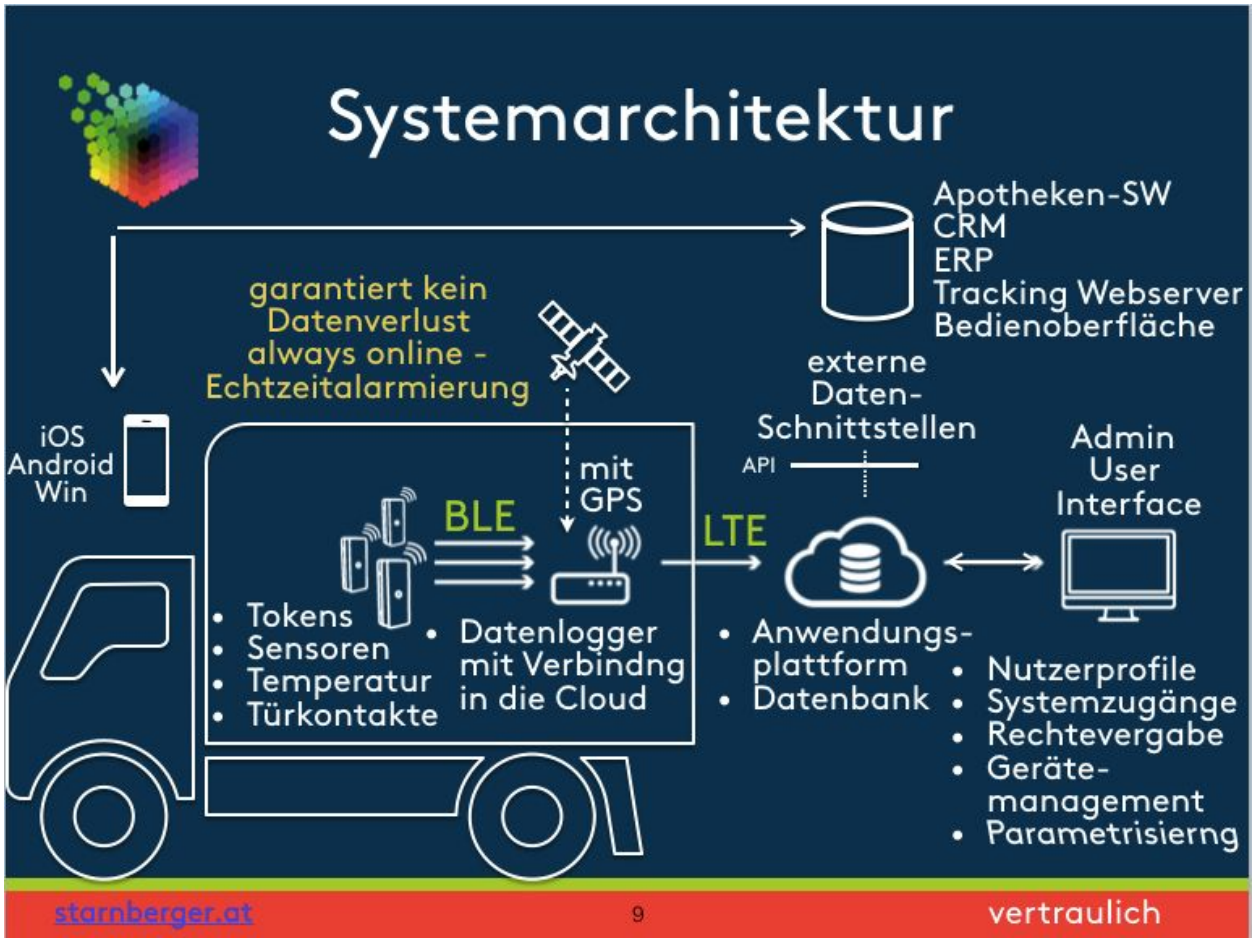
  The sensors continuously record the corresponding parameters and transmit them wirelessly to the radio module (**Tokencube** Gateway).

- The radio module (**Tokencube** Gateway) collects the data, records the position of the vehicle via satellite (GNSS) and transmits the data at regular intervals to a central server (host or cloud service). The radio module is a universal data logger that enables tracking and tracing in a variety of ways.

- The central server collects the data in a database and makes them available to a web interface. The user can always access the required data via smartphone or PC. All data can be audited and the corresponding documentation can be created accordingly.

The following user roles are provided: administrator, dispatcher, driver. They have different access rights and options on the platform or on the smartphone.

The system architecture is shown below:



Advantages of the *Tokencube* Pharma Logistics Monitoring Systems

- Proof of transport quality according to individual quality parameter definition
- Real-time capability, always online
- Real-time alerts
- No data loss, data buffering in the sensor, in the logger and in the cloud
- No system failure due to empty smartphone battery
- Logger costs equivalent to a smartphone purchase
- Sensor tracking and tracing
- App as a cross-platform app available
- No Bluetooth connection problems with the smartphone
- **Can be used for end-to-end tracking!**

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Requirements for Temperature and Door Contact Sensors

Door Contact Sensor

- The door contact sensors provide the opening state of the 2 doors with time stamp. They are recorded by the datalogger.
- A warning is triggered in case the door is open for more than 5 minutes. All alerts can be set via administration interface of the central *Pharma Logistics Monitoring* platform. Custom requirements can be implemented.

Temperature Sensor

- Temperatures are recorded periodically at adjustable intervals (e.g., every 5 minutes).
- The temperature data is recorded and can be validated for proof. No data manipulation is possible. Optional blockchain module.
- The temperature sensors fulfill the following specification:
    - Accuracy of the sensors
      Model Tokencube TC-TH1: +/-0,3°K bei 0...60°C, ±3 % relative humidity

      Model Tokencube TC3001 +/-0,5°K bei 25°C und +/-1°K bei 0...60°C, ±1.5 Pa/K, ±3 % relative humidity
    - The temperature data can be tamper-proof and comply with the FTE 21CFR Part11 standard.
      c.f. Application Note.

Validation, Calibration

- The temperature sensors are calibrated with a calibration box to meet the ISO standard

  c.f. Application Note, FTE 21 CFR Part11 requirements t.b.d.
- The annual calibration of the temperature sensors will be offered as a service.

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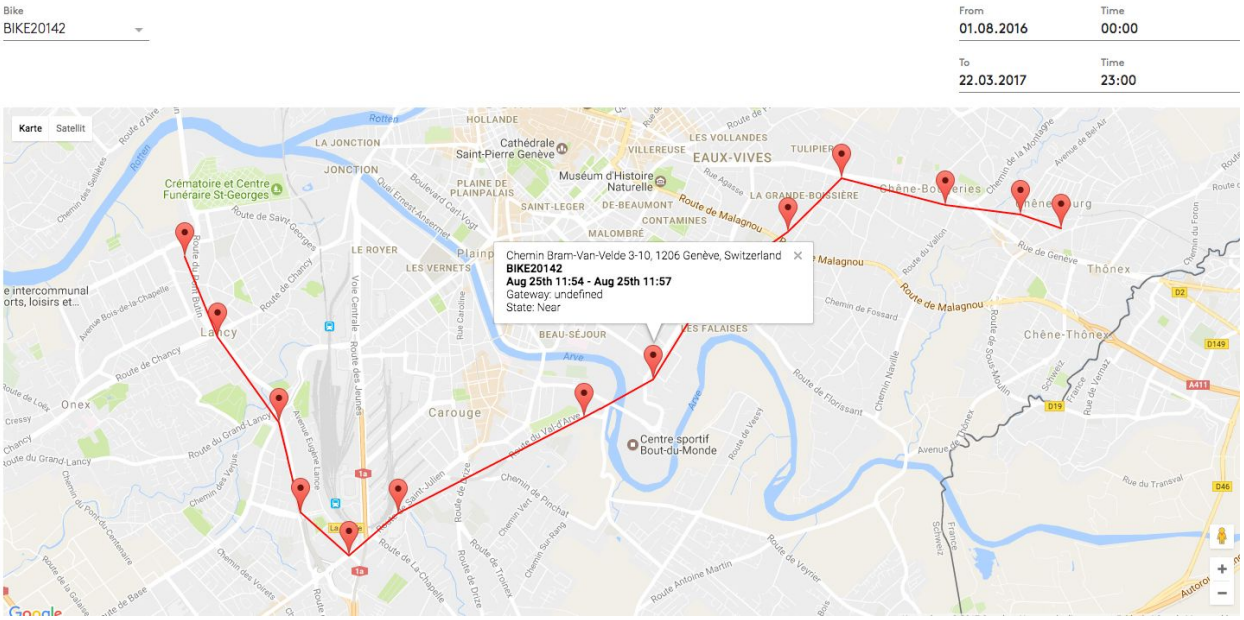
Further Information

Further Use Cases

Use Case: Tracking of Shipments

In addition to the basic requirements, the traces of the consignments can be displayed on a map, whereby the goods status can be retrieved for each waypoint.

Example 1:



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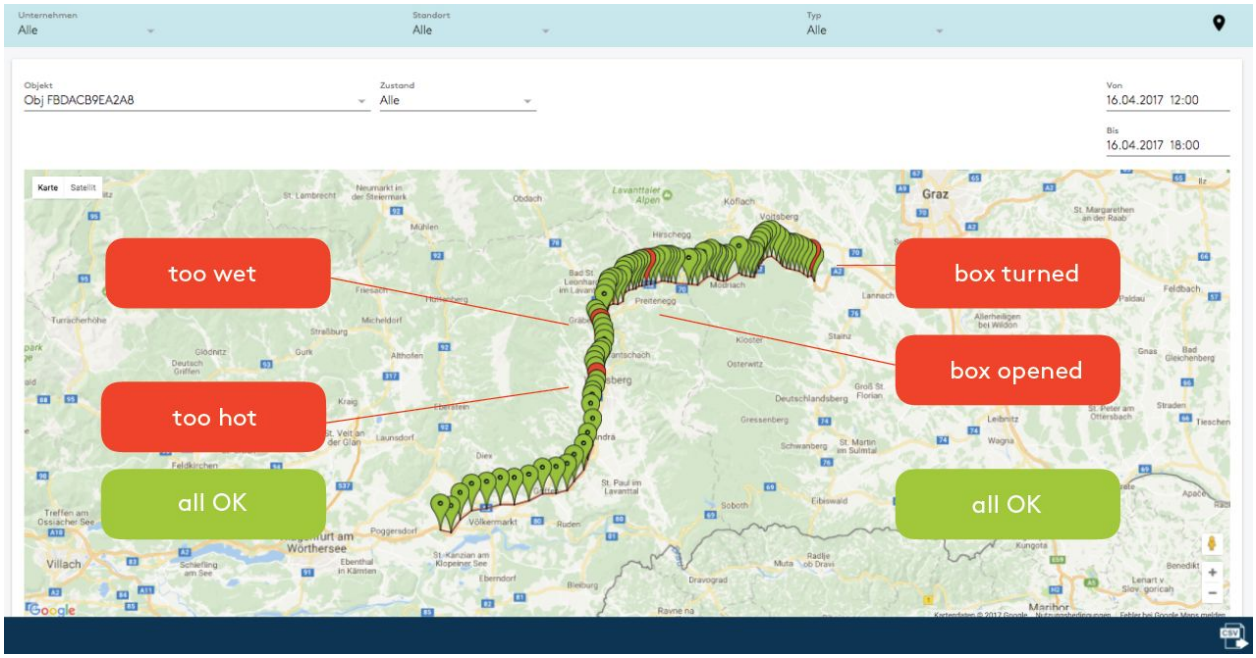
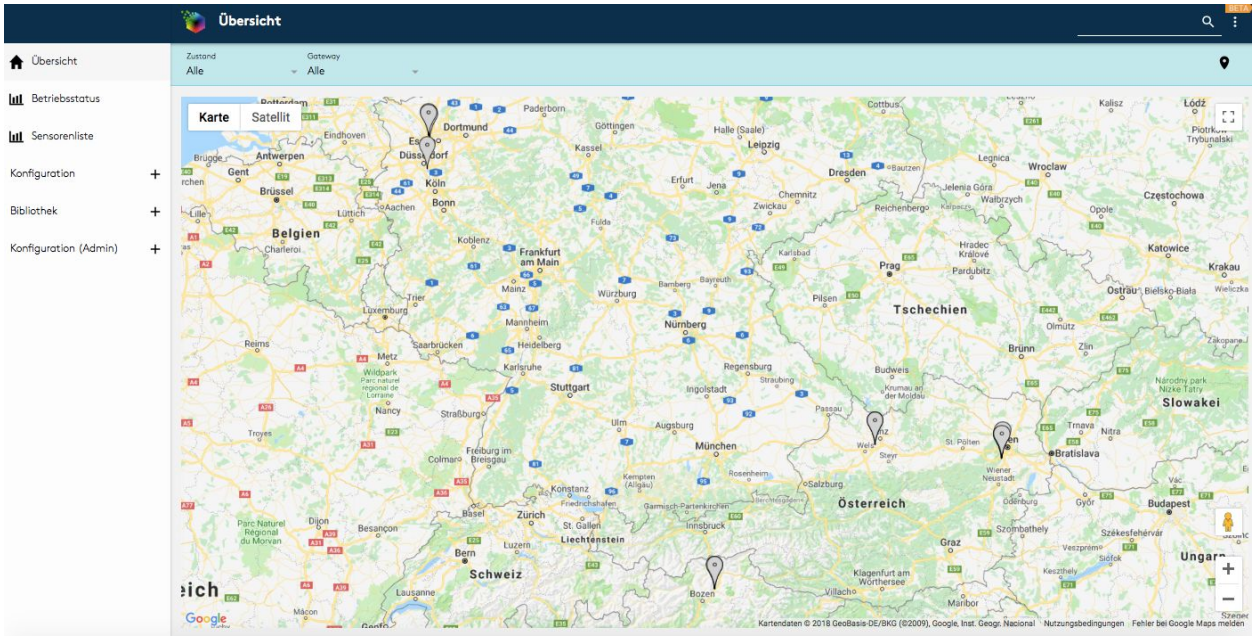
Example 2



Visualization of Central Warehouses or Distribution Centers

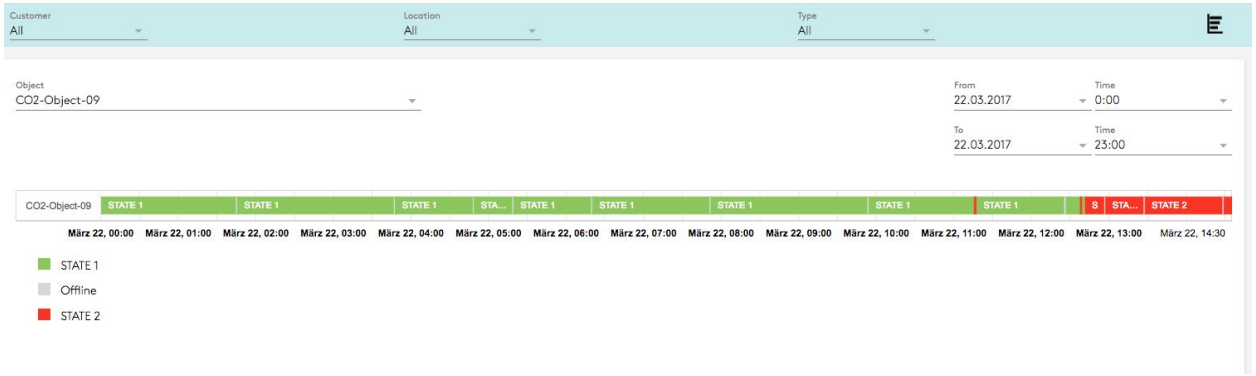


Data Analytics

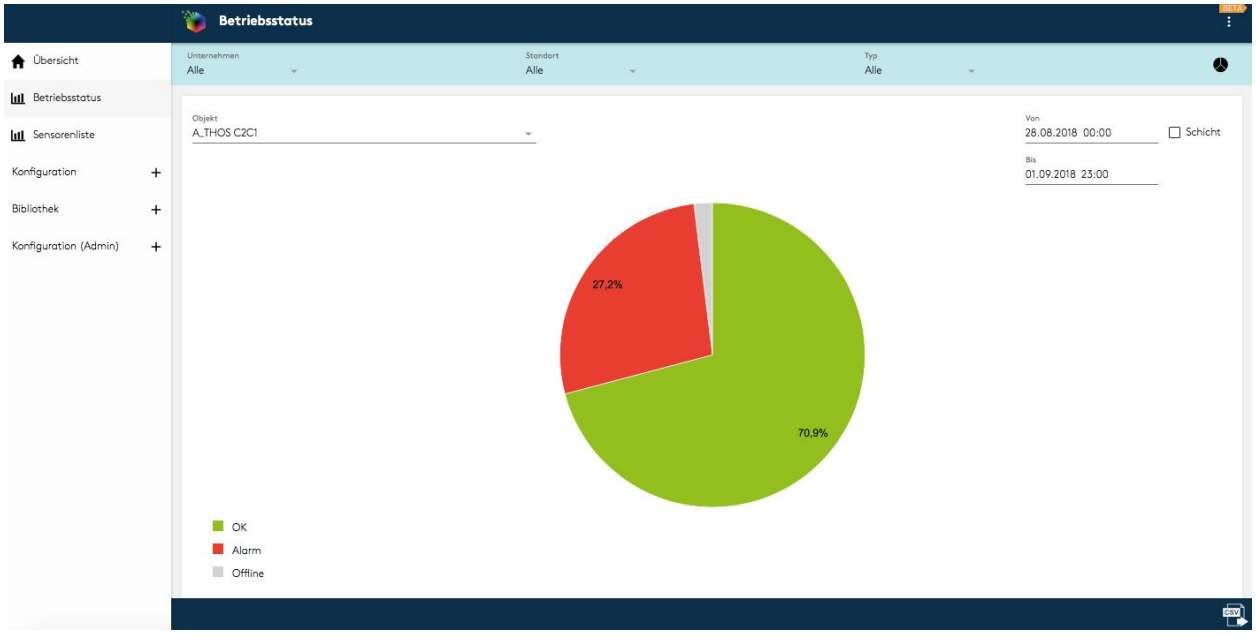
For data analytics different User Interfaces are available.

Example 3 Sensor states ("operating states") related to set alarm thresholds

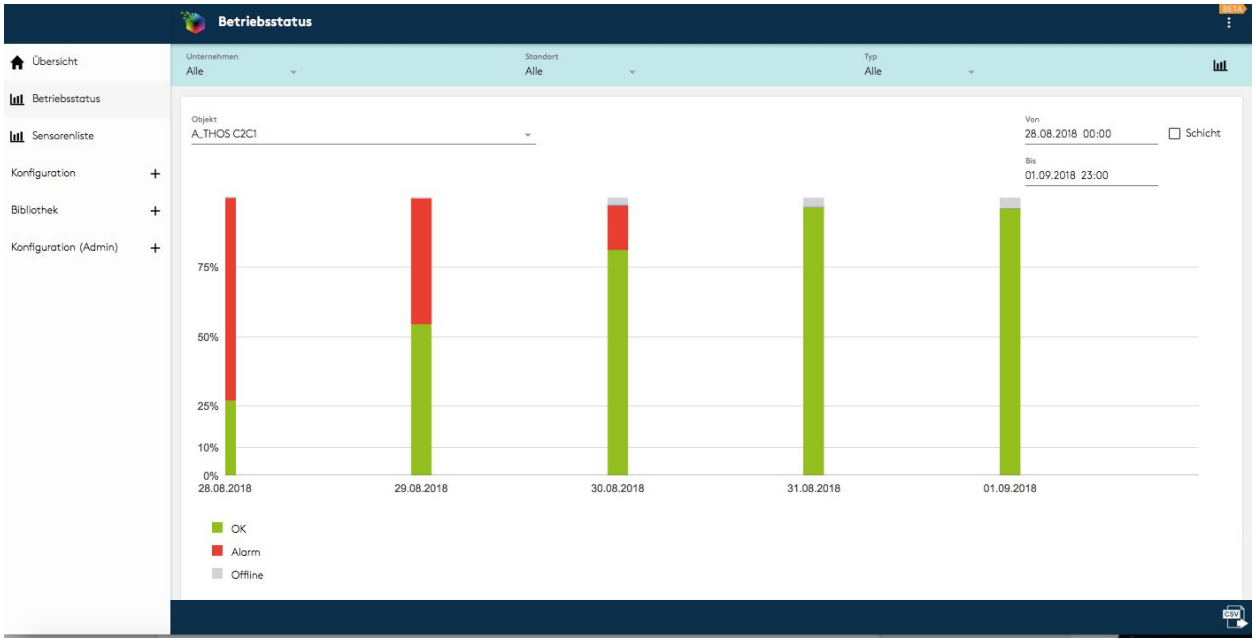
- Display of alarm conditions on a timeline, real-time data updates



- Pie Charts, display of the sum of all alarm violations



- Display of the sum of all alarm violations, daily related



Contact

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Screenshots from Tokencube Pharma Logistics Monitoring System.