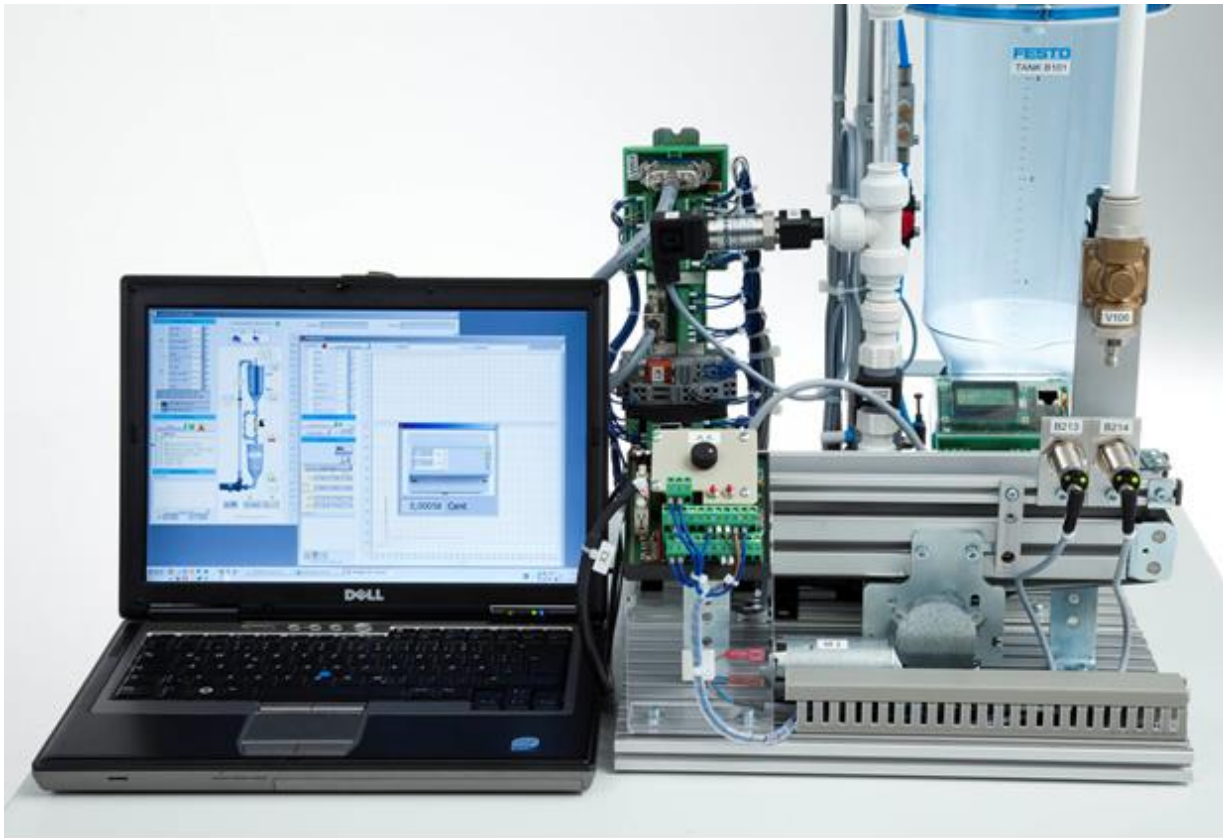


IoT-Kit as supplementary set for Edukit, MPS PA and EDS Watermanagement

Business processes and the Internet of Things – Bottling plant



Overview – Complete business process as a learning scenario

Edukit PA goes IoT – Bottling plant (Internet of Things)

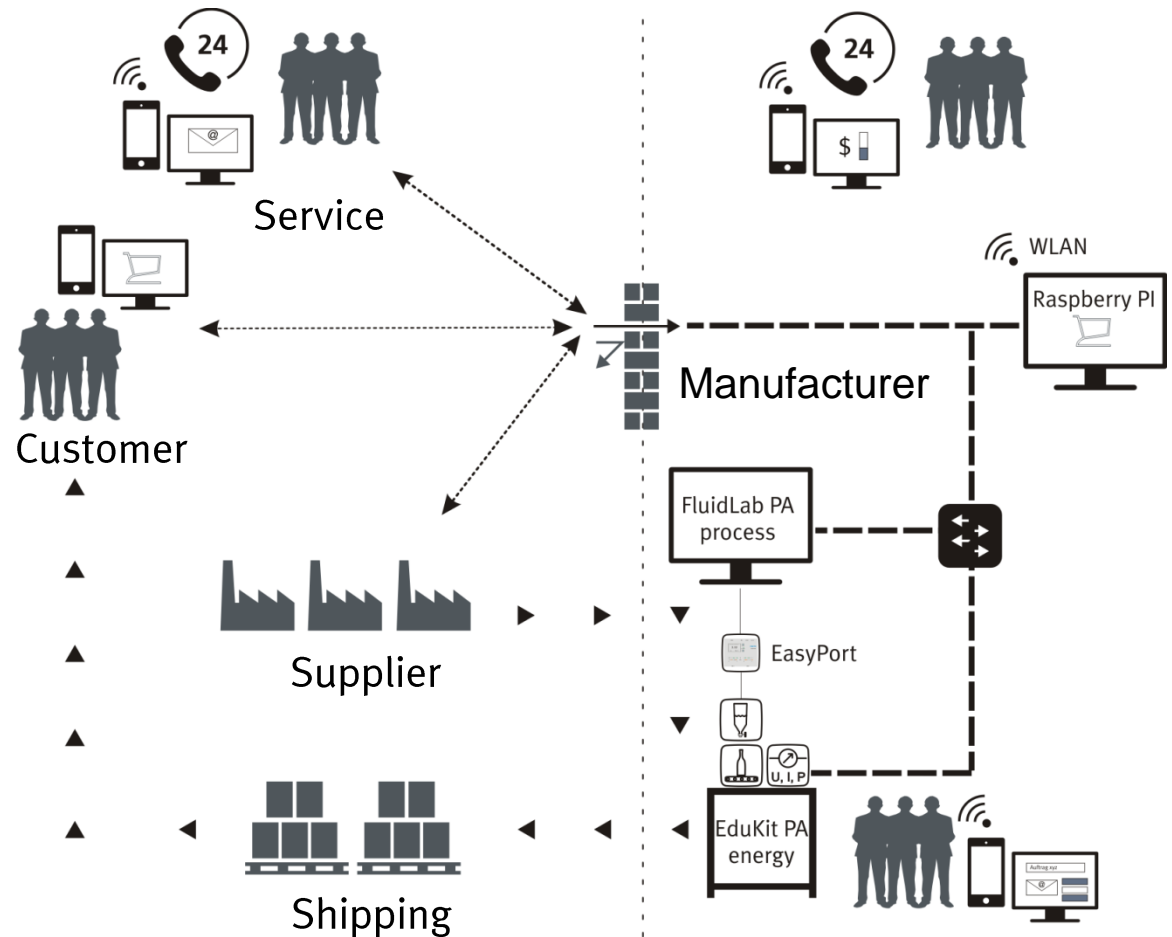
„Without networking no IoT" -----> Starting on a small scale!
Because of the seamless networking, interdisciplinary insight is more important for the business processes than ever.

Customer orders via web shop

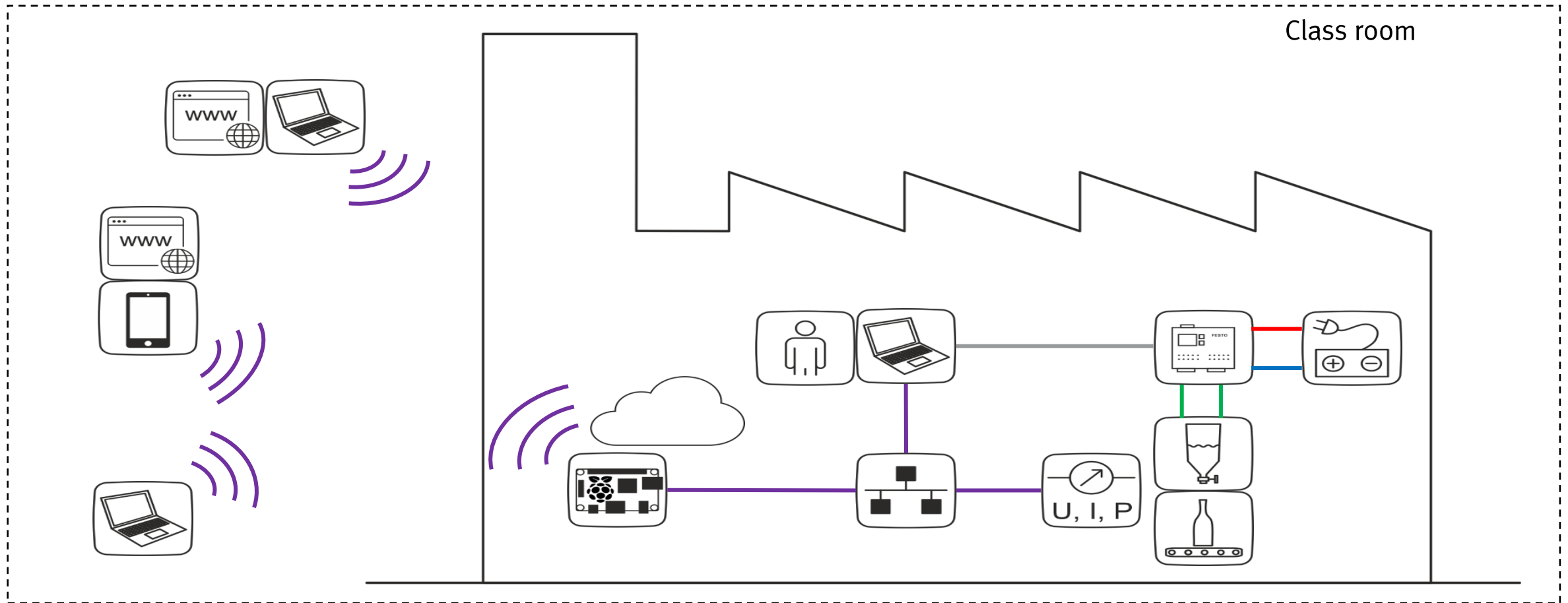
Manufacturer produces the order and captures the energy consumption

Supplier receives stock via sensor signal

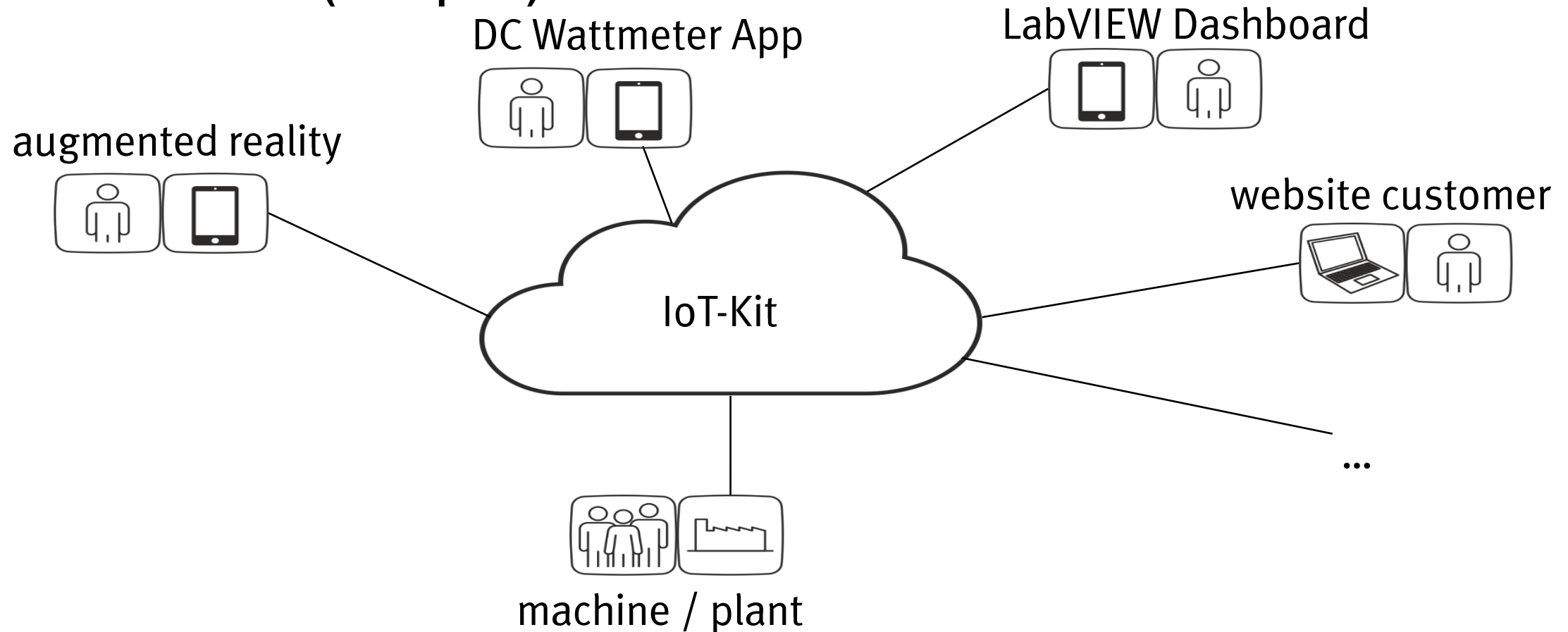
Service person receives mail in cause of failure



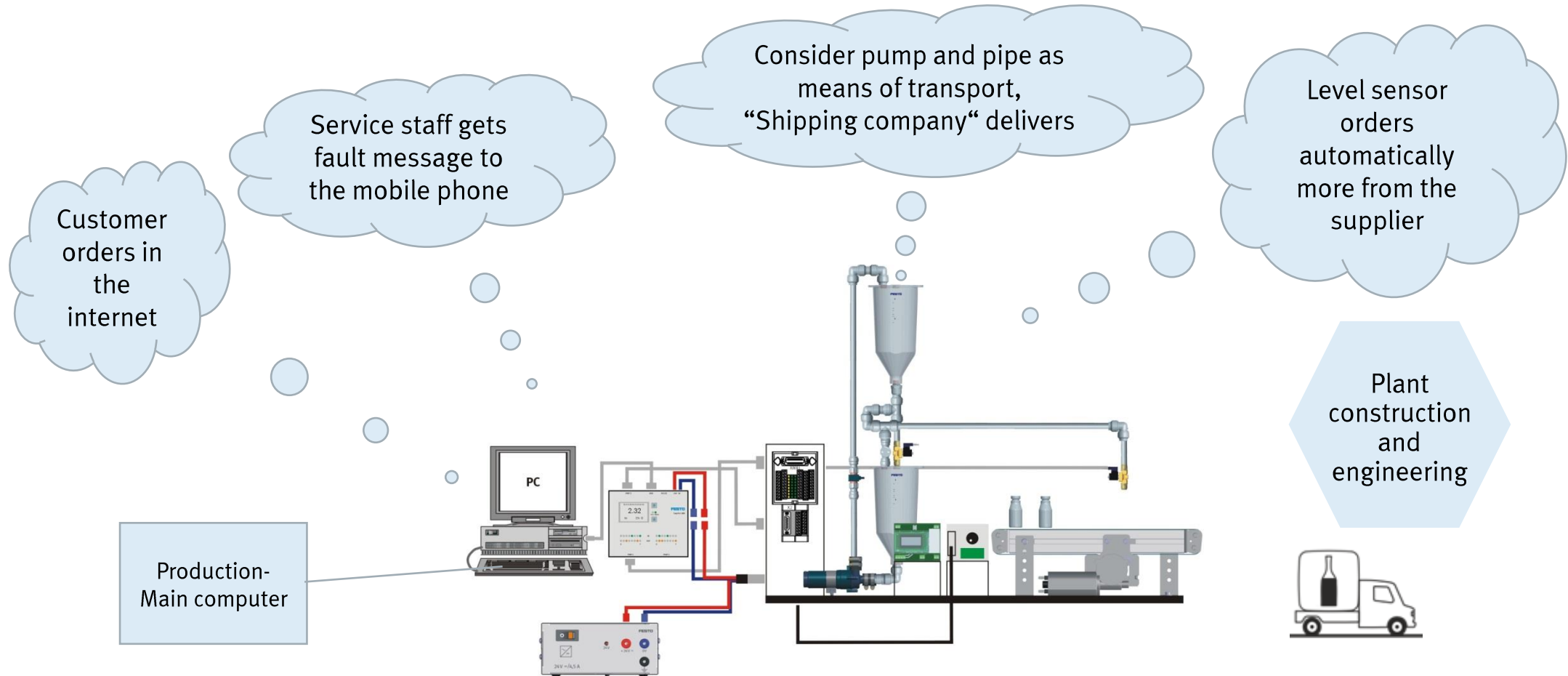
IoT-Kit: Overview using in a classroom, all is prepared for using via internet (example 2)



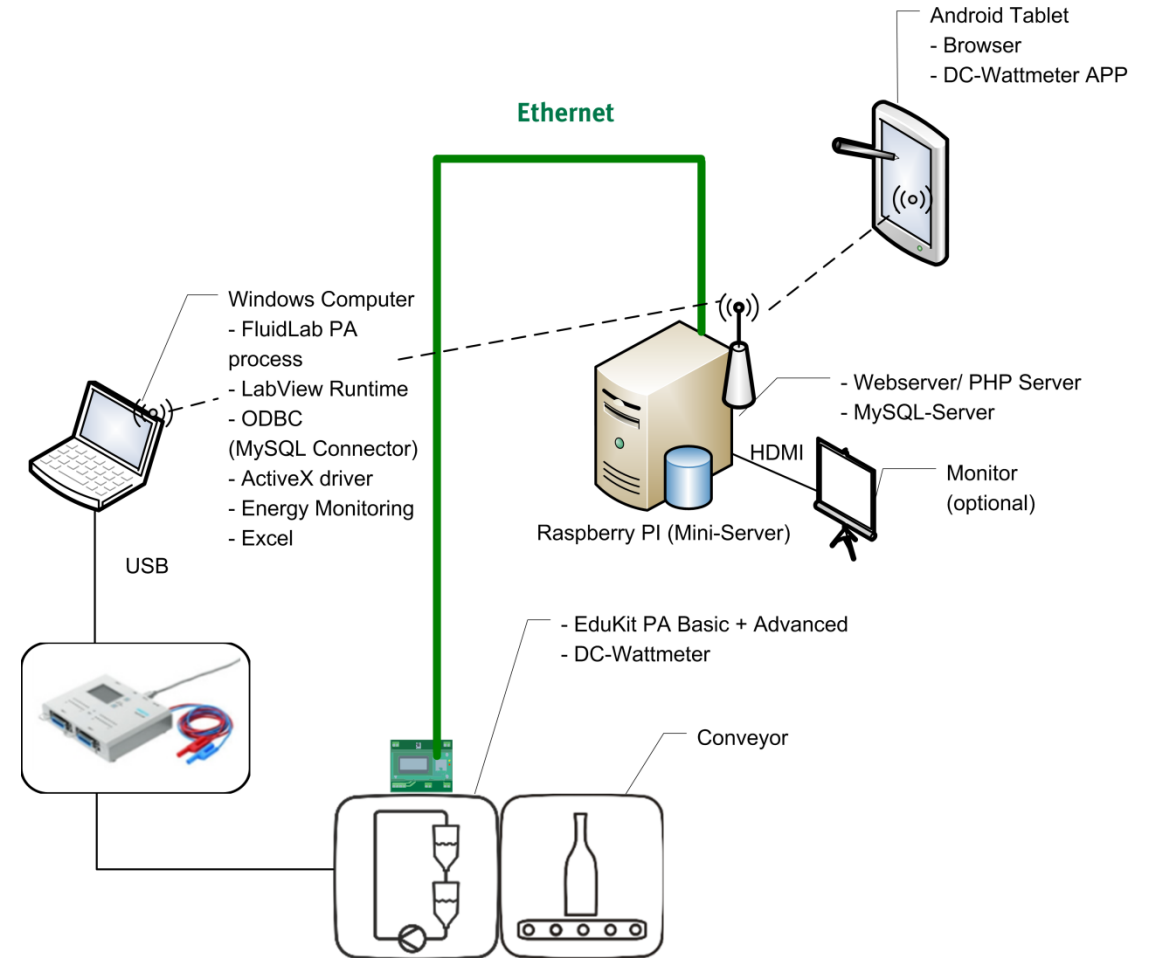
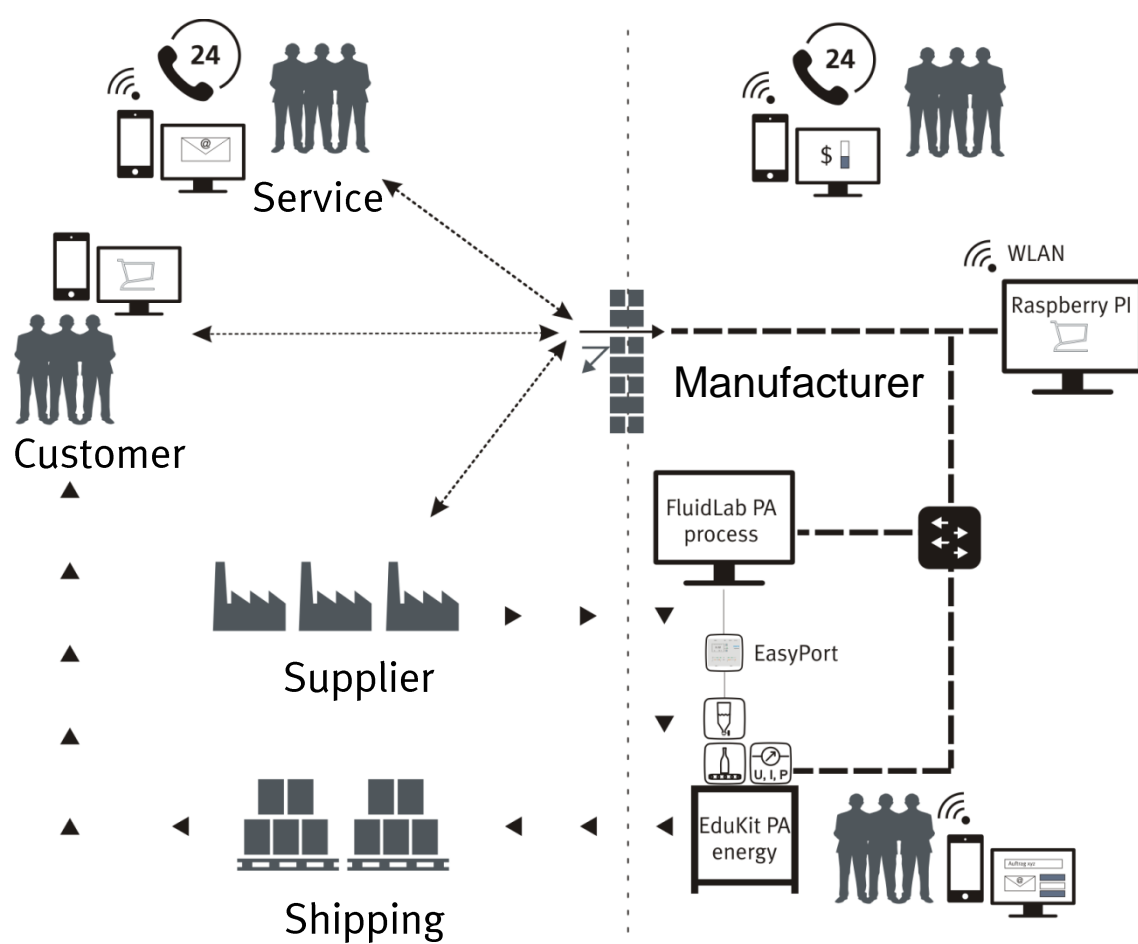
IoT-Kit: Overview (example 1)



Example EduKit PA – Overall system with the supplementary sets "Energy" and "IoT-Kit"



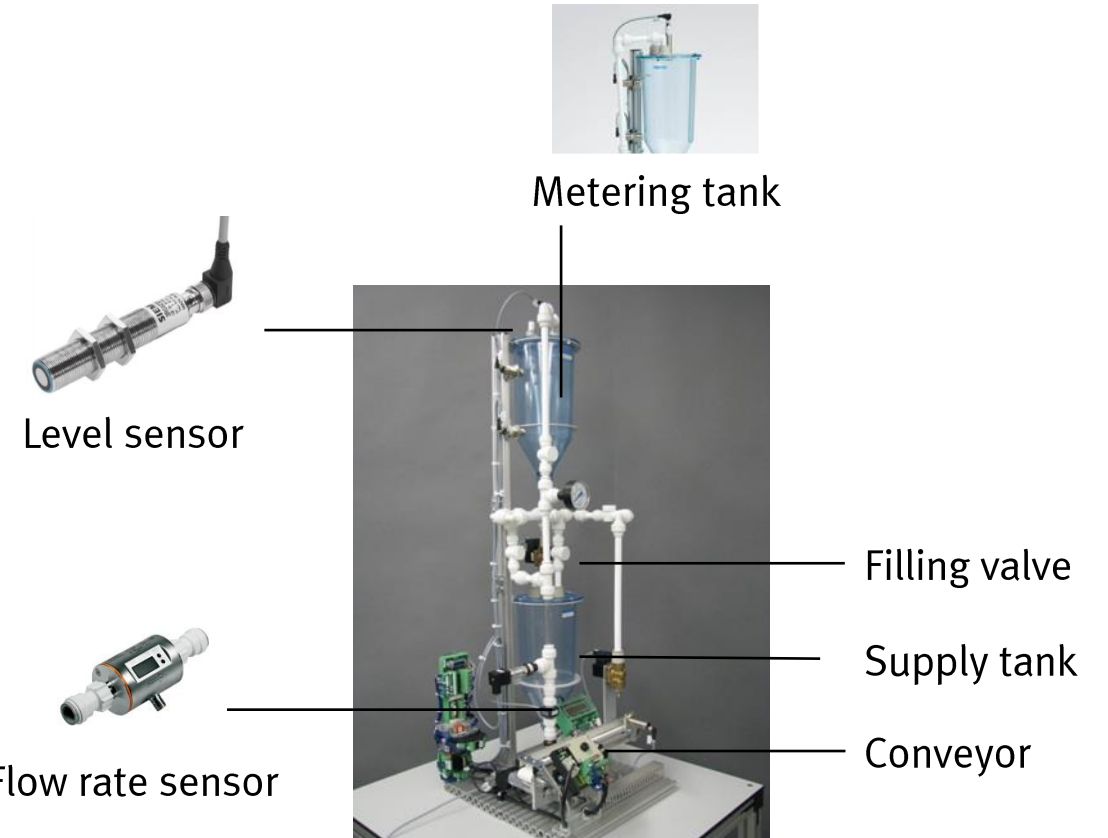
Overview – Networking



Components of the EduKit PA/MPS PA

The EduKit PA modular projects is a 2-Tank system with aluminum profile frame, pluggable piping system, pump, valves and sensors for Level, flow rate and pressure.

In combination with the conveyor for bottle transport, Control via the Festo PC-Interface EasyPort and the Software Fluidlab® PA process IoT it results in a bottling plant, receiving its order data directly through the internet via web shop.



What is required to use the learning scenario EduKit PA /MPS PA goes IoT

EduKit PA Basic



Tabletop power supply unit



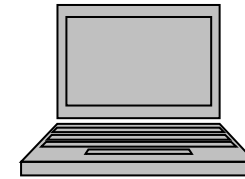
EduKit PA Advanced



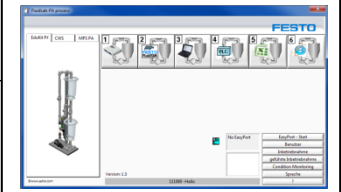
EasyPort + Cable



PC



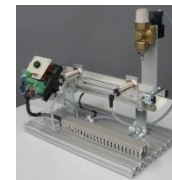
FluidLab®-PA process



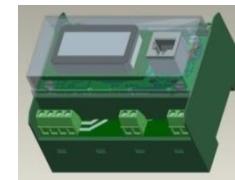
IoT-Kit



Conveyor



Energy Kit



Assisting Media

- Workbook EduKit PA
- On site commissioning with Instruction / Training
- Fluid Lab®-PA - closed loop
- ...

IoT-Kit – Supplementary set: Scope of delivery

- Raspberry Pi 3 with Wireless LAN, Top-hat rail housing, power supply, SD-Card with Raspbian operating system
Services running on the Raspberry PI:
Apache Webserver / PHP Server
(Website with shopping cart)
MySQL-Server (Database)
- 1 Siemens Scalance 5Port Switch
- 1 Adapter for connecting Tablet to Ethernet via cable
- 1 Tablet 7“ preconfigured
- with DC-Wattmeter App
- Network cable set

Top-hat rail housing
Raspberry Pi



Raspberry Pi 3



Siemens Scalance
5 Port Switch



SD-Carte, incl.
Applications-
software



Adapter
USB - Ethernet



Tablet 7”

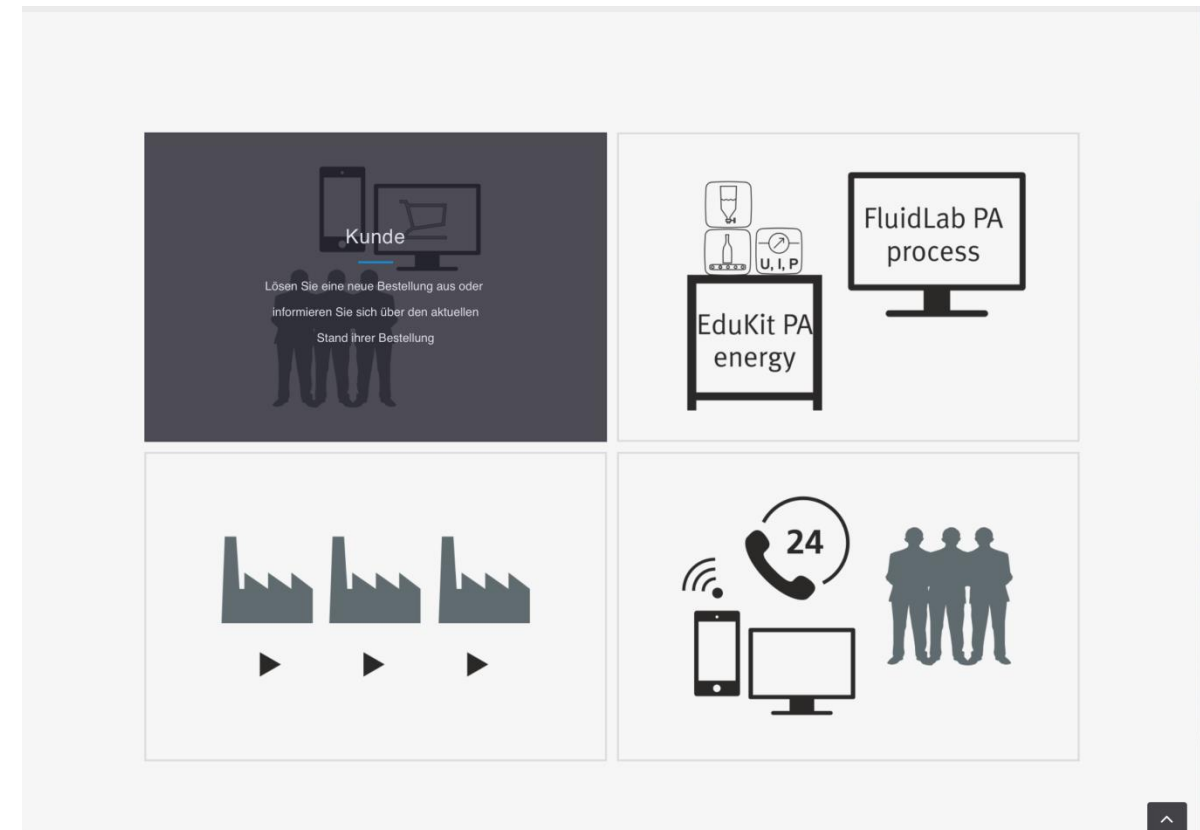


Network cable



Learning scenarios for cloud-based production- and business processes

- Entering customer order at the web shop and notification via e-mail
- Production control for bottling process
- Pop-Up - Instruction for Man-Machine interaction
- Reporting system for production status and plant malfunction with proposed solution
- Automatic ordering/reordering at the supplier
- Energy measurement with DC-Wattmeter and monitoring via PC and Android App, Energy values per charge/piece
- Database connection for order- and production data
- Reading of current production data at any PC in the network „order tracking“.



Communication systems go beyond company borders

Nowadays status signals are being sent over company borders e.g. to report plant malfunctions to the maintenance service



The new FluidLab PA process Menu 6 „IoT“ shows, archives and sends reports via e-mail.

- Report „refill Tank“ via level sensor
- Start the filling process via mouse click
- In case there is no flow rate measured for example, fault message and proposal for troubleshooting:
Piping tight? Water in the suction line of pump? Flow rate sensor okay?
- Emergency stop button pressed!

The „Customer“ is notified about the production state

Aktuell in Produktion

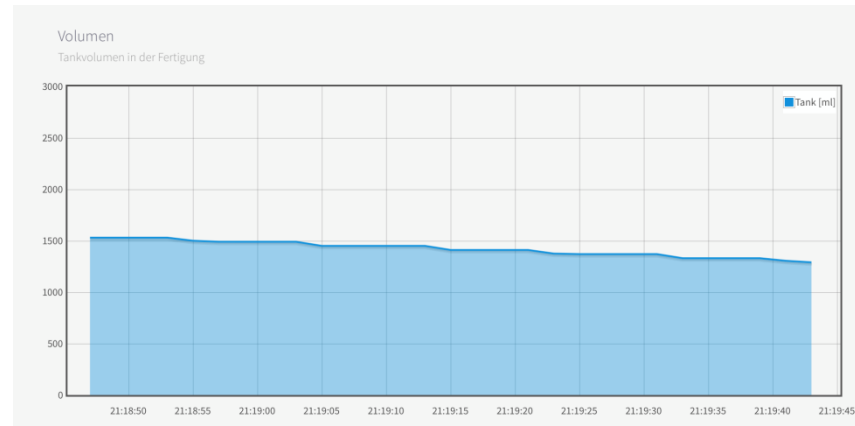
#	Zeitstempel	Typ	Meldung	Quittieren
12	2017-02-08 21:21:39	2 Edukit	08.02.2017 21:21:41 [09332] Notaus betätigt! Produktion wurde gestoppt!	QUITTIEREN

Sensor reorders filling of the Tank at the supplier

Imagine, the tank fill level in a factory is monitored by a sensor. It is then an obvious step to use this signal to place an order at the supplier, or at least announce it.

Such scenarios has become real already. And with the EduKit PA this can become a learning experience.

The lower Tank with pump becomes the supplier, the piping is the transport line and the rest belongs to the bottling plant.



Information technology seamless to the production plant

Due to expanding IT-networking of business processes staff with interdisciplinary insight becomes increasingly important. The IoT Kit offers an operable complete solution of networked processes in table-top size. The use of open source software and the disclosure of many source data allow doing it yourself.

The essential IT-Subsystems:

- Raspberry Pi incl. Wireless LAN, LAMP-Software bundle: Linux Raspian / Apache Webserver / MySQL Database / php-Server, each with EduKit PA IoT-Application code
- FluidLab PA process, LabVIEW Runtime, ODBC (MySQL Connector), ActiveX Driver for the Easy-Port, all Windows based.

phpMyAdmin

Server: localhost » Datenbank: adiro » Tabelle: products

Anzeigen Struktur SQL Suche Einfügen Exportieren Importieren

Zeige Datensätze 0 - 1 (2 insgesamt, Die Abfrage dauerte 0.0011 Sekunden.)

SELECT * FROM `products`

Alles anzeigen Anzahl der Datensätze: 25 Zeilen filtern: Diese Tabelle durchsuche Nach Sch

+ Optionen

	id	name	height [mm]	width [mm]	volume [ml]	price [€]
<input type="checkbox"/> Bearbeiten <input type="checkbox"/> Kopieren <input type="checkbox"/> Löschen	1	Behälter groß	50	25	50	2,20
<input type="checkbox"/> Bearbeiten <input type="checkbox"/> Kopieren <input type="checkbox"/> Löschen	2	Behälter klein	30	25	30	1,70

Alle auswählen markierte: Bearbeiten Kopieren Löschen Exportieren

Alles anzeigen Anzahl der Datensätze: 25 Zeilen filtern: Diese Tabelle durchsuche Nach Sch

id	state	customer_id	product_id	volume_id	content_id	amount	produced	product nam	volume [ml]	content	aufdr
10	production	4	1	2	1	10	0	Behälter groß	10	Wasser	Er
9	finished	4	2	3	2	2	2	Behälter klein	15	Apfelsaft	

Meldungen Fehler Warnung

A playground for Project ideas!

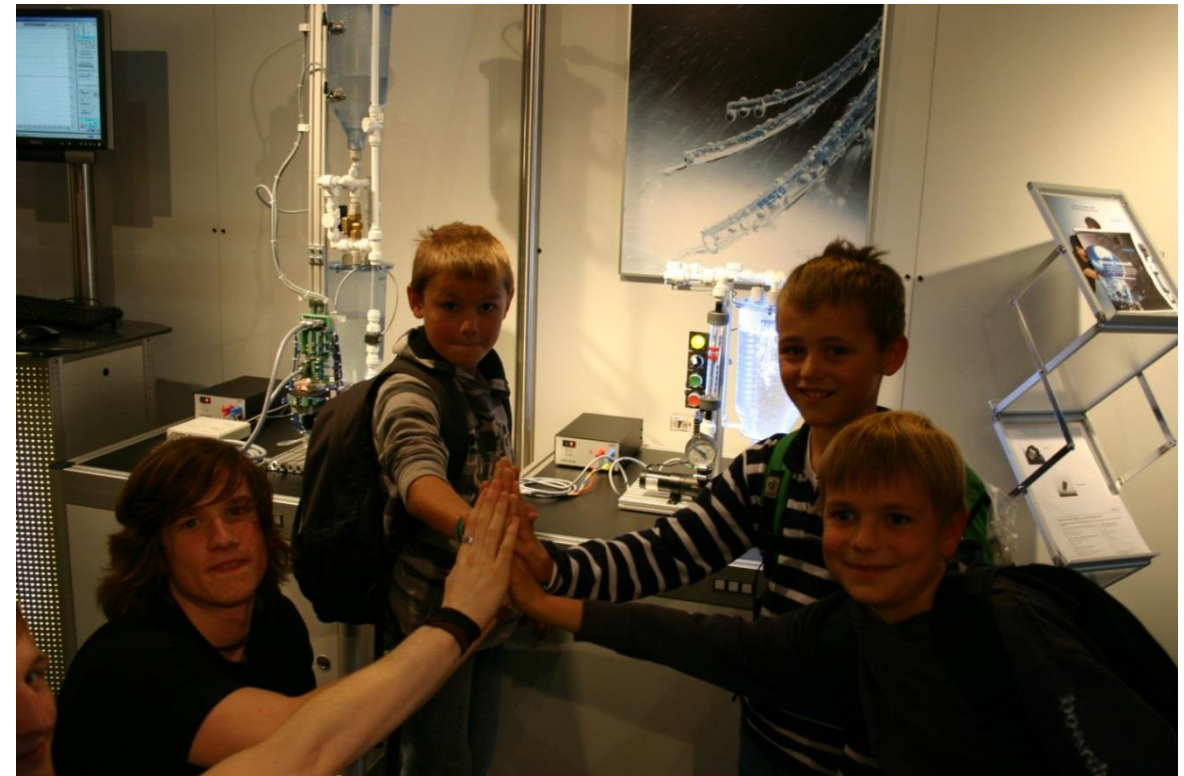
Introduce your learners to a self-contained activity:
Inform – Plan – Decide – Perform – Examine – Grade.

- How to reduce filling time per bottle?
- How to control filling level automatically?
- Which statistical filling amount results?
- How to save energy and resources?
- Which functions have the provided program codes?
- How do they interact?
- Programming tools for programming own code: LabView, Excel, C++, Visual Basic, MATLAB, convertible to PLC by Festo, Siemens and many more.



Your benefit

- Mechatronic plant construction as practice model in table-top size, usable in every classroom, easy modifiable
- The Menu navigation of FluidLab® PA process is the main thread for trainers and learners
- Software contains simulation for virtual commissioning
- „Cloud“-Functions independent of network, comprehensible at a single student-PC
- Water as demonstrative process medium, symbolizes i.e. juice
- Scope of delivery is characterized by software for information technology education
- Commissioning and Training of Teachers on site upon request.



Possible uses MPS PA and EDS Water Management Stations....



MPS PA Compact Workstation

EduKit PA



EDS WMGT
Water supply



MPS PA Bottling



IoT-Kit
Supplementary sets



Thank you for your attention!

You can obtain further information from:

Competence Center Processautomation
Adiro Automatisierungstechnik GmbH
Limburgstr. 40
73734 Esslingen

info@adiro.com

Tel. 0711-919904-0

Oder www.festo-didactic.de

Tel. 0800-5600967

Automation - Robotic - Training



www.adiro.com

Kompetenz schafft Vertrauen

www.adiro.com

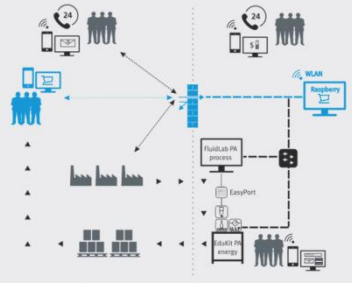
www.youtube.com/user/adirocom

www.google.com/+adirocom

Customer View- ...

Edukit goes I4.0 - Kunde

Sprache



Shop Login Adresse Übersicht


Produktauswahl

Behälter groß (2,20 €)

Wasser (0,10 €/ml)

40ml

Produktvorschau



Bestellhistorie

Datum	Status
2017-02-02 16:58:33	finished
2017-02-02 16:53:57	production
2017-02-02 16:53:55	ready
2017-01-31 12:27:33	order in

Auftrag

Bitte wählen Sie einen Behälter

#	Produkt	Preis	Anzahl	Gesamt
1	Behälter klein	1,70	13	22,10
2	Wasser 20ml	0,10	200	20,00
3			Zwischensumme	48,10
4			Versand	0,00
5			Gesamt	48,10

61_Web_Standalone_Simulation.vi

Werker

Anlage

09.02.2017 15:48

Report-Settings

id	state	customer_id	product_id	volume_id	content_id	amount	produced	product name	volume [ml]	content	aufdruck	energy
10	production	4	1	2	1	10	0	Behälter groß	10	Wasser	Er	0
9	finished	4	2	3	2	2	2	Behälter klein	15	Apfelsaft		493

Meldungen

09.02.2017 15:48:56

[09332] Not-Aus Taster wurde betätigt

Hilfe zu Fehler [09332]:

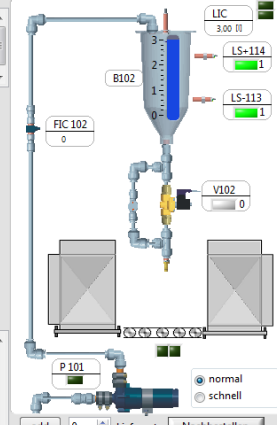
Beseitigen Sie den Fehler, entriegeln Sie den Not-Aus Taster und quittieren Sie die Störung

Meldung - Quittieren

Running

Produktion start

Anlage_Ein



Order information:

order_id

10

product

Behälter groß


volumeOrder

amountOrder

produced

0

Produktvorschau



Protokoll: Meldungen

09.02.2017 15:48:56

[09332] Not-Aus Taster wurde betätigt

Hilfe zu Fehler [09332]:

Beseitigen Sie den Fehler, entriegeln Sie den Not-Aus Taster und quittieren Sie die Störung

add

0

Lieferant:

Nachbestellen

Database – Overview contracts

Detail view - Contract

Kunde

company

Adres

first_name

last_name

Thomas

Schwab

sex

address

Limburgstraße 40

zip

73734

country

Esslingen

email

phone

Bestellung

product

Behälter klein

volume

30

content

Apfelsaft

amount

2

price/peace

0,15

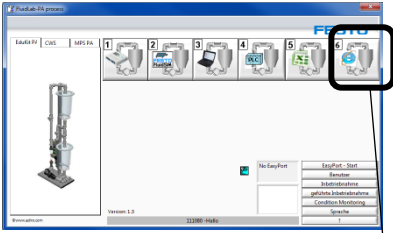
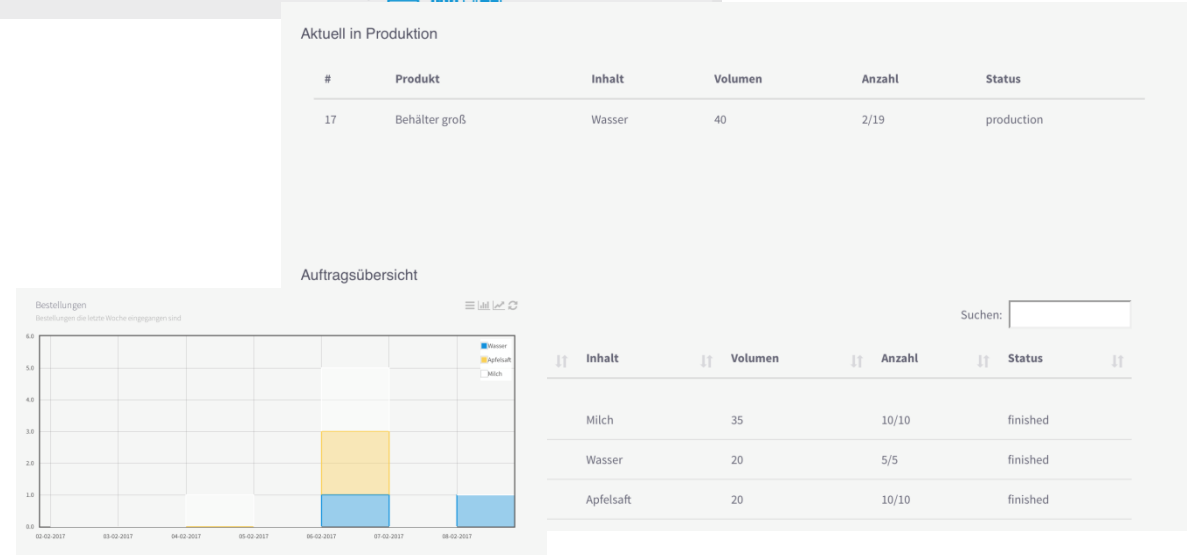
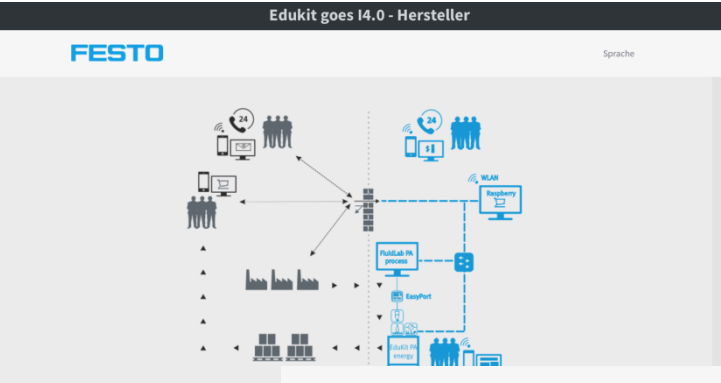
price_sum

9,00

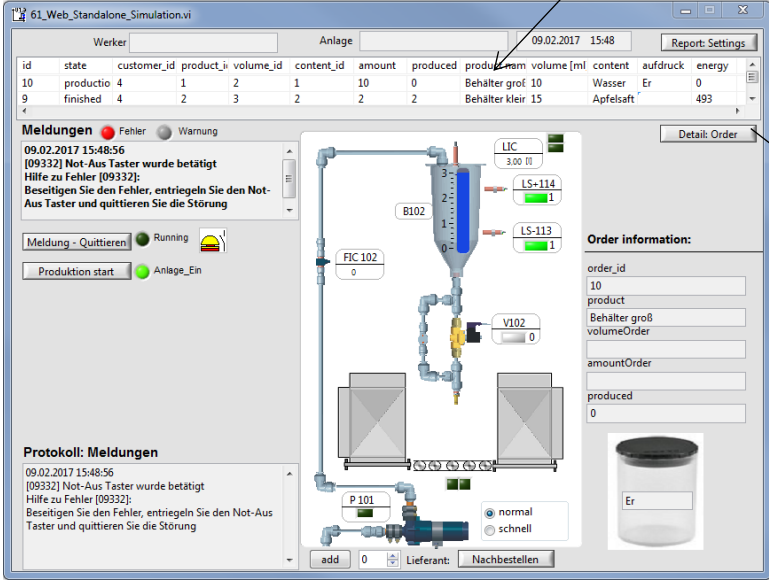
refresh

id	time	order_id	state
44	31.01.2017 18:15:40	9	finished
43	31.01.2017 18:10:46	9	production
42	31.01.2017 18:10:44	9	production
41	31.01.2017 18:10:42	9	ready
40	31.01.2017 18:10:40	9	ready
39	31.01.2017 18:07:48	9	order in

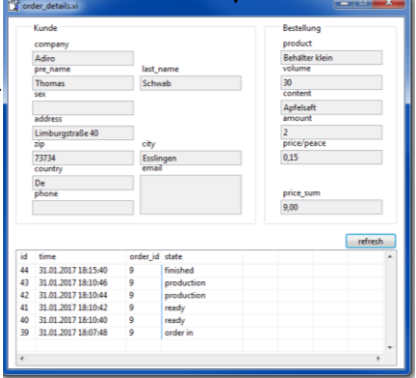
Manufacturer View - ...



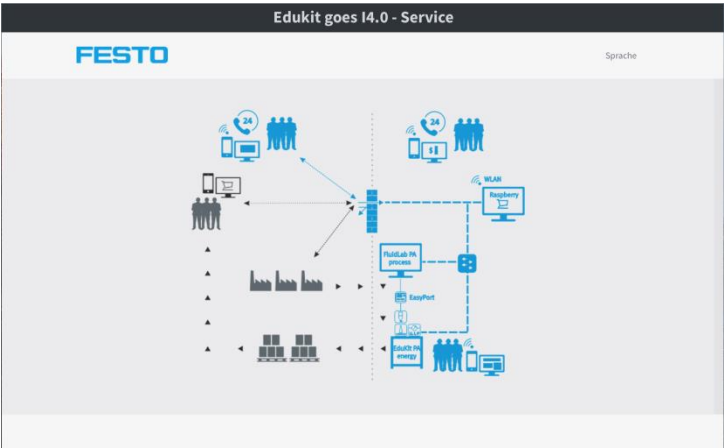
Database – Overview contracts



Detail view - Contract



Service View - ...

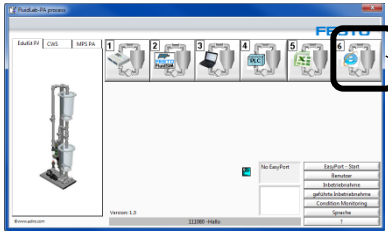


Aktuell in Produktion

#	Zeitstempel	Typ	Meldung	Quittieren
12	2017-02-08 21:21:39	2 Edukit	08.02.2017 21:21:41 [09332] Notaus betätigt! Produktion wurde gestoppt!	QUITTIEREN

Meldungen Historie

#	Zeitstempel	Typ	Meldung	Quittiert?
12	2017-02-08 21:21:54	2 Edukit	08.02.2017 21:21:41 [09332] Notaus betätigt! Produktion wurde gestoppt!	0 Service
11	2017-02-08 21:21:35	2 Edukit	08.02.2017 21:20:05 [09332] Notaus betätigt! Produktion wurde gestoppt!	0 Service



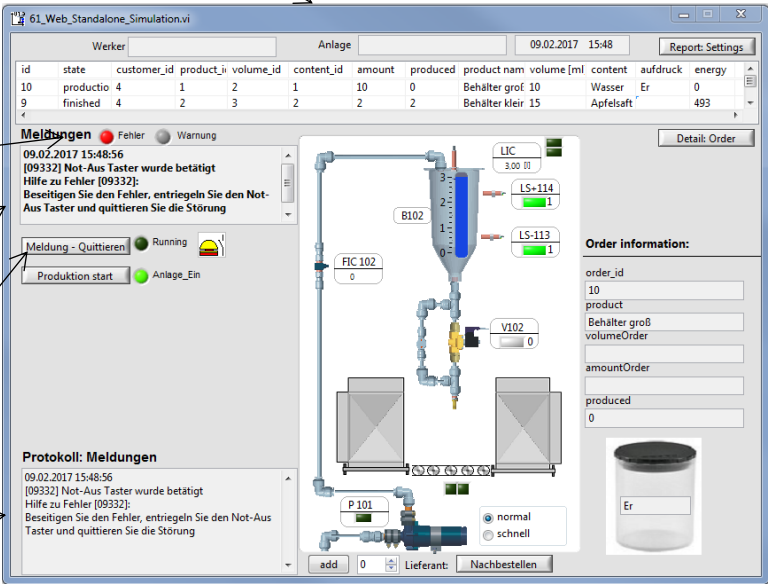
Optical status display

Report with solution proposal

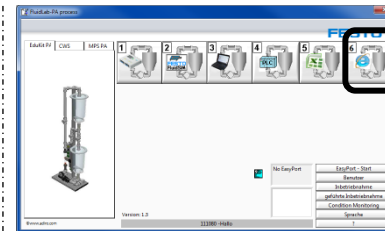
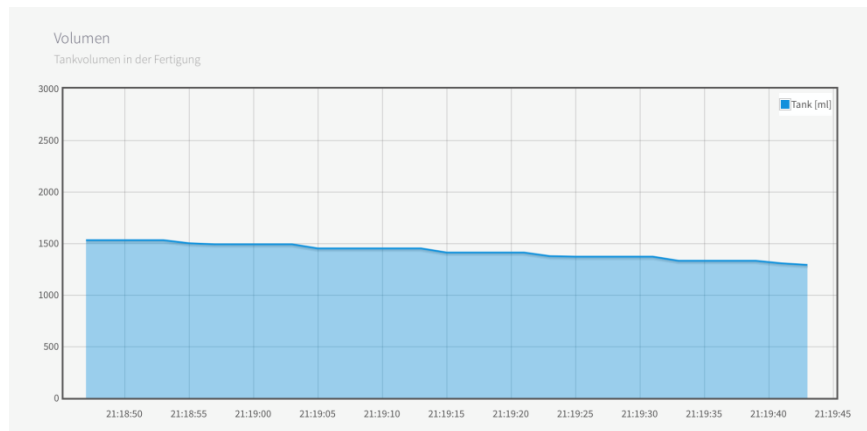
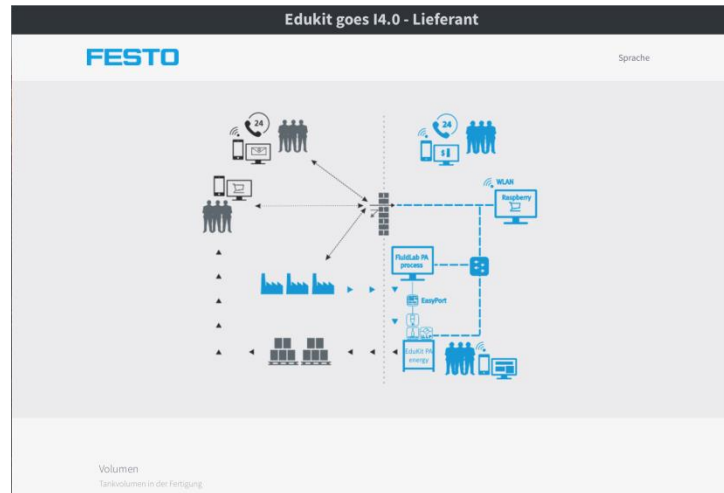
Acknowledge message

Message log

Acknowledge via remote access



Supplier View - ...



61_Web_Standalone_Simulation.vi

09.02.2017 15:48

id	state	customer_id	product_id	volume_id	content_id	amount	produced	product name	volume [ml]	content	aufdruck	energy
10	production	4	1	2	1	10	0	Behälter groß	10	Wasser	Er	0
9	finished	4	2	3	2	2	2	Behälter klein	15	Apfelsaft	Er	493

Meldungen Fehler Warnung

09.02.2017 15:48:56
[09332] Not-Aus Taster wurde betätigt
Hilfe zu Fehler [09332]:
Beseitigen Sie den Fehler, entriegeln Sie den Not-Aus Taster und quittieren Sie die Störung

Meldung - Quittieren Running

Produktion start Anlage_Ein

Protokoll: Meldungen

09.02.2017 15:48:56
[09332] Not-Aus Taster wurde betätigt
Hilfe zu Fehler [09332]:
Beseitigen Sie den Fehler, entriegeln Sie den Not-Aus Taster und quittieren Sie die Störung

Order information:

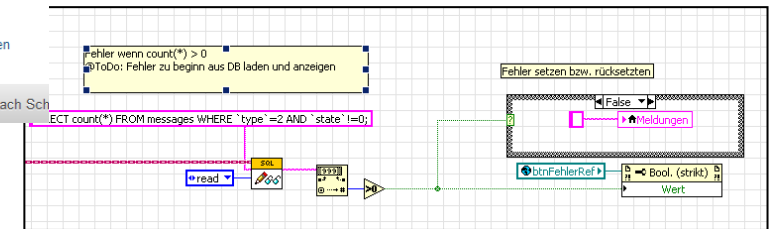
order_id: 10
product: Behälter groß
volumeOrder: 10
amountOrder: 10
produced: 0

Trigger reorder

IT – View - ... What's behind all this ...

```
function getAll() {
    $query = "
        SELECT *
        FROM products
    ";
    return $this->mysqli->read($query);
}

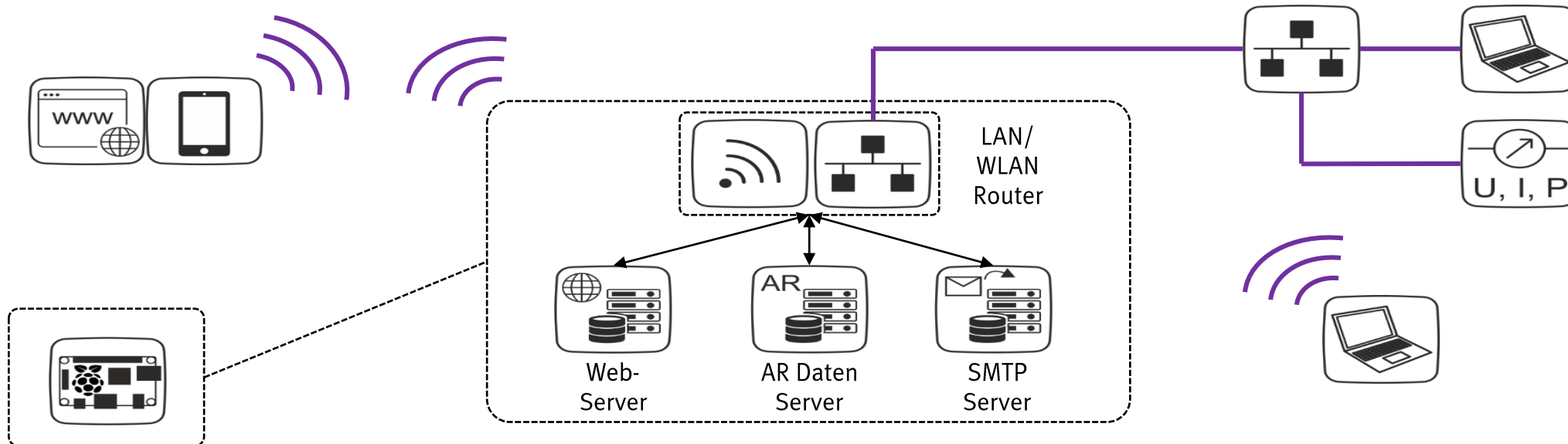
function getById($id) {
    $query = "
        SELECT *
        FROM products
        WHERE id = ".$id."
    ";
    $retVal = $this->mysqli->read($query);
    return $retVal[0];
}
```



id	state	customer_id	product_id	volume_id	content_id	amount	produced	product name	volume [ml]	content	aufdruck
10	productio	4	1	2	1	10	0	Behälter groß	50	Wasser	Er
9	finished	4	2	3	2	2	2	Behälter klein	30	Apfelsaft	

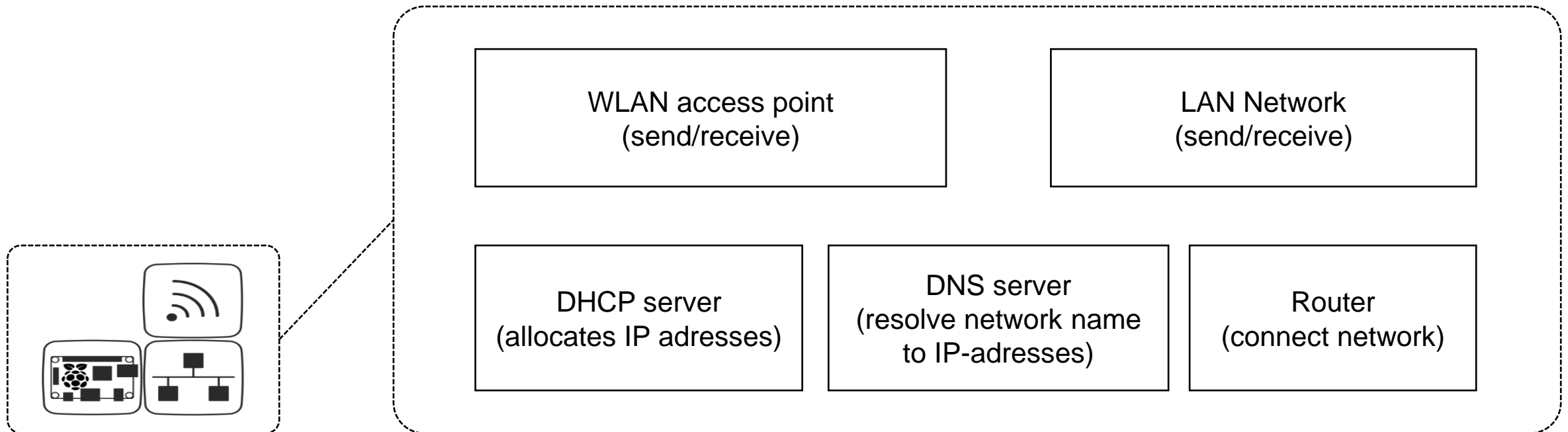
IoT-Kit: Raspberry Pi

Raspberry Pi (RPI) is a single board computer with a WLAN Router. On the RPI we implement an Apache Webserver including Database. Further we use it as a database for Augmented Reality App and SMTP Server.



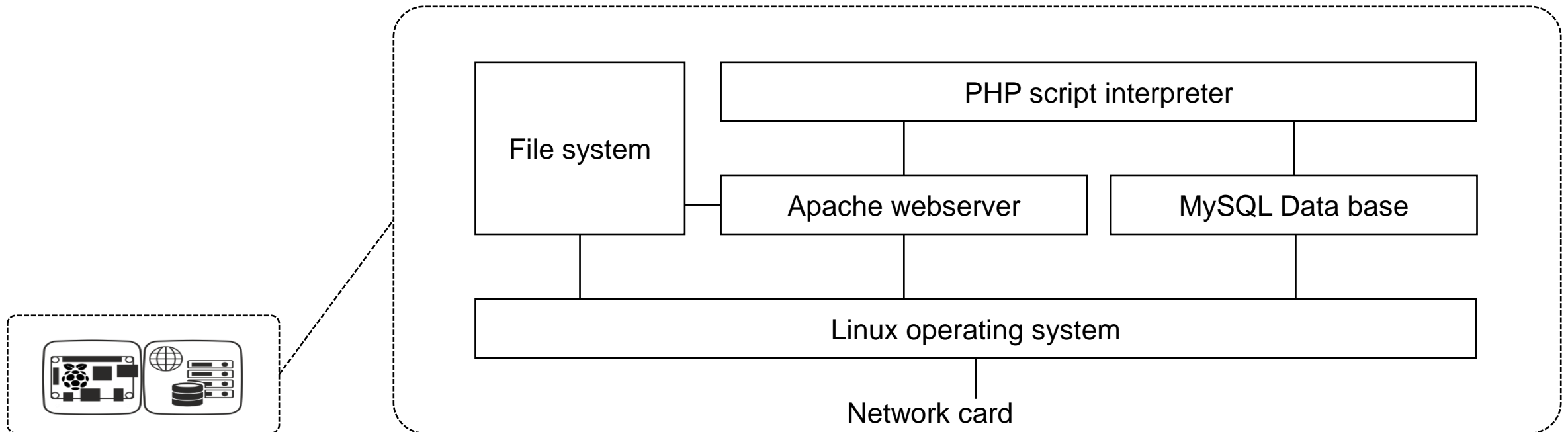
IoT-Kit: Raspberry Pi: WLAN Router

WLAN-Router provides WLAN-Clients over integrated access point with an own IP-configuration. Based on DHCP- and DNS-server.



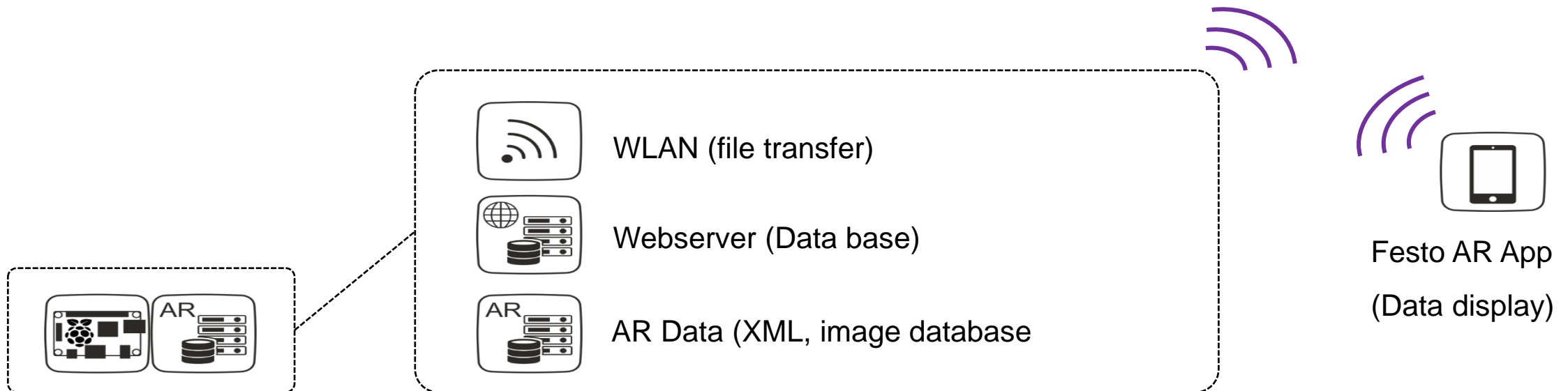
IoT-Kit: Raspberry Pi: Webserver

Programm mix, named LAMP (Linux Apache MySQL PHP) Raspberry Pi becomes a webserver. LAMP is a programming basis for dynamic websides and applications.



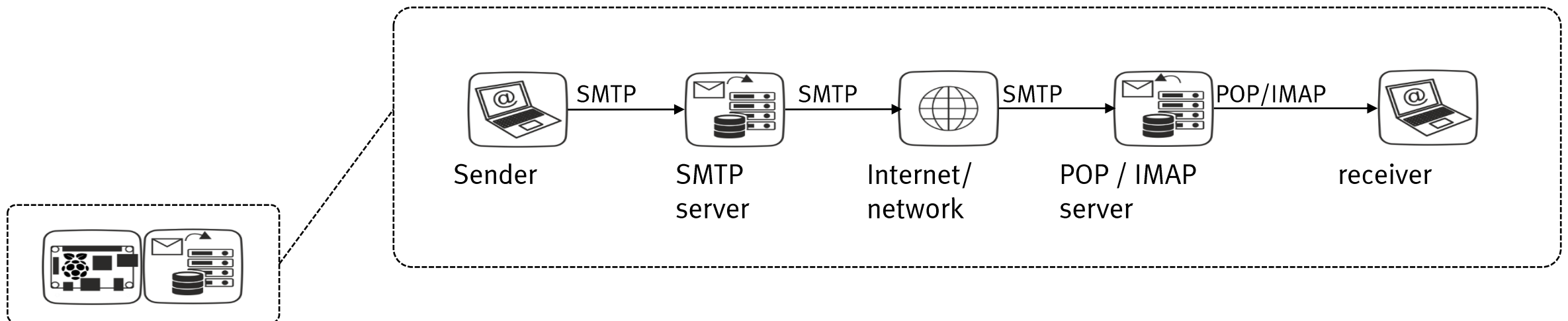
IoT-Kit: Raspberry Pi: AR data server

Augmented Reality (AR) is a computer based information system to complete human view. Festo Didactic AR App provides this for iOS and Android. Data are stored on Raspberry Pi.



IoT-Kit: Raspberry Pi: SMTP Server

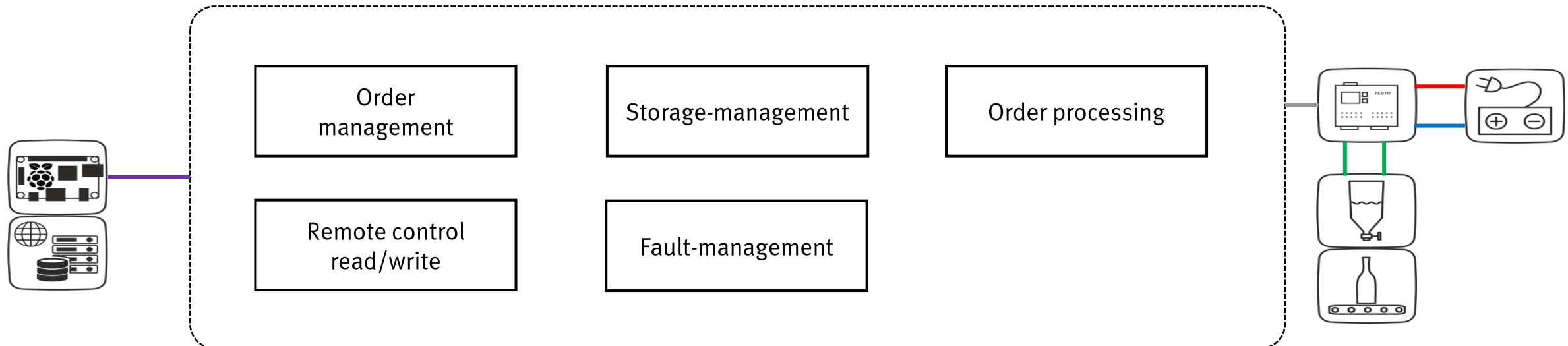
SMTP (Simple Mail Transfer Protocol) is a protokoll for data exchange of email to network. SMTP Protocol is used for sending email. For receiving mail POP3 or IMAP are usual.



IoT-Kit: FluidLab PA process, menu 6

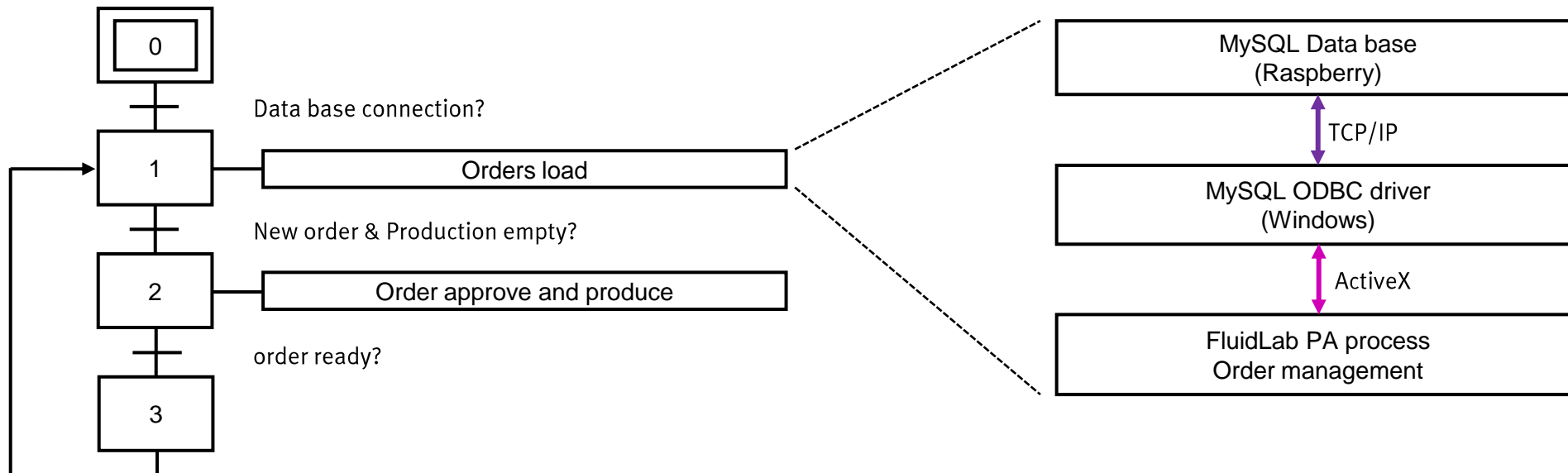
Windows based PC, Software FluidLab PA process, EasyPort are control units for EduKit PA , MPS PA oder EDS Water Management practice models (plant system). Cyclic retrieve order from data base.

FluidLab PA process – Menu 6



IoT-Kit: FluidLab PA process: order management

Cyclic retrieve order from data base. Orders are processed one after the other.

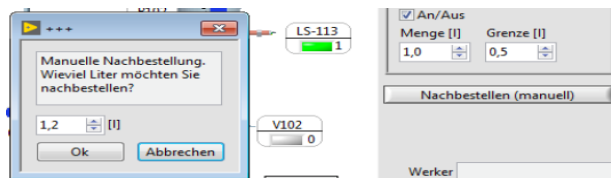


IoT-Kit: FluidLab PA process: Storage management

3 different possibilities to fill up the storage (level upper tank)

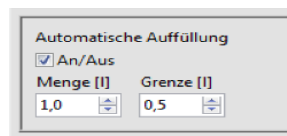
1. Manuell reorder

The operator has the opportunity to fill the level of the upper tank manually. By clicking on the button "reorder" a desired amount can be specified. It is important to ensure that the max. Level is not exceeded. Otherwise it will not be filled up.



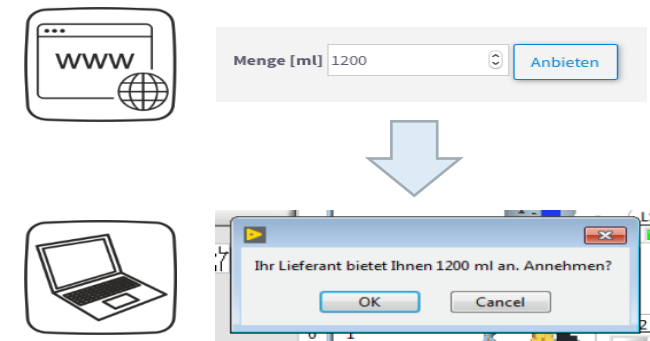
2. Automatic reorder

If automatic filling is activated, the desired "quantity" will be filled up automatically when falling below the "limit". This allows the manufacturer to rely on the fact that there is always enough liquid for its production in the tank.

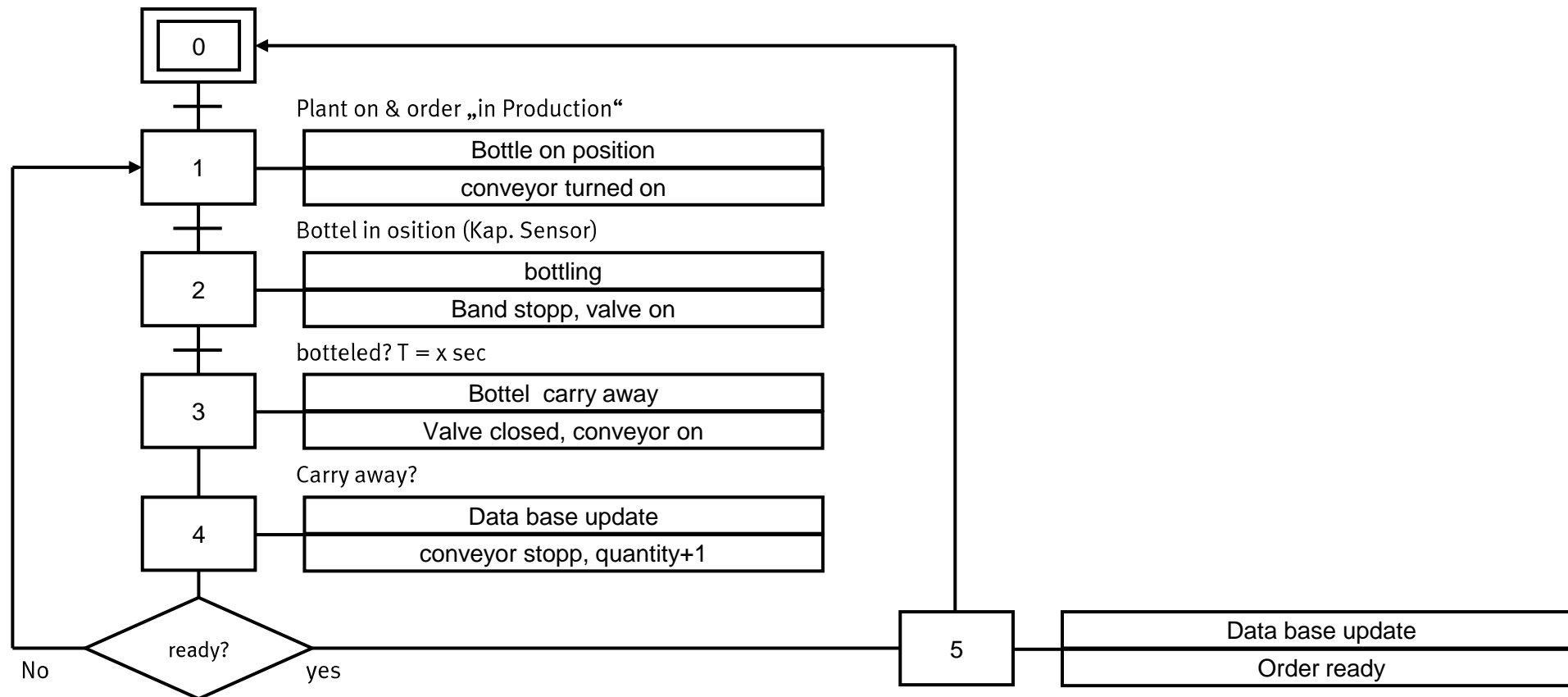


3. Reorder through deliverer

The supplier can send offers to the manufacturer. If the manufacturer accepts the offer, the offered quantity will be filled up.



IoT-Kit: FluidLab PA process: order processing

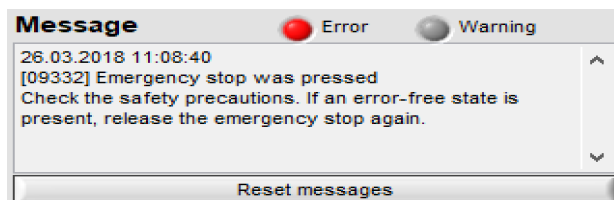


IoT-Kit: FluidLab PA process: Error / Fault management

2 Examples

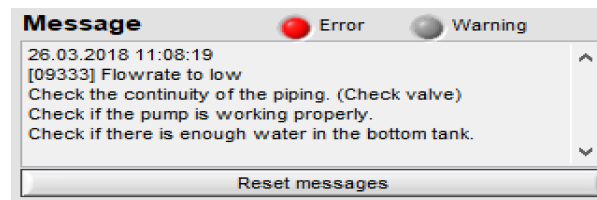
1. Pushed emergency stopp

The operator presses the emergency stop button in menu 6. production stops. Only after releasing the emergency stop button, the error can be acknowledged and production continues.



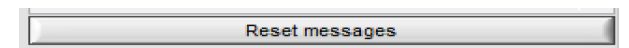
2. No flow

If the pump is active and no (or less than 0.2 l / min) flow is measured for 2 seconds, for example, the fault will be triggered.



3. Acknowledge fault via remote

A message can be acknowledged by using 2 different variants. 1. In the menu directly via reset button or 2. on the IoT Kit website in the service menu



Error messages				
#	Timestamp	Type	Message	Acknowledge
4	2018-03-23 11:12:21	2 Edukit	23.03.2018 11:12:21 [09333] Durchfluss zu gering	QUITTIEREN