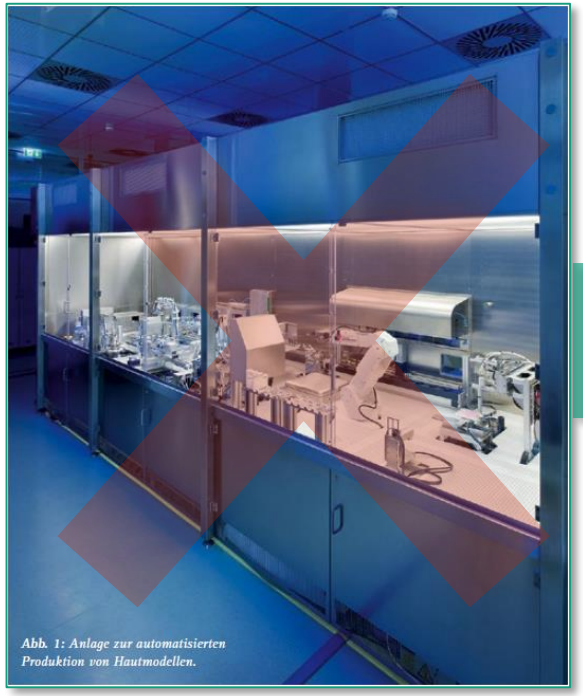
MOBILE LAB ROBOT (KEVIN)

Laboratory automation thought differently

- Motivation
- How it works
- How to set up a lab process
- Our offer to you



Fraunhofer IPA

mobile lab-robot - KEVIN – „alone in the lab…“

Motivation

Tasks and problem definition

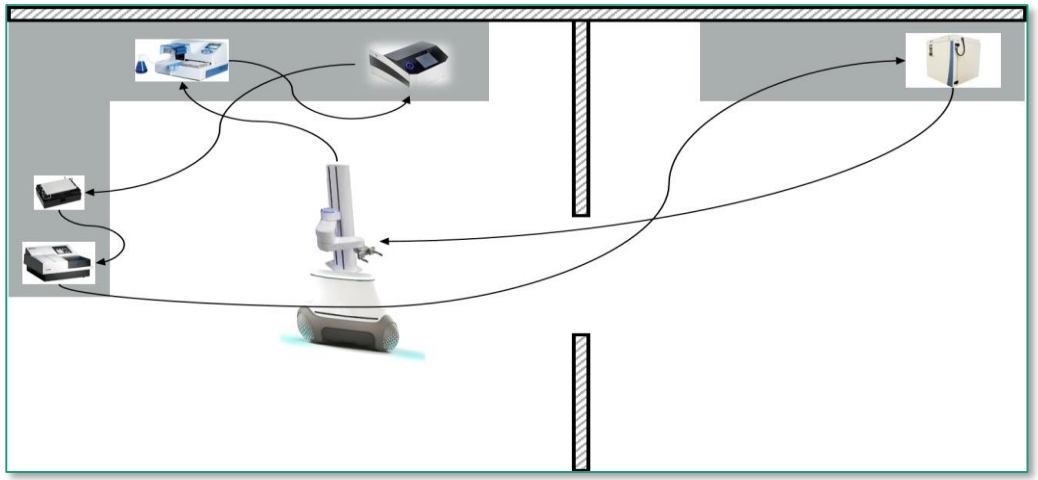
- Many laboratory processes (eg cell cultures) run 24/7 - but staff is often only "nine-to-five" - in order to be able to supervise these processes 24/7, quality assurance has to be done from time to time (in microtiter plates or tubes) sometimes automatically running devices (incubator, reader, media supply, ...) are transported in the laboratory

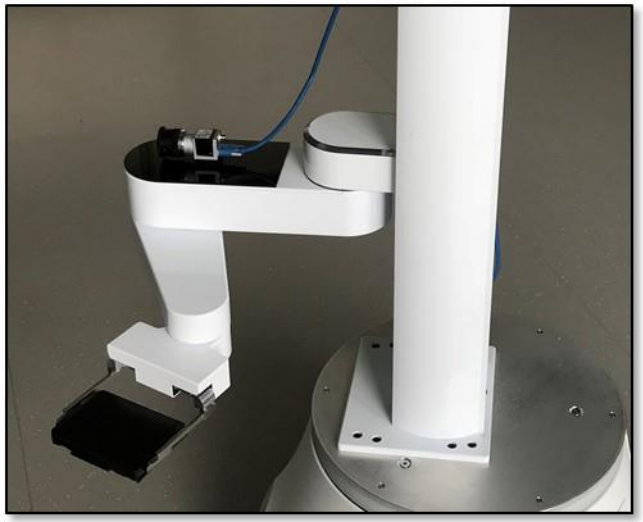
Objective

- Autonomous robot transports consumables between different workstations
- Full automation in the laboratory WITHOUT new investment & device binding in "single-purpose bound" systems

Result

- By image processing (camera on robotic arm), using the Care-O-bot4 base and a robot arm (Precise), it is possible that microplates can be picked up and deposited without any alteration of the device positions





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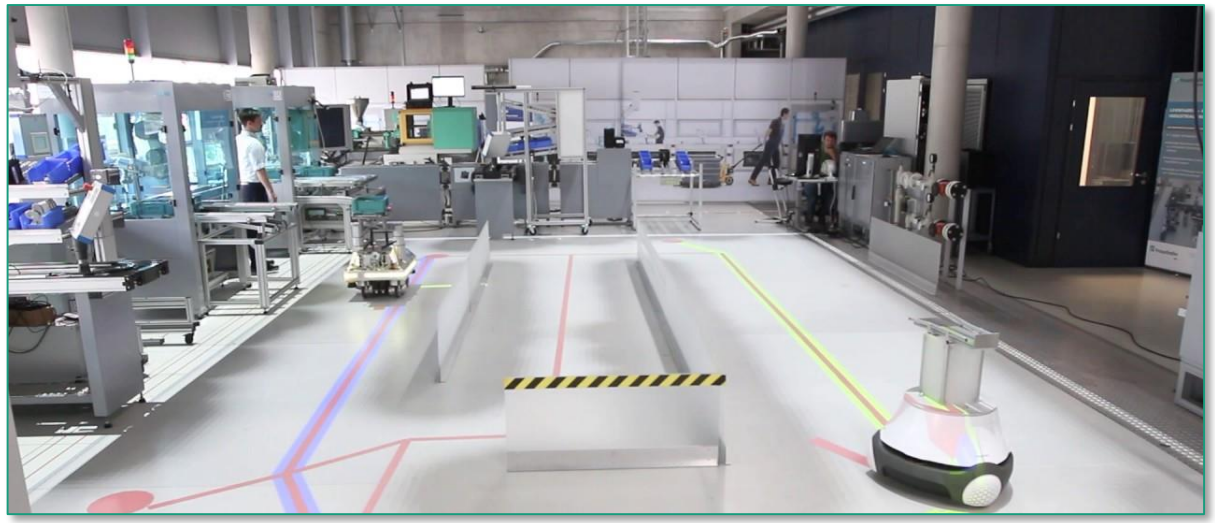
How it works I - mobile base

The mobile base

The unique navigation technology from our Fraunhofer IPA spin-off Mojin-robotics (https://mojin-robotics.de/en/) makes sure that Care-O-bot® 4 base is capable at all times of moving safely and effortlessly from A to B, including in complex environments. Care-O-bot® 4 can negotiate even moving obstacles with supreme ease thanks to the “elastic bands” method. Its high-performance sensors are capable of reliably detecting the entire movement space. This makes it possible, for example, for Care-O-bot® 4 to promptly detect and easily avoid any pallets on the ground or any objects protruding from the storage rack.



Omnidirectional base

Dimensions (L/W/H)	72/72/33 cm
Weight	42 kg
Power Supply	Li-Ion battery48 V External charger 48V@10A Internal levels 48V, 24V, 19V
Communication	Gigabit Ethernet Dual-channel router with DDWRT (2,4GHz+5GHz) Low-level: CANOpen
Computing	1x Intel NUC i5, 256GB, 8GB RAM
Interface	7” touchscreen, power button, break-release, USB port, LAN port
Max Speed	1,1m/s
Lighting	RGB-LEDs in wheel-caps

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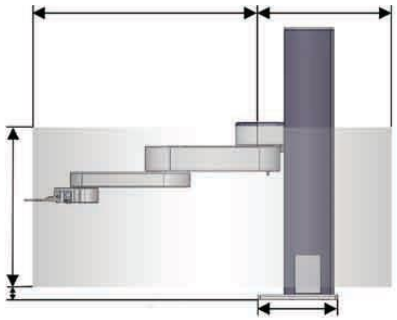
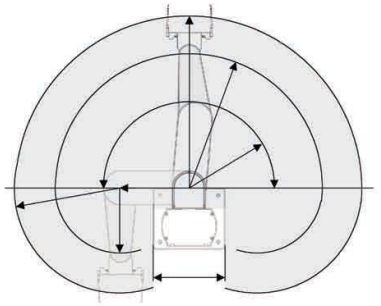
How it works II – robotic arm

The robotic arm

- The PreciseFlex 400/300 are autosamplers developed specifically for benchtop applications. They have been adopted by nearly all of the major life science/laboratory automation integrators.
- The PF400/300 sample handlers include safety features that disable motor power when a minimal, unexpected force is encountered, thus **allowing these robots to operate without safety shields** in benchtop applications. Even at full speed, their inherently safe design limits forces to meet ISO collaborative robot standards, making these mechanisms safe to use even with people or delicate equipment inside the active cell.
- In combination with the mobile base, almost all common laboratory devices that are placed on a laboratory bench or in a system can be operated.
- Many successful tests have already been carried out with the PF400, which is why KEVIN is preferred with this arm. On request, however, an alternative arm can also be used.





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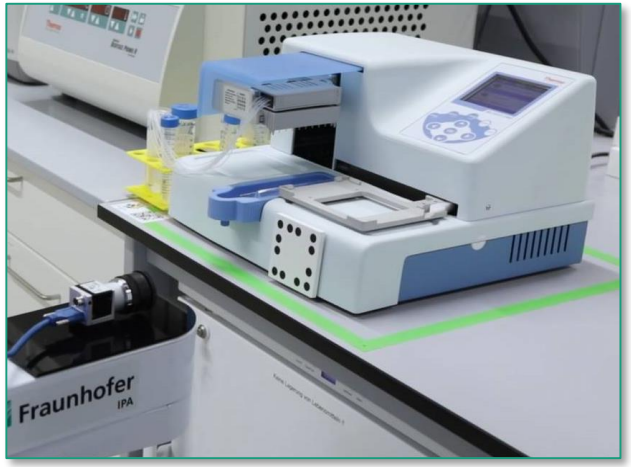
How it works III – picture recognition

Picture recognition

- In order to precisely load and unload disposables such as microtiter plates, falcon tubes, petri dishes or cell culture bottles, the target position must be known exactly. Since the base can only position accurately from about 2-3cm, the arm corrects this error via image processing.
- Each device or position ,which is to be integrated into the automated process, is provided with an optical marker. For each marker, the offset between marker and target position in x, y, z and omega is taught once (very easy with the PF400).



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How it works IV – Safety

Robotic arm

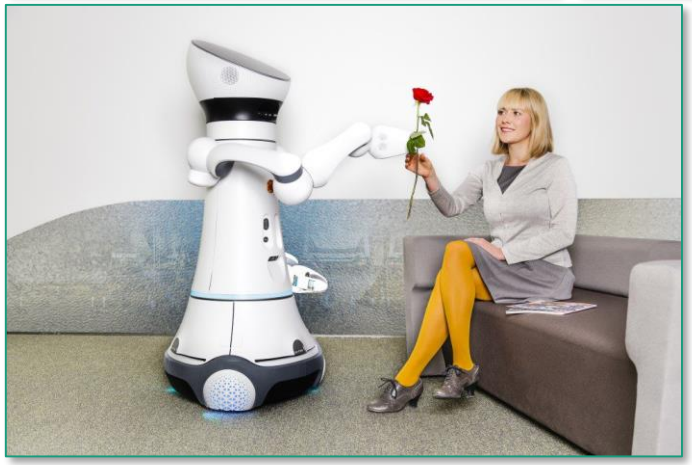
- The PF400 meets ISO collaborative robot standards making these mechanisms safe to use even with people or delicate equipment.

Mobile base

- The mobile base is already in use in many application scenarios in Germany and is designed for direct use with humans. The corresponding risk assessment was carried out successfully.

Combination → Kevin

- Since both units (base and arm) are suitable for working with humans, risk assessment / risk minimization is very easy. It will never be both units "in operation" simultaneously. When the robot drives, the arm is "parked" and only if the base has pulled all the brakes, then the arm is allowed to work.



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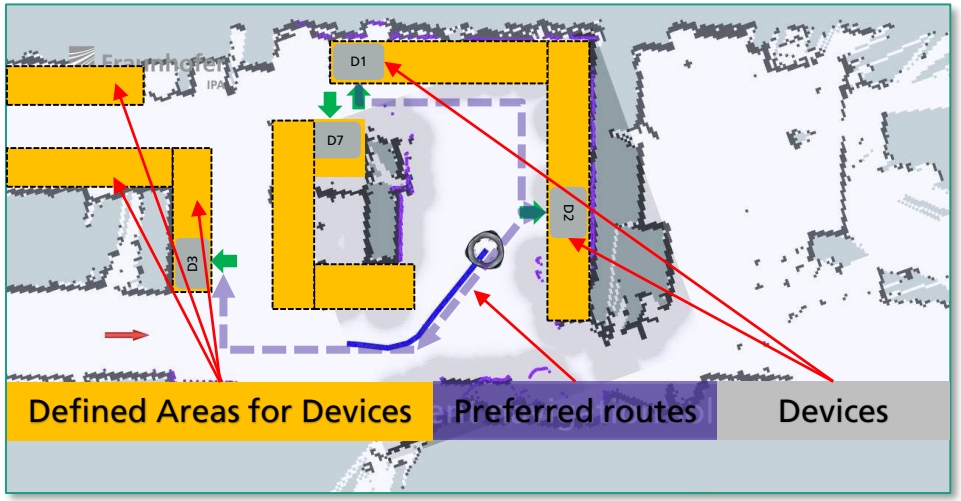
How to set up a lab process

1. **Prepare Devices**
   - Connect devices to a network
   - Attach markers (tags) on the device and teach "plate positions" with KEVIN software
2. **Prepare Room/Lab**
   - Application specialists from IPA allow KEVIN to drive through the lab for about 1-1.5 hours → laser scanner generates an interpretable image for KEVIN. (see picture)
   - In the KEVIN software, you can define the areas in which Kevin is allowed to drive and areas where devices could be placed (benches, tables, automation islands, …). In addition, you can specify preferred routes for KEVIN, which he only leaves when obstacles appear.
3. **Process control software (Scheduler or LIMS)**
   - KEVIN can be operated with different scheduling software. After selecting the one most suitable for you, the process can be set up. The KEVIN software, which runs on the onboard computer, knows the positions of the devices (coarse position and height) and knows from which side it has to start. The exact position is calculated by the image processing algorithm.



Source: www.equicon.de

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Our offer to you as an End-User

We are searching for first movers!!

- We provide you with:
  - The KEVIN mobile platform
  - The scheduling software you prefer (or we recommend one)
  - A turnkey system (teaching of your lab environment, integration of your lab devices to make them „automatable“, 1-10 example processes implemented and a training, so that you can automate your processes by yourself)
  - Full service & maintenance bundle
- Your part:
  - Let`s write an application note
  - Experience an exciting process with Kevin‘s support

Depends on: setup robot, size of lab, # of devices, scheluling SW, …

Fraunhofer IPA

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