SMART AUTOMATION TRACK

We automate lab processes and build a Biohackspace

[APPLY UNTIL 30.8.]

Friday 9.9. to Sunday 11.9

Munich, Free Flixbus Travel Europe

www.techfestmunich.com

AstraZeneca unternehmertum — Center for Innovation and Business Creation at TUM SynBio.INFO — discover Synthetic Biology together Bioflux

cc open source hardware

Mission Smart Automation Track

Precision Medicine and Genomic Revolution are driving the need to identify safe, specific drug molecules dramatically faster than we have in the past to meet the growing demands of health care in society today. However, our ability to tackle many of the world's most pressing diseases is limited by our ability to rapidly discover new drugs. Despite significant advances in automation and miniaturisation drug molecules are still synthesized in laboratories that would be recognisable to chemists of one hundred years ago. Most working steps are done manually, compounds are made on multi-milligram scale, and the overall throughput per scientists is limited.

We aspire to completely transform the iterative design, synthesis and screening of molecules by applying modern automation, machine learning, and miniaturisation techniques to drug discovery activities such as chemistry and biology.

There are significant technical challenges involved; particularly managing a large diverse array of reagents some of which are sensitive. Automation methods such as pipetting robots and microfluidics integrate multiple reaction steps and replicating the manual dexterity and on-the-fly problem solving.

What are we looking for: transformational ideas and technologies which could be used or developed to allow fully automated multistep synthesis. Ideas to store and access reagents in different physical forms and consistencies, machine learning and error handling applied to synthetic chemistry.

We build the lab where milk and honey flows

The SMART AUTOMATION TRACK brings to you our special chemical guests:
HONEY, MILK, FLOUR, WATER, SALT, OIL and SOAP

Your challenge is to automatically move, separate, mix, measure and control them.

Timeline

This is our timeline for making the Smart Automation Track happen and coordinating it throughout the event. It is not yet final and evolves with the input from UnternehmerTUM.

Thursday 8th september and the days prior

Arrival and material preparation for hackathon, team meeting, setting up the machines.

Friday 9th september

07.00 - 08.30	Opening and Registration
09.00 - 09.30	Introduction Techfest by UnternehmerTUM
09.30 - 10.00	5 Min Quick Presentation by AstraZeneca on the Track
10.00 - 11.00	Challenge Opening AstraZeneca - Group 1
11.00 - 12.00	Challenge Opening AstraZeneca - Group 2
12.00 - 13.00	TechTalks by Silver Partners
13.00 - 14.00	Lunch
14.00 - 15.00	TechTalks by Silver Partners
15:00 - 18:00	Start TEAM WORK
	- Presentation of available materials and tools
	- Problem Definition Workshop (Slides)
18:00 - 19:00	First idea pitches & Team formation
19:00 - 20:00	Dinner
20:00 - 22:00	TEAM WORK
22:00 - 23:59	Project Work with Beers

Saturday 10th september

00:00 - 23:59	Project Work

Sunday 11th september

00:00 - 12:00	Project Work and Tech Setup Testing
At 12:00	Deadline for project upload
13:00 - 14:00	Clean-up and room setup for semi-finals with participants
	Jury meets and confirms the 11 project pitches per room
	Finalists on screens
14:00 - 17:30	Tech Slam Pitches
17:30 - 18:00	Top 3 Awards
18:00 - 22:00	Dinner and afterparty

Lab Automation

If you automate, you first think about automating the hands of a person - but the hardest part is to automate the eyes that see and parts of the brain that thinks. Lets use the labrobots as

hands, the sensors as eyes and arduinos, lego mindstorms and our laptops as brains and automate everything one could do in a lab! Click the link below to add your first ideas:
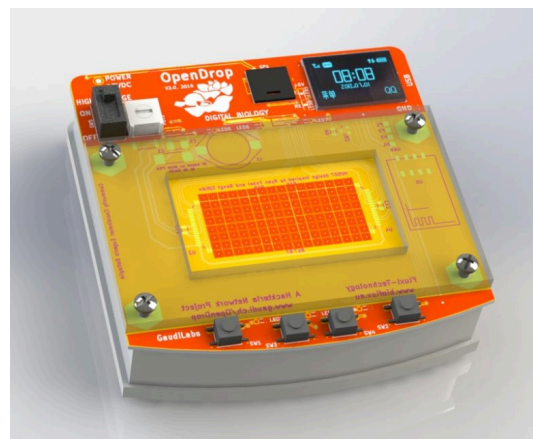
[ADD YOUR IDEAS]

Microfluidics Automation

To successfully automate the Digital Biology technology, BioFlux develops the personal laboratory—a platform that will automate biological and chemical experimental flow with great medical and commercial potential. The personal laboratory from Bioflux will be a combination of a software suite for biologists to plan experiments, a microfluidic device coupled with sensor technology and the required wetware in a disposable cartridge (reagents) to perform a wide range of standardized bioassays and chemical reactions.

In our vision, a digital laboratory should be:
- fully integrated, running all the tasks on the same machine
- easy to use, with a web-based software for design of new experiments
- be linked to publically available data
- general-purpose, allowing easy reconfiguration and design of new experiments
- cheap, offering open-source and do-it-yourself assembly kits

www.bioflux.eu and send specific questions to trojok@bioflux.eu

Macrohandling Automation

The Opentron is a liquid handling robot that is fully customizable. The Co-Founder of the New York based startup will join the TechFest and together, we will automate the liquid and solid handling of diverse materials.

- Website of Opentrons
- Open Protocol Community
- SDK for programming the robot
- TechCrunch on Opentrons

Macrofluidics Laboratory

The descriptions will also be printed out and attached to the different devices so that novices can find their way around. The pictures are the actual devices we've ordered on Amazon.

Incubator

An **incubator** is a device used to grow and maintain microbiological cultures or cell cultures. It keeps a temperature stable in the range between 5 and 60°C.

Centrifuge
(up to 6000rpm)

A **centrifuge** is a piece of equipment that puts an object in rotation around a fixed axis (spins it in a circle), applying a potentially strong force perpendicular to the axis of spin (outward). The centrifuge works using the sedimentation principle, where the centripetal acceleration causes denser substances and particles to move outward in the radial direction. At the same time, objects that are less dense are displaced and move to the center. In a laboratory centrifuge that uses sample tubes, the radial acceleration causes denser particles to settle to the bottom of the tube, while low-density substances rise to the top.

micro Scale

A **scale** that weighs substances with 100 milligram precision up to 2kg

Pipette 1 - 1000 µl

A **pipette** (sometimes spelled pipet) is a laboratory tool commonly used in chemistry, biology and medicine to transport a measured volume of liquid, often as a media dispenser. Pipettes come in several designs for various purposes with differing levels of accuracy and precision, from single piece glass pipettes to more complex adjustable or electronic pipettes. Many pipette types work by creating a partial vacuum above the liquid-holding chamber and selectively releasing this vacuum to draw up and dispense liquid. Measurement accuracy varies greatly depending on the style.

Sonicator

Sonication is the act of applying sound energy to agitate particles in a sample, for various purposes. Ultrasonic frequencies (>20 kHz) are usually used, leading to the process also being known as ultrasonication or ultra-sonication. In the laboratory, it is usually applied using an *ultrasonic bath* or an *ultrasonic probe*, colloquially known as a *sonicator*.

UV-light

UV curing is a speed curing process in which high intensity ultraviolet light is used to create a photochemical reaction that instantly cures inks, adhesives and coatings. UV Curing is adaptable to printing, coating, decorating, stereolithography and assembling of a variety of products and materials owing to some of its key attributes, it is: a low temperature process, a high speed process, and a solventless process—cure is by polymerization rather than by evaporation. Originally introduced in the 1960s this technology has streamlined and increased automation in many industries in the manufacturing sector.

Autoclave

An **autoclave** is a pressure chamber used to carry out industrial processes requiring elevated temperature and pressure different from ambient air pressure. Autoclaves are used in medical applications to perform sterilization and in the chemical industry to cure coatings and vulcanize rubber and for hydrothermal synthesis. They are also used in industrial applications, specially regarding composites, see autoclave (industrial).

Magnetic stirrer

A **magnetic stirrer** or magnetic mixer is a laboratory device that employs a rotating magnetic field to cause a stir bar(also called "flea") immersed in a liquid to spin very quickly, thus stirring it. The rotating field may be created either by a rotating magnet or a set of stationary electromagnets, placed beneath the vessel with the liquid. Magnetic stirrers are often used in chemistry and biology, where they can be used inside hermetically closed vessels or systems, without the need for complicated rotary seals.

Heatplate

A **hot plate** is a portable self-contained tabletop small appliance that features one, two or more electric heating elements or gas burners. A hot plate can be used as a stand alone appliance, but is often used as a substitute for one of the burners from anoven range or a kitchen stove.

A **bunsen burner**, named after Robert Bunsen, is a common piece of laboratory equipment that produces a single open gas flame, which is used for heating, sterilization, and combustion.

The gas can be natural gas (which is mainly methane) or a liquefied petroleum gas, such as propane, butane, or a mixture of both.

Bunsen burner

A **kitchen sink** is the essential place for hacking chemistry. Chemistry hacking is the pursuit of chemistry as a private hobby. Also called DIY chemistry, it is usually done with whatever chemicals are available at disposal at the privacy of one's home. It should not be confused with clandestine chemistry, which involves the illicit production of controlled drugs. Notable amateur chemists include Oliver Sacks and Sir Edward Elgar.
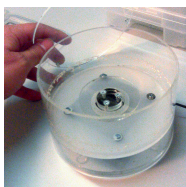
Kitchen sink

A **microwave oven** is a kitchen appliance that heats and cooks by exposing it to microwave radiation in the electromagnetic spectrum. This induces polar molecules in the food to rotate and produce thermal energy in a process known as dielectric heating. Microwave ovens heat quickly and efficiently because excitation is fairly uniform in the outer 25–38 mm (1–1.5 inches) of a homogeneous, high water content item; it is more evenly heated throughout (except in heterogeneous, dense objects) than generally occurs in other cooking techniques.

Microwave & Oven

A **peristaltic pump** is a type of positive displacement pump used for pumping a variety of fluids. The fluid is contained within a flexible tube fitted inside a circular pump casing (though linear peristaltic pumps have been made). A rotor with a number of "rollers", "shoes", "wipers", or "lobes" attached to the external circumference of the rotor compresses the flexible tube. As the rotor turns, the part of the tube under compression is pinched closed (or "occludes") thus forcing the fluid to be pumped to move through the tube.

Peristaltic pump

Spin coating is a procedure used to deposit uniform thin films to flat substrates. Usually a small amount of coating material is applied on the center of the substrate, which is either spinning at low speed or not spinning at all.

Spin Coater

Sensor Automation

With the sensors, we aim at automating the eyes, nose, ears and skin of a scientist.

Essentim Sensors

Essentim is a measurement device, a multi-parameter sensor especially designed for cell culture labs. It's easily attached to any standard cell culture dish by just pressing it gently onto the surface, immediately providing you with data directly from your point of interest. The scope sensor measures temperatur, humidity, pressure, illumination and different motion events.

ArduCAM

ArduCAM now released a ESP8266 based Arduino board for ArduCAM mini camera modules while keeping the same form of factors and pinout as the standard Arduino UNO R3 board. The high light this ESP8266 board is that it well mates with ArduCAM mini 2MP and 5MP camera modules, supports Lithium battery power supply and recharging and with build in SD card slot. It can be an ideal solution for home security and IoT camera applications.

5MP Mini Kamera

ArduCAM-M-5MP is optimized version of ArduCAM shield Rev.C, and is a high definition 5MP SPI camera, which reduce the complexity of the camera control interface. It integrates 5MP CMOS image sensor OV5642, and provides miniature size, as well as the easy to use hardware interface and open source code library. The ArduCAM mini can be used in any platforms like Arduino, Raspberry Pi, Maple, Chipkit, Beaglebone black, as long as they have SPI and I2C interface and can be well mated with standard Arduino boards. ArduCAM mini not only offers the capability to add a camera interface which doesn't have in some low cost microcontrollers, but also provides the capability to add multiple cameras to a single microcontroller.

Pressure and Temperature Sensor

Der BME280 ist einer der neuesten Luftfeuchtigkeits-, Druck- und Temperatursensoren von Bosch mit einem digitalen I2C bzw. SPI Interface.
Auf dem Breakout befinden sich ein Spannungsregler und ein Pegelwandler für die I2C/SPI Schnittstelle, daher kann der Sensor von 3V - 5,5V betrieben werden.

Digital Light Sensor

This module is based on the I2C light-to-digital converter TSL2561 to transform light intensity to a digital signal. Different from traditional analog light sensor, as Grove - Light Sensor, this digital module features a selectable light spectrum range due to its dual light sensitive diodes: infrared and full spectrum.

You can switch between three detection modes to take your readings. They are infrared mode, full spectrum and human visible mode. When running under the human visible mode, this sensor will give you readings just close to your eye feelings.

NeoPixel Ring

16 ultra bright smart LED NeoPixels are arranged in a circle with 1.75" (44.5mm) outer diameter. The rings are 'chainable' - connect the output pin of one to the input pin of another. Use only one microcontroller pin to control as many as you can chain together! Each LED is addressable as the driver chip is inside the LED. Each one has ~18mA constant current drive so the color will be very consistent even if the voltage varies, and no external choke resistors are required making the design slim. Power the whole thing with 5VDC (4-7V works) and you're ready to rock.
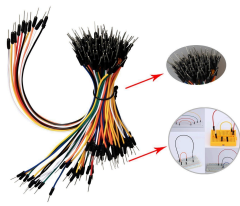
There is a single data line with a very timing-specific protocol. Since the protocol is very sensitive to timing, it requires a real-time microconroller such as an AVR, Arduino, PIC, mbed, etc. It cannot be used with a Linux-based microcomputer or interpreted microcontroller such as the netduino or Basic Stamp. Our wonderfully-written Neopixel library for Arduino supports these pixels! As it requires hand-tuned assembly it is only for AVR cores but others may have ported this chip driver code so please google around. An 8MHz or faster processor is required.

NeoPixel Shield for Arduino - 40 RGB LED

Put on your sunglasses before putting this shield onto your 'duino - 40 eye-blistering RGB LEDs adorn the NeoPixel shield for a blast of configurable color. Arranged in a 5x8 matrix, each pixel is individually addressable. Only one pin (Digital #6) is required to control all the LEDs. You can cut a trace and use nearly any other pin if you need some customization.

To make it easy to start, the LEDs are powered from the 5v onboard Arduino supply. As long as you aren't lighting up all the pixels full power white that should be fine. You can also solder in the included terminal block (pro-tip: put it on the bottom of the board so it doesn't stick up) to attach an external 4-6VDC power supply. There's a polarity protection FET on there in case you wire the power backwards (we would never do that, it was, umm, a friend of ours, yeah that's it!)

Breadboard Jumper Wires

Material- pure copper wire,PVC,Good conductivity,can be used repeatedly
About Quality - Some customers told us that the head of the cables is easy to fall off,so we improve it.Now,it's hard to drop the head of the wire,Unless you want to prove that you are as strong as the Popeye the Sailor man
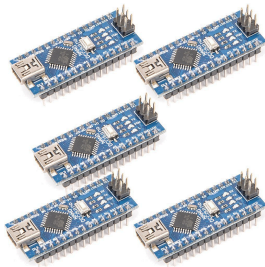Flexible jumper wires for solderless breadboard
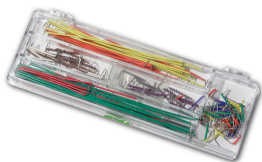
Aukru 433 MHz RF wireless transmitter + receiver

These modules are used for projects when you need to communicate wirelessly between 2 devices. It is possible to increase the range by adding a small length of cable which the device will use as an aerial.

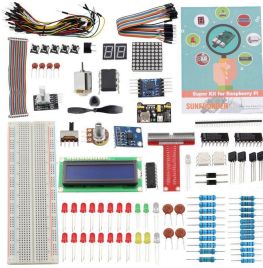- 1 x Transmitter module (433MHz)
- 1 x Receiver module(433Mhz)

5V 16M Mikrocontroller-Brett für Arduino

Jumpers set 140-piece

Sunfounder Project Super Starter Kit for Raspberry Pi

11 Beispielprojekte speziell für die Anfänger, die sich für Raspberry Pi interessieren. Mit scharfen Breadboard Bildern und ausführlicher schematischer Darstellung. Lieferumfang:

1. 1 * RGB Led
2. 40 * Pin Header
3. 1 * Timer 555
4. 2 * Optokoppler (4N35)
5. 2 * 74HC595(Schieberegister)
6. 1 * H-Brücke L293D
7. 1 * ADXL345（Beschleunigungssensor）
8. 1 * Drehgeber
9. 5 * Druckschalter
10. 8 * Widerstand (220Ω)
11. 8 * Widerstand (1KΩ)
12. 4 * Widerstand (10KΩ)
13. 4 * Widerstand (100KΩ)
14. 1 * Widerstand (1MΩ)
15. 1 * Widerstand (5.2MΩ)
16. 1 * Schalter
17. 1 * Potentiometer 50K
18. 1 * Power Supply Modul
19. 1 * LCD1602
20. 1 * Punktmatrix Display(8*8)
21. 2 * 7-Segment-Display
22. 1 * DC motor
23. 16 * Led(rot)
24. 2 * Led(weiß)
25. 2 * Led(grün)
26. 2 * Led(gelb)
27. 2 * Transistor(PNP)
28. 2 * Transistor(NPN)
29. 4 * Keramikkondensator 100nF
30. 4 * Keramikkondensator 10nF
31. 4 * Diodengleichrichter
32. 1 * Breadboard
33. 20 * Dupont Wire male to female
34. 65 * Jumper Wire male to male
35. 1 * Aktiver Buzzer
36. 1 * Propeller

37. 1 * 40-Pin GPIO Extension Board
38. 1 * Sortierbox

We are currently collecting the perfect sensors and will add them here as soon as we've ordered them.

Makerspace

We have access to the all areas besides the metal and woodshop. But if there is a big need for a metal part, we will find a way. Here is a tour around the makerspace: http://www.navvis.com/iv.maker-space-new/

Virtual Reality Automation Control

Virtual Reality and Augmented Reality are both very powerful computer interface and ideal for explaining, understanding and soon even constructing complex structures of any kind. Through the UnternehmerTUM we have access to a HTC Vive and an Oculus Rift and plan to set both up next to the Smart Automation Lab to primary inspire the participants.

We don't plan that anyone will develop with it, we just want to show these programs:
- Lab Education Tutorials, e.g. for HPLC
- Molecules in Augmented Reality - PDF
- Experiments in Chemistry Lab
- Travelling the body

Infoscreen System

We will also set up a newspread Infoscreen system at the Techfest and use one screen to display videos and information for our track.

- Inner life of a cell
- AstraZeneca
  - The new UK Cambridge site: https://vimeo.com/118802850
  - A high throughput screening lab: https://vimeo.com/118802843
  - Advancing the science of cancer diagnosis: https://vimeo.com/118802831
  - DNA damage response: https://vimeo.com/167081359
  - AstraZeneca's iMed Biotech Unit: https://www.youtube.com/watch?v=KqWpEPqzjL4
  - Science recruitment: https://www.youtube.com/watch?v=DrLMNERXA-Q
- Chemistry and around:
  - Research in Synthetic Organic Chemistry https://www.youtube.com/watch?v=LG7ZzMNBqcA

- ○ EFMC Videoclip competition – Why Medicinal Chemistry?
  https://www.youtube.com/watch?v=1zFq8cTnBXY
- ● Virtual reality:
  - ○ Hololens for jet engine engineering
    https://www.youtube.com/watch?v=EXTvB02sw7g
  - ○ Molecular modelling: https://www.youtube.com/watch?v=k3pWdPrMe_g

Lab Material Smart Automation Track

Further Materials we've ordered on Amazon - Descriptions and Links