Fachhochschule Nordwestschweiz
Hochschule für Life Sciences

wet PONG

SMAS Swiss Mechatronic Art Society
SSAM Société Suisse d'Art Méchatronique
SGMK Schweizerische Gesellschaft für Mechatronische Kunst
www.mechatronicart.ch

a creativity approach to project based learning in microfluidics

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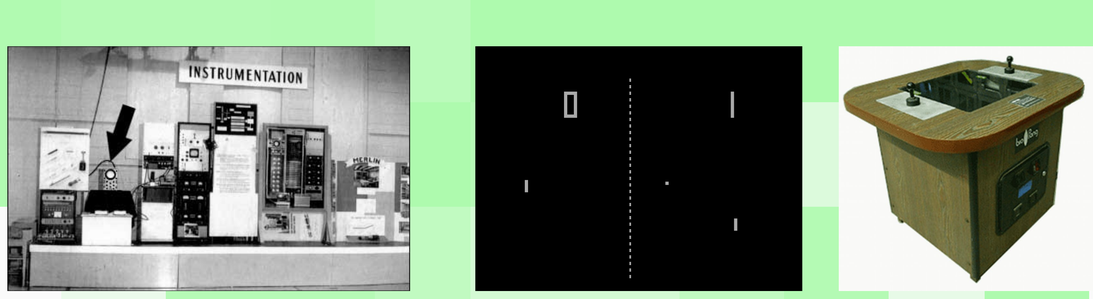
Introduction

The field of micro- and nanosystems in life sciences is inherently highly interdisciplinary. Successful products and research findings can only be achieved when this transdisciplinary collaboration is learned and taught on-the-job and at all levels of education.
This poster introduces a creativity approach to project based learning (PBL) [1,2] in microfluidics using a game concept, inspired by computer games, and the use of open-source software and hardware. It is currently ongoing during a semester course for the bachelor in life science technologies at the University of Applied Science Northwestern Switzerland (FHNW) and the preliminary project developments are presented by the students themselves.



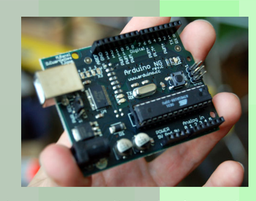
History of computer games from the National Labs to the Arts. A) Tennis for Two, maybe the first computer game ever. Developed by the American physicist William Higinbotham at the Brookhaven National Laboratory in 1958. B) The most famous and very successful video game "PONG" by Atari Inc., 1972, which has led to many clones and further inspirations, such as C) BioPong, a media art project by ZugZwangZukunft developed in 2006. The exhibit uses the design of a classic arcade game, with mechanically controlled pedals to steer the two players, but instead of a ball/pixel a green paper-pixel was attached to the back of a living cockroach, which they termed as an "organic algorithm".

DIY microfluidics

Some examples in the field of microfluidics have been recently published, which describe straightforward means to fabricate and control simple microfluidic systems and can easily be ported into a classroom environment [3,4].
In this project we are using swebcams to serve as microscopes. To create the microfluidic device, we have been testing etched copper-circuitboards and simple photolithography on the bench.

Open-source software and hardware

To facilitate collaboration and student interaction, various open-source software and hardware tools have been used in the project. This enables the students to work on their own using their own laptops and operating systems without bothering about proprietary instrumentation software. And additionally, share what they have learned and use the wide knowledge and instructions on the www, which has already been published by network intelligence and open communities [5,6].

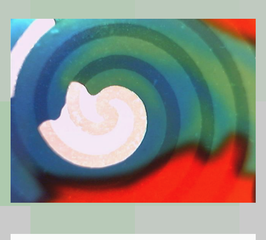


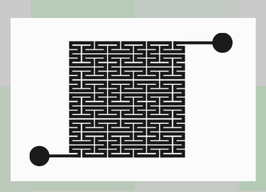
A) MediaWiki allows the web-based documentation of the project and facilitates collaboration. The Project is openly accessible on the lecture's website [6]. B) For the design of the microfluidic system Inkscape has been used, a free and cross-platform vector graphics editor. C) Puredata (pd), a free real-time graphical dataflow programming environment, has been used both for image analysis and hardware control. D) Arduino.cc, is an open-source electronics prototyping platform based on flexible, easy-to-use hardware and software and served as programmable microcontroller and I/O board interfacing with pd.

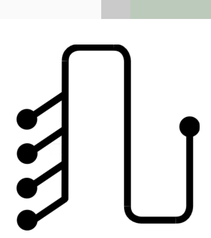
MasterMind

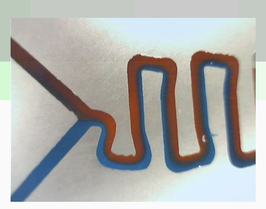
Fabienne Amacher, Gregor Imboden, Daniel Pasku

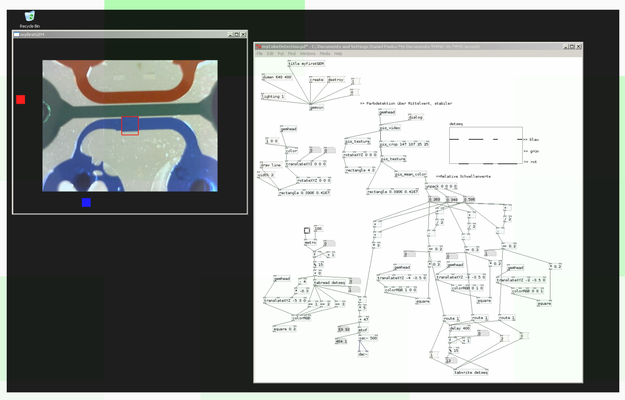
Our idea is to develop a micro-fluidic version of the game Mastermind. The player has to insert colored blocks into a laminar flow and a webcam based video analysis detects these blocks and checks their sequence.







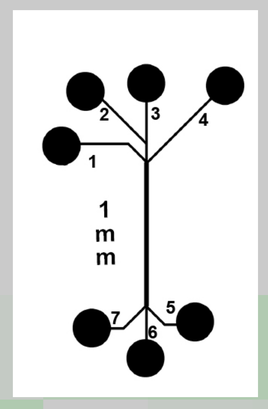


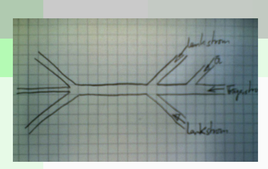


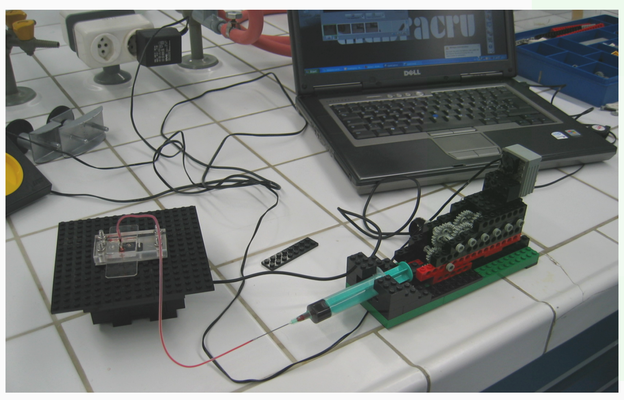
Flow-ers

Corinne Keller, Matthias Näf, Benjamin Wyss

In our opinion, the most fascinating effect in micro-fluidic is the laminarflow. So we developped a microfluidic-game which is based on laminarflow.
The Target of the game is to channel drops in one of the output canals(5,6,7). LEDs displays in which canal the drops have to channel trough. With flows (1,4) on both side of the maincanal(3) it is possible to control the mainflow. Trough dropcanal(2) we inject drops into the maincanal.



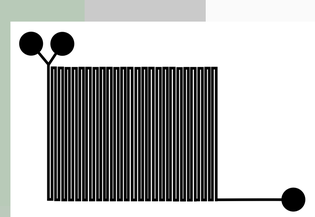




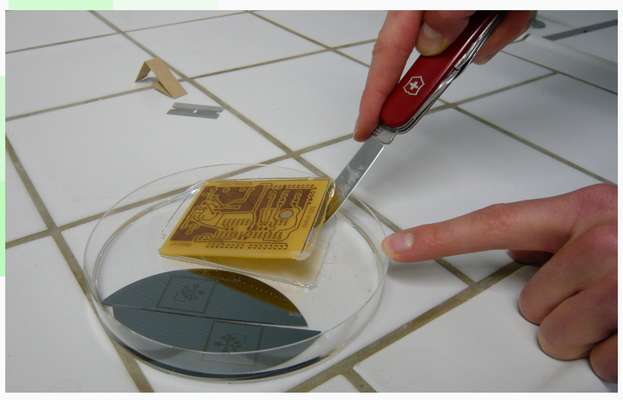
micro_bin|Screen

Boris Budesa, Niki Chantziaras, Fabian Fässler, Robert Uehlinger

Our aim is to construct a microfluidic display by stringing together black and white pixels of fluid in several rows on a snake like grid.



This technique will allow us to produce binary pictures as follows. A digital image is divided into squares. Each square is assigned either a one or a zero, depending on the value of its brightness. These binary values are put together to a string which fits the snake formed grid. The string is then sent to two valves which control the flow of the black and white liquids, so the display is filled with the corresponding pixels.



References and Links

(1) http://en.wikipedia.org/wiki/Project-based_learning
(2) Barron, B.J.S. et al. "Doing with Understanding: Lessons from Research on Problem- and Project-Based Learning", Journal of the Learning Sciences, 1998, 7, 271-311.
(3) Gu, W. et al., "Computerized microfluidic cell culture using elastomeric channels and Braille displays", PNAS, 2004, 101, 15861-15866.
(4) Grimes, et al. "Shrinky-Dink microfluidics: rapid generation of deep and rounded patterns" Lab on a Chip, 2008, 8, 170-172
(5) Stalder, F. "Open Cultures and the Nature of Networks", Editor: New Media Center_ kuda.org, 2005
(6) http://www.dusseiller.ch/mms_wiki

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