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# TEI 2014 Studio Description: Form & Function Toolkit: printed electronics for unconventional Interfaces

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**Abstract**

The studio deals with the potential of printed electronics as a way to embed electronic functionalities into everyday physical objects. Inspired by children educational toys we present a toolkit for experimenting with printed electronics and their tangible applications. It is an experimental prototyping platform for printed electronics that can be combined with different sensors and actuators from traditional and printed electronics. We will build a small toolbox from a pre-fabricated model set, that includes an Arduino connected to a printed circuit board. Different electronic components and sensors will be attached to the board and will be used to record environmental parameters. These smart tangible devices communicate with each other and the Internet. Participants will then develop concepts for future Internet of Things applications based on their experience with the toolkit. In the final step we would like to discuss ideas for developing this platform further with the workshop participants.

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ACM

**Keywords**

Printed Electronics, Embedded Function, Unconventional Interfaces, Prototyping Toolkit, Arduino.

**ACM Classification Keywords**

H.5.2 User Interfaces, Prototyping

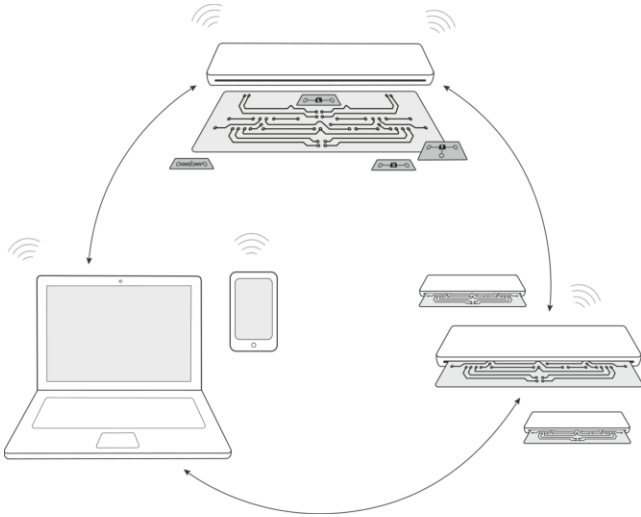
**Introduction**

Printed electronics offer an interesting potential for future embedded devices and the “Internet of Things”. Currently different devices such as displays on flexible substrates [1- 6], thin film transistor circuits [7,8], memory [9], photovoltaics [10] and batteries [11,12] to name a few can be partly or fully printed.

In this workshop we want to explore the potential of this technology for tangible objects in which form and function are united.

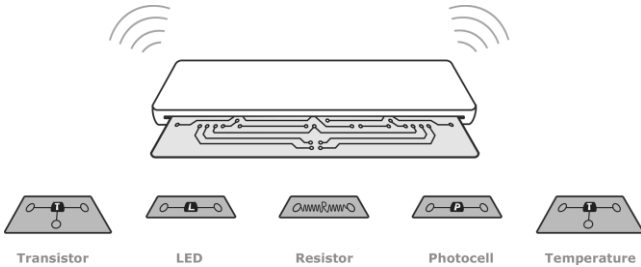
**Studio Proposal**

We present a toolkit that allows first experiments with printed electronics for exploring tangible technologies and practices. The objects have different sensors/properties and will communicate with each other, Laptops and Smartphones via Wifi.



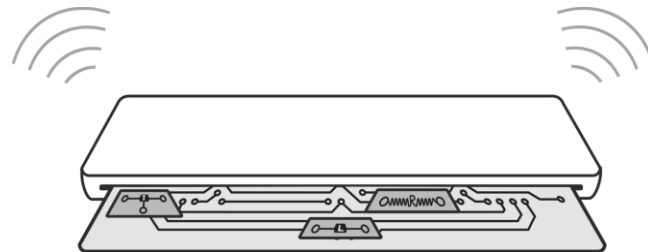
**Figure 1:** Overview of the toolbox system

The toolkit consists of a core toolbox equipped with Arduino/Wifi that connects to the printed circuit board.



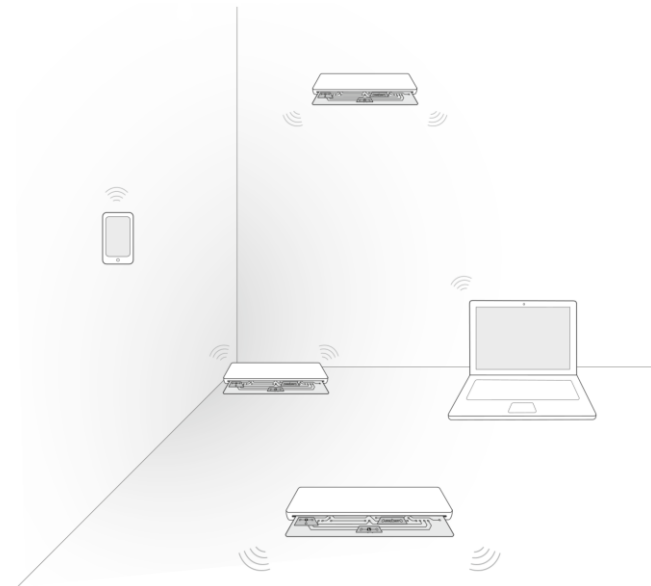
**Figure 2:** Core element with printed circuit

Different electronic components and sensors will be attached to the board.



**Figure 3:** Electronic components and sensors attached to the board

The objects will then communicate with each other and a Server via WiFi. They will establish a small prototypic Internet of Things setup. We will eventually be able to also provide a Smartphone App that communicates with the setup.



**Figure 4:** Prototypic spatial setup

In the initial phase we will build the toolbox from a pre-build model kit, include the Arduino and Wifi boards and connect it to the printed electronic circuit. In the second part we will install some Arduino sketches that communicate with the printed circuit board on the participants laptops. In the next step we will attach different sensors to our toolbox, read their inputs and make the different boxes communicate with each other. In the final step we would like to discuss experiences and future developments for this platform. There are no particular skills required for this workshop. It is nevertheless helpful if you like to assemble things and play around with them in a creative way. Also

knowledge about the Arduino/Processing platform is helpful but not required. You need to bring a Laptop on which we can install Arduino/Processing and connect our toolbox via USB.

### **Studio Topics**

The studio addresses aspects of printed electronics in regard to their potential for tangible interaction devices and the "Internet of Things". Smart objects will become cheaper and more available with the development of technologies in the printed electronics area. Applications and functions will not only be embedded in smart products but will establish new services between different networked environments.

### **Studio Learning Goals**

Participants will build the "form and function" toolbox, connect it to their computer and experiment with a printed circuit board. They will be asked to explore the potential of the "Internet of Things" by building a prototype with the toolbox and connect different boxes via a wireless network. By building the toolbox participants will be able to understand the relevance of printed electronics for tangible devices and their functions. Requirements for the future development will also be discussed based on the experiences of the workshop participants.

### **Studio Supporting Web Documents**

We will provide additional information, material and instructions for the toolbox here: (<http://www.uni-weimar.de/medien/wiki/IFD:fandf>).

### **Acknowledgements**

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### **Citations**

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