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WIRELESS POWER TRANSMISSION FOR TECHNICAL TEXTILES

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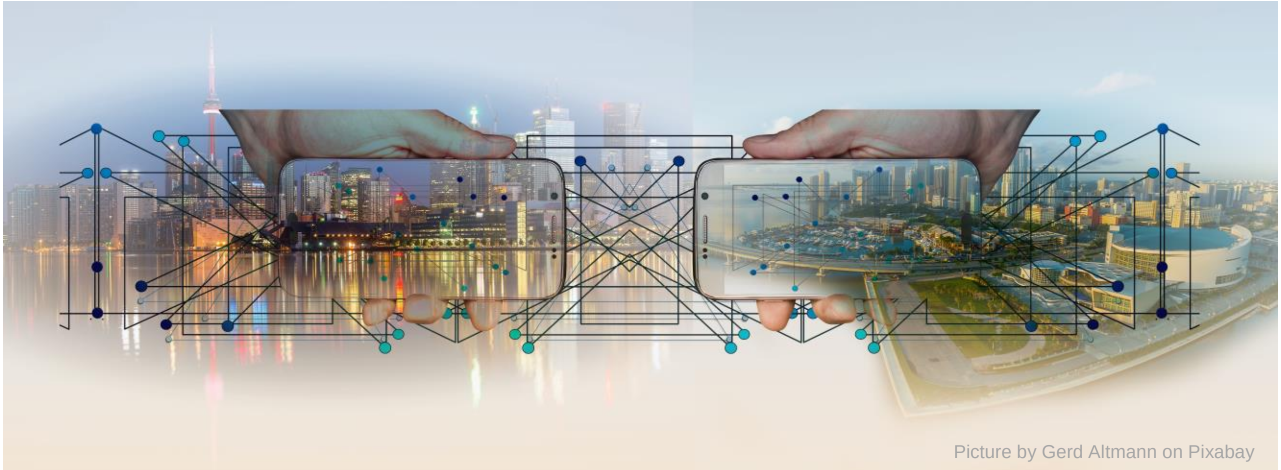
The trend towards the "Internet of Everything" is ongoing. Whether in industrial, medical or everyday applications, more and more electrical devices are connected to each other, record sensing values, exchange data and react to them. Due to smaller structures, new processing possibilities and new flexible materials, such systems are also being used more and more frequently in the textile sector. For example, medical measurements can be recorded directly on a garment, actuators such as EMS electrodes can be integrated directly into the textile or functions such as MP3 players, GPS receivers, fall detectors, heating structures and much more can be embedded simply and intuitively in textiles. Communication and data exchange usually take place wirelessly via WLAN, Bluetooth, RFID or, in the future, via the 5G network.



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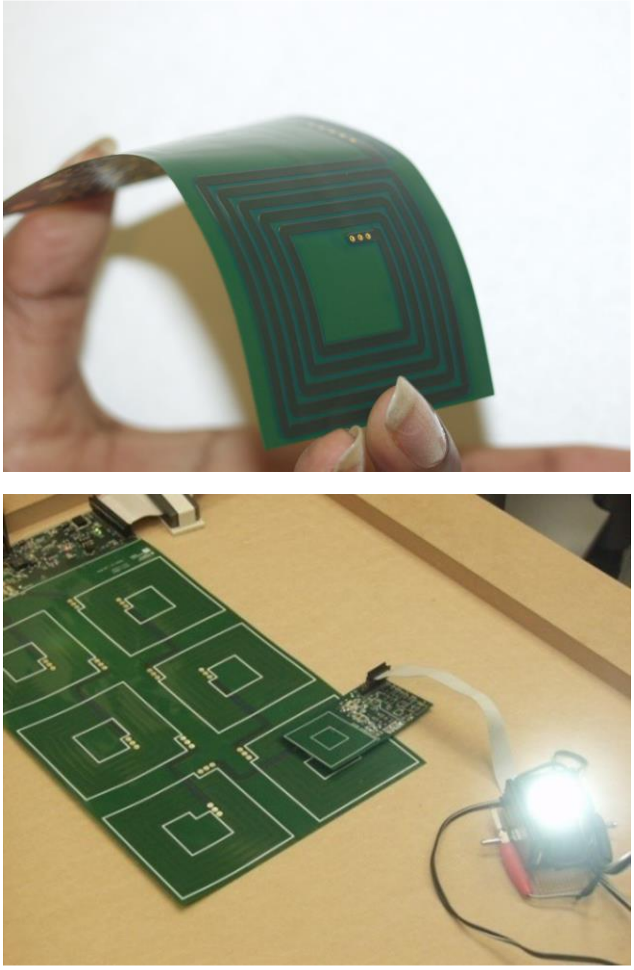
Electrical energy is required for such applications and functions. Despite the efforts to further minimize the energy demand of electronic circuits, it is not always possible to operate these systems completely energy autonomously. Therefore, energy storage devices such as batteries or rechargeable accumulators are necessary for operation. The big advantage of recharging is that smaller, more compact energy storage devices can be used to achieve the same or an increased service life running time. There are two basic concepts for recharging a battery with electrical energy. On the one hand wired and with connections like a micro-USB cable. On the other hand, wireless via wireless power transmission. With wired solutions, contacts can wear out or be added by fuzz, especially in the textile sector. In addition, the connecting process is less flexible and uncomfortable.

Wireless concepts offer several advantages and are therefore better suited. For example, the electronics including energy storage can be completely encapsulated, since no galvanic contacts are required. Among other things, this makes the textile directly machine-washable, because the electronics are protected from water, detergents and sweat. This means that no components need to be removed from the textile when washing. A further purely practical advantage is the simplicity of charging. With the suitable concept, the textile can be hung on hangers, placed in laundry baskets or, ideally, simply placed in the washing machine and charged without any further action of the user. The result is an uncomplicated, charming way of operating smart textiles.



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There are several concepts and possibilities for wirelessly supplying a textile with energy. The most popular and at the same time most efficient method is the inductive power transmission[i]. Two coils are inductively coupled to each other and thus transmit energy wirelessly (Figure 2). Air, wood, plastic, but also liquids such as water or human tissue can be penetrated a few centimetres almost loss-free. There are also various concepts for integrating electronics into textiles. From the production of the entire circuit on thin printed circuit boards to complete textile integration, a wide variety of mixtures are possible. The easiest concepts to develop are those in which all circuit parts are manufactured on printed circuit boards. Thin printed circuit boards can have substrate thicknesses of a few tenths of a millimetre (Figure 1). But flexible possibilities such as manufacturing on silicones are also conceivable. Among other things, the sensors and microcontrollers as well as the coil for inductive energy transfer to the substrate are manufactured. This complete printed circuit board then only has to be connected to the textile, whether by, gluing, sewing or insertion.

Concepts in which the receiver coil is integrated into the textile go one step further. For example, ultra-fine wires or strands are woven or embroidered and the textile material thus becomes the substrate itself as a functionalized textile. The rest of the circuit, which is still integrated on a conventional substrate, is then connected to the coil and the textile. Since some of the spools can have diameters of a few centimetres, one can gain in flexibility because the textile spool can move almost freely. With a complete textile integration, the components are finally attached to the textile and the conductor paths are embroidered or woven in.

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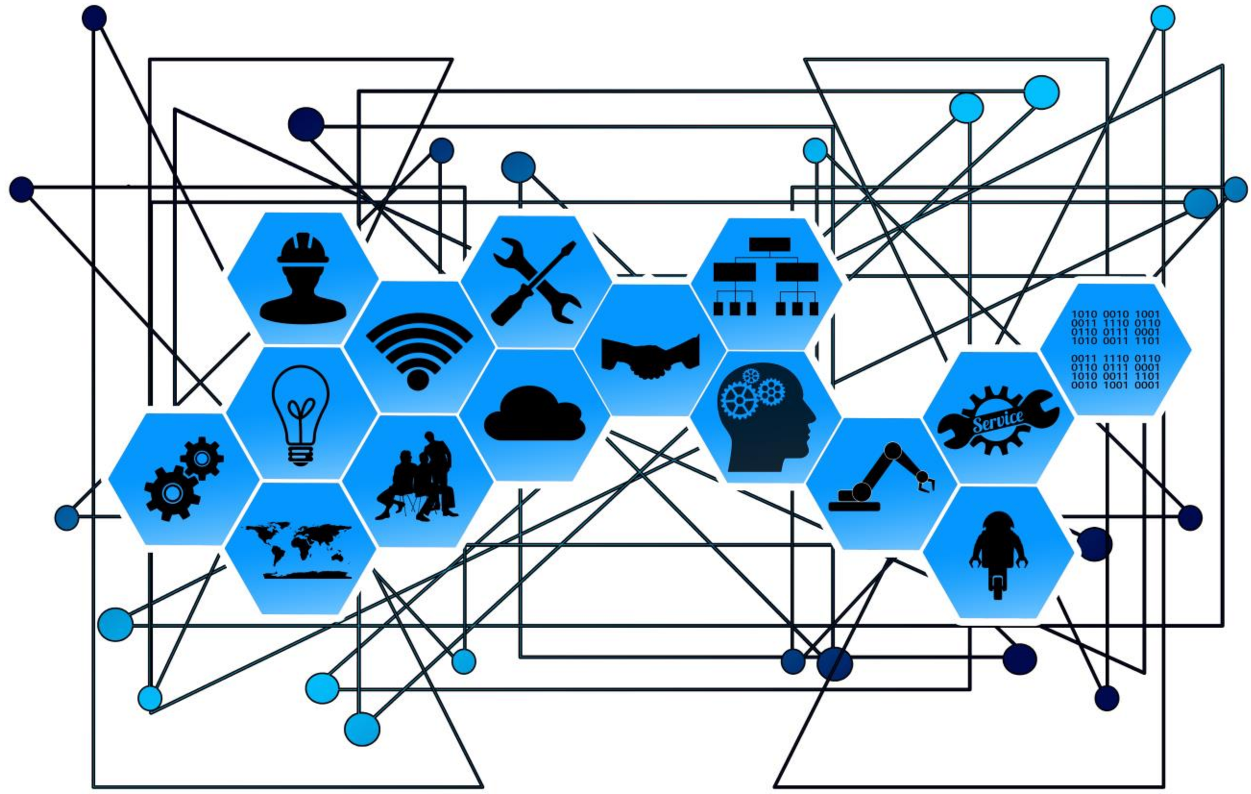
Consistently implemented and used, wireless power transmission as a simple and convenient charging method of textiles can thus contribute to sustainably strengthen the market for smart textiles improving handling and user experience.



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[i] [1] Efficient design methodology for inductive energy transmission, Büker, M.-J.; Hedayat, C.; Hilleringmann, U.; Geßner, T., Smart Systems Integration 2016.
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