Tampere University of Technology
Kankaanpää Unit

The Tampere University of Technology (TUT) Institute of Electronics has conducted research in wearable technology since 1997. The TUT Kankaanpää Unit, established in 2003, is a research unit specialized in wearable technology. It is a part of a wearable technology competence center located in Kankaanpää, Finland. The Kankaanpää Unit's personnel are very interdisciplinary and include researchers from electronics, material technology and textile technology background. This enables us to conduct extensive research on different aspects of wearable technology and quickly adapt information and new results from various disciplines.

The goal is to develop new technologies, applications and services emerging from integrating textiles and electronics. The TUT Kankaanpää Unit is strongly focused on garment integrated electronics and has gained experience in manufacturing flexible and machine washable electronics by casting flexible circuit boards in soft polymer. This enables the electronic devices to be fully integrated and they don't need to be removed during washing cycle as was the case before.

Another issue in wearable technology maintenance is power transfer to the electronics in the garment. It is crucial that the power transfer fits fluently to the normal usage and maintenance cycle of the garment. To tackle this issue we have designed a wireless power transfer system, using inductive power transfer that needs no wires between the garment and the recharging device. When the garment is a shirt, the recharging device was considered to be most user friendly constructed as a clothes hanger.

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Flexible circuit boards and soft polymer casings were used in order to make the electronics as unobtrusive and comfortable to wear as possible. As a proof of concept we designed the NoiseShirt, a garment that measures the ambient noise level, which included all of the techniques presented above. The NoiseShirt was an example of a garment that incorporates fully integrated electronics and can withstand a normal washing cycle. The ideas used in the NoiseShirt have evolved into potential manufacturing techniques for wearable technology and developing these methods further is our main focus for future research.

Research of manufacturing methods for flexibly encased electronics includes research of casing materials, polymer casting techniques and integration methods between polymers and textiles. Another field of research is reliability and in it especially endurance of mechanical and chemical stresses. Mechanical endurance tests and computer modelling are used to predict the functionality of different electronic designs in a flexibly encased system.

Many future applications of wearable technology will be in the field of well-being and fitness, and already a great deal of our research relates to these themes. This provides an excellent chance to apply our expertise of manufacturing garment integrated electronics.
More information about TUT Kankaanpää Unit and its projects can be found on project flyers and on the Internet.