

# Miniature Projection Display

As a result of the Miniature Projection Display Project the Tampere University of Technology has introduced a wearable display solution in the form of a miniature projection display capable of projecting the image onto the user's palm.

The starting point for the research has been a need for an easy to use and easy to wear display that could be integrated into garments. As a wearable application, a projector will be subject to varying lighting conditions and therefore it needs to have enough light intensity to be used even in broad daylight. This requires a display element with exceptionally high optical output power. The presented projector incorporates an ultra-bright Resonant Cavity Light-Emitting Diode (RCLED) -based display element. RCLEDs were chosen because of their high optical power and the possibility to manufacture a monolithic matrix-form display element. The RCLEDs used in the display element were originally developed for polymer optical fibre (POF) data transmission systems, but are also applicable for emissive projection displays. The problem of a broad opening angle of emitted light of RCLEDs can be solved using a novel optical element attached onto the RCLED matrix further enhancing the light output and efficiency. The low resolution of the current matrix component can be enhanced to up to 64x64 pixels without modifications to the production process.

The greatest advantages projectors have over regular displays are the possibility to place the device elsewhere than the surface where the image is presented and the possibility to make the device much smaller than the projected image. These characteristics make projectors very appealing in wearable applications. With a projection distance of approximately 300 mm, the projector can be placed in front of the user's chest. This placement provides much better wearing comfort than a similar sized display integrated onto a sleeve.

It has been demonstrated with the implemented prototypes that an RCLED matrix can function as a compact and powerful light source for a miniature projector. When further reduced in size, the projector can be integrated into a garment giving it an outside appearance of a button.

Contact information:  
Pekka Iso-Ketola, researcher

Tampere University of Technology,  
Kankaanpää Unit

Jämintie 14  
FI-38700 Kankaanpää, Finland

Tel: +358 20 759 5856  
Fax +358 20 759 5855  
Email: [kankaanpaa@tut.fi](mailto:kankaanpaa@tut.fi)  
[www.ele.tut.fi/kankaanpaa](http://www.ele.tut.fi/kankaanpaa)

