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EVALUATION KIT OF OLED BASED BINOCULAR INTERACTIVE SEE-THROUGH HMD

Introduction

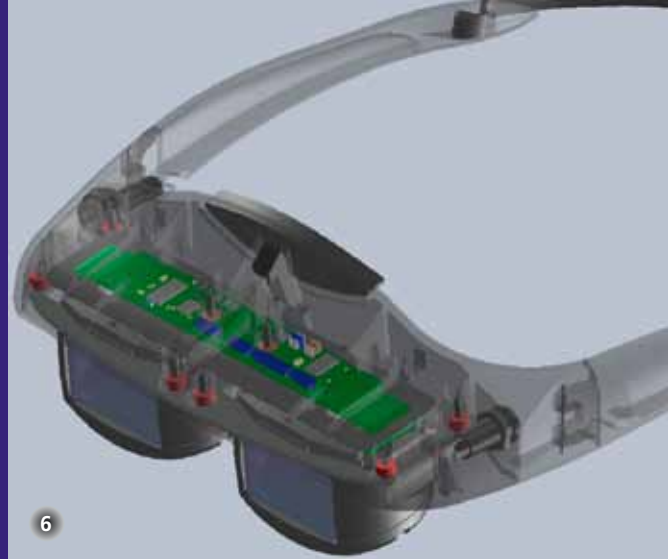
Personalized mobile information systems and devices are an indispensable tool for everyday's life (mobile phone / smartphone, PDA, etc.). Usually, these devices are manually controlled. Microdisplays, i.e. displays with state-of-the-art pixel count but significantly decreased geometrical size have found their way into consumer electronic products, for instance as electronic view finders in cameras. Microdisplays based on Organic Light Emitting Diodes (OLED) are considered a very promising future technology for multimedia applications like video and data display. Their breakthrough is expected to happen within a couple of years.

For the first time ever, OLEDs offer the possibility to integrate highly efficient light sources with photo detectors on a CMOS backplane. This enables fully integrated optoelectronic applications based on

silicon. As a consequence, one can realize micro-scale optical emitters and receivers on the same chip and, here in an array type organization as bidirectional microdisplay (OLEDCam), i.e. a device that presents and captures images at the same time. They can be the foundation for a complete new class of devices for personalized information management: they present information to the user and at the same time optically recognize interaction by the user. He or she perceives the environment as usual, additional information is presented via an advanced form of glasses that carry bidirectional microdisplays (Augmented Reality, AR). This visual information can be deliberately or unconsciously adapted to the context of operation of the system and the user can interact without using hands or speech, but only using movements or actions of the eyes. This results in personalized, mobile, interactive, see-through AR displays.



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Eval-Kit

The goal of the OLED based binocular interactive see-through HMD Eval-Kit is the demonstration and customer evaluation of the unique developed mobile AR technologies. This kit consists of light weight binocular eyeglasses (fig. 1) including bidirectional optics (fig. 2) the OLED Cam device (fig. 3) and HMD interface electronics (fig. 6). Furthermore the system includes an AR platform for small applications (fig. 5) and an additional client computer for gaze-triggered AR applications.

Software components

The Eval-Kit has two operation systems (OS). The AR platform is running an embedded Linux which is part of the evaluation kit. The client system depends on the customer system, and can be for example a Linux or Windows computer. In general the SDK and software running on this client is platform independent.

The AR platform emulates a USB device which can be accessed platform-independently on Windows, Linux and mobile devices like Android (with limitations depending on the mobile OS and the availability of a USB adapter, which can act as OTG or HOST). To use the device on the client side, a proprietary driver and a special software is needed. For expert users a C++ library will be provided to access the device directly and for non-professional users an end-user software (demo) is provided, which inherits the C++ library and offers images, and gaze direction of the user eye and control of the display image.

Main Characteristics

OLED Cam

Display resolution	Monochrome / RGB 640 × 480 pixel
Sub pixel pitch	8 μm × 8 μm
Active viewing area	10.2 mm × 7.7 mm
Resolution of nested camera	128 × 96 pixel
Chip dimensions	13 mm × 11 mm
Operating temperature	-20°C – +40°C

Bidirectional optics

Field of view (FOV) see-through	39.1° (horizontal) × 26.6° (vertical)
Field of view (FOV) info channel	29.0° (horizontal) × 21.6° (vertical)
Distortion info channel	2.96 % (horizontal), 1.7 % (vertical)
Accommodation distance	750 mm
See-through transparency	50%
Exit pupil diameter	5.6 mm
Eye motion box	5.6 mm × 11.2 mm

AR platform

Processor	XScale PXA 320
Interfaces	USB, Ethernet
Storage	Micro SD card

HMD

Weight see-through with headband electronics and cable	187 g
Cable length	2 m

Software AR platform

Operating system	Embedded Linux
OLED Cam interface	Kernel driver
USB emulation	USB Gadget

Software client

Operating system	Windows / Linux
SDK	C++ library
Demo application	World map eyetracking
Development tool	DevEnviro

5 HMD and AR platform

6 Cross section of the binocular HMD