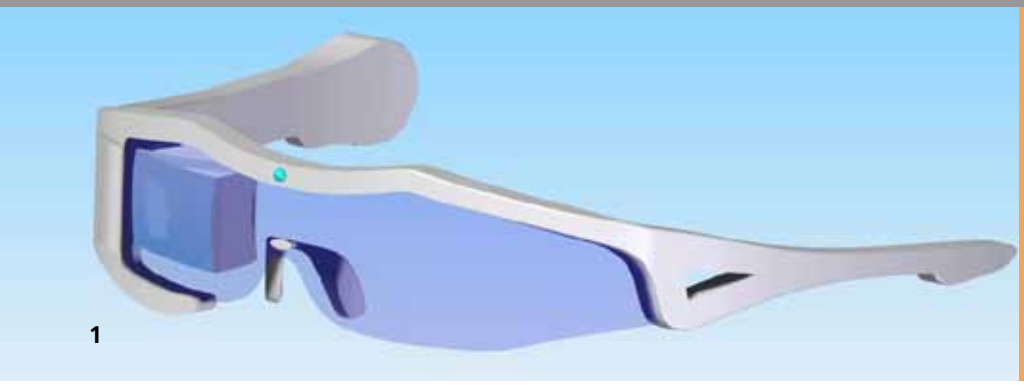
Fraunhofer
IPMS

FRAUNHOFER INSTITUTE FOR PHOTONIC MICROSYSTEMS IPMS



1

2

1 *HMD design concept for new prototypes.*
2 *Illuminated active matrix of the first demonstrator.*

BIDIRECTIONAL OLED MICRODISPLAY

Fraunhofer Institute for Photonic Microsystems IPMS

Maria-Reiche-Str. 2
01109 Dresden

Contact

Ines Schedwill
Phone +49 351 8823-238
ines.schedwill@ipms.fraunhofer.de

Dr. Michael Scholles
Phone +49 351 8823-201
michael.scholles@ipms.fraunhofer.de

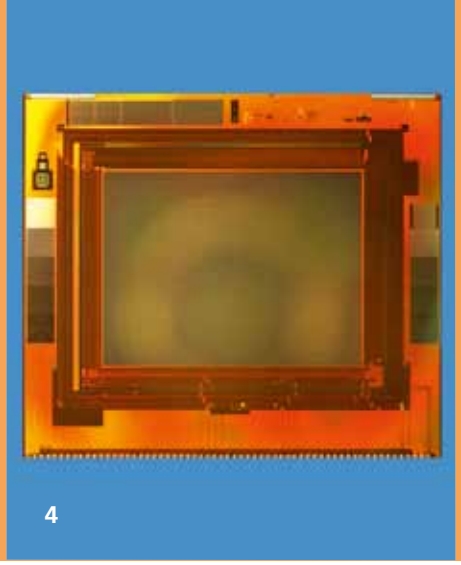
www.ipms.fraunhofer.de

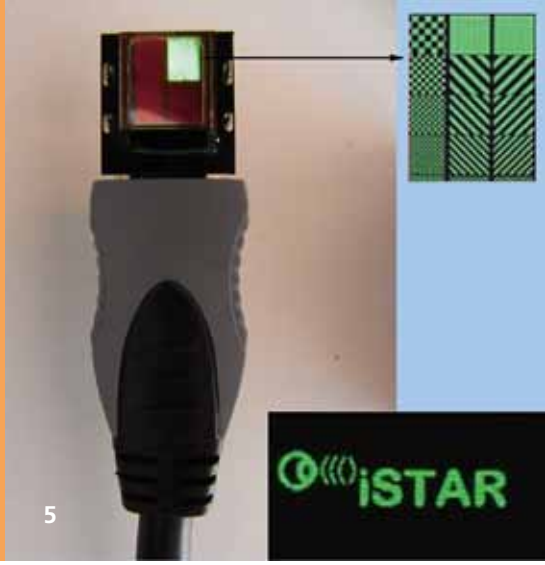
Introduction

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, 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 personal-

3


4



5

ized, mobile, interactive, see-through AR Displays.

OLEDCam Demonstrator

Based on a first demonstrator, the design for two new OLEDCam prototypes has been finished. The second prototype has the same display specifications as the first demonstrator. The monochrome display has been realized in a 0.35 µm technology and has a resolution of 320 x 240 pixels (QVGA), the display data input interface is a typical digital-parallel interface including synchronization signals. In contrast to the first demonstrator, the second prototype has full camera functionality with 160 x 120 nested photo diodes inside the display viewing area. The camera has an analogue-interface with digital synchronisation signals. The resulting chip is shown in fig. 4. The third prototype has similar interfaces. A 0.18 µm technology allowed the design of a colored OLED pixel matrix with a resolution of 640 x 480 pixels (VGA) and a nested array of 128 x 96 photo diodes. Additional the third prototype has a divided frame camera on top and bottom of the active matrix with a resolution of 128 x 80 photo diodes, refer to fig. 5.

Technical Parameters

Prototype 2:

- Brightness: >1000 cd/m²
- OLED efficiency: >15 cd/A
- Display resolution: 320 x 240 pixels (QVGA) monochrome
- Camera resolution: 160 x 120 photo diodes
- Active matrix diagonal size: ca. 0.6″

Prototype 3 (in development):

- Brightness: >1000 cd/m²
- OLED efficiency: >15 cd/A
- Display resolution: 640 x 480 pixels (VGA) colored
- Nested camera resolution: 128 x 96 photo diodes
- Frame camera resolution: 128 x 80 photo diodes
- Active matrix diagonal size: ca. 0.5″

Applications

Numerous applications can be addressed by means of bidirectional microdisplays: (see also fig. 3):

Industry:

- Production, handling
- Maintenance
- Development, planning

Consumer market:

- Mobile communication
- Tourist information
- Advertisement
- Barrier-free IT
- Mobile navigation

Safety and security:

- Disaster management
- Mobile surveillance

3 *Application for consumers (mobile navigation).*
4 *Chip microphotograph of the second prototype.*
5 *Third prototype (preliminary).*