Many smartphones already comprise sensors for environmental parameters like CO₂, humidity or temperature. A small micropump supplying the sensors within the mobile device with ambient air can reduce the sensor response time significantly and improve the measurement results. The heart of the micropump enabled sensor system is the piezo actuated micro diaphragm pump made of silicon. The micropump can handle a wide range of liquids and gases (e.g. for gas analysis, scent dosing and medical applications). The small size and low power consumption make applications in mobile devices feasible. Due to the silicon technology the device is very stable over time and inert to all kinds of gases and most liquids. A demonstrator for gas sensors in smartphones was already realised and shows excellent results.

**Gas sensors:**
- CO₂
- alcohol
- volatile organic compounds (VOC)
- ozone
- environmental gases (e.g. NO₂)

**Particle sensors:**
- fine dust
- allergenes

**Further applications:**
- scent dosing
- medicals (e.g. breath analysis)
- micro pneumatic actuator for optical applications
- haptic displays
Technical innovation

- Micropump feeds ambient air to sensor @ 10 mm³/sec
- Factor of at least 20x improvement in sensor reaction time (see figures)
- Enables fast detection of any gases in small and/or mobile devices
- Energy efficient actuator for mobile devices (power consumption around 8 mW on full operation)
- Cost efficient in mass production
- Small size: 5 x 5 x 0,6 mm³ (3,5 x 3,5 mm² under development)
- Feeds & regenerates multi sensor array

Outlook

- Shrink Roadmap towards smaller footprint (e.g. 3,5 x 3,5 mm²)
- Development of packaging & testing for mass production
- Integration with flow measurements and multiple sensor arrays

Technical data

Overview about characteristic values of different silicon micro membrane pumps developed at Fraunhofer EMFT:

<table>
<thead>
<tr>
<th>Pump type</th>
<th>µP015v1</th>
<th>µP024Av2</th>
<th>µP026v1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Weight (g)</td>
<td>0,07</td>
<td>0,06</td>
<td>0,03</td>
</tr>
<tr>
<td>Size (mm³)</td>
<td>7x7x0,8</td>
<td>7x7x0,7</td>
<td>5x5x0,6</td>
</tr>
<tr>
<td>Stroke volume (nl)</td>
<td>80</td>
<td>140</td>
<td>50</td>
</tr>
<tr>
<td>Max. back pressure (air) (kPa)</td>
<td>90</td>
<td>80</td>
<td>50</td>
</tr>
<tr>
<td>Max. suction pressure (air) (kPa)</td>
<td>-50</td>
<td>-50</td>
<td>-20</td>
</tr>
<tr>
<td>Max. back pressure (fluids) (kPa)</td>
<td>550</td>
<td>140</td>
<td>80</td>
</tr>
<tr>
<td>Max. flowrate (air) (µl/min)</td>
<td>500</td>
<td>1.000</td>
<td>600</td>
</tr>
<tr>
<td>Max. flowrate (fluids) (µl/min)</td>
<td>150</td>
<td>300</td>
<td>60</td>
</tr>
</tbody>
</table>