Active Electrode Based Electrical Impedance Tomography System

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Outlook

- Active vs passive electrode
- Why active electrode?
- Active EIT Electrode architecture
- A thoracic Application
- Conclusions
Passive Electrode

Challenges | Results
---|---
High impedance lines | cable shielding
Stray capacitance | cable shielding
Scalability | 1 cable per electrode
Precision | Uncontrolled Input impedance
## Active Electrode

- **EIT System**
- **Patient**

### BUS

<table>
<thead>
<tr>
<th>Challenges</th>
<th>Results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low impedance lines</td>
<td>No cable shielding</td>
</tr>
<tr>
<td>Stray capacitance</td>
<td>No cable shielding</td>
</tr>
<tr>
<td>Scalability</td>
<td>Fixed bus cable number</td>
</tr>
<tr>
<td>Precision</td>
<td>Controlled Input impedance</td>
</tr>
</tbody>
</table>
System Architecture

![Diagram showing the system architecture with components such as GUI, Ethernet link, FPGA, Analog front-end, Belt bus, Active electrode, and Electrode belt.]
Multiplexing

![Diagram of a multiplexing circuit](image)

central current source | bus | active electrode 1

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Prototype of active electrode

2.5 cm
Prototype of the thoracic belt
Ventilation and cardiac EIT signal

Blue: “heart pixel”
Green: “lung pixel”
Conclusions

- A working prototype for thoracic EIT was developed.
- Ventilation and cardiac related impedance changes were demonstrated.
- Miniaturization of the active electrode.
- More tests in volunteers.

*courtesy: Swisstom AG
Thank you for your attention!
Control system

master → node 1 → node 2 → ... → node L

# of node

Node ID

1·L → 2·L → L·L
Central control system

A2
A1
x Gd
HP
80 kHz
x Gs
LP
2.4 MHz

LP
2.4 MHz
12 bits
100 MS/s

FPGA

sin-0

gnd-in

sync

x1

14 bits
100 MS/s

BP
12 kHz
2.4 MHz
Stray capacitance reduction
Current source internal impedance
Current source internal impedance