ECSEL/IMI Joint Activity Call Information session

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ActiSense is a compact product that allows the monitorization of health aspects like balance, gait, diabetes and mental health aspects. This product emerge from the lack of equipment existent to support medical areas such as alzheimer, demetnia, diabetes, etc. With ActiSense we create a product that give the user the possibility of linking physical analyse namely orthopedics and phisiotherapy to the various neurological areas allowing a less intrusive intervention in patients. Also helps in the improvement of the physical performance associated with the practice of sports.
In conjunction with a foldable electronic insole that is inside the user footwear it allows the possibility of collecting and recording crucial data to be analysed later. The sensor main features are:
- Actuation force as low as 100mbar
- Sensitivity range up to 7 bar
- Up to 1 million actuations under highest humidity conditions
- Usable in a slightly bent position
- Individually calibratable using a 3-point interpolation of the pressure response curve
- Very low hysteresis compared with our standard sensors
ActiSense has an innovative fitment system that allows the integration of two different types of accessories. One to be used with a ribbon and another with a clip to put in the user footwear.
Ribbon

This plastic piece allows the device to be joined to an elastic ribbon to be used both on the arms, chest, legs, etc, giving the opportunity of being comfortably used while doing sports like running, playing football, etc. This piece slides from the side of the device and locks in place at the middle.
This plastic piece allows the device to be clipped to the user's shoes, sneakers, etc. As the device is very light and compact, the user doesn't even notice it when walking, making it very comfortable to use. This piece also slides from the side of the device and locks in place at the middle.
ActiSense has also a single usb-c port that allows both charging and fast data transfers. With this connection the device is totally waterproof making it perfect for being used in every day scenarios.
With the ActiSense device comes the in house developed app. This app allows to connect the device via bluetooth to a mobile device such as a smartphone or tablet.

In the app you can stream the device data and record it to future analysis. You can see in real time the pressure points being applied in the insole sensors as well as the user's balance.
Main features

- Usb-C connection
- 25Hz | 100Hz | 200Hz | report rate
- 9 axes IMU
- Temperature
- Barometer
- Heart rate
- Oxygen
- Smartwatch paring
- App integration
- Accessories
- Same hardware design allow different features
- USB-C cable for charging and fast data transfer
- Long term monitoring
- Up to 50 hours battery
- Dimensions: 36 x 30 x 15mm and 16gr

- Possibility of integration in chest band to allow measurements such as heart rate, SPO2, VO2, ECG, EEG and respiration sensor
- Integration with an app developed in house to configure and evaluate data
Potential of Printed Electronics for Digitalization & Big Data

Printed Electronics in Healthcare
Great Potential for Smart Wearables & Bioelectronic Systems

- Smart headbands
  - Integrated sensors (e.g. EEG)

- Smart glasses
  - OLED μDisplays

- Smart textiles / clothing*
  - Integrated sensors (e.g. ECG, temperature, motion, oximeter)
  - Integrated heating elements
  - Energy harvesting (e.g. solar cells, supercaps, batteries)

- Smart earphones
  - Integrated sensors (e.g. temperature, accelerometer)

- Smart necklace
  - Integrated sensors (e.g. heartbeat, accelerometer)

- Chest Belt*
  - Heart Rate / ECG
  - Breathing rate

- Smart watches / wristbands*
  - Displays
  - Integrated sensors (e.g. heartbeat, oximeter, blood pressure, glucose)

- Smart shoes / socks*
  - Integrated sensors (e.g. pressure, motion, temperature, etc)
  - Energy harvesting (e.g. electroactive polymers)
Ground Contact – Smart Footwear Sensing

In-shoe sensors for eHealth applications to address balance and gait disorders
Monitor, analyze and diagnose health conditions and progressive diseases

<table>
<thead>
<tr>
<th>Neurological</th>
<th>Rehab &amp; PreHab</th>
<th>Wellbeing</th>
<th>Occupational health and safety applications</th>
</tr>
</thead>
<tbody>
<tr>
<td>Monitor &amp; control gait disorders</td>
<td>Posture correction</td>
<td>Control regular activity</td>
<td>Fall detection (e.g. working with chemicals, firefighters, etc.)</td>
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<tr>
<td>Diabetes (Diabetic foot)</td>
<td>Rehabilitation</td>
<td>Support healthy lifestyle</td>
<td>Posture correction (machine &amp; desk workers)</td>
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<tr>
<td>Dementia, Parkinson, Alzheimers, etc.</td>
<td>Post surgery &amp; injury load tracking &amp; recovery</td>
<td>Elderly care (e.g. activity monitoring &amp; fall detection)</td>
<td>Activity tracking</td>
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<tr>
<td>Support nerve &amp; muscle stimulation</td>
<td>Balance, stance, gait, ground contact time</td>
<td>Personal independence (e.g. elderly care &amp; assisted living)</td>
<td>Access control (biometric &amp; integrated chip)</td>
</tr>
</tbody>
</table>
Ground Contact – Smart Footwear Sensing

Record and analyze your gait profile – THE healthcare relevant fingerprint of your body
Use the advantage and stay on top of your health and keep moving...

- **Prosthetics**
  - Worlds 1st feeling prosthesis
  - nerve & muscle stimulation
  - Increased stability, «feel» lost foot & overcome phantom pain
  - Awarded with Good Design Award

- **Parkinson**
  - Detect & Analyze balance problems, tremors, stiffness, slowness of movement, etc...
  - Recognize gait freeze,
  - Estimate fall risk
  - Predictive measurements using AI

- **Diabetes**
  - Control regular activity
  - Increase personal independence
  - Posture recommendation for correct walking
  - Monitor footwear lifetime
  - Support healthy lifestyle
  - Avoid amputation

- **Neuromuscular & Neurological research**
  - Capture & improve motor & ambulatory function in real-life settings
  - Analyze affect of new treatments to gait patterns
  - Unobtrusive capture patients performance changes over time
  - Support disease modifying therapies

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*ActiSense*
Ground Contact – Smart Footwear Sensing

Printed electronics for digital wearables and medical devices offer outstanding long-term flexibility
ActiSense supports advanced medical treatments & healthy aging

**Basics**
- Gait parameters over time
- Detect short term events and long term changes
- Activity tracking
- Warnings & alerts
- Share data with healthcare providers & caretakers

**Social**
- Share daily activity logs
- Remote monitor daily activities
- Participate and interact
- Stay independent & active
- Immediate feedback and warnings

**Ecosystem**
- Combine with multiple different wearables
- Open environment for developers
- Combine with external environmental data available online

**INFONOMICS**
- Create additional revenue to self-sustain the system
- Convert information into assets
- Optimize health care services
- Generate revenue streams by providing information to:
  - Telemedicine provider
  - Health insurances
  - Care-giver
  - Research
Technology

Behaviour
Cognition
Electricity
Anatomy
Chemistry
Biology
**Tracker device**
- Indoor location with existing WiFi infrastructure (802.11 b/g/n)
- Room level, accuracy +/- 3m
- Roaming within pre-defined SSID's, possibility to pre-configure institution infrastructure and user's home setting's.
- Outdoor location with A-GPS, GPRS/GMS report when no WiFi coverage available
- Offline logging when no coverage, for later analysis
- Battery lifetime with 30s period, >5days

**Monitoring device**
- ECG (1, 3 and 6LEAD as standard, 12LEAD upon request)
- Heart rate monitoring and logging, alarm report when detected bradycardia/tachycardia, cardiac shape report upon request
- SpO2 finger/ear sensor
- Temperature
- Humidity
- Respiration band

**Caregiver / Call Center interaction**
- Cell phone type headset
- Loudspeaker upon request

**Event report**
- Panic button
- Fall detection/prevention
- Postura report when requested
- Report when a specific routine wasn't established, (i.e. at 11:00 still in bed, when shouldnt)