Pre-Cognitive Human Extension as the Future of IoT

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Salish-IoT
http://resenv.media.mit.edu
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**CHAIN-API – General, Decentralized Web-based Sensor Framework**

Lightweight, adaptive way to describe sensors (real and virtual) as RESTful resources and specify relations between them with a shared vocabulary.

Now see Open Connectivity Foundation, etc.

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CHAIN-API applies where sensor data touches the ‘net’

Not meant to run on low-powered nodes

Doesn’t specify database standard
The 'Digital Butler' Arises Now

Transitory Phase – Smart environments will become an extension of self

Building the Networked Sensory Landscape
600 acres

‘Perpetual’ Solar power
100 now, soon >300,
Cameras, 30 Audio streams
The Mayton 2.0 Wireless Tidmarsh Node
Easily Expandable for Ubiquitous Wireless Sensing

Can host a variety of sensors

- Soil Moisture
- Soil Redox/Conductivity
- Soil Temperature
- Air/Water Quality
- Etc…

Uses cheap, vintage Telco crimp connectors (waterproof!)
Tidmarsh is a 600-acre property near Plymouth, Massachusetts. After over a century as a large operational cranberry farm, Tidmarsh is now being restored to its natural wetland. Researchers in the Media Lab’s group are developing sensor networks that document ecological processes and allow people to experience the data at different spatial and temporal scales. Small, low-power sensor devices capture climate, soil, water, and other environmental data, while others stream video from high in the trees and underwater. Visit any time from dawn till dusk and again after midnight; if you’re lucky, you might just catch an April storm, a flock of birds, or an army of frogs.

Many scientists in the group are making use of the Tidmarsh site for their projects. The flagship project is a cross-reality sensor data browser constructed using the Unity game engine to experiment with presence and multimodal sensory experiences. We’re looking for new ways to explore and experience data about the environment. Built on LiDAR-scanned terrain data, the virtual Tidmarsh experience integrates real-time data from the sensor network with real-time audio streams and other media. The data is based on real-time sensor data—fetching and visualizing motion when new data comes from each sensor. The music is driven by the sensor readings: higher pitches indicate warmer temperatures, for example. You can visit Virtual Tidmarsh yourself on Mac, Windows, or Linux by grabbing the app from our [download page](#).
Resynthesized Reality - Flora, Ground Cover & Weather based on camera feeds
Sensors drive animations & spatialized audio

Don Derek Haddad
DoppelMarsh 3
Don Derek Haddad, Gershon Dublon, Brian Mayton
Spencer Russell, Evan Lynch, Joe Paradiso
Animals Embody Sensor History
HearThere v2

Attention-Driven Sensory Prosthetic

EEG/EMG

Eye tracker, Pupil ø

UWB/GPS Location

Touch + head tracker

Bone conduction headphone

Chest strap sensor
(heart rate + respiration)
D. Ramsay, J. Paradiso, “Automated Characterization of Consumer-Grade Sensor Accuracy from Supporting Data in Heterogeneous Air Quality Monitoring Networks,” NEMC 2017
IoT & the Built Environment
Lighting Control is Broken

Commercial lighting control panel in the new (2010) Media Lab Building
Nan Zhao et al, ‘A Multidimensional Continuous Contextual Lighting Control System Using Google Glass,’ in Proc. of BuildSys’15 - Best presentation award
Power consumption of the lighting system in %

Power: 52%

Position of operation point in the two dimensional contextual control space
Mediated Atmospheres

Nan Zhao, Robert Richer Asaf Azaria

Understanding perceptual and physiological effects of multimodal mediated environments

• Facial Expressions, Head Orientation, Gaze
• Bio-Signals: ECG, GSR, Respiration, Temperature, etc.
• Basic Posture and Motion

Rovables!

Artem Dementyev (ResEnv)
Cindy Kao (Living Mobile)
Sean Follmer (Stanford)

Best Paper @ UIST 2016
Rovables: Miniature On-Body Robots as Mobile Wearables

Artem Dementyev, Hsin-Liu (Cindy) Kao, Inrak Choi, Deborah Ajilo, Maggie Xu, Joseph Paradiso, Chris Schmandt, Sean Follmer

MIT Media Lab, Stanford University

Ars Electronica 2016
Summary

• Sensors are getting out there, piggybacking on commercial products
• Once affordances are shared across devices, we’re living in an ecology of devices & applications
  – This will happen fast once common protocols appear
  – Phase transition into true Ubicomp/IoT
• How will human presence generalize?
• Where does ‘self’ stop and ‘other’ begin?