REAL WORLD WEB

Living Within The Internet of Things

A psfk LABS Special Report by PSFK with iQ intel iQ.intel.com

Foreword

PIERS FAWKES
Founder. President, PSFK Labs
labs.psfk.com

The Real World Web report from PSFK Labs aims to make sense of the ideas and issues connected to the growing of volume of sensitive and responsive technology in our lives. Underwritten by the kind generosity of Intel, our independent research helped me understand the themes and trends that are shaping the topic often described as the Internet of Things.

I resisted naming this report the Future of the Internet of Things - or the Future of Stuff - because I find the term Internet of Things misleading. For most people today, the internet is something they access when they look at a browser on their PC - it's not something they think they access when they use their phone to check their emails or upload a photo. The terms 'internet' and 'online' have become antiquated rapidly and can probably be better associated with an earlier era of our digital lives.

The Real World Web is a more descriptive term, I believe. We are already living within this web of sensors - in the hallways of our homes, at the sink in bathrooms, in changing rooms in stores, in the interiors of our cars. The world is full of tech that watches, learns, predicts, and responds. We are living inside the internet of things.

This Real World Web will deliver an evolution in social media - it will allows us to connect with communities nearby or likeminded. The Real World Web will learn to look after us - it will watch and prompt us into action, learn and serve us appropriately. The Real World Web will manage the world around us - directing city ecosystems, national power grids and global infrastructure.

By framing the subject better and understand the key trends driving change, incredible innovation should take place. I'm excited to share the work of PSFK Labs to inspire new ideas for better living for all of us. I hope you find it useful.

Introduction

In just over five years, technology research firm, Gartner, estimates that we could see over 30 billion devices connected to the web, the majority of which won't be a smartphone, tablet or PC. As everything from home appliances and vehicles to entire city systems literally comes online, we'll see an explosion of object able to capture data about what's happening in and around them, and report that information out to people and other systems in near real-time. Increasingly, these behaviors will be accompanied by some level of automated response, moving us towards a world that is both self-aware and self-regulating.

Driven by a combination of low-cost sensor technologies (capture), far-reaching Wi-Fi networks (connect) and cloud intelligence (analyze), this so-called 'Internet of Things' has far-reaching consequences for the lives of individuals and society, many of which we're still trying to conceive of and understand. As noted technology expert, Tim O'Reilly, says, "so many of the most interesting applications of the Internet of Things involve new ways of thinking about how humans and things cooperate differently when the things get smarter."

To that end, imagine a future where ours homes are able to understand a complex range of human behaviors and emotions, providing personalized assistance and support at key moments in our days. Eventually, this could even lead to our technologies anticipating our needs, offering up a host of relevant actions - a reminder to take your vitamins, a soundtrack ideally suited to your current mood or ordering up milk and eggs before you run out. When scaled up to the level of municipal infrastructure and natural systems, we're seeing the potential to change the way our planet operates, delivering greater knowledge, safety and efficiencies. This could mean crops that send alerts about soil and weather conditions to optimize their yield, vehicles that brake or turn to avoid cyclists and pedestrians or street lighting that constantly adjusts to traffic flow to cut down on wasted energy.

Of course, this push to connect every aspect of our world raises a number of issues as well. While autonomous systems hold great promise for freeing up our time and other resources, how much control are we actually willing to give up and how do we ensure we maintain a sense of agency? Add in the notion of personal information privacy, which takes on an even bigger role when we're no longer the ones pushing send, and we'll need to begin making important decisions about who owns this data, who can use it and where it all goes. And in the same way the World Wide Web held the promise of universal and unfettered access for every global citizen with the ability to get online, we'll need to figure out a set of open standards and practices for governing the Internet of Things as it becomes more fully integrated in the fabric of our lives.

The following report on the Real World Web, in a partnership between PSFK Labs and IQ by Intel, is intended to open up the conversation around the possibilities and challenges created by the Internet of Things. In it, we've described ten trends organized around three larger themes - Community Web, Empathetic Tech and Self-Aware World - that explore the role that Wi-Fi-enabled technologies will play in the connected ecosystems of the future, and their impact on consumer lifestyles and behaviors. Each of the trends have been supported by six best-in-class examples of related products and services, along with a list of experts, industry statistics and implications, which point to potential opportunities to leverage these insights.

www.psfk.com/real-world-web

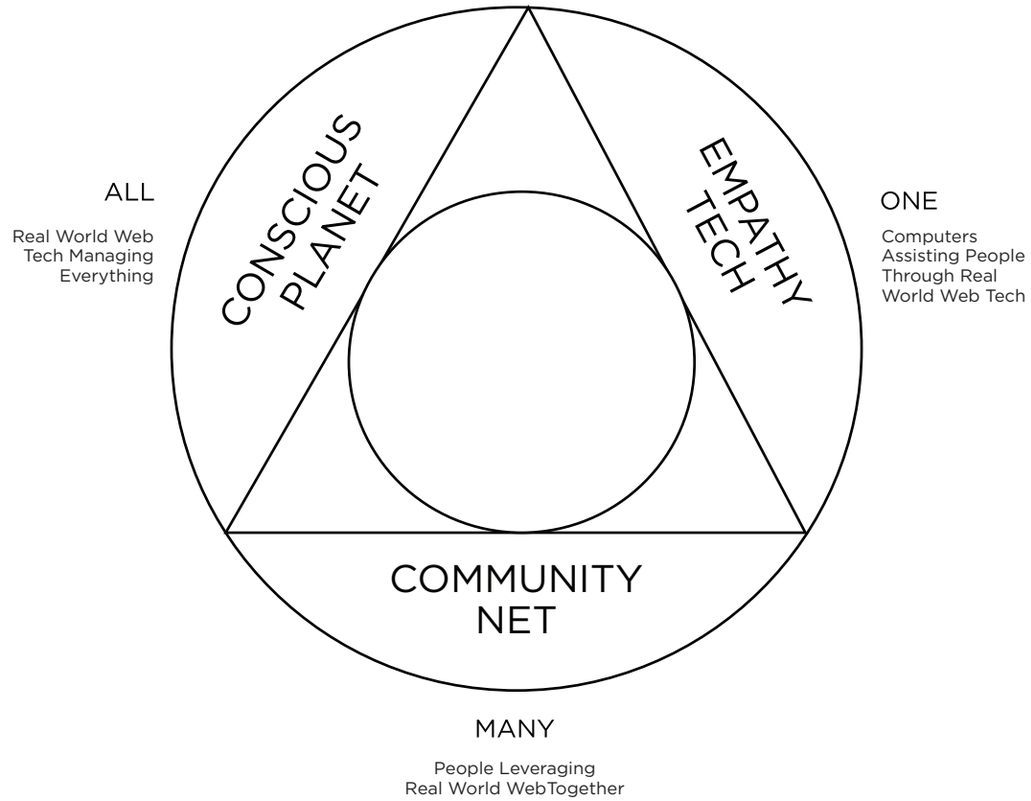
About This Document

This document outlines a ten week editorial plan intended to engage audiences around the future of internet-enabled technologies and device ecosystems of the future. The plan is further divided into two sub-sections which describe the weekly structure of the content that will be produced and a description of the social efforts around all content pushes.

STRUCTURE

This document presents 10 key trends clustered within 3 larger macro trends. They have been uncovered during the analysis of PSFK Lab's research into progressive changes around internet-enabled technologies. Each trend is accompanied by descriptions of 3 best-in-class manifestations and three supporting examples. These trends will serve as a foundation for creating an active conversation and actionable vision for Intel.

Version .9



Initial Trends

COMMUNITY NET

The development of a new set of software platforms and tools is building a growing network of individuals, sensors and wearable devices around the open exchange of real-time information streams. Intuitive programming interfaces combined with a universal set standards allow anyone to connect an object to the internet to create custom data and experiences that can be shared and accessed by the broader community, contributing to the collective knowledge of the planet.

EMPATHY TECH

A new breed of social and attentive machines are being meaningfully integrated into daily life. These devices and systems are capable of understanding a wider range of human needs and behaviors to provide relevant assistance and support at key moments, which opens the possibility of more intimate relationships with the objects in our lives.

CONSCIOUS PLANET

As a wider array of connected objects capture, analyze and communicate information to other networks about their own conditions and those of the surrounding environment, we're seeing the emergence of self-aware systems. These intelligent machines are able to respond to a range of situations with appropriate pre-determined actions without the need for human input, and even learn more sophisticated responses over time. This higher degree of autonomy is intended to ease the burdens associated with certain tasks, while adding greater safety and efficiencies into the world.

About iQ by Intel

This independent report has been kindly underwritten by iQ by Intel. iQ by Intel is a news site that narrates the impact of technology on our lives. It connects readers to the trends and discussions that are moving our planet forward.

Their mission is to highlight how far we've come as a human race, to explore our basic notion of human capabilities and to remind us all of the many ways our lives are connected and enriched through technology.

At its core, iQ is an intelligent system that curates content shared by leading thinkers, engineers and scientists at Intel. iQ is powered by ideas, but it also shares the content grabbing our attention beyond Intel's walls, getting smarter through the developments and discussions from the wider social web.

Their aim is to provide insight into what is driving our belief that technology unleashes the world's human potential to create a better future. iQ is Intel's home on the web to help share this story.

"iQ by Intel" is brought to you by the employees of Intel, our global partners and the Intel Social Media Center of Excellence.

iq.intel.com

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Since 2004, PSFK content team has been providing up-to-the-minute ideas and inspiration to audiences. Their publishing experience allows them to understand what gets both clicked and shared.

Working with clients in the beverage, pharmaceutical and technology sectors, PSFK Labs' team has crafted content for a variety of platforms including Facebook, Twitter, Pinterest and more.

PSFK Labs has been producing iQ by Intel content since 2012.

labs.psfk.com

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iQ by Intel is an online magazine curated by Intel employees that narrates the impact of technology on people's lives. The publication connects readers to new ideas around design, technology social and big data.

iq.intel.com

COMMUNITY NET

The development of a new set of software platforms and tools is building a growing network of individuals, sensors and wearable devices around the open exchange of real-time information streams. Intuitive programming interfaces combined with a universal set standards allow anyone to connect an object to the internet to create custom data and experiences that can be shared and accessed by the broader community, contributing to the collective knowledge of the planet.

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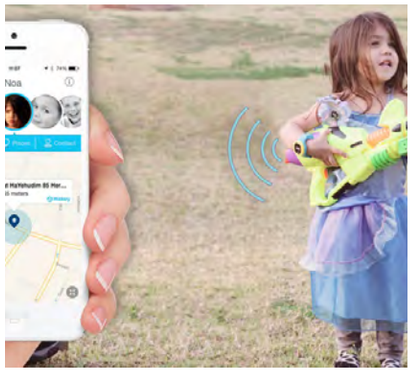
01. Shared Awareness

Wearable and mobile devices are automatically capturing and broadcasting contextually relevant information at key moments to enable a seamless flow of communication between people. These systems are continually monitoring individual data like location and activity level to deliver a preprogrammed set of notifications to a trusted peer group, activating a network around timely support and care.

Mimo: Onsie Streams Baby Bio Data To Illuminated Mug



hereO: GPS Watch Tracks Children When They Enter Or Leave An Area

INTEL EXPERT

"I might know, for example, if my mom is lonely, because maybe we agree to let each other see- not our actual emails- but analytics of those emails which tell me information about her emotional state. "

— Margaret Morris, Senior Researcher, Intel Labs

Lunar: Device Creates 'The Butterfly' Feeling When Someone Nearby Likes You

"The change in the emotional landscape conferred by people being able to communicate very cheaply irrespective of geography is still only dimly understood."

— Tim Bray. Developer. Internet Engineering Task Force (IETF)

"It will be a world more integrated than ever before. We will see more planetary friendships, rivalries, romances, work teams, study groups, and collaborations."

— Bryan Alexander. Senior Fellow. National Institute for Technology in Liberal Education.

"Having a system in the home that only your family can access will let you see signs that your parents are becoming old and listless, and track warning signs of something serious in the works."

— Russell Ure. Co-founder and CEO. Piper

" The Internet of things space, which is getting lots of buzz and investment, will reshape many industries over the next decade. Elder care is likely one industry that will experience some of the biggest changes, as costs are high, demand is increasing, and emerging technology is directly applicable at nearly every layer of the market."

— Michael Wolf. "Here's Why Elder Care May Be The Next Billion Dollar Technology Opportunity". April 2014. Forbes

ONSIE STREAMS BABY BIO DATA TO ILLUMINATED MUG

The Mimo Baby Monitor is a device designed to put anxious parents at ease by providing them with a constant stream of data about their child. It works via a series of sensors embedded in an infant bodysuit, called the Kimono, which monitors the baby's respiration. The data is passed on to a small turtle-shaped gizmo, nested in the Kimono, which in turn measures skin temperature, body position and the activity pattern. All this information is then relayed via low-power Bluetooth to a Wi-Fi enabled docking station and a connected coffee mug that visualizes the information on the side, giving parents an easy and intuitive way to track their baby's health. The device provides a simple and accessible way for parents to regularly monitor the condition of their children.

mimobaby.com
slate.me/1gFlyJU

GPS WATCH TRACKS CHILDREN WHEN THEY ENTER OR LEAVE AN AREA

The hereO is a GPS-connected smartwatch that is designed to strap onto a child's wrist, allowing parents to monitor their whereabouts via a connected app. The devices features a built-in SIM-Card, that auto-connects to a local carrier in more than 140 countries. Once connected, users can set parameters so that the GPS watch and app will notify them when a child enters or leaves a specific area such as a school. Parents can also use hereO to simply see where their child is at any given moment. The device can give parents an added peace of mind, knowing that their child is always within a safe distance.

hereofamily.com
bit.ly/1n9imJb

DEVICE CREATES 'THE BUTTERFLY' FEELING WHEN SOMEONE NEARBY LIKES YOU

Design studio Lunar Agency has created a wearable jewelry concept that connects nearby people who have shared interests. Called Wizz, the pendants gather information from your entire social network, and use that to figure out whom you might like. It uses this information to send you an alert when there is someone with the same interests in the area around you, adding a tangible element to people's relationships.

lunar.com/home.shtml
bit.ly/1piG3hN

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Behere: *App Lets Teachers Take Attendance Using iBeacon Technology*
bit.ly/1kcE1Q5
tcrn.ch/1mJCmFi

SensFloor: *Sensor-Equipped Flooring Can Tell If Someone Has Fallen*
bit.ly/1idVEjg
bit.ly/N6Fyee

IMPLICATIONS

- Remote relationships can be bridged through communicating states of loved ones through lighting or app pings, connecting those temporarily removed from one another.
- Geo-fencing could be used to alert anyone when connected individual moves outside of a set of established parameters.
- Consider frequently used objects like coffee mugs or mirrors as new interfaces and displays for tracking and serving relevant information to people in the midst of daily life.
- Sensors capturing an array of information placed throughout a home could communicate information visualized in a centralized dashboard for loved ones to tap into at any given time.

02. Programmable Lifestyle

An emerging marketplace of simple programming interfaces is allowing anyone from seasoned hackers to computer novices to experiment with internet-enabled sensors and devices in their own lives. These interactive 'recipes' enable people to connect multiple objects together into automated actions that respond to a specific set of conditions, and share the resulting data and experiences with the wider community.

Piper: Sensor Allows Homeowners To Program Their Home To React To Different Situations

NinjaBlocks: Device Lets Users Control All Their Internet Connected Devices Together

Automatic: System Lets Owners Program Their Car Into A Social Media Object

When enough of these devices are connected to the Internet, we will be able to choreograph them to work together based on our specific needs. While many people have labeled this forthcoming revolution the "internet of things," a more accurate description is the "programmable world."

— Alex Hawkinson. Founder and CEO. Smart Things

"A few key elements for the IoT in everyday life will be awareness and control. User's mental models of what's going to happen have to be supported."

— Florian Michaelles. Associate Director. Auto-ID Labs

"Economic value-add (which represents the aggregate benefits that businesses derive through the sale and usage of IoT technology) is forecast to be $1.9 trillion across sectors in 2020. The verticals that are leading its adoption are manufacturing (15 percent), healthcare (15 percent) and insurance (11 percent).

— Gartner. 2013

SENSOR ALLOWS HOMEOWNERS TO PROGRAM THEIR HOME TO REACT TO DIFFERENT SITUATIONS

Piper is a home a sensor with a built in camera that allows users to program their home to respond to various conditions. Using the Piper mobile app, a user might add 'If motion is sensed, then send me a text message,' or, 'If a door is opened, then sound the (105 decibel) siren,' thus creating their own custom alarm system. The functionality is similar to that of IFTTT, a site that popularized the ability to use if/then commands to allow online tools to interact. By connecting with home devices and allowing the user to define their own commands based on situational requirements, Piper greatly expands on the use cases for which these technologies integrate into home ecosystems.

getpiper.com

DEVICE LETS USERS CONTROL ALL THEIR INTERNET CONNECTED DEVICES TOGETHER

The Ninja Sphere is a household device that is aiming to give users complete control over every object in their home. With features like LED lights, built-in Bluetooth and Wi-Fi, the gadget lets users keep tabs on the things, even the pets, in their home. For example, by placing, a Bluetooth tag on the cat and the Ninja Sphere will track its travels. The key to the system is that it does not come packaged with a pre-determined purpose other than to help things communicate, and it is up to the user to program in interesting and useful ways to make this happen.

ninjablocks.com
bit.ly/1fYfzkx

SYSTEM LETS OWNERS PROGRAM THEIR CAR INTO A SOCIAL MEDIA OBJECT

Automatic is a smart driving assistant that installs a small piece of hardware in car to convert the vehicle into a smart object that can interact with various roadside services. Leveraging Apple's iBeacon, the tech could be used to offer automatic toll, gas payments, or other functionalities related to geo-fencing. Many of the applications are so far only theoretical, but the company is testing real-world applications. Over time the system learns the driver's repetitive habits, which it can then use to make recommendations for how to become a more efficient driver.

.automatic.com
bit.ly/1jR2ryk
wrd.cm/1jR2Gtw

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Sense: *Sensors Turn Quantified Self Data Into A Visual Storyboard*
bit.ly/1eQYlCo
bit.ly/1fheIIp

Ocho Pad: *Wireless Communications Hub For Organizing Your Life*
ochopad.com
bit.ly/1pgQ4kX

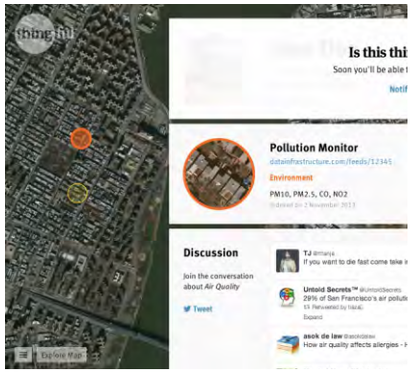
Homee: *Universal Smart Home Hub*
hom.ee
bit.ly/1jR9mI4

IMPLICATIONS

- Products can offer a library of pre-programmed and easy to use 'recipes', allowing users an easy entryway into programming their connected devices together
- Plants and perishable items could be programmed to push alerts to homeowners to take a required action.
- Inventory for a business could be programmed to communicate with a central hub, alerting managers if supplies are low and need replenishing.

03. Open Source Access

A mix of manufacturers, service providers and organizations are working to establish the infrastructure required for the seamless interoperability and fluid transmission of data between internet-enabled technologies. These emerging systems and protocols challenge the notion of ownership and privacy in this space, building an open framework to link different connected devices and empower people to interact with them in a more holistic way.



Thingful: Discovery Engine Creates 'Google Search' For The Internet Of Things

Bug Lab: Software Allows Devices To Push Information About Themselves Over Social Channels

Shodan: Search Engine Allows Users To Tour The World's Connected Webcams

INTEL EXPERT

"We see a future that will have billions of connected devices with huge commercial applications. Our aim is to bring the complex technology into the hands of people so that it is simplified and enables them to produce something within minutes that used to take us decades to produce"

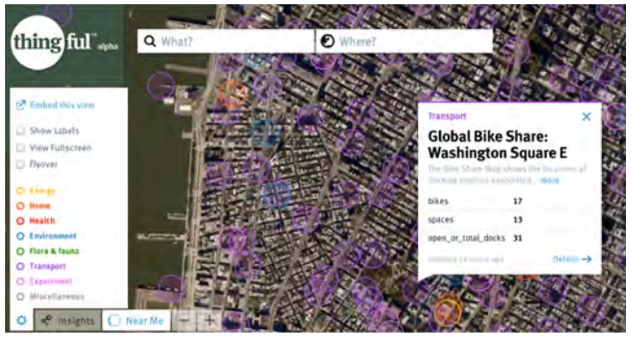
— Brian Krzanich, CEO, Intel

"There will be increased franchise and information sharing. There will be changes to business models to adapt to the economics of digital communication and storage. Privacy must be improved but transparency about what information is retained about users also has to increase."

— Vint Cerf. Vice President and Chief Internet Evangelist. Google

"The biggest impact on the world will be universal access to all human knowledge. The smartest person in the world currently could well be stuck behind a plow in India or China. Enabling that person — and the millions like him or her — will have a profound impact on the development of the human race. Cheap mobile devices will be available worldwide, and educational tools like the Khan Academy will be available to everyone. This will have a huge impact on literacy and numeracy and will lead to a more informed and more educated world population."

—Hal Varian. Chief Economist. Google.



DISCOVERY ENGINE CREATES 'GOOGLE SEARCH' FOR THE INTERNET OF THINGS

Thingful is a UK-based startup that is working to create a search index for the Internet of things. In the same way that Google indexes web pages, Thingful aggregates and indexes objects worldwide providing direct links to data sets, data streams or profile pages, and places people at the very center by structuring objects' ownership around Twitter profiles. People can log information about why and how they are using the devices that they add to the index. Thingful indexes across eight categories including health, environment, home, transport, energy, flora and fauna. The project aims to help people better understand how to take control over the Internet of things, and interact more deeply with their surroundings.

thingful.net
bit.ly/PUoDwV

SOFTWARE ALLOWS DEVICES TO PUSH INFO ABOUT THEMSELVES OVER SOCIAL CHANNELS

Dweet.io is software allowing any product, device, machine, or 'thing' connected to the Internet to easily publish its own data socially. Created by the New York based software company Bug Lab, Dweet.io lets users insert a bit of code onto a device and push the data across social media platforms. One company experimenting with the software used the code to connect their foosball table to the Internet, for instance. Additionally, the data from Dweet.io can be used to create graphical displays to easily visualize the collected information.

buglabs.net/products/dweet.io
bit.ly/1jHT2Gw

SEARCH ENGINE ALLOWS USERS TO TOUR THE WORLD'S CONNECTED WEBCAMS

Shodan is a search engine that links to any Internet connected emotion environment camera to provide its surfers a voyeuristic glimpse inside. The search engine looks for connected devices across the world like routers, refrigerators, cars or live webcams, and lets the user navigate through them by paying a one-time fee. For example, Shodan's probes cycle through Internet protocol addresses finding webcams, databases, control panels for large caterpillar tractors or even medical devices. The service randomly allows users to view these networks occasionally revealing things that aren't supposed to be made public.

shodanhq.com
wrd.cm/1iSD1B3

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Industrial Internet Consortium: *Consortium Wants To Standardize Internet of Things*
iiconsortium.org
zd.net/1pusTUa

AllSeen Alliance: *Open Source Platform Challenges A Proprietary Internet of Things*
allseenalliance.org
bit.ly/1mEZTVj

BRCK: *Portable Router Brings The Internet To Remote And Rugged African Areas*
brck.com
bit.ly/1nfYc2V
bit.ly/1nfYiaV

IMPLICATIONS

- Connected webcams could be indexed and accessed based on industry, location, and so on for people to access for any purpose they desire.
- People contributing to this connected ecosystem have clear channels for opt-out as well as details over exactly what information they are providing.
- DIY kits can help rural or low income communities connect items to the internet for specific purposes and share data from remote parts of the world.

EMPATHY TECH

A new breed of social and attentive machines are being meaningfully integrated into daily life. These devices and systems are capable of understanding a wider range of human needs and behaviors to provide relevant assistance and support at key moments, which opens the possibility of more intimate relationships with the objects in our lives.

04. Behavioral Nudge

Connected products are capable of monitoring daily routines to understand behavioral patterns and weigh them against predetermined goals as a way to help people stay on track or incrementally change their lives. By interceding at key moments with timely prompts, these systems can nudge people towards smarter decisions in the moment, which can contribute to improved physical and emotional well-being.

Simone Rebaudengo: Underused Products Let Owners Know They'd Be Better Off Elsewhere

Lucas Neumann: High-Tech Stress Ball Keeps Procrastination At Bay

Credit Card Finder: Purse Snaps Shut And Stops Owners From Spending Too Much

"We may well see wearable devices and/or home and workplace sensors that can help us make ongoing lifestyle changes and provide early detection for disease risks, not just disease. We may literally be able to adjust both medications and lifestyle changes on a day-by-day basis or even an hour-by-hour basis, thus enormously magnifying the effectiveness of an ever more understaffed medical delivery system."

— Aron Roberts. Software Developer. University of California-Berkeley

"Implantable chips that monitor the number of steps we take, hours we sleep, all of our vital signs, blood chemistry and beyond. The chip data will be used to adjust our medications, offer suggestions to change our behavior and automatically send an ambulance — self-driving, of course."

— Clara Shih. CEO and Founder. Hearsay Social.

INTEL EXPERT

"The integration of sensors in products is already careening down the path of more personalized feedback for users. The challenge here, however, is how to work towards personalized feedback that doesn't isolate people from one another and instead seeks to promote the social relationships that are so fundamental to the things that we do in our daily lives. "

— Maria Bezaitis, PhD and Principal Engineer of Intel's User Experience Ethnographic Research Lab

UNDERUSED PRODUCTS LET OWNERS KNOW THEY'D BE BETTER OFF ELSEWHERE

Munich-based interaction designer Simone Rebaudengo has created a series of connected toasters called 'Brad' that when neglected, signal the network that they are unhappy and wish to leave. Owners of the toasters became more aware of their responsibility of ownership and used the once undervalued product more as a result or were simply aggravated by their neediness. By injecting some personality into products, the designer hoped that he could help people notice that they're not really using everything filling their home.

simonerebaudengo.com
bit.ly/1IY0EI5

PURSE SNAPS SHUT AND STOPS OWNERS FROM SPENDING TOO MUCH

iBag is a location enabled purse that has built-in mechanisms to stop shoppers from overspending. Developed as a concept by Australia-based Credit Card Finder, the bag is programmable to help users avoid the stores they spend the most by physically locking during periods of most frequent shopping. GPS is used to warn users when they're getting too close to a favorite shop and the bag will send a text message to trusted persons to let them know a user is overspending.

creditcardfinder.com.au/ibag
bit.ly/1fYdcy9

HIGH-TECH STRESS BALL KEEPS PROCRASTINATION AT BAY

Design student Lucas Neumann has developed a new desktop device called Bossy to help entrepreneurs and self-employees manage their time and be more productive. The device relies on gamification to keep workers engaged and concentrated, making a game out of working time to help people establish a goal-oriented mindset and avoid distractions. The device is also sensitive to the bodily and emotional needs of its owner and presents small ideas for breaks. Bossy also connects to different apps, social media, calendars, and reminder information, so users never have to open Facebook or check apps and get distracted. The physical presence of Bossy is also important so it's a constant reminder of time efficiency.

lucasn.com/bossy
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Hammacher: *Pillow Gets You To Turn Over If You're Snoring*
bit.ly/1ePfFMa
bit.ly/1gQzgLR

Sunsprite: *Device Tells Users When They Need More Sunlight*
sunsprite.com
bit.ly/1mk420w

Vigo: *Energy-Gauge Headset Tracks Blinks To Keep Wearers Awake*
wearvigo.com
bit.ly/1lgWGK0

IMPLICATIONS

- Products could alert owners when they are being underused and signal an opportunity to reduce the number of material objects in their possession.
- Connect 'nudges' to a person's existing behaviors, tailoring reminders to specific preferences and contexts to provide them information that feels relevant at a certain place in time.
- Create opt-in controls which enable user to set their own parameters, ensuring that 'nudges' are timely and compelling.
- Game mechanics and other added incentives can add an extra layer of motivation to keep users aligned with their goals.

05. Emotional Response

Sensors and image recognition capabilities are being paired with sophisticated algorithms to bring a deeper understanding of human emotion, awareness and thought processes to electronic devices and systems. By interpreting how a person is feeling or what they are thinking, these technologies can tailor their responses more appropriately, contributing to more human-like interactions and experiences.

The Royal Automobile Club: Brainwave-Monitoring Car Slows Down When The Driver Is Distracted

École Polytechnique Fédérale de Lausanne: Driver Emotion Detectors Could Lead To Safer Roads

Patrick Levy Rosenthal: Artificial Intelligence Cube Makes Spike Jonze's "Her" A Reality

"Emotions are often the result of predicting a likely outcome. For example, fear comes when we are predicting that something bad (or unknown) is going to happen to us. Love is an emotion that evolution built into us because we are social animals and we need to reproduce and take care of each other. Future AI systems that interact with humans will have to have these emotions too."

— Yann LeCun, Director of AI Research, Facebook.

"It is easy to train a computer to recognize basic emotions, such as fear or anger. It is more difficult to recognize more complex emotional states, that might also be culturally dependent, such as confusion, interest and concentration. The field is relatively new, and only recently has it been possible to recognize emotions in real world environments with a degree of accuracy. The approaches are getting better every year, leading to more subtle expressions being recognizable by machines."

— Tadas Baltrušaitis. Researcher. University of Cambridge Computer Laboratory.

"In the future, such technologies (using a variety of sensors all over the human body) could also be used to help children learn by monitoring if they are bored or fidgety, and then enticing a teacher to change a lesson plan or assignment."

— Nick Bilton. "Devices That Know How We Really Feel". May 2014. New York Times

BRAINWAVE-MONITORING CAR SLOWS DOWN WHEN THE DRIVER IS DISTRACTED

The Royal Automobile Club of Western Australia has create an 'attention-powered car' that slows down when drivers find themselves drifting off. Developed as part of an attempt to reduce the number of road accidents caused by distractions while driving, the headset is equipped with 14 sensors and measures the type and amounts of brainwaves, which can quickly respond to the emotional state of the driver. Any lapse in concentration is immediately relayed to the driver and the car automatically slows down to a safe speed of 9 mph

rac.com.au
wrd.cm/1fYcJw0

ARTIFICIAL INTELLIGENCE CUBE MAKES SPIKE JONZE'S "HER" A REALITY

EmoSPARK is a cube-shaped "artificial intelligence console" that uses face-tracking and language analysis to assess user emotions and deliver relevant content suited to the situation. Created by inventor Patrick Levy Rosenthal, the cube is able to assess multiple people's emotions at the same time, information which it uses to create an Emotional Profile Graph (EPG). Apart from in-person conversations, users can also talk to the cube by typing or talking on a smartphone, tablet or computer. Over time, the cube will learn more about users and their preferences based on eight basic human emotions: joy, sadness, trust, disgust, fear, anger, surprise and anticipation.

bit.ly/1hTZC10
bit.ly/PclXds

DRIVER EMOTION DETECTORS COULD LEAD TO SAFER ROADS

An in-car detection system has been designed to watch for emotions like anger and disgust which could negatively affect driving and provide feedback to the driver so they become aware of their mental state. Developed by researchers at the École Polytechnique Fédérale de Lausanne in France while collaborating closely with PSA Peugeot Citroen and developing, the system uses an infrared camera system to identify the driver's emotions. The main idea is that the system will detect when the driver is stressed or irritated, emotions that may negatively affect his or her driving, and then flash warning signals or trigger a limiting function on the car's speed to make sure the driver is driving safely. Researchers are still working on improving the system, and considering the inclusion of a fatigue detector and a detector for other states like distraction as well as lip reading or vocal recognition systems.

bit.ly/1gQiCvL
bit.ly/1jecFXU

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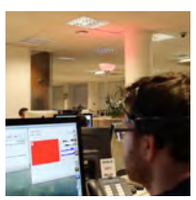
bit.ly/STljo5

Kristina Höök.
Professor. Swedish Institute of Computer Science
@ProfessorHook
bit.ly/RGSgDk



Ulybka Radugi: *Checkout Counter Checks You Out And Offers Discounts To Happy Customers*
r-ulybka.ru
synqera.com
bit.ly/1jbUFyW

CEDE: *Mood Lighting Responds To Owner's Emotions*
projectcede.org
bit.ly/1je0LMv

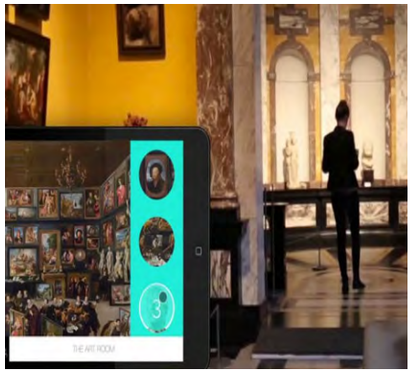
IMPLICATIONS

- Objects can pick up on nuanced biometric signals such as stress or anger, guiding users towards specific remedies during particular situations or use cases.
- Connect a person's mood with a broader, connected ecosystem which responds to positively affect their well-being through programmed elements like lighting and ambiance.
- Personal devices can become biometrically attuned to users and automatically identify and curb detrimental behavior through periods of locking and/or encouraging them to take a break from an activity after an extended period of stress.
- Games, educational materials, and online content could become reactive to mood/state of being and automatically curate appropriate materials.

06. Contextual Experience

Sensors are leveraging a combination of user data, location, time of day and other related conditions to automatically deliver relevant information and experiences to people on their mobile devices. By proactively serving guidance like recommendations or directions, or even switching modes to tailor an interface to a particular situation, these platforms help streamline people's interactions with their devices.

Cover: Home Screen Curated Based On Time and Location



Prophets: Bluetooth Pucks Transmit Additional Info On Art To Bring Gallery To Life

MindMeld: Algorithm Predicts And Provides Information Related To Context Of Conversation

"Contextual search aims to give people the right information, at the right time, by looking at signals such as where they're located and what they're doing—such as walking or driving a car. Mobile devices tend to provide a lot more of those signals....When I look at things like contextual search, I get really excited."

— Marissa Mayer. CEO. Yahoo

"Tracking how our bodies are responding throughout the day could allow you to tailor your life according to what's happening to your body throughout the day. When we are wearing five different computers and they can all talk to each other, that sort of input information will cause an exponential increase" in what humans can do."

— Prerna Gupta. Chief Product Officer. Smule.

"For retailers, the growth of this universe of interconnected devices, people and equipment opens more possibilities in improving business efficiencies and delivering greater shopping experiences to customers throughout the retail supply chain."

— "Infographic: The Internet of Retail – Digitizing the Retail Supply Chain", by Christine Lee. Total Customer, March 2014.

HOME SCREEN CURATED BASED ON TIME AND LOCATION

Cover is an app that automatically organizes shortcuts on the lock screen to bring up the user's favorite apps according to when and where they are most often used. Using Wi-Fi and cell towers to pinpoint the phone's location for modes such as Home, Work, and Out, Cover will seamlessly transition lock screen shortcuts as the user physically moves between these spaces. Cover can even learn app usage (with user permission) according to hours of the day, and also use the phone's gyroscope and accelerometer to determine when to activate Car mode. The app was recently purchased by Twitter, offering some interesting potential ways in which the service could push messages to its users.

bit.ly/1j2qugq
bit.ly/18xIzc0

BLUETOOTH PUCKS TRANSMIT ADDITIONAL INFO ON ART TO BRING GALLERY TO LIFE

The gallery at Rubens House in Antwerp, Belgium has layered iBeacon technology onto their existing mobile application to create a unique art experience that prompts visitors to further explore the gallery's historic pieces. Building upon the information in museums' mobile applications, the digital agency Prophets placed small pucks that use Bluetooth low energy waves to connect with visitors' phones as they approach pieces. Visitors can learn more detailed information about the works they're looking at - like how the painter hid family members in popular portraits - and see other paintings hidden under the final image.

bit.ly/PTZBhs
bit.ly/PTZHWn

ALGORITHM PREDICTS AND PROVIDES INFORMATION RELATED TO CONTEXT OF CONVERSATION

MindMeld is a new app for iOS, which functions as a voice conferencing assistant that understands conversations and, depending on what people are talking about, will find a map of a city and tourist information if the chat is about a trip, or restaurants if it is about eating out. The app detects words and phrases related to current events and local businesses and searches the Internet while people are speaking to each other to gather more information related to the conversation. Up to eight people can join a chat, and the app also summarizes key concepts of the discussion. To protect privacy, conversations are not recorded or stored.

bit.ly/1gQiJHL
bit.ly/PUzhnq

TOPIC EXPERTS

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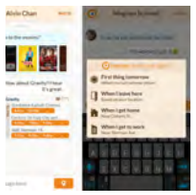
@slavin_fpo / bit.ly/1jjCxja

Alexandra Deschamps-Sonsino.
Interaction & Product Designer. Designswarm
@iotwatch
bit.ly/1lc6x1X



Philips: *LEDs Broadcast Location-Specific Information To Shoppers' Phones*
philips.com
bit.ly/1jopZKI

Emu: *Text Messaging App And Personal Assistant In One*
emu.is
bit.ly/1jRazPm

BMW: *Testing In-Car Ads Based On Current Location And Destination*
bit.ly/1mk4Q5D
bit.ly/1lgXXkg

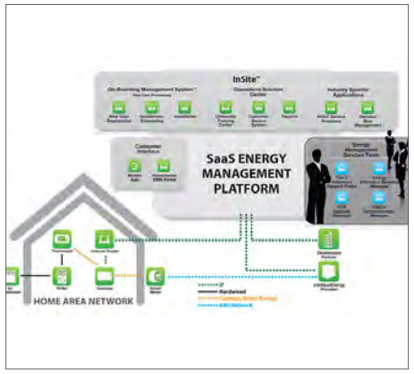
IMPLICATIONS

- Custom learning materials could be delivered to students or tourists moving throughout a museum, city and so on, which could be further curated through age-appropriate interfaces, content and methods of delivery.
- Internet-enabled objects can learn from a user's behavior and couple it with additional data such as time and weather to deliver appropriate experiences.
- Connected objects in home could alert users in real-time when supply is running low and remind them to pick up an item when and where it is available at a store nearby.
- Emergency items and supplies could be programmed to react alongside corresponding alerts and warnings, helping people locate critical items during crisis.

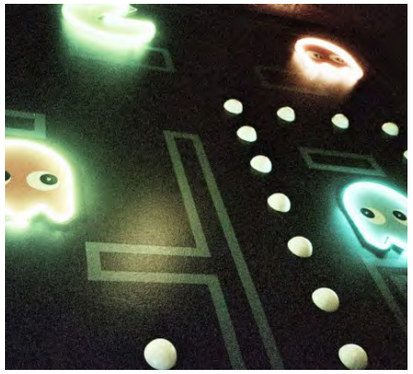
07. Adaptive Machines

Connected objects and devices are evolving from reactive to adaptive by learning from accumulated data and experiences to automatically improve efficiencies and personalize performance to better suit the needs of their owners. As these systems become more advanced, they're even becoming capable of sharing that intelligence with other machines and networks to grow their collective knowledge base.

Smartcar.Io: Self-Learning System Helps Drivers Cut Their Electric Bills



NRG Energy: Connected Algorithm Analyzes Energy Usage To Control Home Thermostats



Taylor Francis Online: Computers Teach Other Computers To Play Pac-Man

"The Internet is morphing from the global library into the global supercomputer. By 2025, almost every application or service we can imagine will be enhanced by the application of enormous computation enabling widespread applications of capabilities like mining, inference, recognition, sense-making, rendering modeling as well as proactive contextual computing."

— Mike Liebhold. Senior researcher and Fellow. Institute for the Future.

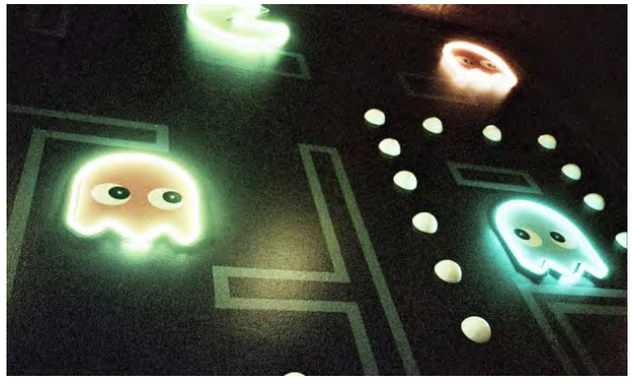
"IoT examples focused around operational efficiencies, rather than transformational change. Stuart Orr, of consultants Accenture, ACN -0.34% said courier company United Parcel Service Inc. UPS -0.58% had saved nine million gallons of fuel by monitoring routes and minimizing left turns in the U.S. and Canada. While that sounds impressive, at today's prices that is a saving of about $31 million: a drop in the ocean for UPS, which reported total annual operating expenses of some $39 billion in December 2012."

— Ben Rooney. "Internet of Things Poses Big Questions". July 2013. Wall Street Journal

SELF-LEARNING SYSTEM HELPS DRIVERS CUT THEIR ELECTRIC BILLS

The in-car app Smartcar for Tesla helps drivers reduce their electricity bill by optimizing energy use while driving the car as well as avoiding peak hour rates when recharging. The learning system adapts to the driver's behaviors for a more personalized driving experience, such as knowing when to heat up the car on a cold morning before a commute.

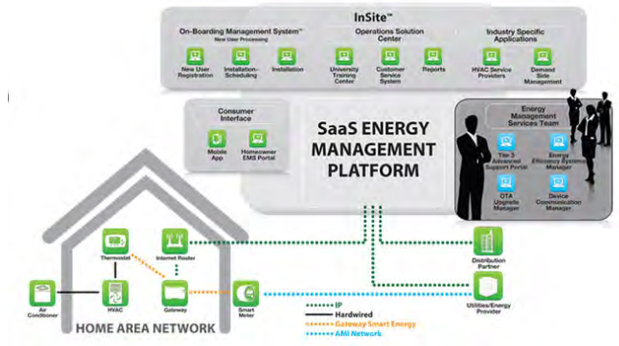
smartcar.io
bit.ly/PU2gYF



COMPUTERS TEACH OTHER MACHINES TO PLAY PAC-MAN

An international team of computer science researchers have improved computer learning by utilizing teaching algorithms that coach other computers to beat high scores in video games in less time than unaided algorithms. The program challenged computers to beat goals in Pac-Man and Starcraft, which serve as a great analogy for real life decision engines, by improving their ability to face crucial decisions and improve their outcome over time.

bit.ly/PUtv5p
bit.ly/PUtm1M



CONNECTED ALGORITHM ANALYZES ENERGY USAGE TO CONTROL HOME THERMOSTATS

Power company NRG Energy has invested in startup EcoFactor, which uses smart algorithms, large data sets and connected thermostats to reduce customers' home energy consumption. EcoFactor has created software that pulls in data about things like weather, demographics, and homeowner behavior. The system then uses all this data to tweak a home's connected thermostat settings to shave off energy consumption, but also to maintain a comfortable temperature in the home. The technology demonstrates how constant small changes based on outside conditions and user behavior can add up to greater efficiency in the long run.

nrgenergy.com
bit.ly/1h6mgSi

TOPIC EXPERTS

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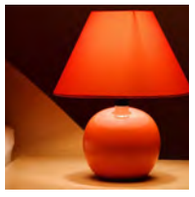
Washington State University
Artificial Intelligence School.
bit.ly/1olHQ0O



Parce One: *Smart Wall Plug-In Manages Home Energy Use With Visual Reports*
parce.de
bit.ly/1f3t5jl

SMARCOS: *Human-Computer Interface Tracks Wearer's Actions To Offer Help When Needed*
smarcos-project.eu
bit.ly/1gQ94Rm

Rhythm Downlight: *Intelligent Light Bulbs Adjust To Individual User's Rhythms*
lsgc.com/products/fixtures/glimpse
on.mash.to/KiCOtC

IMPLICATIONS

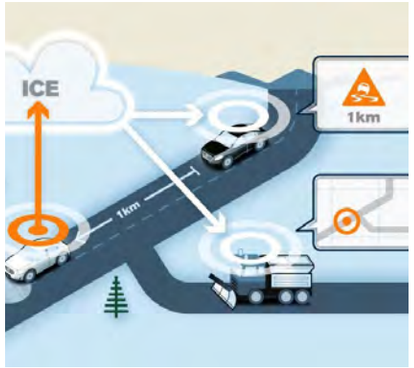
- Each device within a connected home ecosystem can share data around user behavior, resulting in smarter response and more efficient operations.
- Vehicle GPS systems can communicate with those around it, routing connected cars to different route, easing traffic flow.
- Wi-fi systems within the same umbrella network could redirect bandwidth according to usage, taking advantage of any time a network is underused.

CONSCIOUS PLANET

As a wider array of connected objects capture, analyze and communicate information to other networks about their own conditions and those of the surrounding environment, we're seeing the emergence of self-aware systems. These intelligent machines are able to respond to a range of situations with appropriate pre-determined actions without the need for human input, and even learn more sophisticated responses over time. This higher degree of autonomy is intended to ease the burdens associated with certain tasks, while adding greater safety and efficiencies into the world.

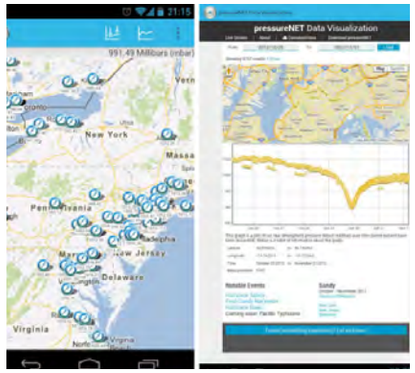
08. Distributed Intelligence

A greater number and variety of sensors are being embedded into objects and devices, creating a mobile network of nodes for passively gathering and broadcasting data. Through access to a wider pool of data that can often be communicated and analyzed in real-time, these sensor networks are aiding in decision making.



Volvo: Dedicated Testing Cars Anonymously Share Road Condition Data

Intel: Electronics Company Transforming Dublin Into An Urban Internet Of Things



PressureNET: Pooled Data From Individuals Creates Crowdsourced Weather Forecasts

"A new wave of consumer applications is putting big data at everyone's fingertips. Even as consumers worry about the effect on their privacy of all the personal information that is widely shared, many are finding ways to benefit from new, readily accessible, data-rich services."

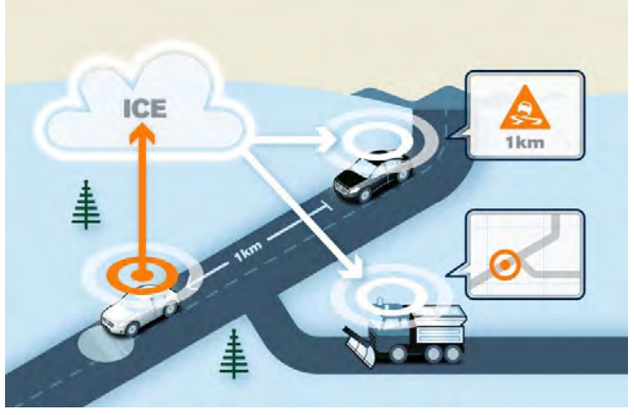
— "How Consumers Can Use Big Data", by Lora Kolodny. The Wall Street Journal, March 2014.

"I see the Internet of Things having an impact in areas where collective intelligence makes a difference to isolated personal experience. An Internet of Things should foster the sharing of best practices for every situation in life."

— Florian Michaelles. Associate Director. Auto-ID Labs research group at ETH Zurich

"Devices will more and more have their own patterns of communication, their own 'social networks,' which they use to share and aggregate information, and undertake automatic control and activation. More and more, humans will be in a world in which decisions are being made by an active set of cooperating devices. The Internet (and computer-mediated communication in general) will become more pervasive but less explicit and visible. It will, to some extent, blend into the background of all we do."

— David Clark. Senior research scientist. MIT's Computer Science and Artificial Intelligence Laboratory.



DEDICATED TESTING CARS ANONYMOUSLY SHARE ROAD CONDITION DATA

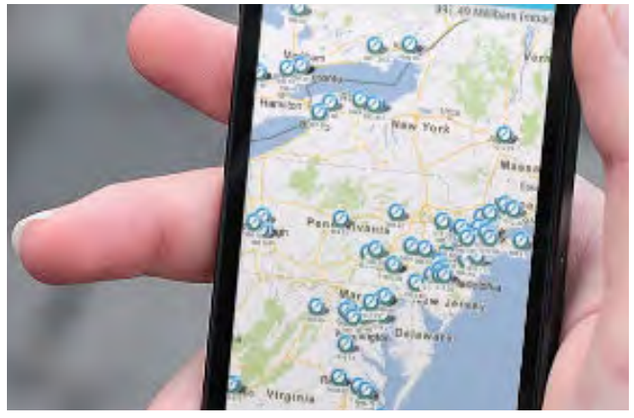
Volvo has placed 50 test vehicles on Scandinavian roads which are able to automatically communicate real-time data about road conditions with each other and road administrators. Working in conjunction with the Swedish Transport Administration (Trafikverket) and the Norwegian Public Roads Administration (Statens Vegvesen), Volvo's test cars detect icy or slippery conditions, road friction, and transmits that information via a mobile phone network to Volvo Cars' database. Warnings are then transmitted to nearby vehicles and a slippery road warning on the instrument cluster alerts drivers approaching the hazard to take appropriate action. An alert is also sent to road maintenance authorities to help improve the management of dangerous conditions.

bit.ly/1jdHbjs
bit.ly/1tinPll

ELECTRONICS COMPANY TRANSFORMING DUBLIN INTO AN URBAN INTERNET OF THINGS

The technology corporation Intel has partnered with the Irish City Council to install an Internet of Things demonstration platform in the city of Dublin. Intel will place 200 sensing gateways around the Irish capital cito gather and monitor environmental data such as air quality, noise or climate conditions. Dublin will become the most densely sensored city in the world. The collected data will be available to the city administration to support decision making, as well as to citizens on an open basis philosophy. This pioneer project aims to improve efficiency and environmental management and allow the people to become involved in the improvement of the city.

intel.ly/1lgs9fg
bit.ly/1mjPNZT



POOLED DATA FROM INDIVIDUALS CREATES CROWDSOURCED WEATHER FORECASTS

PressureNET is a project by Canadian company Cumulonimbus that uses a phone's built-in barometric sensor in combination with the company's app to collect atmospheric pressure data from users around the world. Leveraging the barometric sensor which is currently offered in several Android phones, the app user can manually annotate and submit weather conditions for their current location to the service. Data and location sharing preferences can be controled on a granular level and range from completely public to restricting data to certain research groups. The end goal of this project's collection process is to create more accurate local thunderstorm and short-term weather forecasting to the public and offer academic researchers new data points beyond what the widely distributed sensor systems available today can produce.

bit.ly/1f3950q
bit.ly/1nfSVZm

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David Clark.
Senior Research Scientist. MIT Computer Science & Artificial Intelligence Laboratory.
bit.ly/QAkEpj

Ototo: *Crowdsourced Public Transit Data Ensures You Never Miss The Bus*
ototo.pt
bit.ly/1dYZJay

Copenhagen Wheel: *Connected Bicycle Wheel Collects Environmental Data*
superpedestrian.com
bit.ly/1i2PBZC

Leibniz University of Hanover: *Cars Double As Rainfall Monitors*
uni-hannover.de/de
bit.ly/PUhwoo

IMPLICATIONS

- Sensor networks can gather data on movement within a city and create real-time visualizations and offer optimal wayfinding instructions.
- Crowdsourced information can be analyzed to look for patterns and direct city resources accordingly (e.g. towards bridges, sidewalks under or overused)
- Citizens can offer their data collected by sensors within smartphones to provide real-time information about social conditions requiring qualitative assessment.
- Connected health devices can pool the biometric data of users to create 'health maps' across cities or countries.
- Sensors placed on infrastructure in decay can provide a complete overview of the 'pecking order' in which projects require funding.

09. Environmental Whisper

Sensors are being embedded within natural and artificial systems to gather and communicate key pieces of data about their performance and condition, giving a voice to the planet, while also helping to ensure their overall health and functionality.

The Climate Corporation: Connected Plants Talk To Farmers When They Need Water Or Are Ripe For Harvest

Enevo: Waste Bins Send Alerts When They Need To Be Emptied

Sarvajal: ATMs Provide An Easy Solution To Distribute Low Cost Clean Water

"[W]e estimate that only one percent of things that could have an IP address do have an IP address today, so we like to say that ninety-nine percent of the world is still asleep. It's up to our imaginations to figure out what will happen when the ninety-nine percent wakes up."

— Padmasree Warrior. Chief Technology and Strategy Officer. Cisco.

Utilities lose an estimated $9.6 billion every year just from leaked water.

— Sensus. 2014

"As more of the global population comes online, there will be increased awareness of the massive disparities in access to health care, clear water, education, food, and human rights."

— Nicole Ellison. Associate Professor, School of Information. University of Michigan

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CONNECTED PLANTS TALK TO FARMERS WHEN THEY NEED WATER OR ARE RIPE FOR HARVEST

Combining connected agricultural machinery with soil and plant sensors, The Climate Corporation is looking to streamline the seasonal flows of harvests to limit wasted water, fertilizer and crops. The Climate Technology Platform uses soil sensors to track the health of the land with a plant growth tracker algorithm that uses over 30 years of weather data and agricultural knowledge to predict upcoming storms that might be dangerous, as well as alerting farmers of key harvesting dates.

bit.ly/1r52vM4
bit.ly/1lgP2Tl

WASTE BINS SEND ALERTS WHEN THEY NEED TO BE EMPTIED

The Finnish startup Enevo is looking to avoid inefficiencies in the waste management industry and optimize the resources by picking up the waste containers when they need to be emptied. Envo has developed a project to install wireless sensor in every waste container to provide real-time data to local waste management systems. This data will include details on container fill levels, service needs predictions, fleet management integration, and notification alerts if unusual movements or temperatures are detected, and it can be accessed through easy-to-use web service.

enevo.com
bit.ly/1h9YW1C

ATMS PROVIDE AN EASY SOLUTION TO DISTRIBUTE LOW COST CLEAN WATER

India-based Sarvajal has developed ATM-style systems that can distribute low cost, clean water to customers for a small fee. The water filtration and distribution company already has 35 of its water ATMs installed in urban areas in India, and the plan is to launch another 50 in the coming months across slum redevelopment communities in Delhi. The ATMs are owned and managed by local franchisee entrepreneurs and the devices have some 25 sensors, which manage and monitor water pressure and filtration, and make maintenance and repair of the systems low cost and easy. The device offers consumers a quick, reliable, and easy way to purchase fresh water, which is a much needed alternative to government-sponsored water tankers that often require hours of waiting.

sarvajal.com

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bit.ly/1mRxyKt

Deborah Estrin.
Founder & Director. Cornell NY Tech Center for Embedded Networked Sensing
bit.ly/1l3jv3h

Smart Santander: *How Cities Can Use Smart Technology And Social Media For Improvement*
smartsantander.eu
bit.ly/1je35mz

Pegula: *Guerrilla Sensors Chart The Crowds At Your Favorite Local Haunts (Combine)*
isitbump.in
bit.ly/1qV1hEX

Dept. Of Fisheries: *Twitter-Connected Sharks Alert Swimmers To Potential Attacks*
daff.gov.au
bit.ly/1pgSwrA

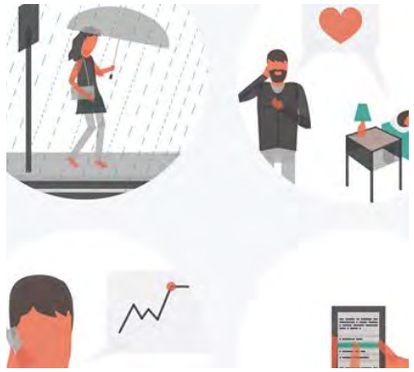
IMPLICATIONS

- Home pantry can send notifications to a person's phone, providing real-time updates on stock and if any items are on the verge of spoiling to avoid waste.
- Trash bins can provide updates as to when they are overflowing and additionally be used to learn where more receptacles can be strategically placed.
- Areas prone to erosion or flooding can be equipped with sensors to provide updates on condition, providing nearby homeowners real-time information on their safety as well as potential insurance needs.
- Sensors placed throughout a city can collect information regarding allergens and/or pollution and relay that data to pedestrians and bikers considering where to spend their time outside, or renters/homeowners considering a community to move into.
-

10. Anticipated Action

As sensors gather and analyze collected data from their owners they're moving away from being reactionary to anticipatory systems to deliver experiences and actions against future needs and behaviors. Researchers and engineers are designing self-awareness into systems and sensors that allow them to work together in tandem to automatically respond to stimuli for greater safety and efficiency.

Tvilight: Street Lights Activate Only When People Are Nearby



Ginger IO: Algorithm Detects Early Signs Of Depression By Monitoring Phone Behavior

Honda: Prototype Care Syncs With Traffic Lights To Ensure Continuous Traffic Flow

"Devices will more and more have their own patterns of communication, their own 'social networks,' which they use to share and aggregate information, and undertake automatic control and activation. More and more, humans will be in a world in which decisions are being made by an active set of cooperating devices. The Internet (and computer-mediated communication in general) will become more pervasive but less explicit and visible. It will, to some extent, blend into the background of all we do."

— David Clark. Senior research scientist. MIT's Computer Science and Artificial Intelligence Laboratory

"By 2020, component costs will have come down to the point that connectivity will become a standard feature, even for processors costing less than $1. This opens up the possibility of connecting just about anything, from the very simple to the very complex, to offer remote control, monitoring and sensing,"

— Peter Middleton. Research Director. Gartner.

INTEL EXPERT

"If there is a way to more efficiently distribute parking, based on an understanding when someone is looking for parking, based on the current context as well as historical context, it could have a huge impact. It seems simple but would have a massive impact on transportation overall and the management of a city in terms of how people within that city move about."

— Jennifer Healey, Researcher, Intel Labs

STREET LIGHTS ACTIVATE ONLY WHEN PEOPLE ARE NEARBY

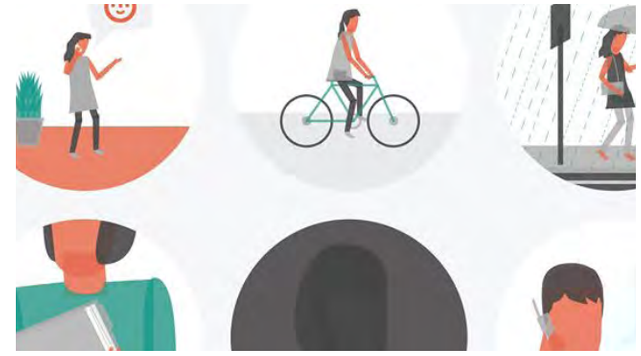
Lighting solution company Tvilight has designed a system for cities that tracks vehicles and pedestrians, lighting up the nearest street lamp as they approach. Using motion sensors and predictive analytics, the sensors detect how fast cars, bicycles, and pedestrians are traveling and supply light as required, rather than simply reacting to stimuli. Europe spends $13 billion powering street lamps, which is more than 40 percent of its energy expenditures, but the solution is expected to cut CO2 emissions by 80 percent. While Tvilight's sole function is responsive lighting, there has been speculation about how the technology could be used, such as traffic lights turning red if an ambulance is approaching.

tvilight.com
vimeo.com/74326736
bit.ly/1lgLPTF

PROTOTYPE CAR SYNCS WITH TRAFFIC LIGHTS TO ENSURE CONTINUOUS TRAFFIC FLOW

Multinational motor company Honda has developed a new prototype system that allows cars to communicate with traffic lights by combining the vehicle position and speed data with information around the cycling of lights. This technology, based on vehicle-to-vehicle communication, will advise drivers of the proper speed they need to make in order to pass through the green light and avoid constant start-and-stop, and will alert to an impending red light so the driver can slow down gradually. Recently, Audi announced a similar system of traffic light recognition that works by reading the automated signals from the central traffic computer in each city, and transmitting that information to the driver. Audi's system will also calculate and count down the time remaining until the next green light. Both projects seek to improve the flow of traffic in big cities while increasing fuel efficiency.

bit.ly/1lgitBs
bit.ly/1jQluaW
bit.ly/1r4PP8b



APP PICKS UP ON EARLY SIGNS OF DEPRESSION BY MONITORING PHONE BEHAVIOR

Ginger IO is an app that can predict signs of depression up to two days before outward symptoms manifest. The app works by utilizing the phone as a tool for recording everyday behavior, which allows it to pick up on patterns and early warning signs. Ginger IO focuses in particular on people with diabetes, a condition which has a very high correlation with depression. The app taps into the built-in sensors of every smartphone to transform it from an everyday object into a powerful first line of defense in personal health.

ginger.io/for-individuals
bit.ly/PUop9f

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youtu.be/hgC2cKtSaEI
bit.ly/1lgEKCs

IMPLICATIONS

- Traffic lights can respond to road traffic to ensure optimal flow during peak and normal hours.
- Personal devices such as phones and tablets can learn from user behavior over time, and respond by streamlining processes around schedule and usage to save battery life and processing power.
- Trains and other public transportation can automatically re-route additional resources to avoid overcrowding and maintain smoother operations.
- Roadside signage could evaluate traffic and offer suggestions for re-routing based on current conditions.

Methodology

To arrive at the trends showcased within this report, PSFK Labs used a methodology called Grounded Theory Analysis. A global team of researchers gathered 800+ data points over the course of a few weeks. Pattern recognition was applied to this data to identify clusters of emerging micro and macro trends. The team also spoke to the business leaders behind many of the examples featured in this report. In doing so, PSFK's researchers were able to gain a behind-the-scenes look into the factors driving change.

About / Team

At PSFK, We Tell The Future

PSFK.com is the go-to source for new ideas and inspiration for business leaders and creative thinkers. Millions of readers from around the world visit PSFK.com every month to engage with the emerging ideas, provocative perspectives, and exhilarating innovations identified by our editorial team. Through our digital platform, signature events, and creative consultancy, we provide our audience and clients with rich content and deep insights that encourage new ways of thinking, spark vibrant conversations, and inspire thrilling visions for the future.

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