UNIVERSIDADE PORTUCALENSE

CONTENT

1. Smart cities
2. Smart transportation
3. Smart houses
4. Environment, agriculture and forests
5. Smart factories
6. Health / Personal Wireless Networks (WBAN)
7. Logistics

Smart cities

https://www.thedailystar.net/opinion/the-grudging-urbanist/news/debunking-the-smart-city-myth-1749721

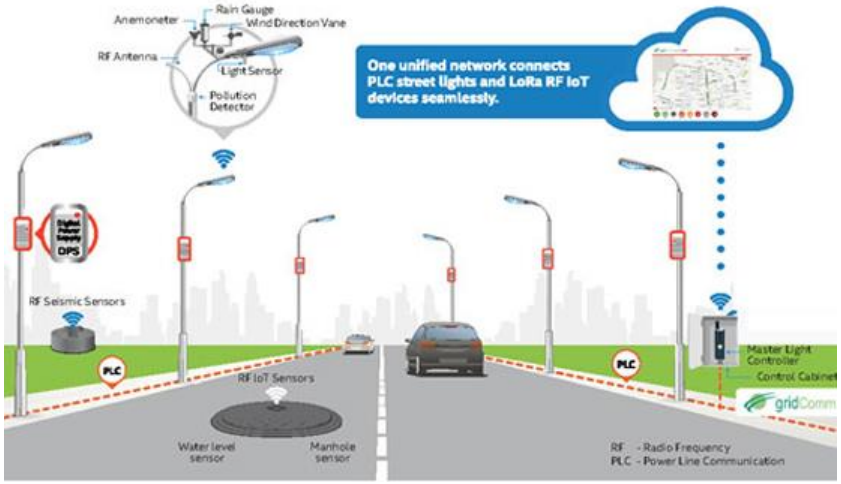
Smart cities

- Integration of several information technologies
- Objective: manage city assets as intelligently as possible
- Use IT to manage and integrate public infrastructure
    - Roads, parking, schools, power plants, hospitals, courts, police stations, …

Examples:

- Smart control of street lighting (e.g.: luminosity and rain sensors instead of timers)
- Traffic control (e.g.: traffic data collection to change the status of traffic lights and information panels)
- Parking (e.g.: presence sensors; possibility of booking spots)
- People control (ex: RFID or NFC on tickets for various integrated transport)
- Monitoring and control of infrastructures (e.g.: detection of water / gas leaks in pipelines, fire / flood alerts,…)
- Optimization of utilities (e.g.: detecting when trash cans are full)

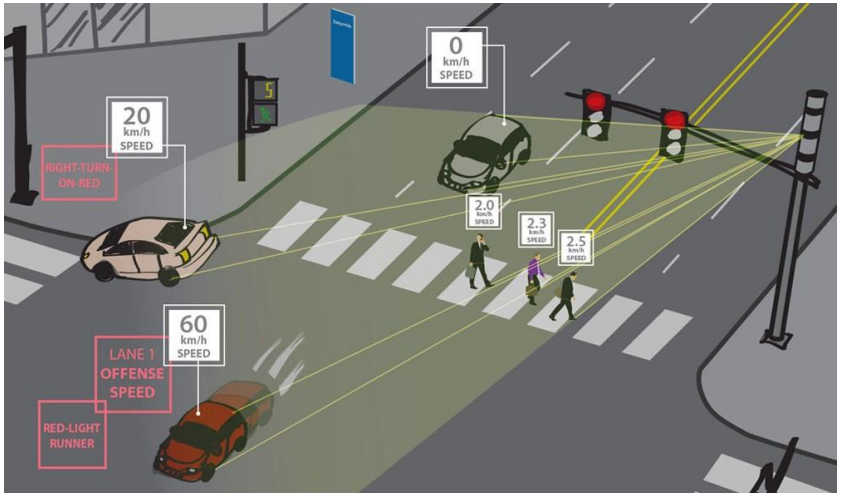
Smart street lighting



http://www.gridcomm-plc.com/streetlightsolution.htm

- Light intensity regulation
  - According to environmental data
- Real-time infrastructure monitoring

Intelligent traffic control



https://crossroadoptics.com/find-out-more-about-smart-traffic-management/

- Detection of cars and pedestrians
- Change of state of traffic lights
- Counterordinations

Smart parking

https://www.ewinsonic.com/automation/smart%20parking.html

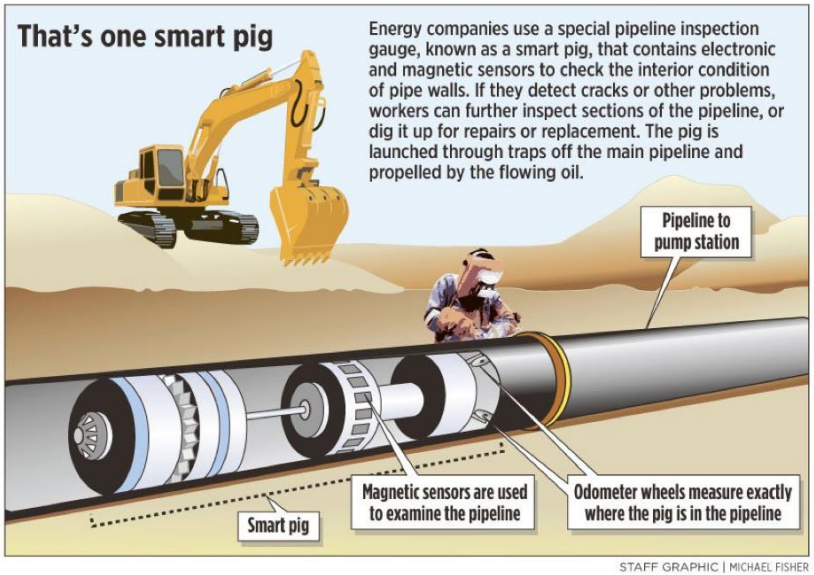
- Licence detection
- Free spot detection and notification

Access control

https://www.linhandante.com/

- Permission to access places (eg transport)
- Automatic access payment
- Price sharing between different operators

Infrastructure control



https://www.allerin.com/blog/smart-oil-pipelines-are-already-here

- Sensors to inspect pipelines

Smart trash bin

- Notifies when needed to empty
- It also serves as a Wi-Fi hotspot

https://www.straitstimes.com/singapore/solar-powered-smart-bins-that-act-as-wi-fi-hotspots-launched-at-orchard-road

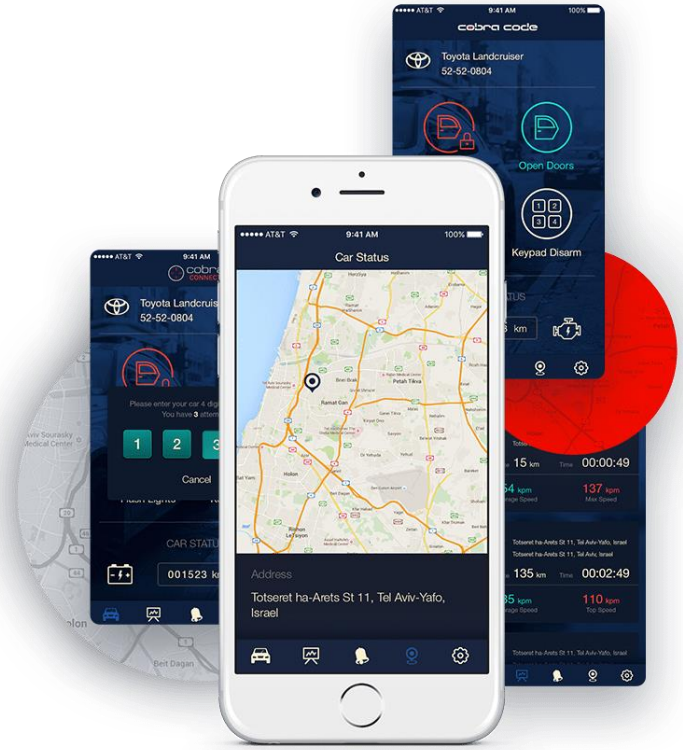
Smart transportation

https://www.reuters.com/brandfeatures/venture-capital/article?id=46402

Smart transportation

- Smart cars
- Smart planes

Examples:
- Air conditioning system, lights, sound, windshield wipers, airbags, brakes, cruise control
- Inform the workshop that a certain component is not working well, or a revision is approaching
- Control vehicle according to obstacles
- Drones (surveillance)



https://easternpeak.com/works/mobile-apps/

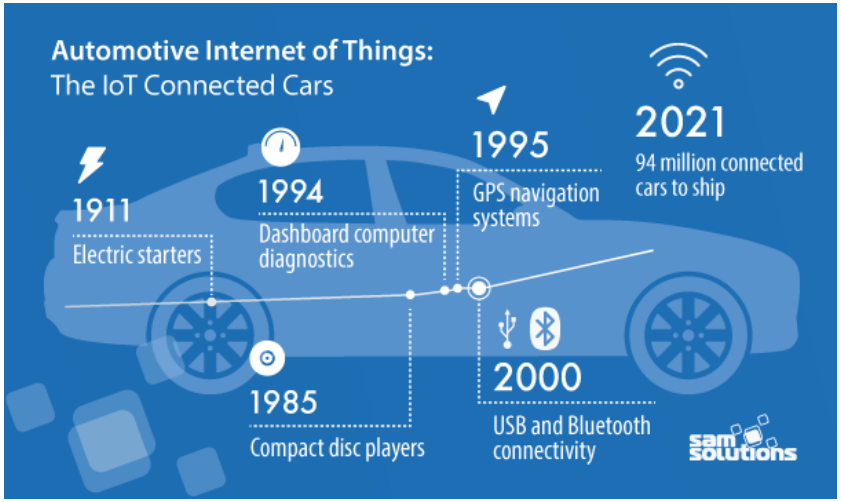
Objective
Vehicle remote control

Why is it good?
- Open and close the car remotely
- Car tracking
- Trip report
- Engine monitoring

Why is it bad?
- Limited safety: access to the smartphone grants access to car
- Drains car battery
- Not compatible with all cars

Luís Teles (2019/20)

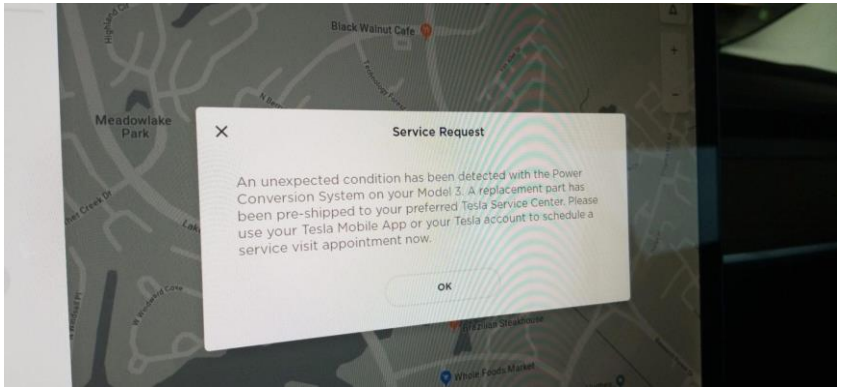
Sensors in vehicles



https://www.sam-solutions.com/blog/automotive-internet-of-things-the-iot-connected-car/

- GPS
- Rain / windshield sensor
- Luminosity / light sensor
- …

Cars with self-diagnosis and communication to the mechanic



https://electrek.co/2019/05/06/tesla-diagnose-pre-order-parts-service/

- Automatically detect malfunction
- Service request to mechanic

Detection and avoiding objects

- Automatically detect obstacle
- Automatically change route to avoid obstacle

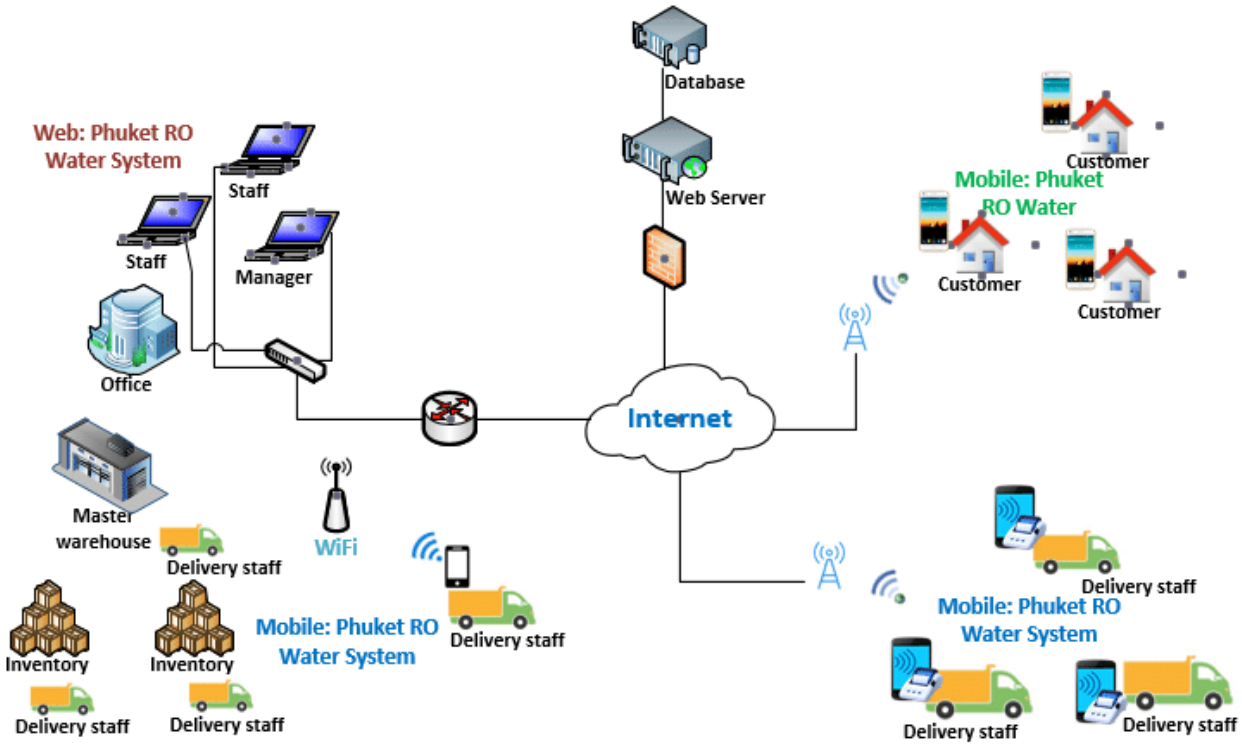
https://medium.com/@theteamorcad/how-do-collision-avoidance-systems-work-eee02adc745

Surveilance drones

- Use drones to surveil some places

https://www.pymnts.com/amazon/2019/amazon-patents-surveillance-as-a-service-via-drone/

Logistics



Werapun, W., Srimala, W., Chaowanawatee, K., & Karode, T. (2019). Smart Logistics Framework: A Case Study of Phuket RO Water System. In MATEC Web of Conferences (Vol. 259). EDP Sciences.

Logistics

- Identifiers to keep track of all products
  - Passive or active RFID
  - NFC
- Drones (parcel delivery)

Examples:
- Product identification
- Drones for parcel delivery

Amazon Dash

Main objetive
Consumer goods ordering service:
a replenishment service by Amazon

Why is it good?
- Easy ordering when you run out of something
- Compact/ small size
- Programmable

Why is it bad?
- Accidently/ unknowingly ordering
- Someone can troll by pressing a lot
- You might aswell use a subscription
- End of service in 2020

Source:
https://en.wikipedia.org/wiki/Amazon_Dash
https://gizmodo.com/15-idiotic-internet-of-things-devices-nobody-asked-for-1794330999

Alperen Kandemir (2020/21)

Uber Eats

https://www.ubereats.com/pt/

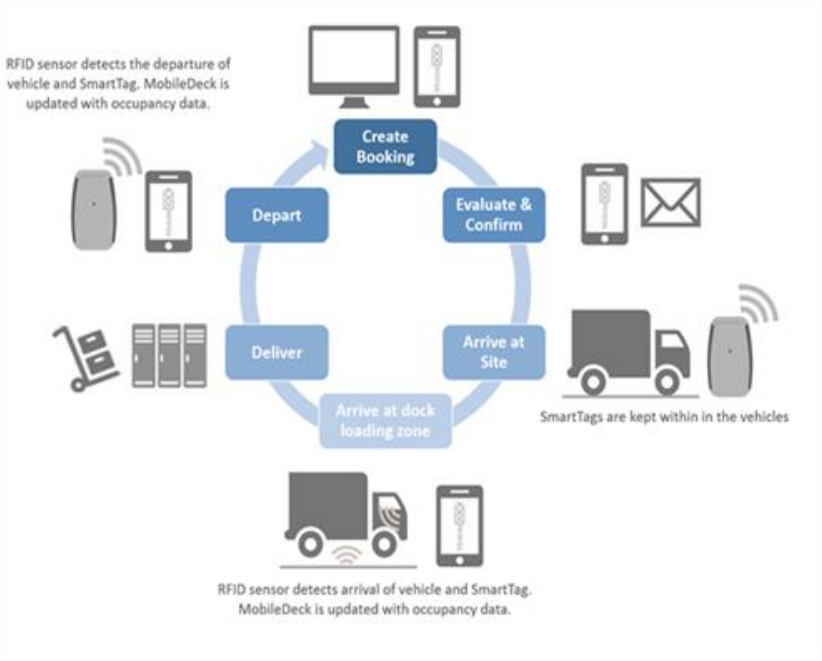
Main objective
- Deliver meals from restaurants.
- At any moment one can
    - Order a meal online.

Why is it good?
- One can have a meal without preparing it or going out.

Why is it bad?
- It's more expensive than cooking
- At lunch/diner time it takes longer, compromising the meal quality.

José Santos (2020/21)

Product identification



http://jomeitec.com/Solution_3.aspx

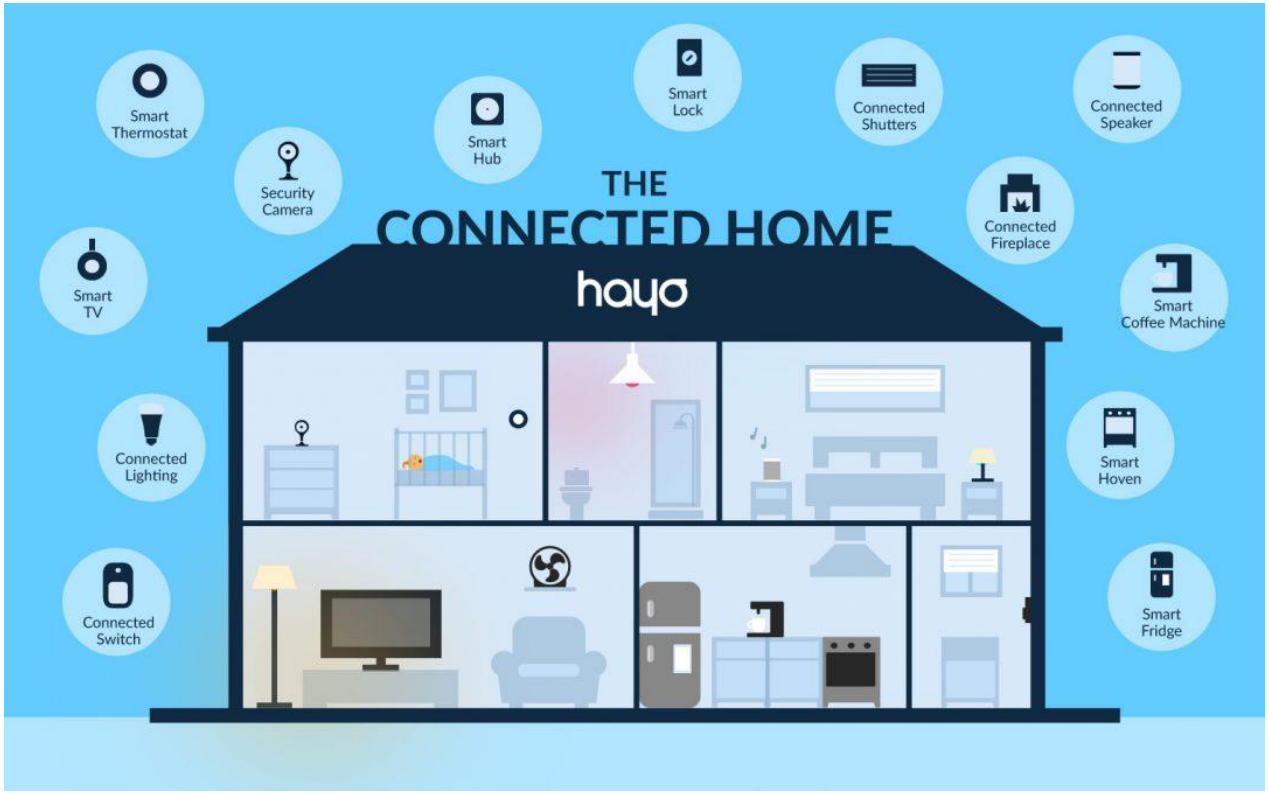
- Real time product tracking
  - Ex: RFID

Drones for parcel delivery

https://www.inc.com/business-insider/amazon-drone-patent-deliveries-scan-your-house.html

- Drones used to deliver parcels

Smart homes



https://hayo.io/what-is-a-smart-home/

Smart homes

- Device automation: lights, heating, device control
- Know what happens inside the house through *smartphone*
    - Ex: movement / presence sensors
- Objective: automatise manual processes
    - Ex: turn on heating when temperature falls bellow threshold
- Easy to implement using sensors, actuators
    - Virtually everything that is connected to power can be automated

Examples:

- Home weather station (temperature, rain, vind direction/speed, moist, pressure, air quality)
- Video-vigilance and alarms (sensors: movement, door/window opening, humidity, smoke, gas, carbon monoxide)
- Water plants and gardens
- Control: heating, garage door, lights, kitchen appliances, accesses
- Smart TV

Smart Life – Smart Living

Main objective

Control smart devices

Why is it good?

Comfort and comodity

Lower power consumption

Why is it bad?

Smart devices are expensive

Security: cyber-atacks

MenuPlanner

Main objetive

Present menus based on the ingredientes available on the fridge;
Count the number of calories of the ingredientes on the fridge;
Notifications:

- warns when the daily calory limit is reached

Why is it good?

- Helps on the daily diet management
- Helps people who don't want to plan menus
- Heps have a more diverse diet

Why is it bad?

- Most people don't care about those aspects of their diet;
- The calory counting can be performed with other devices

Jose Pedro Carvalho (2020/21)

Home weather station

https://weatherflow.com/smart-home-weather-stations/

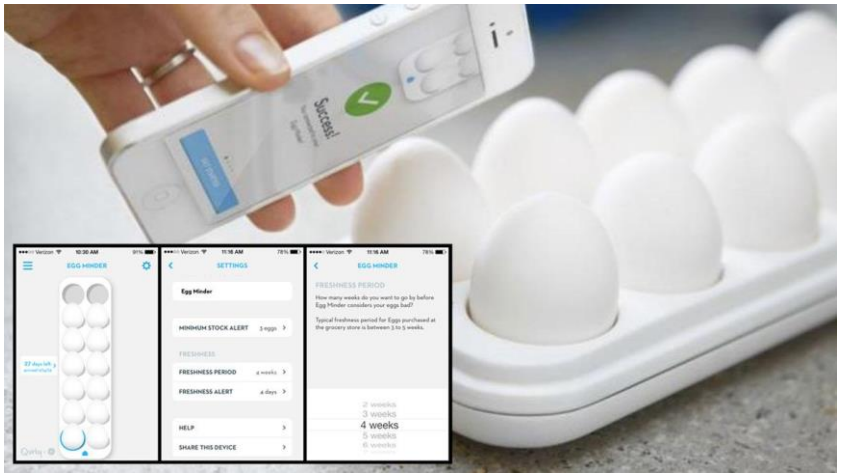
- Luminosity
- UV / solar radiation index
- Temperature
- Humidity
- Pressure
- Thunder (up to 40km)
- Rain
  - Alert on start
  - Rain intensity
  - Rain duration

Security system

- Intruder detection
- Surveillance of specific zones
- Recording
- Alert police from smartphone

https://www.amazon.com/Arlo-Pro-Wireless-Security-Rechargeable/dp/B01LWS96JV?ref_=fsclp_pl_dp_1

Egg Minder



https://quirky.com/

Notifications
- “Buy eggs”

Know, at any time
- How many eggs are in the fridge
- When the “oldest” was added

Opening the fridge door:
- An LED indicates the oldest egg

Wi-Fi Lamps

https://ocanova.com.br/blogs/noticias/smart-home-lampadas-wifi

Main objetive

The main objective of Wi-Fi lamps is to save energy costs in a home and allow the user to remotely control the lamps, through an Internet connection.Many of these lamps come with built-in sensors or surveillance cameras and smart programming options, which provide the user with an easy and dynamic way to control the lighting in their home.

Why is it good?

- Energy saving timer
- Control the lights that are on from anywhere
- User detection sensors/cameras
- Substitute for a video surveillance network

Why is it bad?

- Requires internet connection
- Has the same vulnerabilities as a home network
- Compromises the privacy of users

Philips' Hue

https://www2.meethue.com/

- Lamp with millions of possible colours
- Managed with smartphone or wireless remote
- Alarm clock function
- Movies/movie sinchronization

Wifi Connected Goal Light

https://www.shopbeergear.ca/pages/budweiser-red-light

- Lamp is turned on when your team scores
- Configurable for multiple teams

Smart Propane tank

- Monitors available propane quantity
- Alert when refill is needed

https://quirky.com/

Smart Washing Machine

- Real-time malfunction diagnosis
- Offer solutions for malfunctions

https://www.samsung.com/us/home-appliances/washers/front-load/wf5000-4-2-cu-ft-front-load-washer-white-wf42h5000aw-a2/

Sense Mother

https://www.myrobotcenter.eu/en/sense

- Personal assistant
- Home temperature control
- Plant monitoring
- Reminder to brush your teeth or take medication

Smart cooker

https://www.myrobotcenter.eu/en/sense

- Start cooking before arriving home

Smart Mirror

https://www.smart-mirror.net/

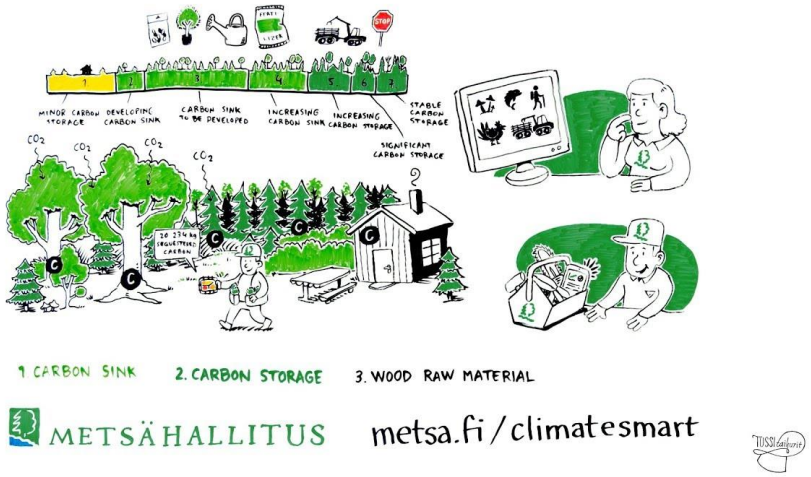
- Personal assistant
- Weather reports
- Traffic reports
- Calendar

Smart TV

https://www.lg.com/au/tvs/lg-43LJ550T-full-hd-tv

- Internet connection
- Apps
- Voice control
- Integration with other devices

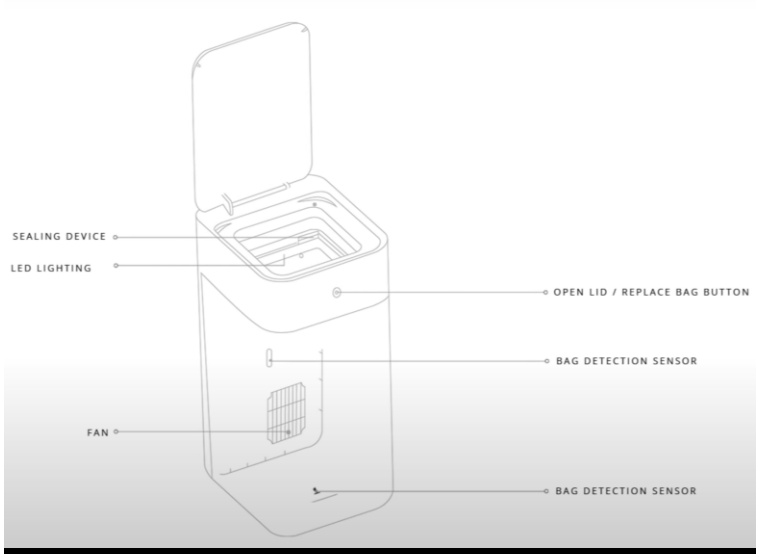
Environment, agriculture and forests

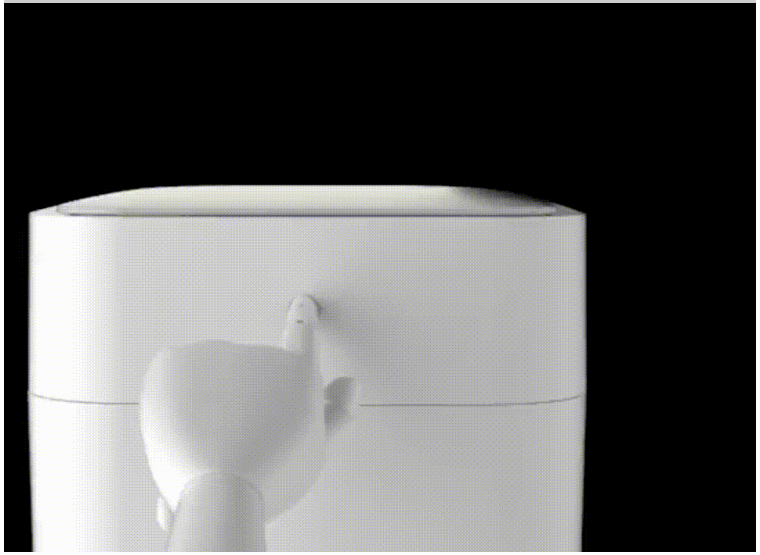


https://www.youtube.com/watch?v=xFyVxPFU6dY

https://myrepublica.nagariknetwork.com/news/making-agriculture-smart/

Townew smart trash can





The waste bin is able to identify itself when the waste is full and close the bag with a sealing device already built in.

Advantages:

- fast process
- practicality in the exchange of garbage

Disadvantages:

- high cost
- taking out the trash manually is not hard work

Environment, agriculture and forests

- Sensors for monitoring

Examples:
- Animal control
- Soil monitoring
- Watering control
- Tree height control
- Detection of extreme events (fires, snow, ice, earthquakes, floods, radiation, landslides)
- Monitoring air pollution
- Detection of chemical or biological contamination in rivers
- Monitoring dam water level
- Prevention of illegal logging

Edyn

Edyn Garden Sensor

Edyn Water Valve

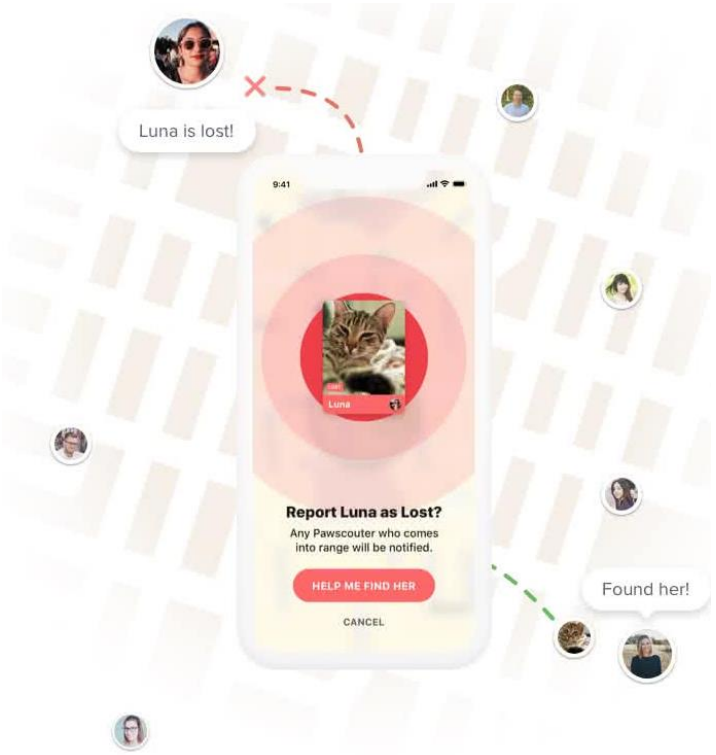
Main objetive
Edyn is a smart garden system that monitors and tracks environmental conditions, helping plants to grow.

Why is it good?
- Gathers and analyzes data about changing weather and soil conditions.
- In the App is displayed the data in real-time of the garden and pushes alerts and suggestions to maximize plant health.
- Edyn Water Valve, uses the data collected by the sensor to smartly control the existing watering system, watering the plants only when needed.

Why is it bad?
- …

Source:
https://www.kickstarter.com/projects/edyn/edyn-welcome-to-the-connected-garden

Beatriz Carvalho (2020/21)



www.pawscout.com

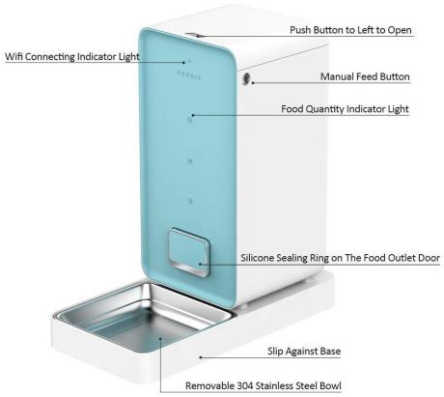
Main objective
Find lost pets

Why is it good?
- Any user in the area is notified when a pet gets lost /runs away
- Community for pets' (and owners') socialization
- Monitoring activity / walks

Why is it bad?
- Few users in the area → No use
- Keeps track only in a 200m radius
- Should not demand app to be installed to report a pet found

Raquel Santos (2019/20)

Animal control



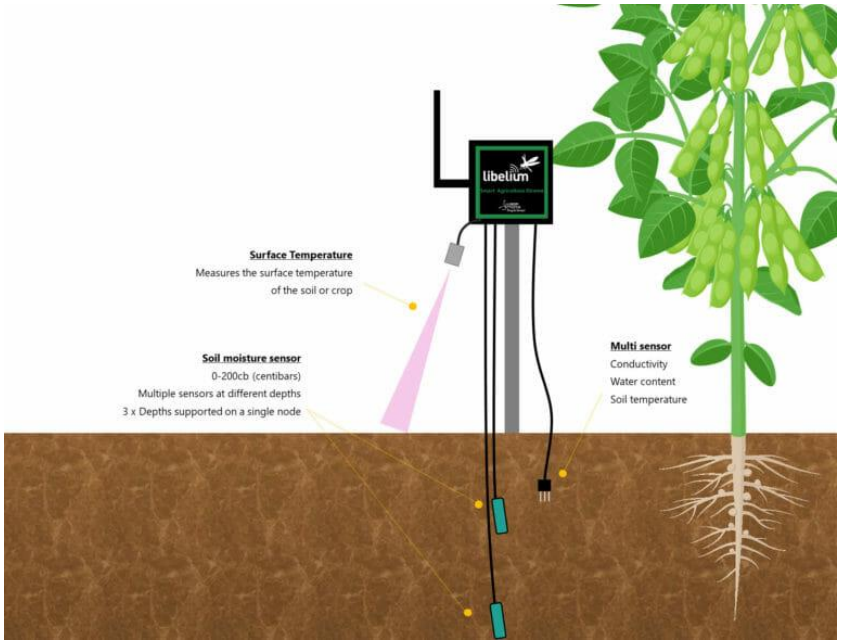
- Pet control: feeding, positioning
- Livestock control: health, positioning, feeding

https://www.amazon.com/PETKIT-Automatic-Dispenser-Enabled-Compatible/dp/B07MLRYPJV

https://www.globalsign.com/en/blog/connected-cows-and-crop-control-to-drones-the-internet-of-things-is-rapidly-improving-agriculture/

https://www.wikihow.pet/Track-a-Pet-with-a-Microchip

Soil monitoring



https://www.manxtechgroup.com/soil-monitoring-with-iot-smart-agriculture/

- Automatic measurement
  - Temperature
  - Humidity
  - Radiation (ex: UV)
  - Meteorology
  - Soil oxygenation
  - Plant characteristics
  - …

Niwa Smart Hydroponic System

https://getniwa.com/

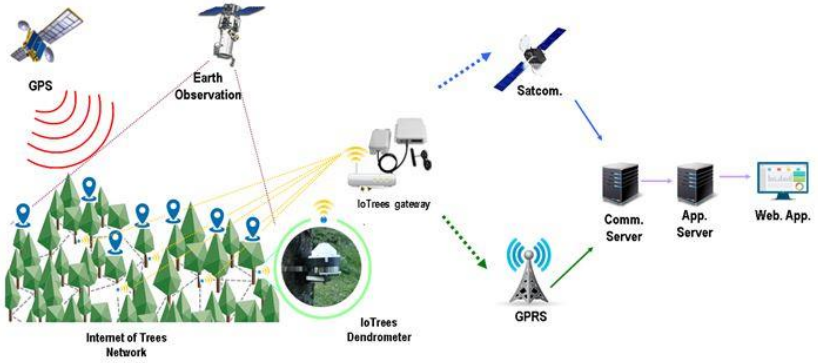
- Automated garden
  - Watering
  - Temperature / climate control

Lono Smart Sprinkler System

- Automated watering system
- Control by smartphone app

https://www.amazon.com/Lono-Connected-Smart-Irrigation-System/dp/B00UNELCXM

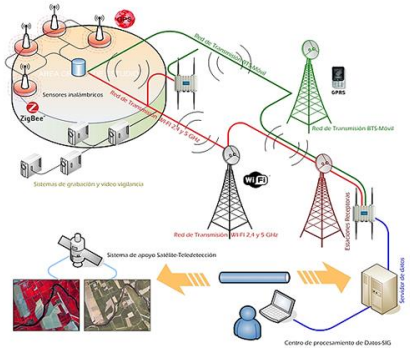
IoTrees



https://business.esa.int/projects/iotrees

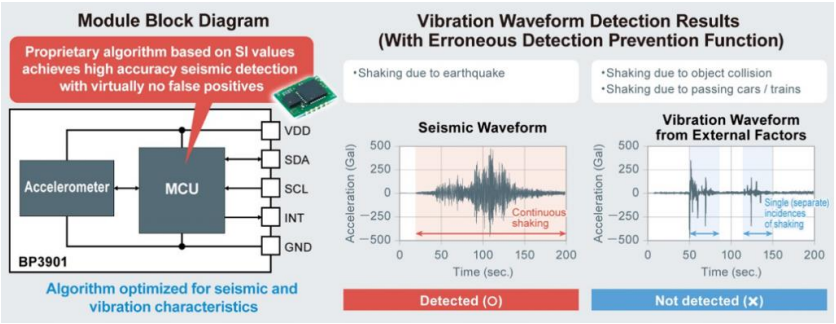
- Automatically measure tree height
- No need for manual measuring

Extreme condition detection



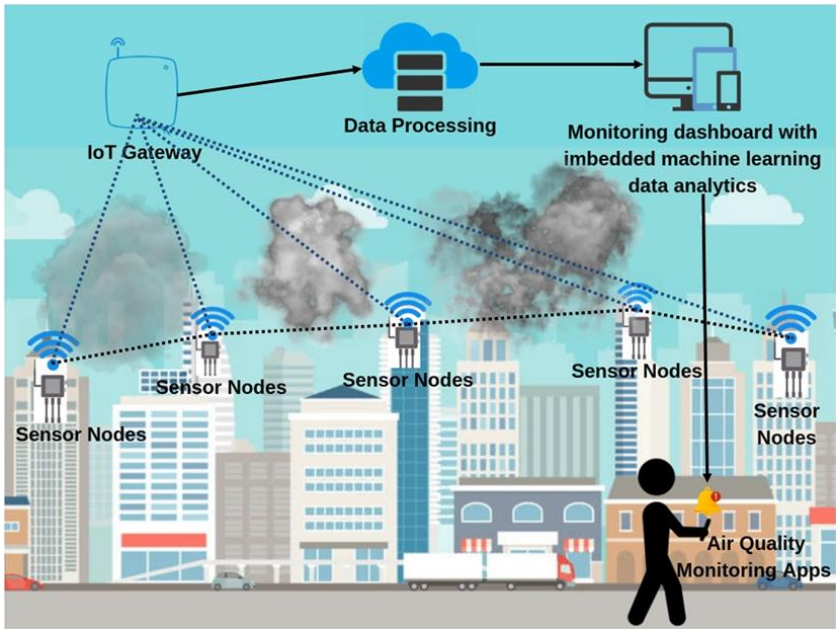
http://www.libelium.com/wireless_sensor_networks_to_detec_forest_fires/

- Fires
- Snow / ice
- Earthquakes
- Flooding
- Radiation
- Landslides
- …



https://www.iotglobalnetwork.com/iotdir/2019/06/27/ultra-compact-high-accuracy-earthquake-detection-sensor-module-launched-by-germany-based-rohm-19744/

Monitoring air pollution



- Sensors in several places in the city
- Aggregated information visible in smartphone app

https://www.iotchallengekeysight.com/2019/entries/smart-land/211-0515-025039-real-time-air-quality-monitoring-system-based-on-iot

Detection of water quality in rivers

- Metrics:
  - pH
  - Dissolved oxygen (DO)
  - Oxidation-reduction potential (ORP)
  - Conductivity (salinity)
  - Turbidity
  - Temperature
  - Dissolved ions (Fluoride (F-), Calcium (Ca2+), Nitrate (NO3-), Chloride (Cl-), Iodide (I-), Cupric (Cu2+), Bromide (Br-), Silver (Ag+), Fluoroborate (BF4-), Ammonia (NH4), Lithium (Li+), Magnesium (Mg2+), Nitrite (NO2-), Perchlorate (ClO4), Potassium (K+), Sodium (Na+)

http://www.libelium.com/smart-water-sensors-to-monitor-water-quality-in-rivers-lakes-and-the-sea/

Monitoring water levels

https://www.hackster.io/pankaj6/iot-solution-for-water-level-monitoring-using-thingscloud-0bae0e

Prevention of illegal logging

- Location
- Warnings

https://hitachi.co.in/press/2017/20171011.html?WT.ac=in_press_2017_171011

Smart Factories

https://internetofbusiness.com/complete-guide-10-smart-factory-trends-to-watch-in-2019/

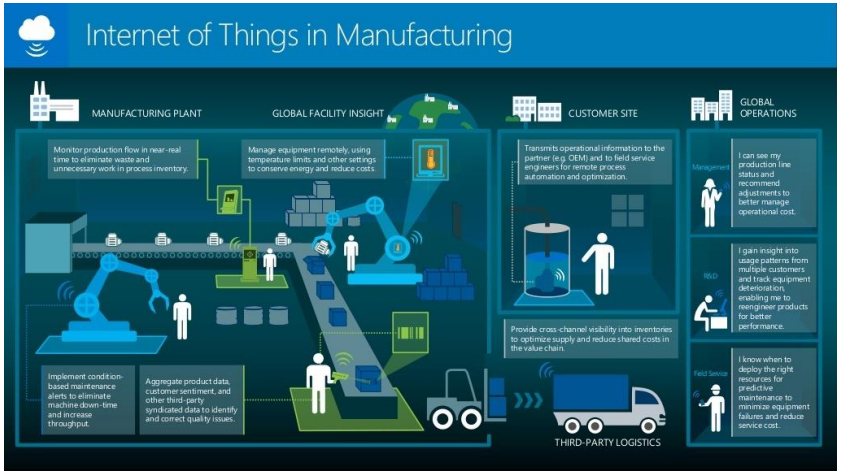
Smart Factories

- Monitor the manufacturing process
- Control the manufacturing process

Examples:

- Monitoring by applying sensors at various points on an assembly line or manufacturing process
    - Feeding information system with real-time data
- Control of production, distribution and manufacturing logistics processes
- Monitoring and maintenance control of critical equipment
    - Real-time fault prediction and detection
    - Enables predictive maintenance

Smart Factories

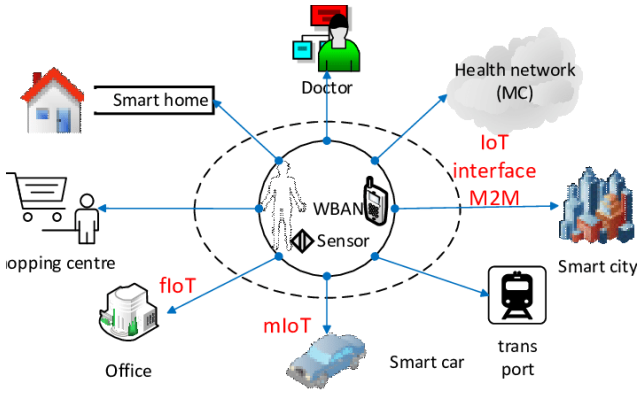


- Sensing at various points on an assembly line
- Global control of the production process
- Equipment maintenance monitoring and control

https://www.newgenapps.com/blog/8-uses-applications-and-benefits-of-industrial-iot-in-manufacturing

Health / Wireless Personal Networks (WBAN)

http://www.elephantkiosks.co.uk/smart-health/



Kang, J. J., Adibi, S., Larkin, H., & Luan, T. (2015, November). Predictive data mining for converged Internet of Things: A mobile health perspective. In 2015 International Telecommunication Networks and Applications Conference (ITNAC) (pp. 5-10). IEEE.

Health

- Remote monitoring of specific parameters in patients (hospitals / day-to-day)
- Automatic collection of information for central systems
- Physically accessible information / alarm generation
- Administration of medications in certain situations (eg insulin in diabetics)

Examples:

- Blood pressure sensors
- Heart rate sensors, electrocardiogram
- Electroencephalogram sensors
- Breathing monitors (pulmonary ventilation)
- Blood glucose sensors
- Intelligent pacemakers (send information)
- Pregnancy monitors (fetal heartbeat)
- Blood oxygenation sensors
- Sleep monitors
- Body temperature sensors
- Scales
- Body mass index meters

Wireless Body Area Networks (WBAN)

- Wireless Body Area Networks

Examples:
- NFC suit (unlock mobile phone, exchange business cards, other proximity functions)
- Smart glasses (augmented reality)
- Smart bra (records distance traveled, heart rate / breathing)
- Smart t-shirt (male version of smart bra)
- Subcutaneous chip in hand (access control - like microchips used in animals)
- Contactless jacket (mobile payments)
- Smart running socks / insoles (position recording, distance covered, running time and style, GPS directions)
- GPS tracking shoes (locate people)
- Fitness - devices to monitor:
    - sleep,
    - physical exercise
    - Pulse
    - movements (eg swimming strokes, step)
    - position tracking (children, elderly, detained under house arrest, mountaineer, animals, vehicles)
    - Effort
    - lifted weights
    - diverse biological parameters

HAPIfork

https://www.hapilabs.com/product/hapifork

- Monitor eating habits
- Warns you when you eat too fast

Oral-B Smart

- Improve brushing habits
- Real-time indications for better brushing
- Reduces brushing speed and alerts you to be gentler if you are brushing too hard

https://www.oralb.pt/pt-pt/produtos/escovas-de-dentes-eletricas-oral-b/escova-de-dentes-eletrica-oral-b-smart-4-4000n

Smart blood pressure monitor

- Monitor blood pressure
- Possibility of sending directly to the attending physician

http://iotinnovator.com/tag/blood-pressure-monitor/

Telcare meter

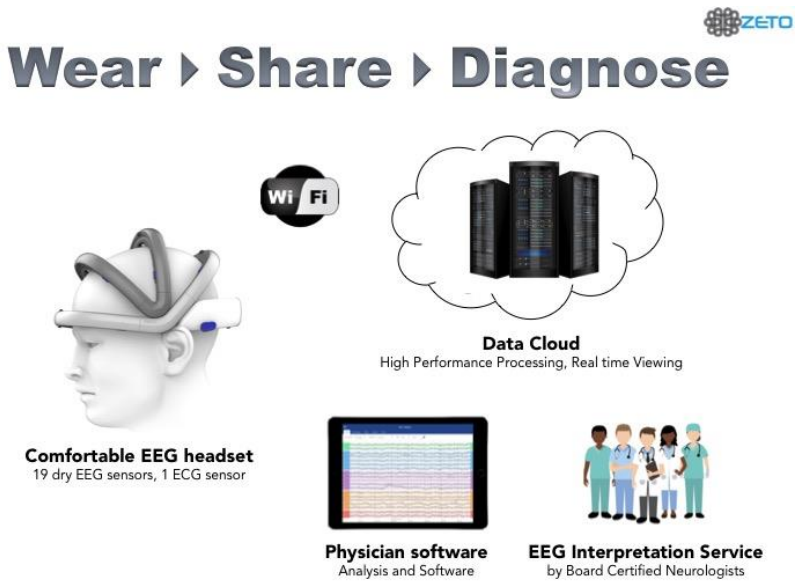
- Monitoring blood glucose levels
- Immediate feedback
- History stored on a secure server
- Notifications for attending physician and family members

Fitness bands

https://www.mi.com/global/mi-smart-band-4

- Monitor
  - Sleep
  - Physical activity
  - Heart rate

Electroencephalogram



https://www.innovationworldcup.com/zeto-democratizing-eeg-healthcare/

Monitor breathing and heart rate

https://vitaliwear.com/products/vitali-smart-bra-gem

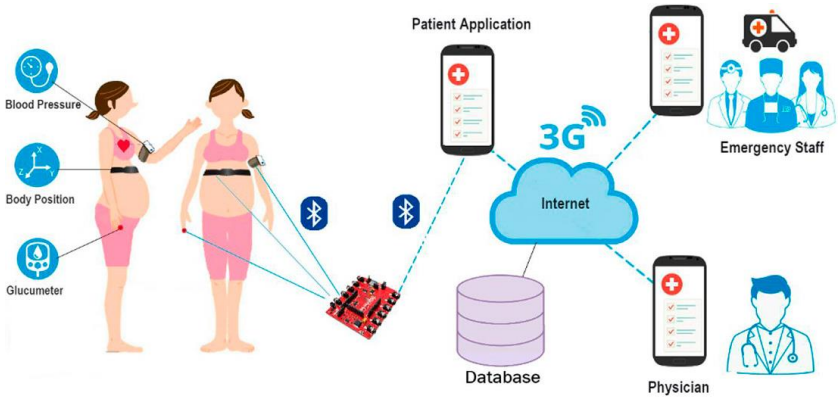
https://telecomdrive.com/broadcast-wearables-debuts-smart-fitness-t-shirt-navigation-india/

Smart Pacemakers

- Monitoring of cardiac functioning
- Automatic sending of the obtained data
- History of measurements made

https://www.futuremedicineindia.com/medtronic-launches-mobile-app-to-support-pacemakers/

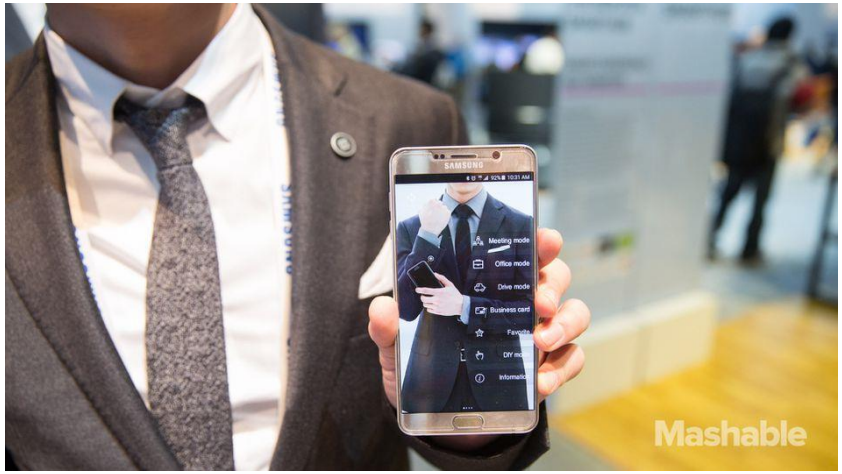
Pregnancy monitors



- Blood pressure
- Glucose
- Child's position / heartbeat

http://www.libelium.com/e-health-application-developed-with-mysignals-first-winner-in-health-competition-ishic-2017/

NFC suit



https://mashable.com/2016/01/09/samsung-smart-fashion/?europe=true#.EoRpYe2QiqY

- Smartphone interaction
  - Unlock
  - Do not disturb mode
  - Contacts sharing…

Subcutaneous implants

- Payments
- Access control
- …

https://www.paymentssource.com/news/chip-and-skin-implantable-rfid-gives-payments-its-matrix-moment

GPS insoles

https://canary.is/

- Connected to GPS
- Vibrate to indicate the direction to take

Other applications

- https://youtu.be/Z-NmuFeMPls (https://www.robugtix.com/t8x)

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Do conhecimento à prática.