

Applications

A hand-drawn purple oval encircles the word "Applications". A vertical line is drawn at the right edge of the oval, and a purple arrow points from this line towards the handwritten text "IoT".

*IoT*

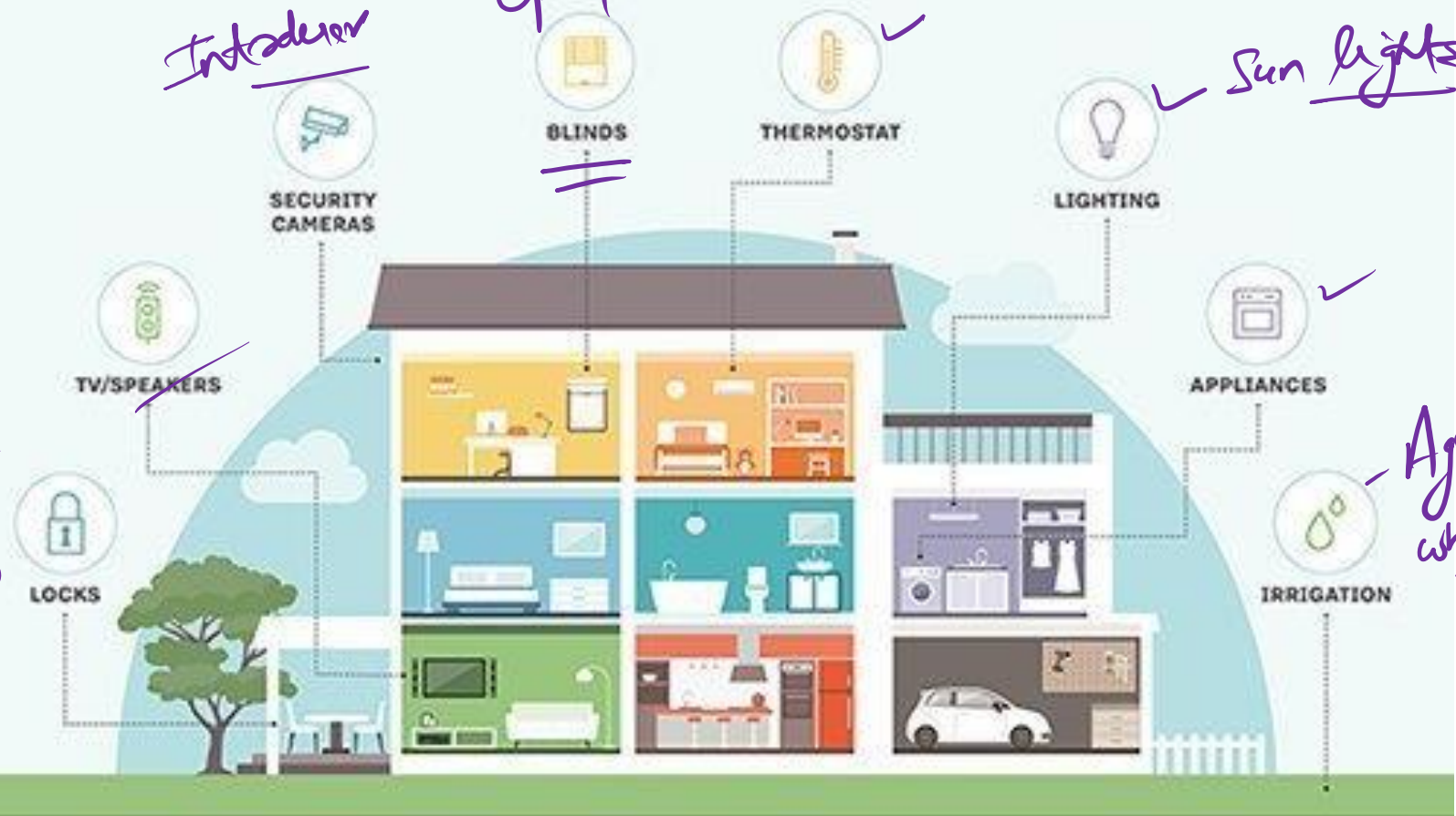
# Smart Homes

(Most Common)

open/class

Introducer

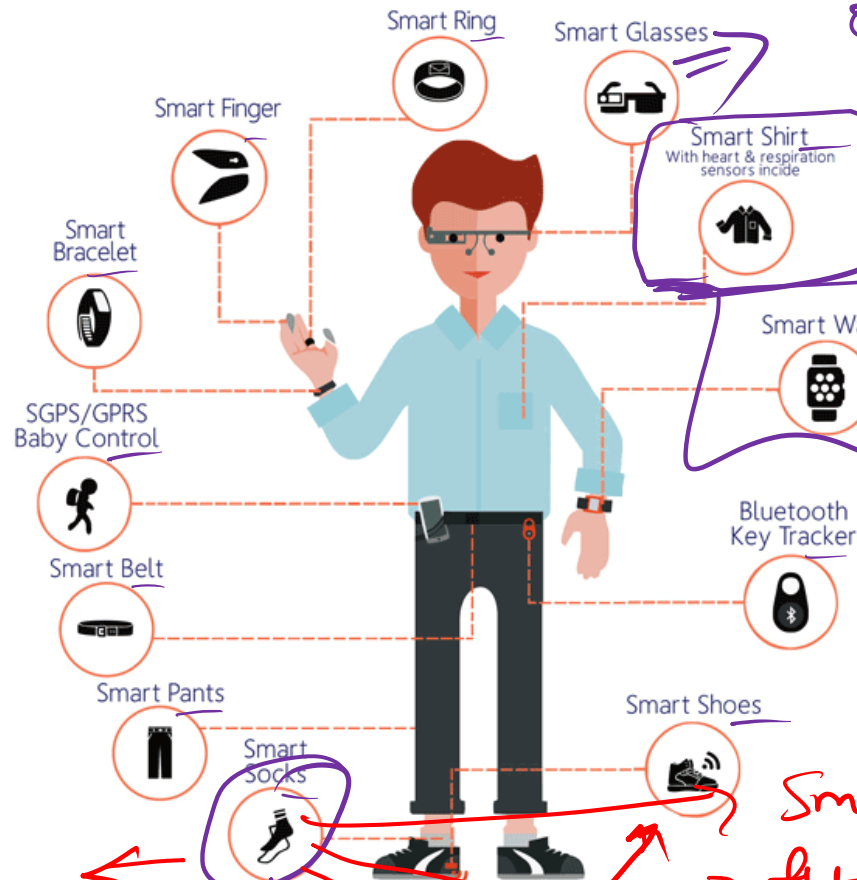
✓ Sun lights



Smart

- Agriculture when

# Wearable ➔



OK - Abnormal  
visually input?  
 → Blood pressure, Temp?  
 then air & heart beat  
 IoT wearable

Smartphone ← Steps

Smell -  
 flat/not - pressure -  
 foot heat map -  
 Sleep walking?

Street light - Motion / Night time  
Sensor

Temperature - Monitoring

Transportation

Green - Coordinator for Ambulance

# SMART CITY

BUILDING TOMORROW'S CITIES

Smart homes

Public transport -

GPS

freq

prediction

ENERGY

Solar

MOBILITY

Safety

Waste Mgmt

INDUSTRY



SECURITY



RETAIL



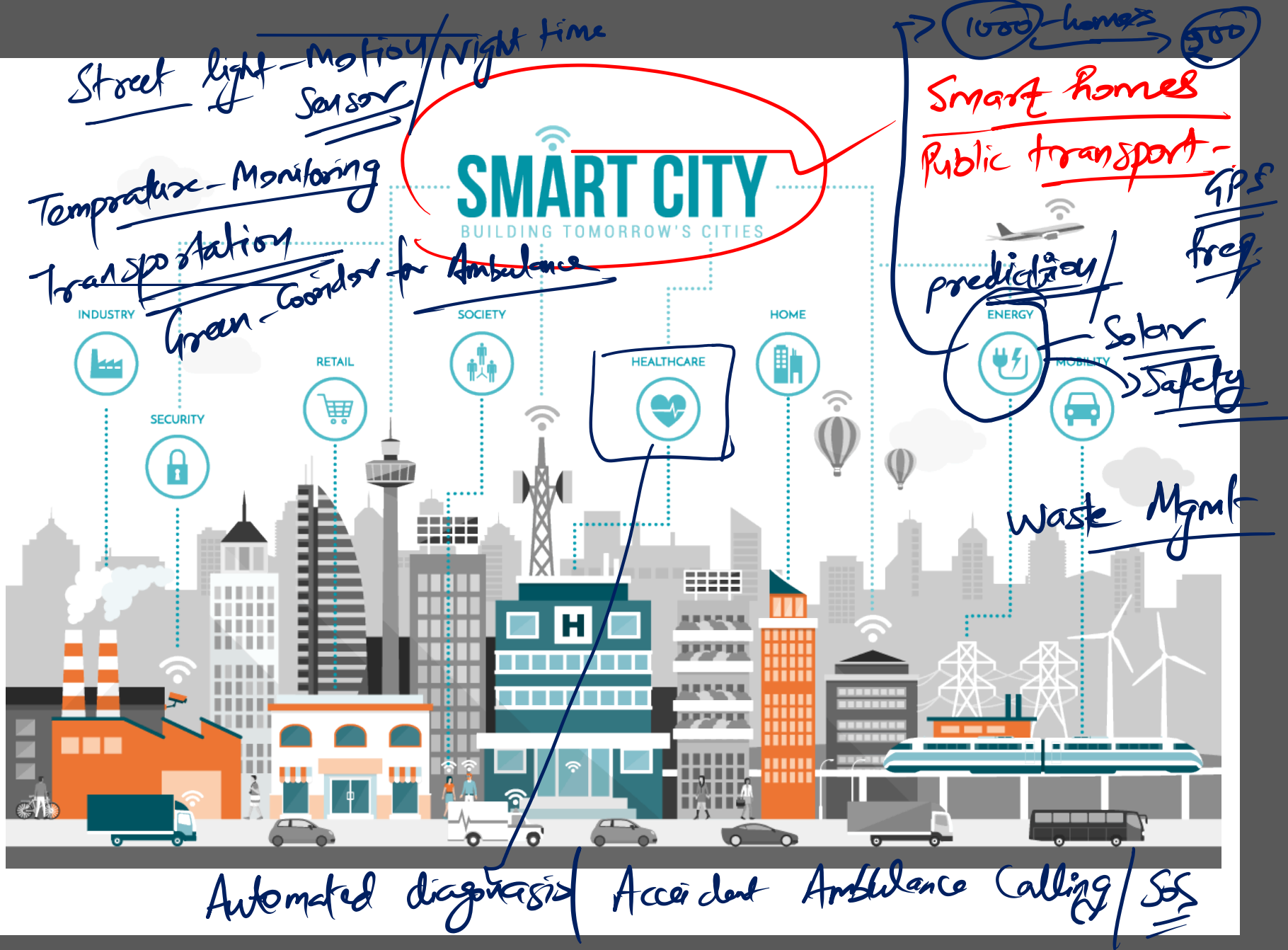
SOCIETY



HEALTHCARE



HOME



Automated diagnosis / Accident Ambulance Calling / SOS

# IoT Privacy & Security

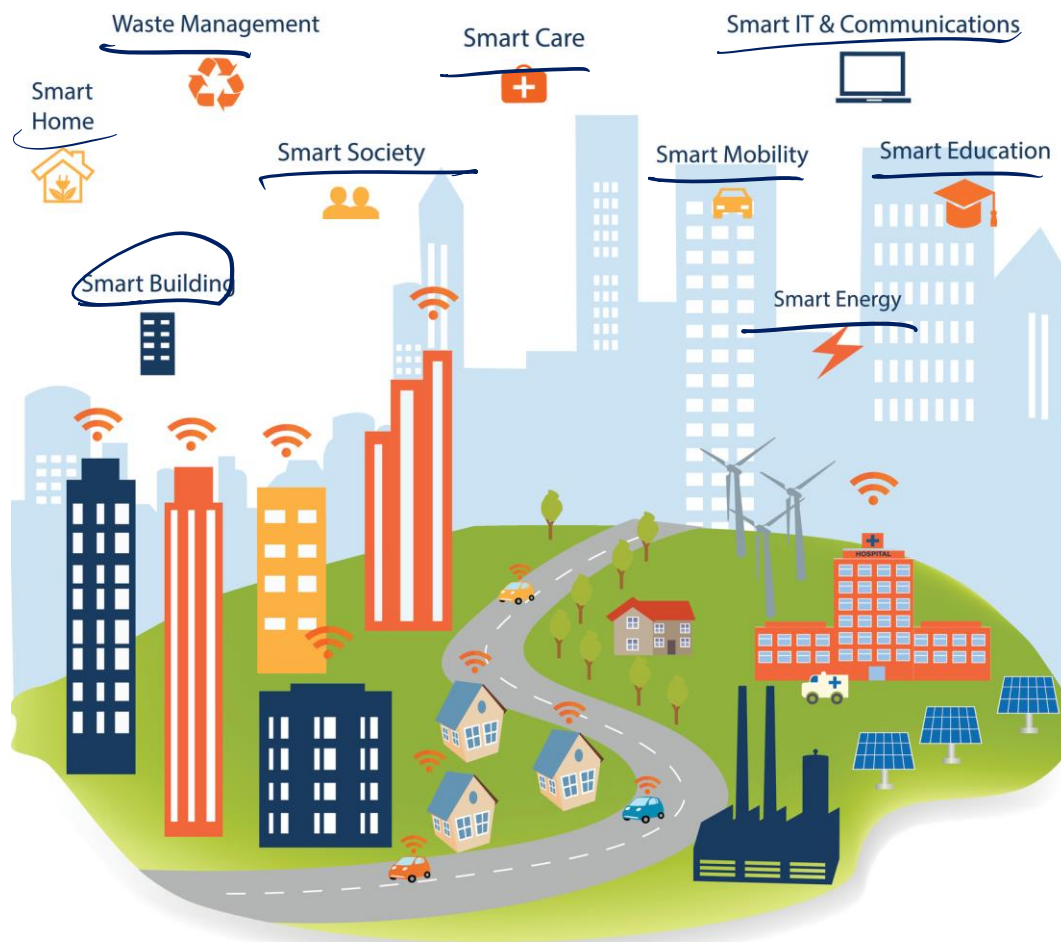
## The 10 most popular Internet of Things applications

A ranking based on web analytics



# Augment Existing Things





## Augmenting Life With New Things

- Smart City
- Smart Car
- Smart Me (healthcare, fitness, wellness)



# Example: Connected Roadways

## Under the bonnet

How a self-driving car works

Signals from **GPS (global positioning system)** satellites are combined with readings from tachometers, altimeters and gyroscopes to provide more accurate positioning than is possible with GPS alone

**Radar sensor**

**Ultrasonic sensors** may be used to measure the position of objects very close to the vehicle, such as curbs and other vehicles when parking

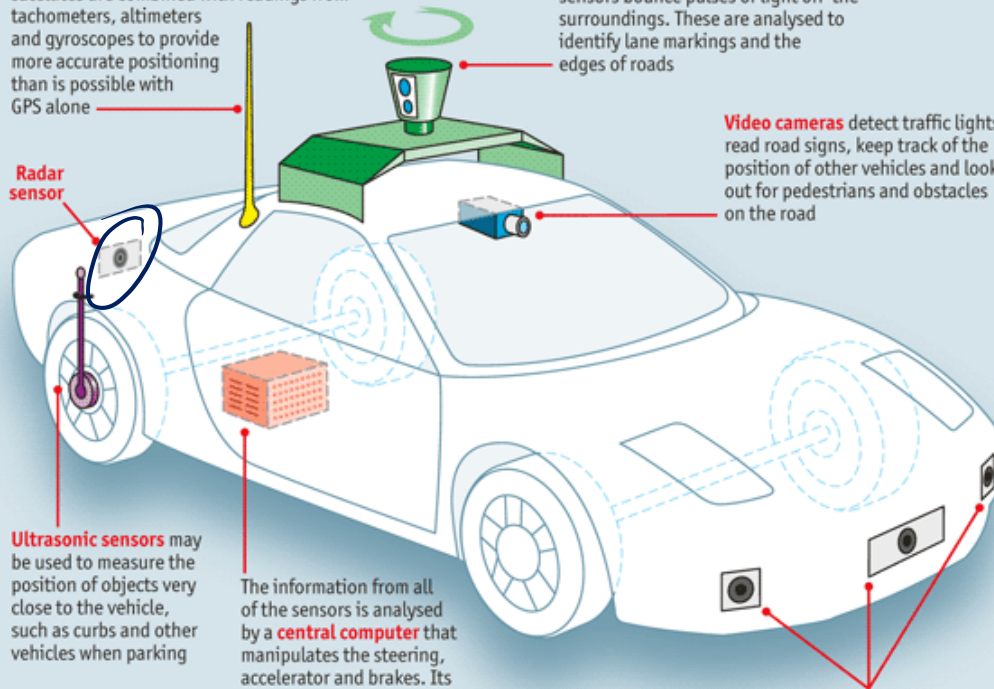
The information from all of the sensors is analysed by a **central computer** that manipulates the steering, accelerator and brakes. Its software must understand the rules of the road, both formal and informal

**Lidar (light detection and ranging)** sensors bounce pulses of light off the surroundings. These are analysed to identify lane markings and the edges of roads

**Video cameras** detect traffic lights, read road signs, keep track of the position of other vehicles and look out for pedestrians and obstacles on the road

**Radar sensors** monitor the position of other vehicles nearby. Such sensors are already used in adaptive cruise-control systems

Source: *The Economist*





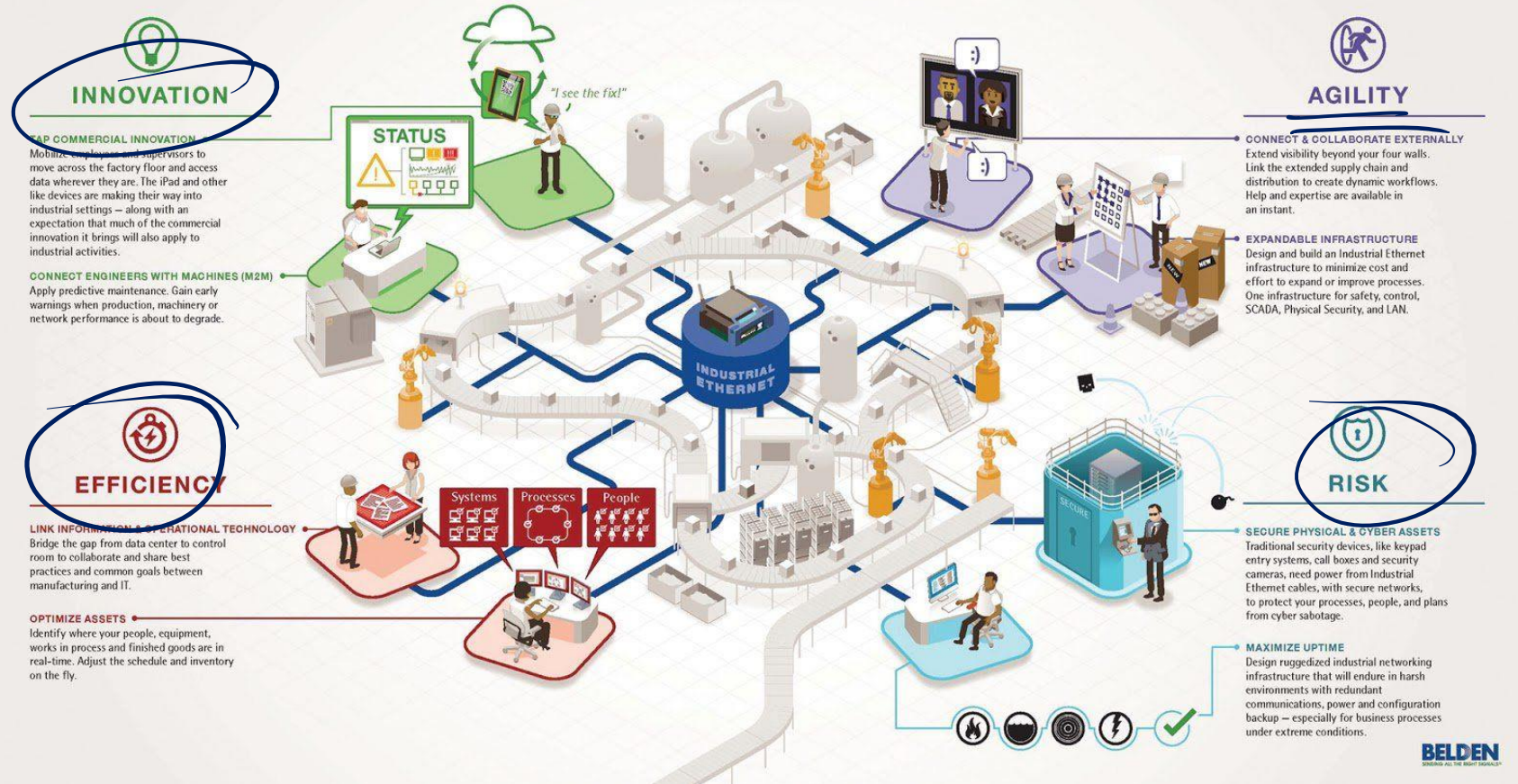
# Example: Connected Roadways

State of Self-Driving Car



# Industrial IoT (IIoT)

## The Connected Factory in Action



## Example: Connected Factory

- New product and service introductions  
faster
- Increasing production, quality, uptime
- Mitigating unplanned downtime
- Protecting from cyber threats
- Worker productivity and safety



## Example: Smart & Connected Buildings

- Energy management
- Lighting
- Safety
- HVAC
- Building automation
- Smart spaces



# Example: Smart Creatures

## The connected cow

### Necklace

Connecterra, a Dutch company, makes Fitbit-style necklaces that monitor a cow's movement and feeding habits. The sensor can be used to detect health problems and to tell when the cow is in heat, so that insemination can happen at an optimum time.

### Acid monitor

Well Cow, a British company, has developed a bolus that is inserted into the cow's rumen to monitor acidity levels. This helps detect digestive problems.

### Pedometer

Afimilk, based in Israel, makes a pedometer for cows. Cows typically increase their walking as they come into oestrus, so the pedometer alerts farmers to the best time for insemination.

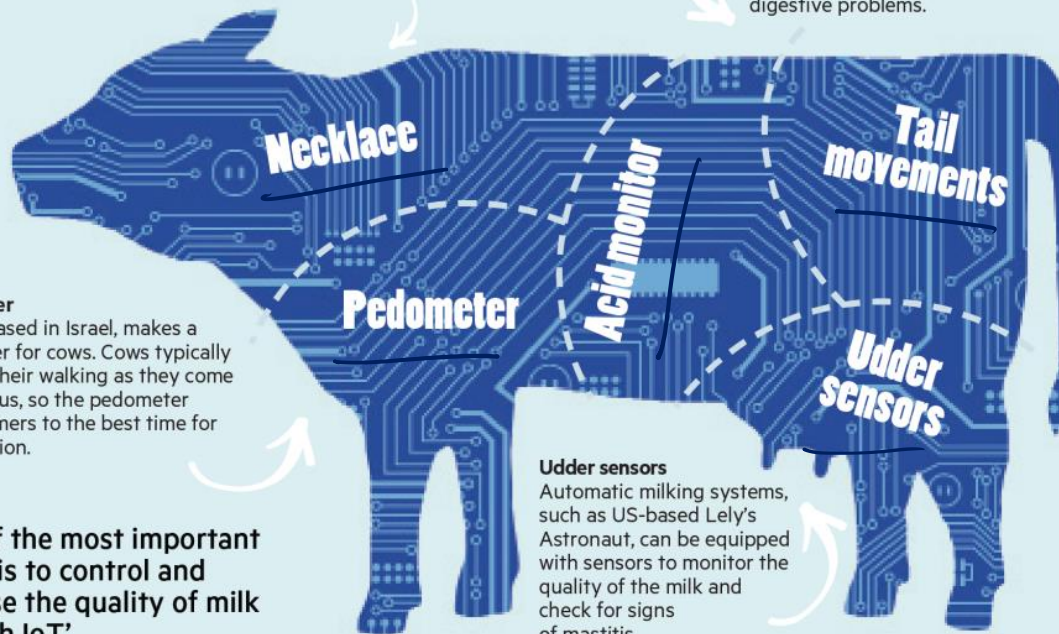
**'One of the most important issues is to control and increase the quality of milk through IoT'**

### Tail movements

Moocall, an Irish company, makes a birthing sensor that attaches to the tail. It measures tail movements triggered by labour contractions, and sends a farmer an SMS alert approximately one hour before a cow is due to calve.

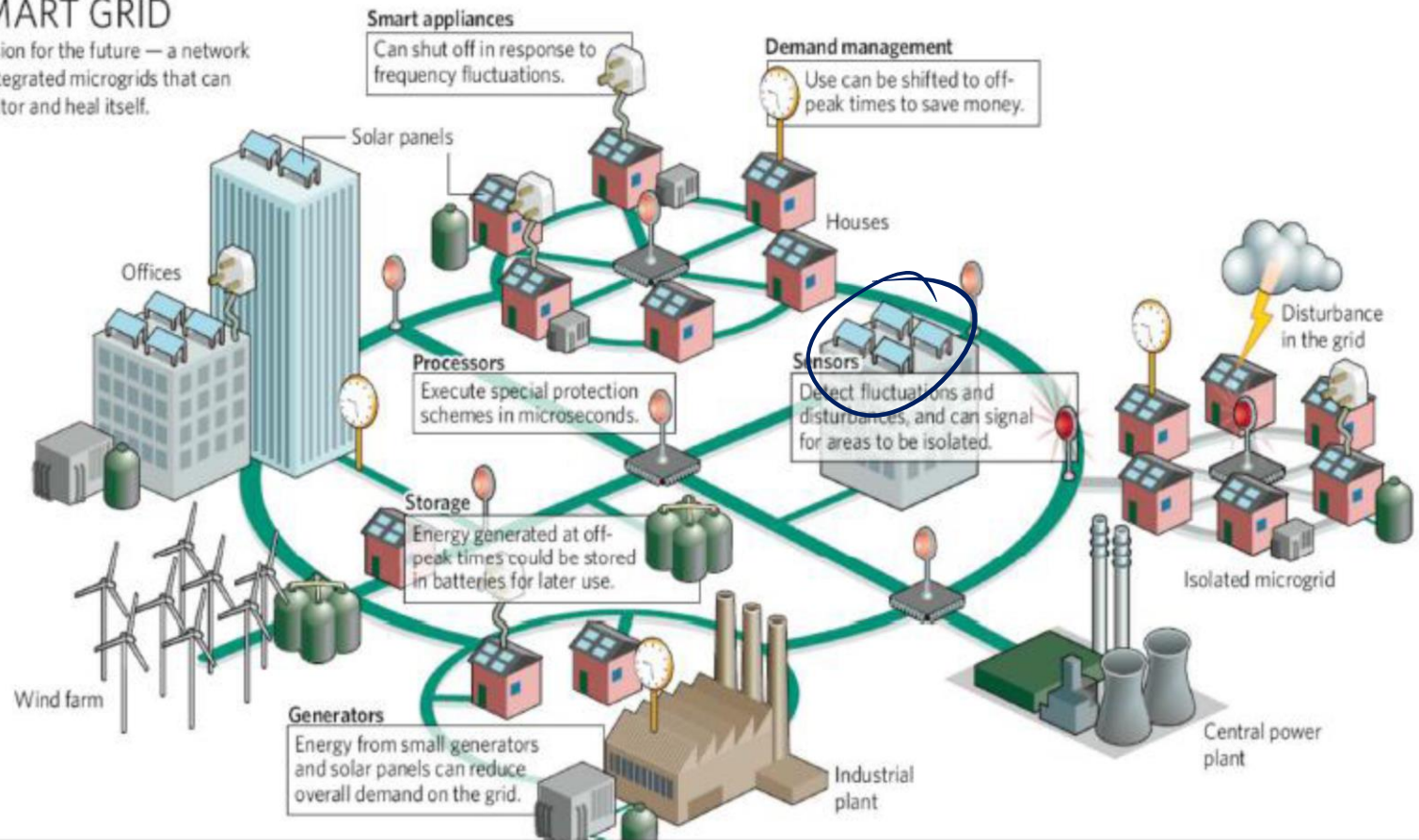
### Udder sensors

Automatic milking systems, such as US-based Lely's Astronaut, can be equipped with sensors to monitor the quality of the milk and check for signs of mastitis.



## SMART GRID

A vision for the future — a network of integrated microgrids that can monitor and heal itself.



Example: Smart Grid





## Enablers: Portability

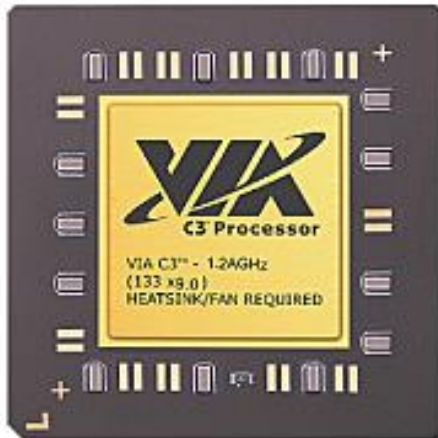
Reducing the size of hardware to enable the creation of computers that could be physically moved around relatively easily



(Rpt)

# Enablers: Miniaturization

Creating new and significantly smaller mobile form factors that allowed the use of personal mobile devices while on the move



50mm x 50mm

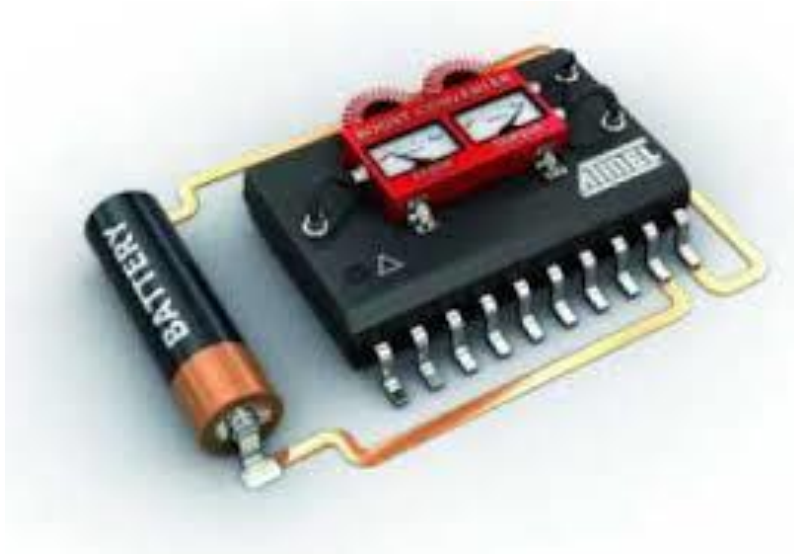


35mm x 35mm



15mm x 15mm

# Enablers: Low Power and Low Heat



- Low power architectures
- Low power radios
- Sleep modes
- Energy harvesting

# Enablers: Connectivity

- Developing devices and applications that allowed users to be online and communicate via wireless data networks while on the move



Bluetooth®

# Enablers: Convergence

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Integrating emerging types of digital mobile devices, such as Personal Digital Assistants (PDAs), mobile phones, music players, cameras, games, etc., into hybrid devices.



# Enablers: Divergence

Opposite approach to  
interaction design by  
promoting  
information  
appliances with  
specialized  
functionality rather  
than generalized ones





# Enablers: Ecosystems



The emerging wave of *digital ecosystems* is about the larger wholes of pervasive and interrelated technologies that interactive mobile systems are increasingly becoming a part of.

# Example: Smartphone

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- Portability: carry it anywhere you want
- Miniaturization: make it possible to build device to fit in your pocket
- Connectivity: Wi-Fi, LTE/4G, cellular, Bluetooth
- Convergence: phone, camera, gaming device, movie streaming, music player, ...
- Digital Ecosystem: cloud, social networks, software development kits, app stores, big data, standardization ...

# IoT Issues & Challenges

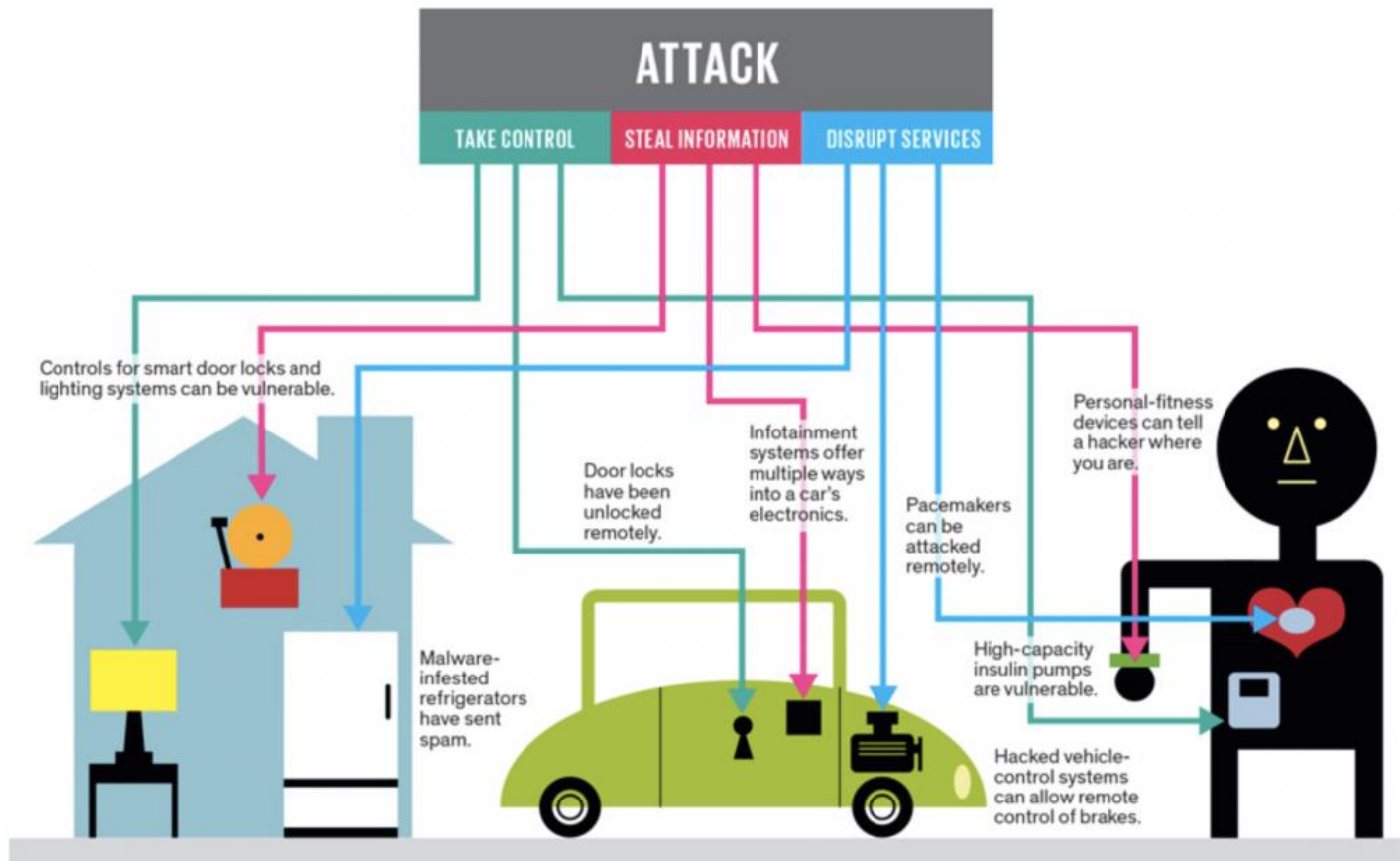


Illustration: J. D. King

BREAK

