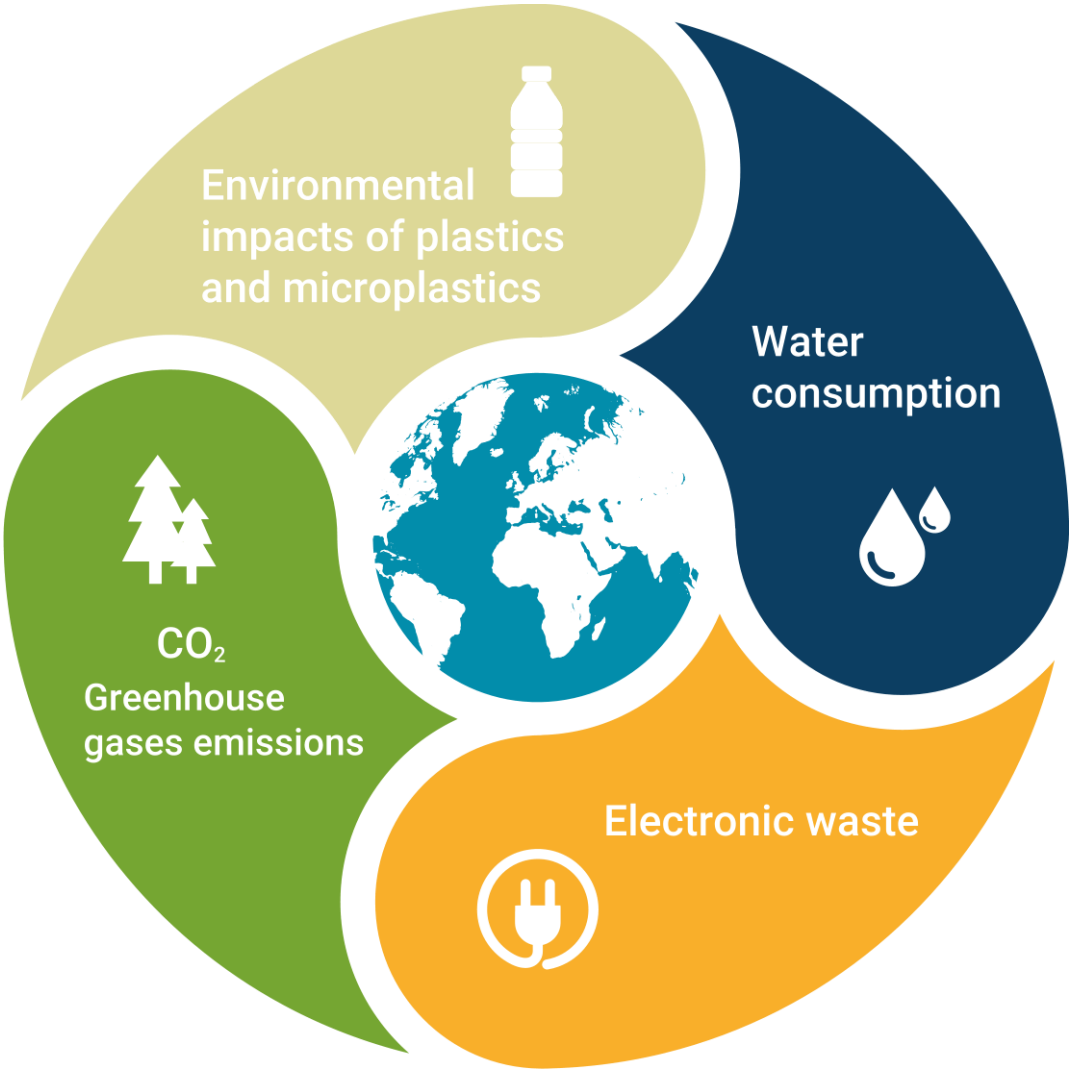
Ecodevices 2023/03



4 BIG environmental problems

The Earth is facing a number of environmental problems: from environmental impacts of plastics and water consumption to greenhouse gas emissions and electronic waste.

The impact of plastic on the environment is a significant problem. This plastic pollution can choke and kill marine life, contaminate food sources, and damage ecosystems.

Water consumption is also a major issue. This high level of water consumption can put stress on local water resources and lead to shortages.

Greenhouse gas emissions are another concern. These emissions contribute to climate change and global warming.

E-waste is also a growing problem. Electronic devices contain valuable materials such as gold, silver, and copper that can be recycled or reused. However, most e-waste is not recycled properly and ends up in landfills where it can leach harmful chemicals into the soil and air.

carbon footprint

Greenhouse Gases emissions

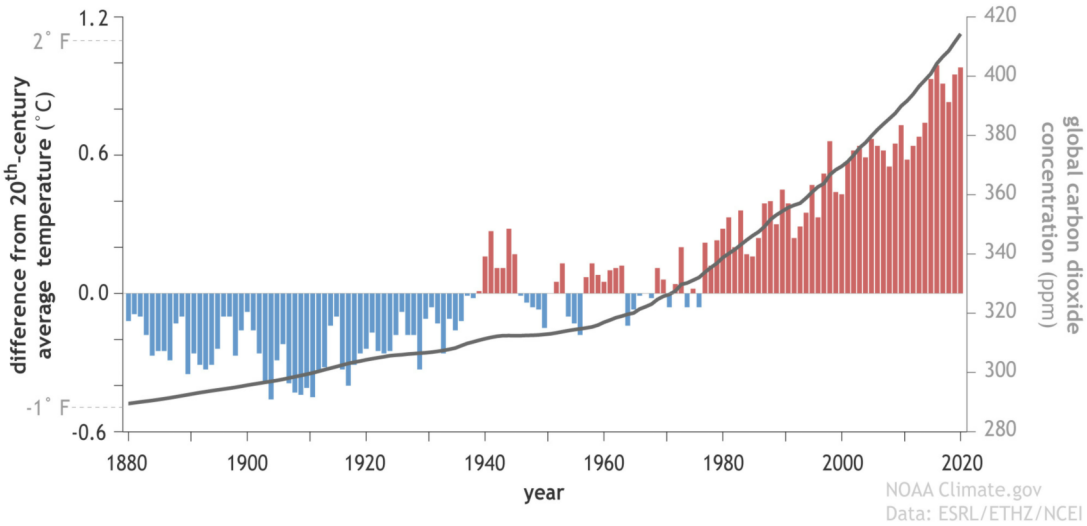
Carbon Footprint

Carbon footprint is the measure of the total duty of greenhouse gases (Greenhouse Gases - GHG) emitted directly or indirectly by an activity, a company, a person, an event or a product. It is expressed as tons of equivalent CO2, calculated along the entire life cycle of the system in analysis: from the extraction of raw materials to dispose in landfills.

CO_2

CO2 is one of the greenhouse gases that trap the heat of the sun in the atmosphere and contributes to the rise in the average temperature of the planet, with consequent environmental disasters. These gases are already present in nature, but man's activity increases concentrations in the atmosphere, as a consequence of industrial activity
An effect of the excess carbon dioxide is climatic overheating ("**Global Warming**") [1]

Global atmospheric carbon dioxide and surface temperature (1880-2020)



Global annual average temperature (as measured over both land and oceans) has increased by more than 1.5°F (0.8°C) since 1880 (through 2012). Red bars show temperatures above the long-term average, and blue bars indicate temperatures below the long-term average. The black line shows atmospheric carbon dioxide (CO2) concentration in parts per million (ppm). While there is a clear long-term global warming trend, some years do not show a temperature increase relative to the previous year, and some years show greater changes than others. These year-to-year fluctuations in temperature are due to natural processes, such as the effects of El Niños, La Niñas, and volcanic eruptions. [2]

water footprint

Water Footprint

Water consumption

Water Facts

- Water covers about 71% of the earth's surface.
- 97% of the earth's water is found in the oceans (too salty for drinking, growing crops, and most industrial uses)
- 3% of the earth's water is fresh. (70 % of the world's fresh water is frozen in the polar ice caps, 29% is underground, 1% is available in rivers and lakes) [1]
- Water scarcity: by 2025, 1800 million people are expected to be living in countries or regions with "absolute" water scarcity (<500 m3 per year per capita) (in the North African belt, sub-Saharan Africa, and the Middle East) [2]

Water Footprint

Water footprint is the amount of fresh water used to produce goods or services.

WF is an indicator of direct and indirect water usage by an individual:
- direct water footprint, is the water used directly by the individuals
- indirect water footprint is the summation of the water footprints of all the products consumed

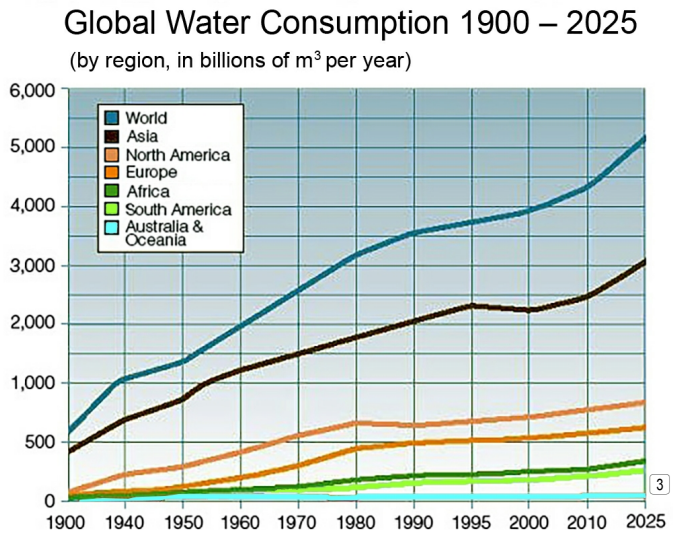
Every product we consume, from a cup of coffee to a pair of jeans, has a 'hidden' water footprint.

Three kinds of water footprint exist, the green, the blue and the grey:

Blue water footprint: water consumed from surface water and ground water
Green water footprint: water consumed from rainwater
Grey water footprint: water needed to dilute pollutants

Products	Fresh Water Consumed
car	151,416 Litres
cotton shirt	2,900 Litres
pair of leather shoes	8,000 Litres
pair of jeans	10,000 Litres
smartphone	12,760 Litres

Numbers can vary from country to country depending on local irrigation, production and manufacturing systems, as well as the climate



plastic pollution

Plastic Pollution

Environmental impact of plastic waste

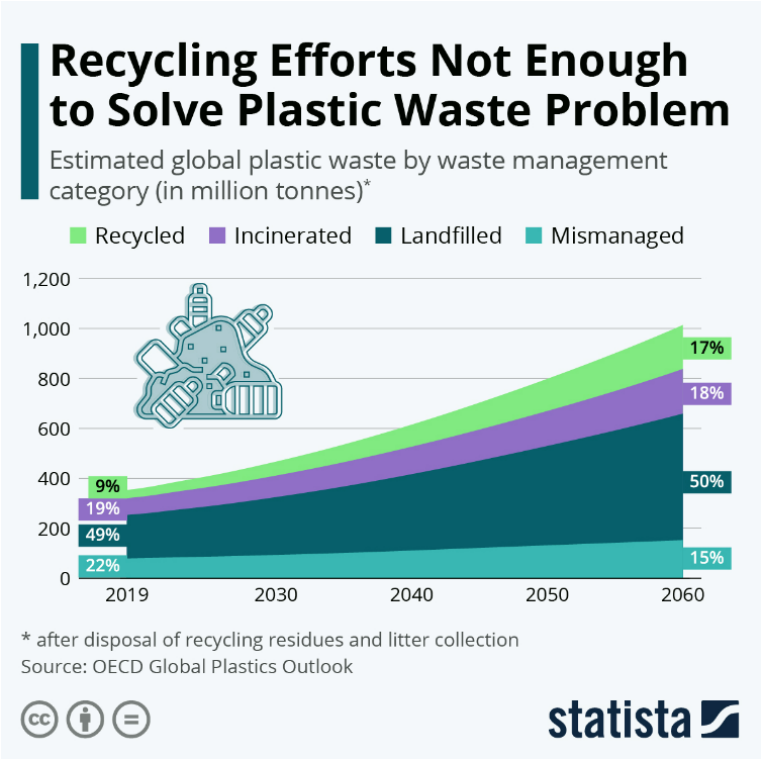
Plastic Footprint

Plastic Footprint is a measurement of the amount of plastic that someone uses and then throws away, considered in relation to the damage this causes to the environment: from plastic wrap, water bottles, plastic in devices, and anything that contains plastic.
The plastic footprint is usually quantified by mass (pounds, kilograms, or metric tons)

What is the Difference Between a Plastic Footprint and a Carbon Footprint?
A carbon footprint is the amount of greenhouse gases that are emitted by our actions into the atmosphere whereas a plastic footprint is the amount of plastic your lifestyle consumes.

How long does it take for garbage to decompose?

Products	Time
plastic bag	10-1000 years
plastic bottle	70-450 years
foam plastic cup	50 years
disposable diaper	450 years
plastic-coated paper milk carton	5 years
nylon clothes	30-40 years



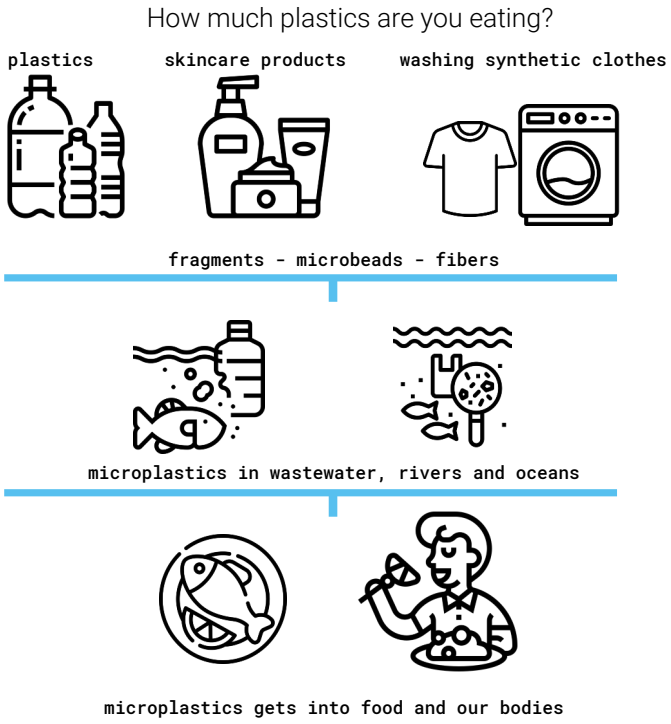
plastic pollution

Plastic Pollution

Environmental impact of plastics and microplastics

Microplastics Waste in the Oceans

Microplastics are fragments of any type of plastic less than 5 mm (0.20 in) in length
Because plastics degrade slowly (often over hundreds to thousands of years),microplastics have a high probability of ingestion, and accumulation in the bodies and tissues of many living organisms. [1][2][3][4]



Endocrine Disruptors

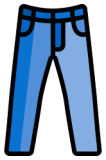
Plastics contain hazardous chemicals, including endocrine-disrupting chemicals (EDCs) that threaten human health. EDCs are chemicals that disturb the body's hormone systems and can cause cancer, diabetes, reproductive disorders, and neurological impairments of developing fetuses and children.

Safe Plastic Numbers

[5]

1 - Polyethylene Terephthalate (PET or PETE)	
2 - High-Density Polyethylene (HDPE)	Recycling
3 - Polyvinyl Chloride (PVC or Vinyl)	
4 - Low-density polyethylene (LDPE)	Recycling
5 -Polypropylene (PP)	Recycling
6 -Polystyrene (PS)	
7 -Other (BPA Bisphenol A , Polycarbonate and Lexan)	

denim pollution



Denim Pollution

Environmental impact of blue jeans

Fashion industry by the numbers

Estimated percentage of industrial water pollution that came from textile dyeing and treatment
7,000-29,000 litres of water for 1 Kg of cotton [1]

Responsible for 10% of global greenhouse gas emissions

Cotton production

In cotton production large amounts of water, fertilizers and pesticides are used. The amount of water for irrigation can be as high as 25.000 liter per kg of cotton produced. This causes enormous environmental impact as the course of rivers is altered to be able to irrigate the cotton field, soil is becoming very salty, as the evaporating water leaves its salt content behind, an effect which is increased by the heavy use of fertilizers. The use of pesticides has, besides protecting the cotton crop, a very negative effect on the environment and is killing many organisms. [2]

Health hazards caused by denim industry [2]

Process	Sources	Health hazards
Spinning and weaving	Emission of dust	Byssinosis
Energy generation	Emission of heat	Irritates respiratory system
Sizing and dyeing	Emission of sizing and dyeing compounds	Bloating and diarrhea Irritant to eyes and skin
Bleaching	Emission of chlorine	Causes lung and respiratory system failure
Finishing	Resin finishing	Carcinogenic
Finishing	Sand blasting	Silicosis
Chemical storage	Emission from storage of all chemicals	Irritates respiratory system

Azo dyes are the largest group of synthetic dye, which are used in 60% to 70% of all dyes, release chemicals when the fabric of a clothing piece comes in contact with skin.

CO2 and Water footprint of cotton goods [3]

		
	**2700** litres	**7500** litres
	**15** Kg	**33.4** Kg

Eco-friendly alternatives:

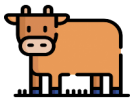
- Oeko-Tex, Gots or Fairtrade certified organic cotton or BCI cotton.
- Second hand to extend their life

leather pollution

Leather Pollution

Environmental impact of leather goods

Global average water footprint



17093 litres /
1 kg of bovine leather

The leather processing industry produces large quantities of solid organic waste, in the form of un-tanned and tanned waste, from raw hides and skins, semi-finished leather and sludge from waste water treatment. If not properly treated and disposed of, these solid wastes can cause environmental damage to soil and groundwater, as well as odour and toxic greenhouse gas emissions to the atmosphere. [1]

CO2 and Water footprint of leather goods [2]



	30270 litres	**17128** litres	**12370** litres
CO_2	**176** Kg	**100.5** Kg	**40.7** Kg

Tanning process

Conventional leather is heavily criticized for the environmental impact of the tanning process. Chromium, in particular, is considered one of the most dangerous toxic chemicals in the leather industry.

Eco-friendly alternatives

But leather can also be eco-friendly. There are not many options in the market yet, but they do exist. These include Ecolife™ by Green Hides, which creates eco-friendly, chrome-free leather in Italian tanneries that recycle and purify wastewater.
The Leather Working Group is also promoting sustainable environmental practices within the leather industry. [3]

Higg Index Sustainability Profile [4]
Oeko-Tex [4]

Benefits of Leather [5]

- Natural
- Durable
- Long-lasting
- Stylish

e-waste

E-Waste Pollution

Environmental impact of electronic waste

What is e-waste?

Electronic and electrical waste, or e-waste, covers a variety of different products that are thrown away after use.

Large household appliances, such as washing machines and electric stoves, IT and telecommunications equipment (smartphones, laptops, printers), consumer equipment (TV, video cameras, fluorescent lamps, radios), photovoltaic panels and small household appliances (coffee maker, microwave).

Toxic substances

Almost 50 million tonnes of electronic waste are produced every year, exposing people and the environment to toxic substances such as lead, cadmium, chromium and brominated flame retardants, which can also accumulate in soils, water and food. [1] [2]

Pollutants	Occurrence
Arsenic	Semiconductors, diodes, microwaves, LED, solar cells
Barium	Electron tubes, filler for plastic and rubber, lubricant additives
Cobalt	Insulators
Lead	Lead rechargeable batteries, transistors, lithium batteries, PVC (polyvinyl chloride) stabilizers, lasers, LED, thermoelectric elements, circuit boards
Lithium	Mobile telephones, photographic equipment, video equipment batteries)

What can be done?

- Stop Planned Obsolescence

Planned obsolescence describes the practice of designing products to break prematurely or become obsolete in the short to mid-term, often to sell another product or an upgrade.

- Switch from Linear economy to Circular economy

Manufacturers should make products durable and recyclable, designed with components and materials "greener" and long lasting materials.

They can also provide simpler options to obtain repairs, updates and related spare parts.

- Right to Repair Everything We Own

ifixit.com repair.eu repair.org

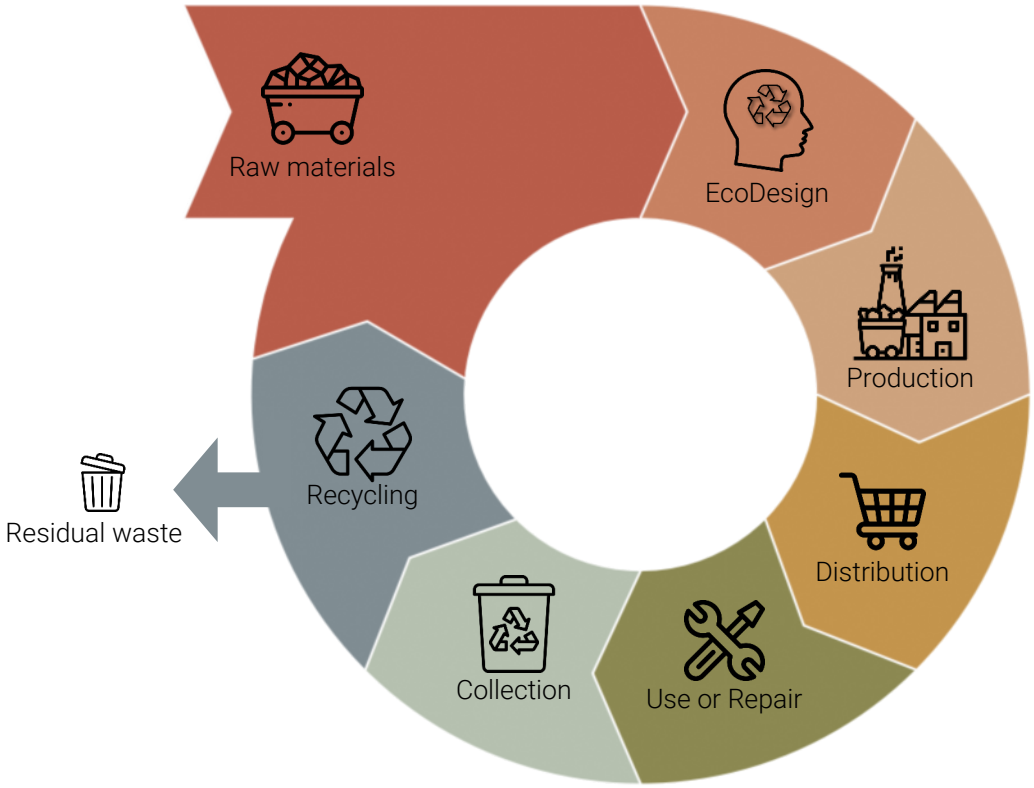
e-waste

Linear Economy

The linear economy is designed to extract the raw materials, make products from them, and eventually throw them away as waste. This model requires large quantities of materials and energy.

Circular Economy

The purpose of the circular economy is to maintain the products and materials in use as long as possible, to their maximum value, and then recycle them in new products.
In a circular economy, the products can be repaired and reused as much as possible. High quality components and a modular design are needed, so that, for example, the battery and other parts can be removed without destroying the product.



Benefits of a Circular or Closed-Loop Economy

- Reduce waste ending up in landfills
- Decrease pollution
- Lower resource consumption
- Create overall sustainability

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Circular Economy for electronics devices

Recycling **leather** remnants has a number of benefits. Using recycled leather helps minimize waste, which helps reduce the environmental impact of leather production. Recycled leather is also more sustainable than other materials, such as synthetic leather or polyurethane.
Leather also looks stylish and can be used to make a wide range of products.

When designing **electronics** for projects, it is important to consider the principles of modularity, easy disassembly, repair and upgrade. Modularity allows components to be easily swapped and replaced, while ease of disassembly allows components to be easily taken apart and reassembled. Component repair and upgrade allows existing components to be reused, saving both time and money. In addition, disassembling, repairing and upgrading electronics allows for more efficient recycling and reuse of components.

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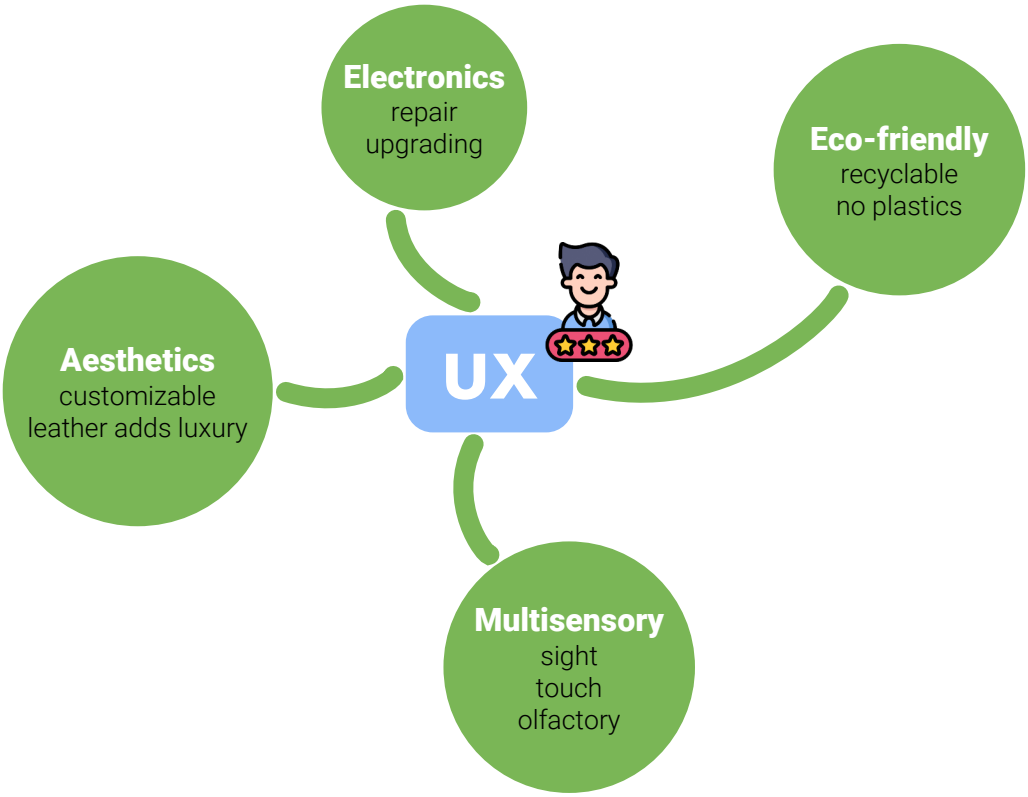
Ecodevices design guideline

As part of a project to design and develop prototypes for a circular economy, I conducted research and experimentation on prototypes designed to make products more sustainable, easy to maintain and repair, and customizable by the user.

The project aims to design a range of small electronic devices that can be repaired, recycled or reused. The structure can be made of cardboard and finished with leather scraps or non-synthetic fabrics (cotton, linen or felt). Leather scraps can be used to provide a decorative and aesthetically pleasing finish as well as a strong, durable outer covering for the structure.
The following subsections describe each of these devices in detail.

Devices in this range are able to connect to the Internet and play music, as well as collect data from the world around them.
These devices include sensors, cameras, microphones and other environmental or health monitoring devices.
Sensors are typically used to measure specific physical parameters such as temperature, pressure, humidity and motion.



Positive User eXperience

- Product life extension: upgrade - replace worn parts
- Smart material choices: eco-friendly material - recyclable materials
- Closed loop: reuse leather scraps and carboard
- Modularity: easy to disassemble - standard electronic components
- Multisensory perception: influence mood with colors, textures and aromas

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Multisensory perception

Olfactory

Leather smells good

Research has shown that smell can have a profound effect on emotional states. The olfactory system is closely connected to areas of the brain associated with emotional processing. The sense of smell can trigger memories and emotions that are tied to past experiences. Studies have also shown that certain scents can trigger feelings of happiness, comfort, and relaxation. [1]

Leather has a distinct and pleasant smell that many people find pleasing.

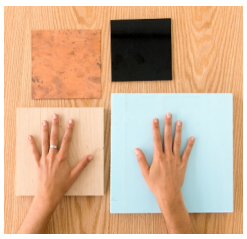
This is due to the natural oils found in leather and the tanning process used to preserve it. The combination of these two elements creates a unique smell that is both earthy and musky, which can be quite pleasing to some people.

Sight

Influencing Mood With Color & Texture

80 percent of information transmitted to the brain is visual: color (hue saturation), object shape (golden ratio, symmetry, contour, complexity)

The colors of surfaces and objects can also have a significant effect on satisfaction, comfort; warm-toned, natural materials like wood and leather are associated with positive mood.



Touch

Touch experience enhances perception of the product quality

Our skin is our largest organ. Touch plays an important part in the way we interact with things.

Surfaces, temperatures and other attributes of textures can have a significant impact on our emotions. In a recent study made by psychologists, soft materials, such as fur, velvet, silk and leather, were associated with the positive emotion of happiness.

Positive emotions

Multisensory perception is a phenomenon that occurs when we experience emotions through more than one sense. This means that our emotional reactions can be triggered by multiple senses such as sight, smell, touch. [2] [3] [4] [5]

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Web Radio

Streaming Audio on the Web

Web radio, also known as Internet radio, is a form of streaming audio that is broadcast over the Internet. This type of audio streaming allows to listen audio content from a variety of sources, including radio stations, podcasts and online music services. Web radio gives listeners access to a wide range of audio content from around the world and can be streamed to a variety of devices, including computers, smartphones and tablets.

Main characteristics

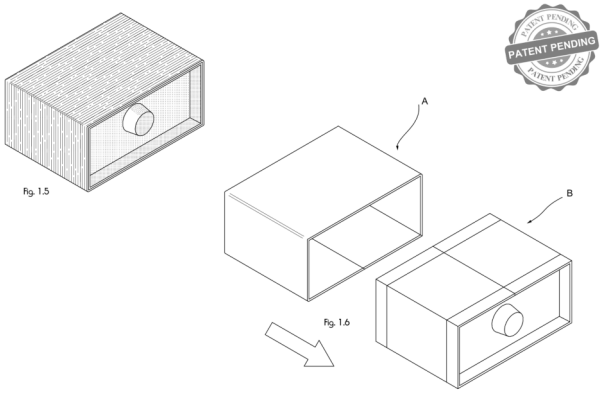
Wi-Fi IEEE 802.11 b/g/n 2.4 GHz
Presetting web radio stations
Software update
Rechargable battery
Volume control
Miniature Speaker 3W 8Ohm
USB charging port
5V 1A charger

Hardware components

Esp32 microcontroller with integrated Wi-Fi
PAM8403 3W+3W Power Amplifier with volume control potentionmeter
Rechargeable Lithium Ion Battery 3.7V 1000mA

Assembling

Internal frame made of cardboard - external removable cover is made of fabric or leather



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FM Radio

FM Tuner with RDS and a rechargeable battery

This project is based on Arduino microboard to control an FM radio module (RDA5807) and an OLED display. A Li-ion rechargeable battery is also included to power the system. The user is able to adjust the volume and search for radio stations using touch controls. The Arduino controls the user input and communicates with the display, radio module and battery. The radio module is responsible for tuning into and receiving radio stations, while the display show the current radio station, volume, and other information.

Main characteristics

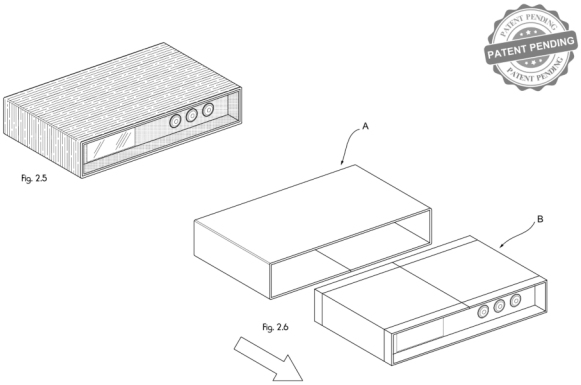
76-108 Mhz Stereo FM receiver
Autonomous search tuning
Touch controls for radio tuning and volume
RDS Radio Data System
Software update
Rechargable battery
Miniature Speaker 3W 8Ohm
USB charging port
5V 1A charger

Hardware components

Arduino nano
PAM8403 3W+3W Power Amplifier
RDA5807 FM radio module
Rechargeable Lithium Ion Battery 3.7V 1000mA

Assembling

Internal cardboard frame and external leather or denim cover



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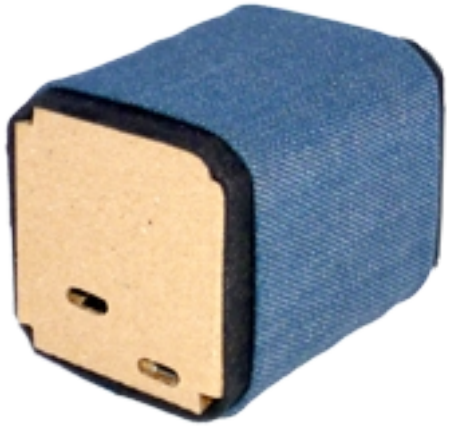

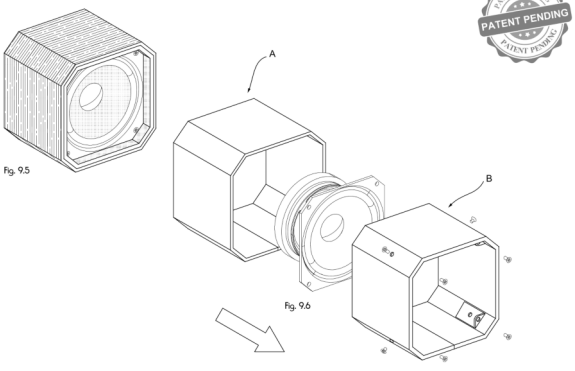

Mini speaker

Mini speakers for PC

Mini speakers for PC are small speakers designed to be used with PCs and other computing devices. They usually have a compact size and provide a good sound quality. They can be used for a variety of purposes, including listening to music, watching movies, playing games, and more. They are usually powered by either USB or batteries and can be connected to PCs via a 3.5mm audio jack.

Main characteristics

Input 3.5mm audio jack
Speaker 3W 8Ohm
USB Power
5V 1A charger

Hardware components

PAM8403 3W+3W Power Amplifier

Assembling

Internal cardboard frame and external denim cover

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Air quality monitor
Bluetooth speaker
Data Displaying System with TFT Screen
Live stream with camera
RFID Media Player
Weather Station
.... and more

sources

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