Prototype Technology for Future HCI

Christel Joy A. Abordaje

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Instructor: Josie Calfoforo

Make a research on the other top ten (10) emerging prototype

technologies for future Human-Computer Interaction (HCI).

1. Fuel cell vehicles

- Zero-emission cars that run on hydrogen. Unlike batteries, which must be charged from an external source, fuel cells generate electricity directly, using fuels such as hydrogen or natural gas. In practice, fuel cells and batteries are combined, with the fuel cell generating electricity and the batteries storing this energy until demanded by the motors that drive the vehicle. Fuel cell vehicles are therefore hybrid and will likely also deploy regenerative braking – a key capability for maximizing efficiency and range. Unlike battery-powered electric vehicles, fuel cell vehicles behave as any conventionally fueled vehicle.

2. Next-generation robotics

- Rolling away from the production line. The popular imagination has long foreseen a world where robots take over all manner of everyday tasks. Advances in robotics technology are making human-machine collaboration an everyday reality. Better and cheaper sensors make a robot more able to understand and respond to its environment. Robot bodies are becoming more adaptive and flexible, with designers taking inspiration from the extraordinary flexibility and dexterity of complex biological structures, such as the human hand. And robots are becoming more connected, benefiting from the cloud-computing revolution by being able to access instructions and information remotely, rather than having to be programmed as a fully autonomous unit.

3. Recyclable thermoset plastics

- A new kind of plastic to cut landfill waste. Thermoset plastics can only be heated and shaped once, after which molecular changes mean that they are “cured”, retaining their shape and strength even when subject to intense heat and pressure. Due to this durability, thermoset plastics are a vital part of our modern world and are used in everything from mobile phones and circuit boards to the aerospace industry. But the same characteristics that have made them essential in modern manufacturing also make them impossible to recycle. As a result, most thermoset polymers end up as landfill. Given the ultimate objective of sustainability, there has long been a pressing need for recyclability in thermoset plastics.

4. Precise genetic engineering techniques

A breakthrough offers better crops with less controversy. Conventional genetic engineering has long caused controversy. However, new techniques are emerging that allow us to directly “edit” the genetic code of

plants to make them, for example, more nutritious or better able to cope with a changing climate.

Currently, the genetic engineering of crops relies on the bacterium *agrobacterium tumefaciens* to transfer desired DNA into the target genome. The technique is proven and reliable, and despite widespread public fears, there is a consensus in the scientific community that genetically modifying organisms using this technique is no riskier than modifying them using conventional breeding. Genetic engineering may become less controversial, as people recognize its effectiveness at boosting the incomes and improving the diets of millions of people.

These techniques promise to advance agricultural sustainability by reducing input use in multiple areas, from water and land to fertilizer, while also helping crops to adapt to climate change.

5. Additive manufacturing

The future of making things, from printable organs to intelligent clothes. As the name suggests, additive manufacturing is the opposite of subtractive manufacturing. The latter is how manufacturing has traditionally been done: starting with a larger piece of material (wood, metal, stone, etc), layers are removed, or subtracted, to leave the desired shape. Additive manufacturing instead starts with loose material, either liquid or powder, and then builds it into a three-dimensional shape using a digital template.

6. Emergent artificial intelligence

Artificial intelligence (AI) is, in simple terms, the science of doing by computer the things that people can do. Emergent AI takes this a step further, with progress arising from machines that learn automatically by assimilating large volumes of information. Artificial intelligence, in contrast to normal hardware and software, enables a machine to perceive and respond to its changing environment.

7. Distributed manufacturing

The factory of the future is online and on your doorstep. Distributed manufacturing turns on its head the way we make and distribute products. In traditional manufacturing, raw materials are brought together, assembled and fabricated in large centralized factories into identical finished products that are then distributed to the customer. In distributed manufacturing, the raw materials and methods of fabrication are decentralized, and the final product is manufactured very close to the final customer. In essence, the idea of distributed manufacturing is to replace as much of the material supply chain as possible with digital information.

8. ‘Sense and avoid’ drones

Flying robots to check power lines or deliver emergency aid. Flying vehicles will never be risk-free, whether operated by humans or as intelligent machines. For widespread adoption, sense and avoid drones must be able to operate reliably in the most difficult conditions: at night, in blizzards or dust storms. Unlike our current digital mobile devices (which are actually immobile, since we have to carry them around), drones will be transformational as they are self-mobile and have the capacity of flying in the three-dimensional world that is beyond our direct human reach. Once ubiquitous, they will vastly expand our presence, productivity and human experience.

9. Neuromorphic technology

Computer chips that mimic the human brain. Neuromorphic chips aim to process information in a fundamentally different way from traditional hardware, mimicking the brain’s architecture to deliver a huge increase in a computer’s thinking and responding power. Neuromorphic technology will be the next stage in powerful computing, enabling vastly more rapid processing of data and a better capacity for machine learning.

10. Digital genome

Healthcare for an age when your genetic code is on a USB stick. While the first sequencing of the 3.2 billion base pairs of DNA that make up the human genome took many years and cost tens of millions of dollars, today your genome can be sequenced and digitized in minutes and at the cost of only a few hundred dollars. The results can be delivered to your laptop on a USB stick and easily shared via the internet. This ability to rapidly and cheaply determine our individual unique genetic make-up promises a revolution in more personalized and effective healthcare.

This new knowledge is also making precision medicine a reality by enabling the development of highly targeted therapies that offer the potential for improved treatment outcomes, especially for patients battling cancer.