Relevant Technologies in Other Fields

Biology

- **Nanotechnology**
  - is science, engineering, and technology conducted at the nanoscale, which is about 1 to 100 nanometers.

    (source:*https://www.nano.gov/nanotech-101/what/definition*)

  - When we talk about nanotechnology, we are mainly talking about particles artificially developed on a microscopic scale. Many are spheres used to bind to living materials and cells for a medical purpose. Others are hollow capsules containing other materials that act as a delivery system. This is often the case for dyes and the direct transportation of drugs. The main particles are often covered in protective materials like silica to keep them intact until delivery. These layers are then absorbed, and the particle can do its job. These particles, therefore, have many potential applications in medicine, surgery, and other commercial practices.

    (source: *https://www.nanotechetc.com/6-of-the-best-applications-of-nanotechnology-in-biology-and-medicine/*)

Six Applications of Nanotechnology:

1. **Protein Detection** – There are a few microscopic tools in protein detection using gold particles and dyes. These particles can bind to the offending cells and show up in scans or with cameras. The problem is that they can often be limited in their efficiency. Nanotechnology can take this to a new level with nanoprobes that target the proteins more accurately, dispersing gold, dyes and perhaps both. This may sound like science fiction to some, with some curiosity about the practical implications. However, the

actual benefit of these new approaches is clear with the next development.

2. **Cancer Therapy** – One of the most interesting uses of nanotechnology for many that are new to the science is cancer therapy. There are many new developments in screening and treatment options for colon and prostate cancer that include nanotechnology. The aim is to enhance the potential of photodynamic cancer therapy by highlighting the cells to be then targeted by the lasers. The more accurate the detection rate, the more effective the treatment. Nanotechnology can increase the chances of dyes and gold particles reaching the cancer cell. This means greater detection rates, that makes it easy to catch the problem and treat it faster. This could help to reduce prostate and colon cancer mortality rates.

3. **Tissue Engineering** – At the moment, one of the main developments here is in the use of artificial implants. This includes new joints, plates to replace broken bones and other structural work following accidents. The problem with current materials, such as titanium, is that the body can easily reject them as foreign objects. A recent discovery showed that nanoparticle tissue engineering could create a new tissue surface that would allow the new "bone" and tissues to fuse. This surface could also allow for a porous structure that would allow for nutrients to pass through. With further development in this area, this could have important implications in transplants and plastic surgery.

4. **Multicolor Optical Coding** –color coding is an important part of genetics when determining a sequence. It provides a visual map of genes and proteins that makes it much easier to identify sequences, defects, and anomalies. The problem with the old system of dyes is that there were only

so many colors to use in a series. The development of nanotechnology and colored particles has changed that. This new system uses a series of the compound semiconductor to manipulate more freely and combine to form new patterns and colors. There are even fluorescent options available for a different tone and level of visibility. Recent studies showed a range of colors and intensities that allowed for more than a million coding combinations. This means a bead identification accuracy of 99.99%.

5. **Cell Manipulation** – the beauty of a human-made nanoparticle is that they are now crafted from materials best suited to the job, with the right properties. Some use capsules to transport and disperse items to a particular area of the body. Others use magnetism to use those particles to manipulate the shape of cells. The impact of the particles and the magnetic force can be fine-tuned using different ranges and thickness of metal. It is not just the biological cells under manipulation here but the technology itself. It is adaptive and mobile. This is ideal for dealing with issues case by case, rather than a one-size-fits-all approach to health care. This is clearly an area with room for further improvement and we are probably yet to see the full implications.

6. **Commercial Exploration** – the current state of nanotechnology means that our current understanding can take developers into many different areas. One thing to note is that nanotechnology is not all about medicine and drug delivery — although this is the main focus for many developers. There are commercial endeavors — some related to medical care and others less so — where nanotechnology can be of use. One is the creation of band aids and dressings with nanoparticles of silver and other

antimicrobial elements. Others want to explore the potential in the filtration systems with nano–ceramics and metals. Then there are those looking into hybrid bio–nanomaterials for electronics and optoelectronics.

- ○ **Biotechnology**
  - it harnesses cellular and biomolecular processes to develop technologies and products that help improve our lives and the health of our planet. *(source: https://www.bio.org/what–biotechnology)*

  - Biotechnology is the use of living organisms, their parts or by–products in industrial applications. The term Biotechnology can refer to a wide range of applications from a vaccine, to Chitosan coated wound dressings (Chitosan is derived from crab–shell), developing new sources of biofuel, genetic modification of crops, beer brewing and even anti–aging cosmetics. *(source: https://lscconnect.com/what–is–biotechnology/)*

Biotechnology using a colour classification:
  - ✓ RED BIOTECHNOLOGY
  - Red Biotechnology (Biopharma) brings together all those Biotechnology uses connected to medicine and veterinary products. Red Biotechnology includes producing vaccines and antibiotics, developing new drugs, molecular diagnostics techniques, regenerative therapies and the development of genetic engineering to cure diseases through genetic manipulation.
  - ✓ WHITE BIOTECHNOLOGY
  - White Biotechnology relates to industrial Biotech. White Biotechnology pays special attention to designing low resource–consuming processes and

products, making them more energy efficient and less polluting than traditional ones. An example of white Biotech is the use of microorganisms in chemical production, the design and production of new plastics/textiles and the development of new sustainable energy sources such as bio–fuels.

- ✔ YELLOW BIOTECHNOLOGY
- Yellow Biotechnology, has been used to refer to the use of Biotechnology in food production, for example in making wine, cheese, and beer by fermentation.
- ✔ GREY BIOTECHNOLOGY
- Grey Biotechnology refers to environmental applications, and is focused on the maintenance of biodiversity and the removal of pollutants/contaminants using microorganisms and plants to isolate and dispose of different substances such as heavy metals and hydrocarbons.

Sociology

- o **Social Media** —a computer–based technology that facilitates the sharing of ideas and information and virtual networks and communities.
- o **Telecommunication devices** such as smartphones — Telecommunications is no longer limited to phone and fax services. Today, this industry encompasses high–speed internet, messaging, video streaming, mobile payments and more. Emerging technologies, such as 5G and cloud–hosted VoIP, are fueling its growth. From traveling and watching TV to doing business, telecom services are at the center of everyday life. According to a World Economic Forum report, modern telecom technology is the driving force behind digital transformation. Thanks to it, people all over the world have access to the latest information, products and marketplaces.

These services facilitate remote work, virtual meetings, and real–time collaboration between teams, regardless of distance.

(source: https://smallbusiness.chron.com/benefits–using–telecommunication–businesses–18676.html)

o **Modern hybrid transportation –** the use of vehicles propelled by more than one form of energy. … Every internal combustion engine (an engine that burns fuel in cylinders to drive pistons) can turn only a fraction of the energy into its fuel into useful mechanical motion. (source: https://www.encyclopedia.com/science/encyclopedias–almanacs–transcripts–and–maps/hybrid–transportation#:~:text=Hybrid%20transportation%20is%20the%20use,than%20one%20form%20of%20energy.&text=Every%20internal%20combustion%20engine%20(an,fuel%20into%20useful%20mechanical%20motion.)

o **RFID tags** used in ID, credit cards, travel cards etc. – RFID is an acronym for "radio–frequency identification" and refers to a technology whereby digital data encoded in RFID tags or smart labels (defined below) are captured by a reader via radio waves. RFID is similar to barcoding in that data from a tag or label are captured by a device that stores the data in a database. RFID, however, has several advantages over systems that use barcode asset tracking software. The most notable is that RFID tag data can be read outside the line–of–sight, whereas barcodes must be aligned with an optical scanner.

- RFID belongs to a group of technologies referred to as Automatic Identification and Data Capture (AIDC). AIDC methods automatically identify objects, collect data about them, and enter those data directly into computer systems with little or no human intervention. RFID methods utilize radio waves to accomplish this. At a simple level, RFID systems consist of three components: an RFID tag or smart label, an RFID reader, and an antenna. RFID tags contain an integrated

circuit and an antenna, which are used to transmit data to the RFID reader (also called an interrogator). The reader then converts the radio waves to a more usable form of data. Information collected from the tags is then transferred through a communications interface to a host computer system, where the data can be stored in a database and analyzed at a later time. *(source: https://www.abr.com/what-is-rfid-how-does-rfid-work/)*

o **Cryptocurrency –** a digital or virtual currency that is secured by cryptography, which makes it nearly impossible to counterfeit or double-spend. Many cryptocurrencies are decentralized networks based on blockchain technology—a distributed ledger enforced by a disparate network of computers. A defining feature of cryptocurrencies is that they are generally not issued by any central authority, rendering them theoretically immune to government interference or manipulation.

- A cryptocurrency is a new form of digital asset based on a network that is distributed across a large number of computers. This decentralized structure allows them to exist outside the control of governments and central authorities. *(source: https://www.investopedia.com/terms/c/cryptocurrency.asp)*

Environment

o **Renewable energy** – technology advancement that creates energy through efficient ways.

o **Weather forecasting devices** – to predict weather conditions for the next hour, day or even week.

o **Electric cars** – aka RC which uses more electric than fuels to avoid air pollution

o Other electronic gadgets used in offices to become paperless.

Gaming

o **Facial Recognition** –3D scanning and facial recognition technology allows systems to actually create your likeness in the gaming world (so you can create a custom avatar that looks just like you), or to inventively transfer your own expressions to other digital creations. On top of that, the Intel®RealSense™ 3D camera could allow developers to create games that adapt to the emotions of the gamer by scanning 78 different points on a person's face. For example, a few grimaces at your game screen means the system would dial down the game's difficulty instantly.

The figure above is an example of a face recognition game called Flying Face. In this game, the flying object can be controlled by moving the face up and down to pass through the moving pillars. *(source: https://images.app.goo.gl/npSbFucmPr4cNi6L8)*

o **Voice Recognition –**Too lazy to pick up that controller? No problem! Voice controlled gaming has been around for a while, but the potential of using the technology in gaming systems has finally caught up to reality— computers are now able to easily recognize voice commands from the user. Not only can you turn the console on and off using this tech, but you can also use

voice commands to control gameplay, interact on social media, play selections from your media library, or search the web, all by simply talking to your gaming system.
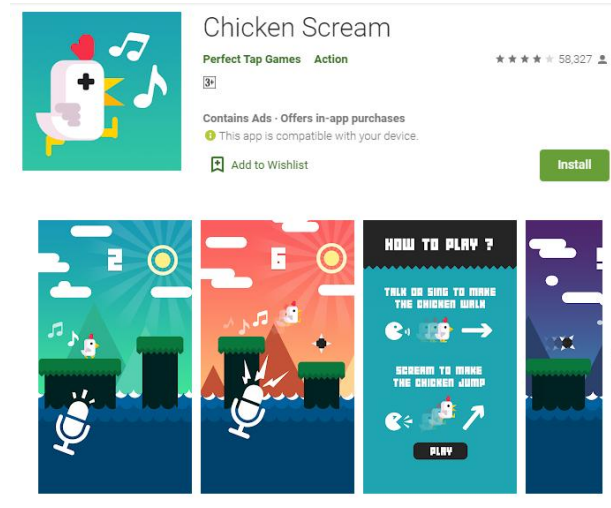
The figure above shows the game Chicken Scream which is a fun and interactive non tapping addictive game where your voice controls the chicken.

o **Gesture Control —** this technology allows you to play first person shooter games—or simply interact with your device—with just a few waves of your hand. Using a 3D camera that tracks 22 separate points in your hand, gesture control allows users to connect with their gaming experience by using the natural movements of your body. For example, the game Warrior Wave employs RealSense technology so you can use your hand (the outline of which shows up on the screen) to lead a group of Ancient Greek soldiers to safety.
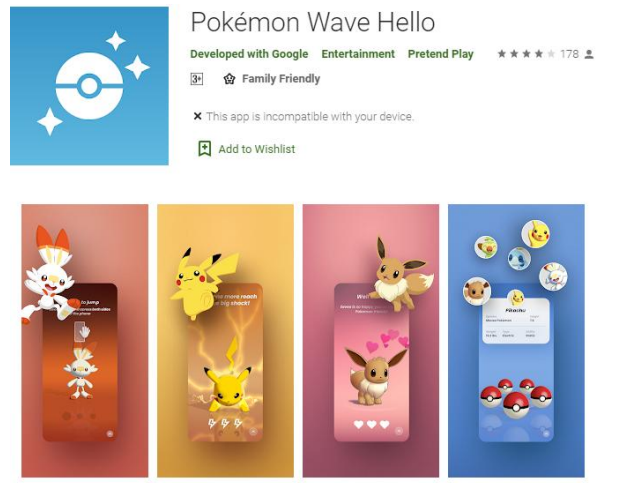
the example above is a gesture–controlled game which is called Pokemon Wave
Hello. *(source: https://www.google.com/search?q=pokemon+wave+hello&oq=pokemon+wave&aqs=chrome.1.69i57j0l7.6206j1j4&sourceid=chrome&ie=UTF–8)*

- o **Amazing Graphics** – we've come a long way from the days of basic 8–bit graphics in gaming. Cutting edge advancements now allow gamers to experience games in fully rendered worlds with photo realistic textures. The ability to increase playability with higher image quality makes it seem like you're right inside the game.

- o **High–Def Displays –w**ith gaming graphics this good, you need to have a bona fide way to show them off. Enter Ultra 4K gaming. Though televisions with 4K capabilities (meaning it must support at least 4,000 pixels) or 4K laptops (like the Intel–powered Lenovo Y50) started out at thousands of dollars, their price points have steadily declined, making this format the eventual standard in the way we watch the games we play. With unbeatable colors and crispness, there's nothing else that can come close. And you thought 1080p looked good.

- o **Virtual Reality –**though many virtual reality gaming consoles haven't been commercially released as of yet, those developing VR headset displays are poised to grant gamers a fully immersive gaming experience the likes of which nobody has seen before. You'll actually be

able to lose yourself in the game before you come back to reality.

- o **Augmented Reality –** maneuver spaces within the real world and make the object of the game applicable to real-life situations. For example, play table hockey on your kitchen counter from any angle, or partake in some puzzles mapped out via obstacles in your backyard.

- o **Wearable Gaming** – whether it's smartwatches or glasses, wearable games make gaming portable without being too invasive. Companies that started by using wearable technology for fitness applications are now aiming to incorporate entertainment into the mix as well. Wearables aren't only extensions of your body, but also extensions of the gaming consoles you know and love.

- o **Mobile Gaming –** with the advent of smartphones, the gaming experience has been taken out of the arcade and the living room and put into the palm of your hand. As evidenced by the countless people on your morning train commute huddled over games on their devices, mobile technology has made the love of digital gaming spread beyond hardcore console-consumers and online gamers.

Cloud Gaming –instead of creating video game systems that require more powerful hardware, developers are looking to lighten the load with the cloud. Games no longer need be limited by the amount of memory that discs or consoles have to offer. Using the cloud opens games up to massive server-size limits where images are streamed to your screen through the Internet.