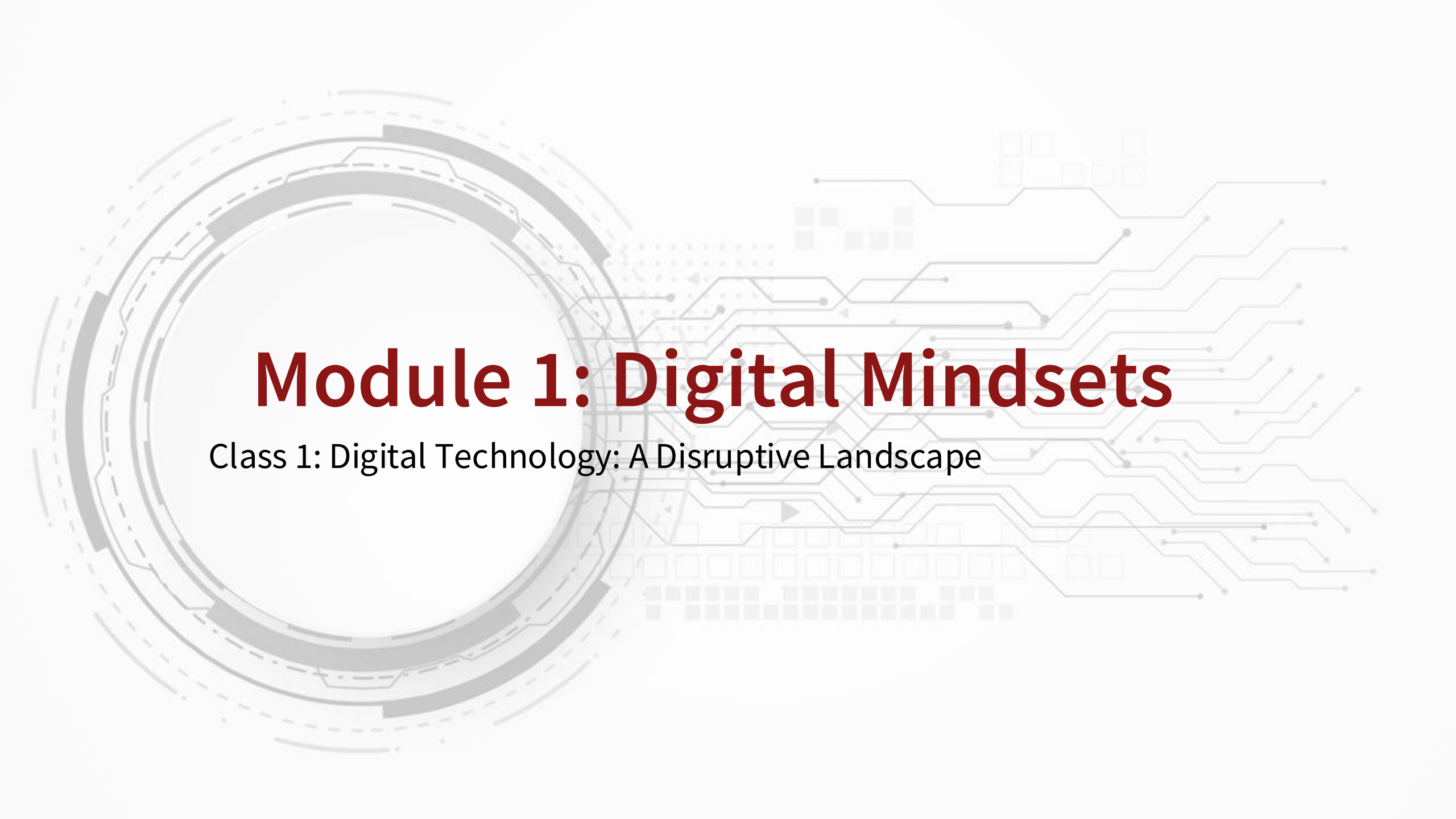




Digital 101 Emerging Technologies

Dr. Mohammad Alshehri



Module 1: Digital Mindsets

Class 1: Digital Technology: A Disruptive Landscape

Session Learning Outcomes

01 Understand the extremely broad scope of impact that emerging digital trends and frontier technologies will have on every aspect of our lives.

02 Learn of a few specific socio-technical trends or notions, such as smart cities, personalized medicine, and the metaverse.

03 Have a good grasp on the logistics and structure of the course.

Session Layout

Introduction

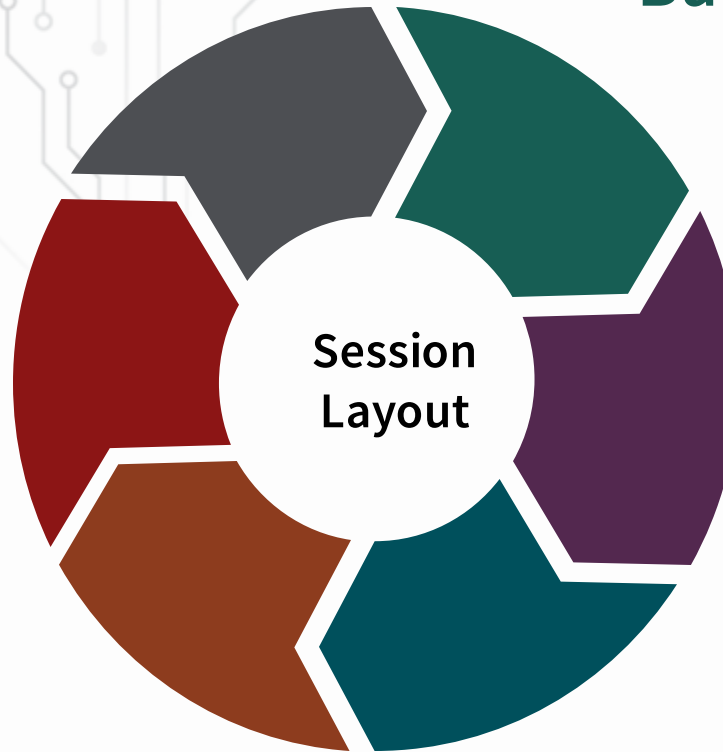
Course topics, schedule, and assignments

Concluding Thoughts

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Future of Reality with Metaverse

Discuss the impact of emerging technologies on our lives



Background on Moore's Law

What it is and how it impacted technology

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Future of Medicine

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Introduction to the Course



Topics



Schedule



Assignments

Topics

Module 1: Digital Mindsets

1. Digital Technology: A Disruptive Landscape
2. Mindsets and Practice of Technology Innovation
3. Data Mindset: Learning and Communicating with Data

Topics

Module 2: Digital Technologies: Key Topics

1. Artificial Intelligence and Machine Learning
2. Internet of Things and 5G
3. Cybersecurity
4. Virtual and Augmented Reality
5. Additive Manufacturing
6. Blockchain and Distributed Ledger Technology
7. Robotics, Drones, and Autonomous Vehicles

Topics

Module 3: Digital Technologies: Applications

1. Digital Ethics
2. Applications and Impact on Individuals, Business, Society, and Government Policy
3. Wrap-Up and Student Project Work Presentation

Schedule:

- **Days:** Every Sunday and Tuesday (except 1st week)
- **Time:** 4:00 pm to 6:00 pm

September

S	M	T	W	T	F	S
28	29	30	31	1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	1
2	3	4	5	6	7	8

October

S	M	T	W	T	F	S
25	26	27	28	29	30	1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	1	2	3	4	5

Dates	Sunday	Monday	Tuesday	Wednesday	Thursday
4/9 & 7/9	Digital Technology: A Disruptive Landscape			Mindsets and Practice of Technology Innovation	
11/9 & 13/9	Data Mindset: Learning and Communicating with Data		Artificial Intelligence and Machine Learning		
18/9 & 20/9	Internet of Things and 5G		Cybersecurity		
25/9 & 27/9	- Virtual and Augmented Reality - Additive Manufacturing		Blockchain and Distributed Ledger Technology		
2/10 & 4/10	Robotics, Drones, and Autonomous Vehicles		- Digital Ethics - Applications and Impact on Individuals, Business, Society, and Government Policy		
9/10	Projects' Presentations				

Grading Policy

1. Class attendance and participation: **20%**
2. Quizzes and study questions: **40%**
3. Final project: **40%**

Quizzes and Study Questions

Outside of class, students are expected to:

- complete assigned readings
- engage with one another in discussions, and
- submit a final project at the end of the course

Students will complete the Pre-Class Assignment individually and then work in groups of three or four to complete the study questions prior to attending class.

Final Project

- The purpose of the final project is to allow the students to integrate the material covered in the course and envision how the collection of technologies and concerns discussed in class improves an area or several areas of societal importance .
- Groups of 3-4 students will need to complete this project assignment outside of the class sessions.
- The project groups should be the same groups of students that have been working together for the weekly discussions of the study questions.
- The project concludes with a final presentation due at the end of the course.

Topics for the Final Project

Emerging Technology

Entertainment Industry

Physical Infrastructure System

Social Impact & Equity

Mental Health

Session Layout

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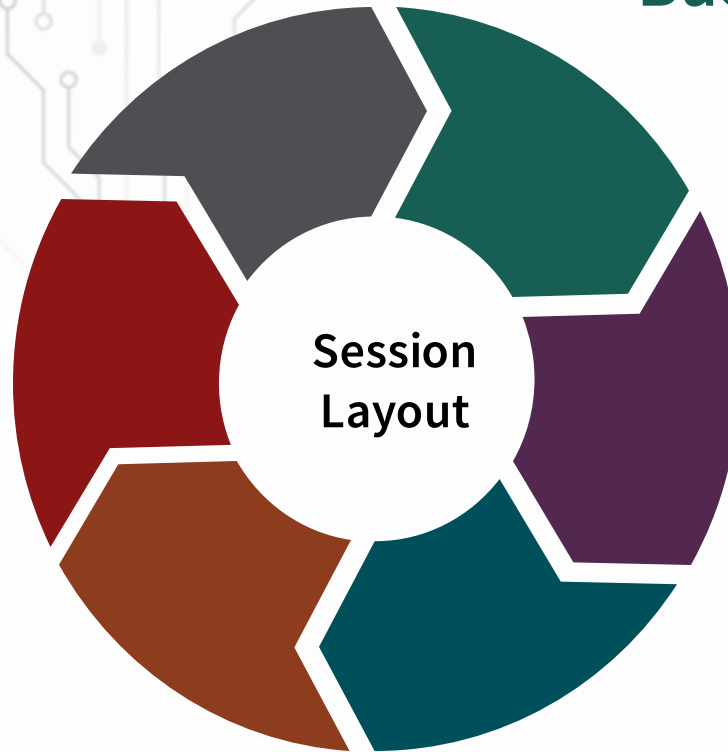
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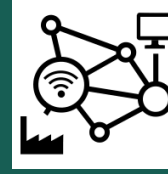
Future of Medicine

Discuss the impact of emerging technologies on our lives

Moore's Law and how it applies to CPUs and GPUs



The concept of Moore's Law and how it applies to CPUs and GPUs



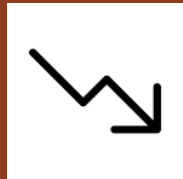
Emerging technology is no longer just about making faster processors



Companies like Intel and AMD have developed multi-core CPUs



Making smaller, more energy efficient chips, more specialized chips



The rate of processor speed increases seems to be slowing

The concept of Moore's Law and how it applies to CPUs and GPUs



- Gordon Moore co-founded Intel Corporation in 1968.
- Moore's law is a term used to refer to the observation made by Gordon Moore in 1965 that **the number of transistors in a dense integrated circuit (IC) doubles about every two years.**

The concept of Moore's Law and how it applies to CPUs and GPUs

Moore's Law: The number of transistors on microchips doubles every two years

Our World
in Data

Moore's law describes the empirical regularity that the number of transistors on integrated circuits doubles approximately every two years. This advancement is important for other aspects of technological progress in computing – such as processing speed or the price of computers.

Transistor count

50,000,000,000

10,000,000,000

5,000,000,000

1,000,000,000

500,000,000

100,000,000

50,000,000

10,000,000

5,000,000

1,000,000

500,000

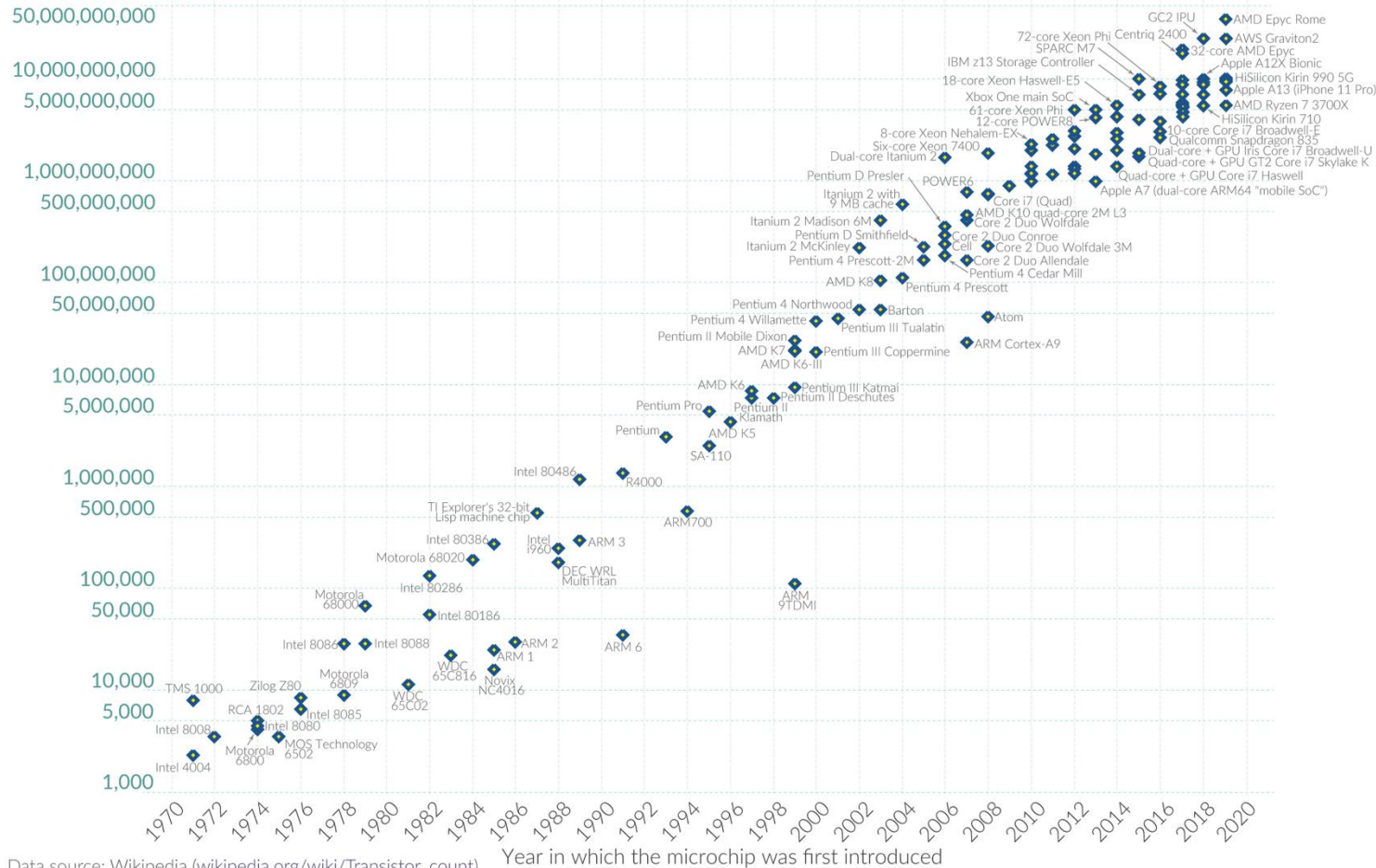
100,000

50,000

10,000

5,000

1,000

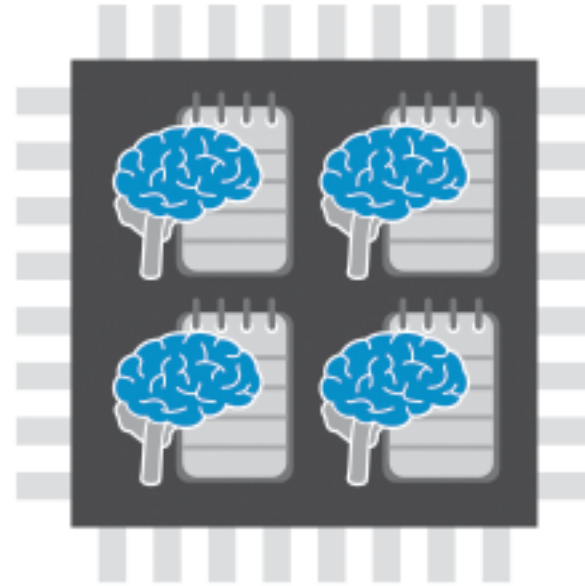
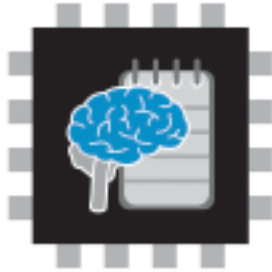


Data source: Wikipedia ([wikipedia.org/wiki/Transistor_count](https://en.wikipedia.org/wiki/Transistor_count))

OurWorldinData.org – Research and data to make progress against the world's largest problems.

Licensed under CC-BY by the authors Hannah Ritchie and Max Roser.

Companies like Intel and AMD have developed multi-core CPUs

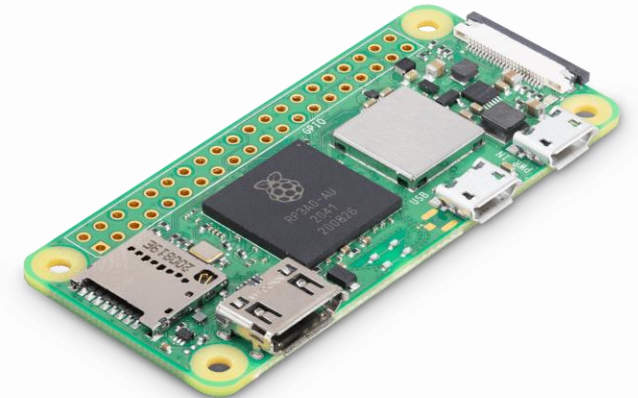


- A single-core microcontroller has just one processor inside.
- A multicore microcontroller has two or more processors, also called cores, inside one chip.

The Rate Slowed Down but New Technologies Emerged

- Emerging technology is no longer just about making faster processors.
- Making smaller, more energy efficient chips, more specialized chips.

 CPU	 GPU	 TPU
    	    	   
		  



<https://www.raspberrypi.com/products/raspberry-pi-zero-2-w/>

Session Layout

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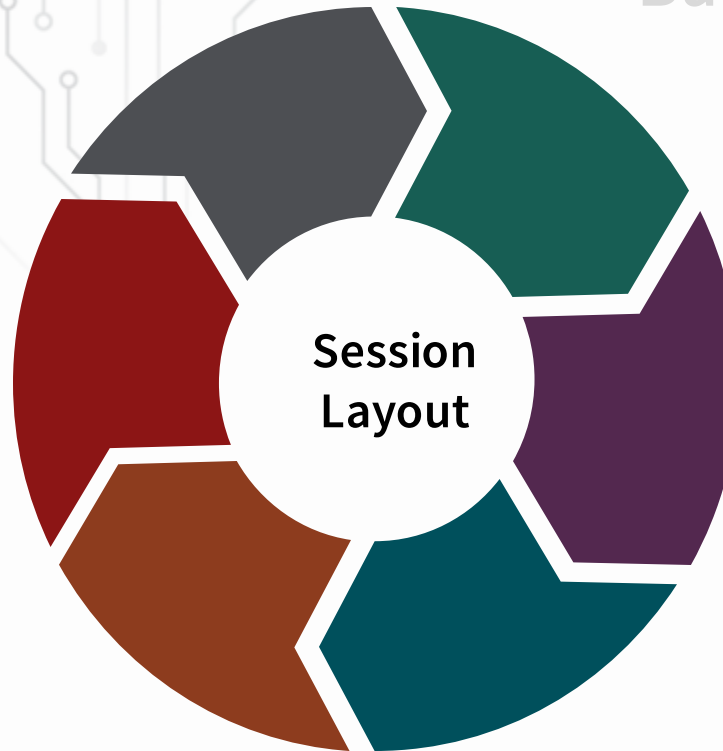
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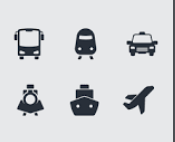
Future of Transportation Systems and Smart Cities

Discuss the impact of emerging technologies on our lives

Future of Medicine

Discuss the impact of emerging technologies on our lives

Future of Transportation Systems and Smart Cities



How emerging technologies in transportation will impact our day to day lives



Recent trends in the future of mobility



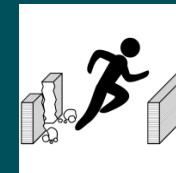
The biggest problems with the transportation system today and possible solutions



5G and the future of autonomous vehicles



What the future of transportation systems looks like



Challenges to reaching the future of transportation systems and smart cities

Activity: Group Discussion on the Problems with the Transportation System Today

Part 1: Groups Discussion (10 minutes)

In groups of 3-4 students, the class will discuss about the following issues:

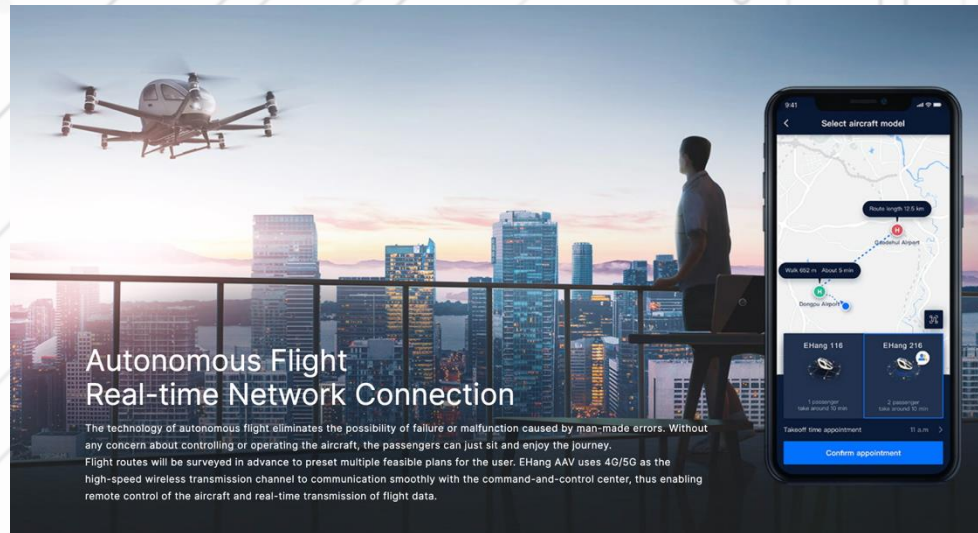
- What do you think are the biggest problems with the transportation system today?
- How do you see these problems being solved?
- What will the future of transportation systems look like in 10, 20, or 30 years?
- How will the way we travel, work, and live change as a result?

Part 2: Groups Presentation (3 minutes for each group)

Each group will present a summary of their discussion.

What the future of transportation systems looks like

Autonomous Aerial Vehicles (AAVs)



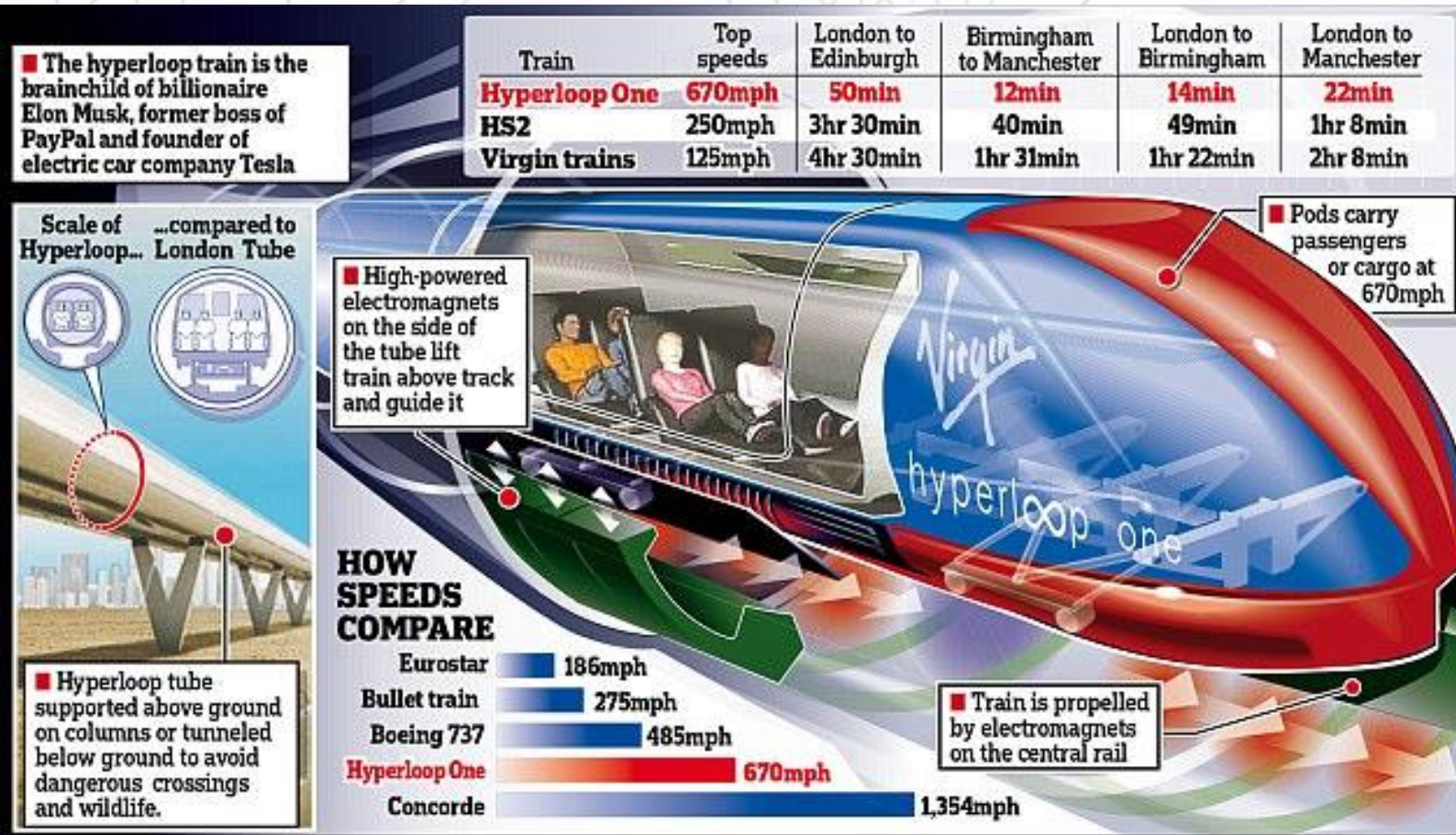
<https://www.ehang.com/ehangaav>

Autonomous Vehicles (AVs) Vehicle-to-X

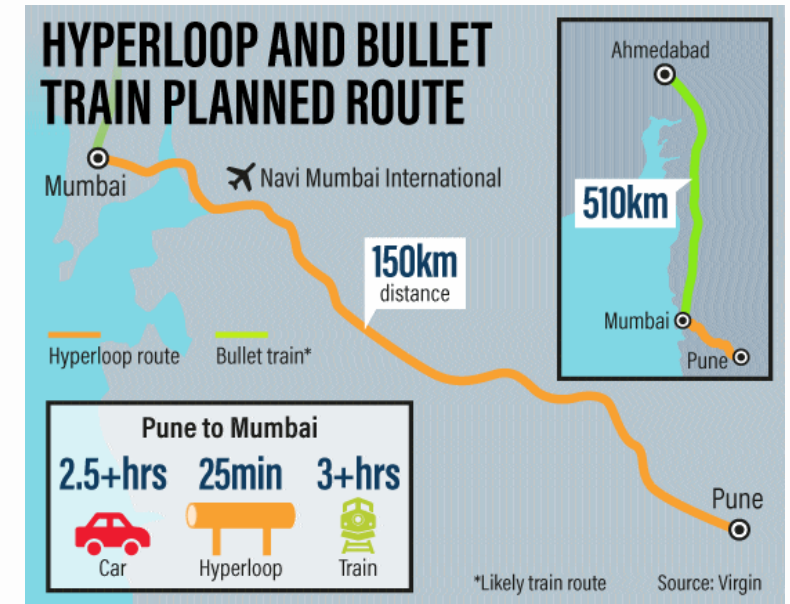


https://scwcontent.affino.com/AcuCustom/Sitenam/DAM/014/Autonomous-vehicle-AdobeStock_174958313_rm.png

What the future of transportation systems looks like



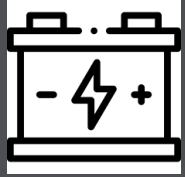
Hyperloop



<https://port.today/wp-content/uploads/2018/11/hyperloop-india.png>

<https://www.iasparliament.com/uploads/files/hyperloop.jpg>

Challenges



Technological constraints



Societal acceptance



Regulations



Current infrastructure



Economic constraints

Session Layout

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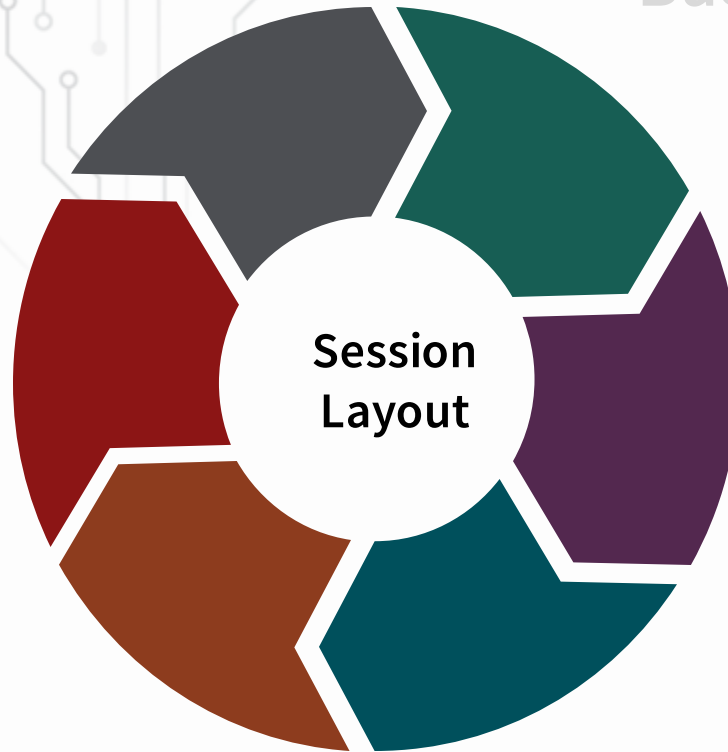
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How emerging technologies in medicine will impact our day to day lives



What is DeepMind?

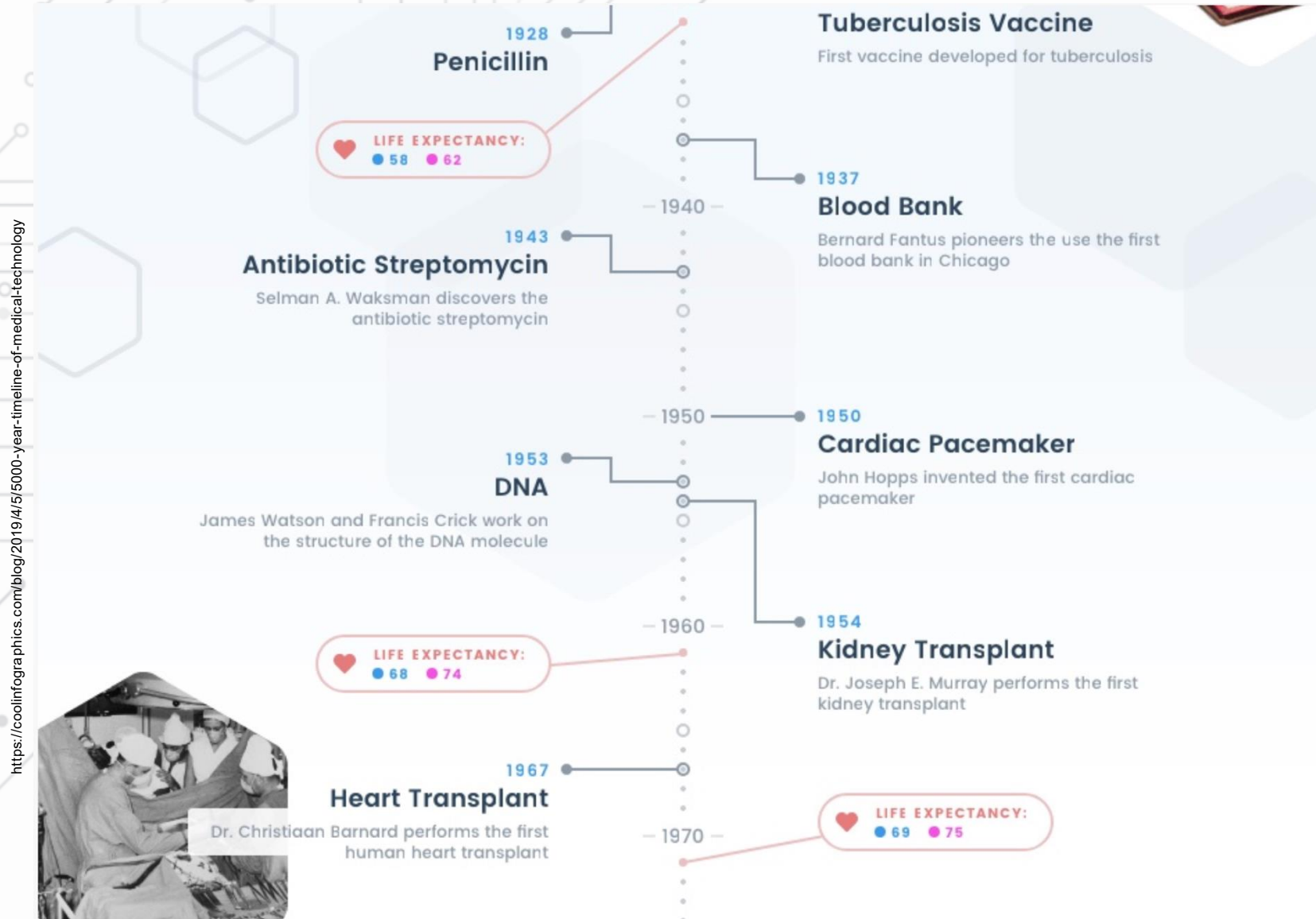


Medical innovation in the last 100 years

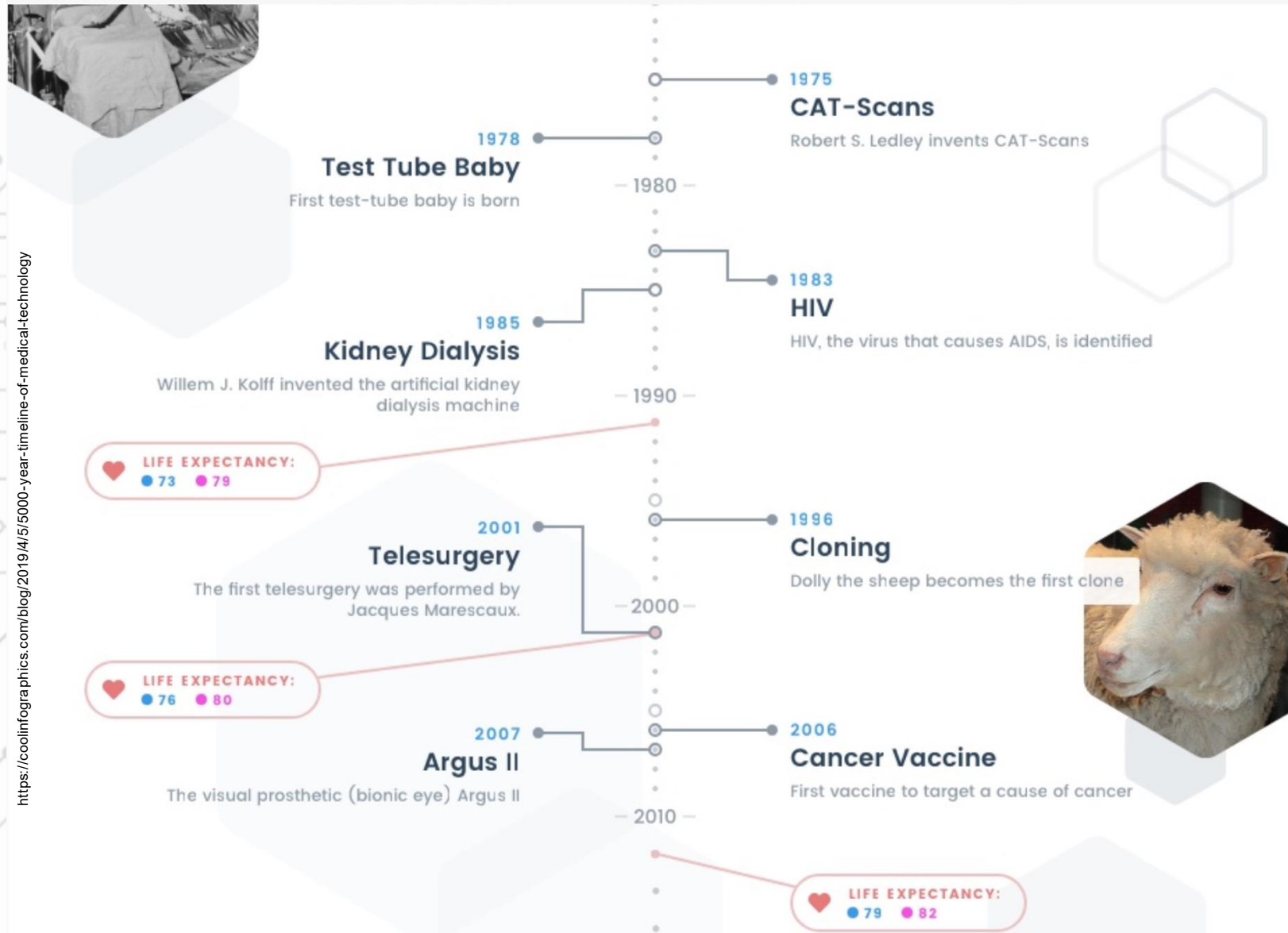


What CRISPR is, how it works, and why CRISPR is crucial to gene editing and diagnostics.

Medical innovation in the last 100 years

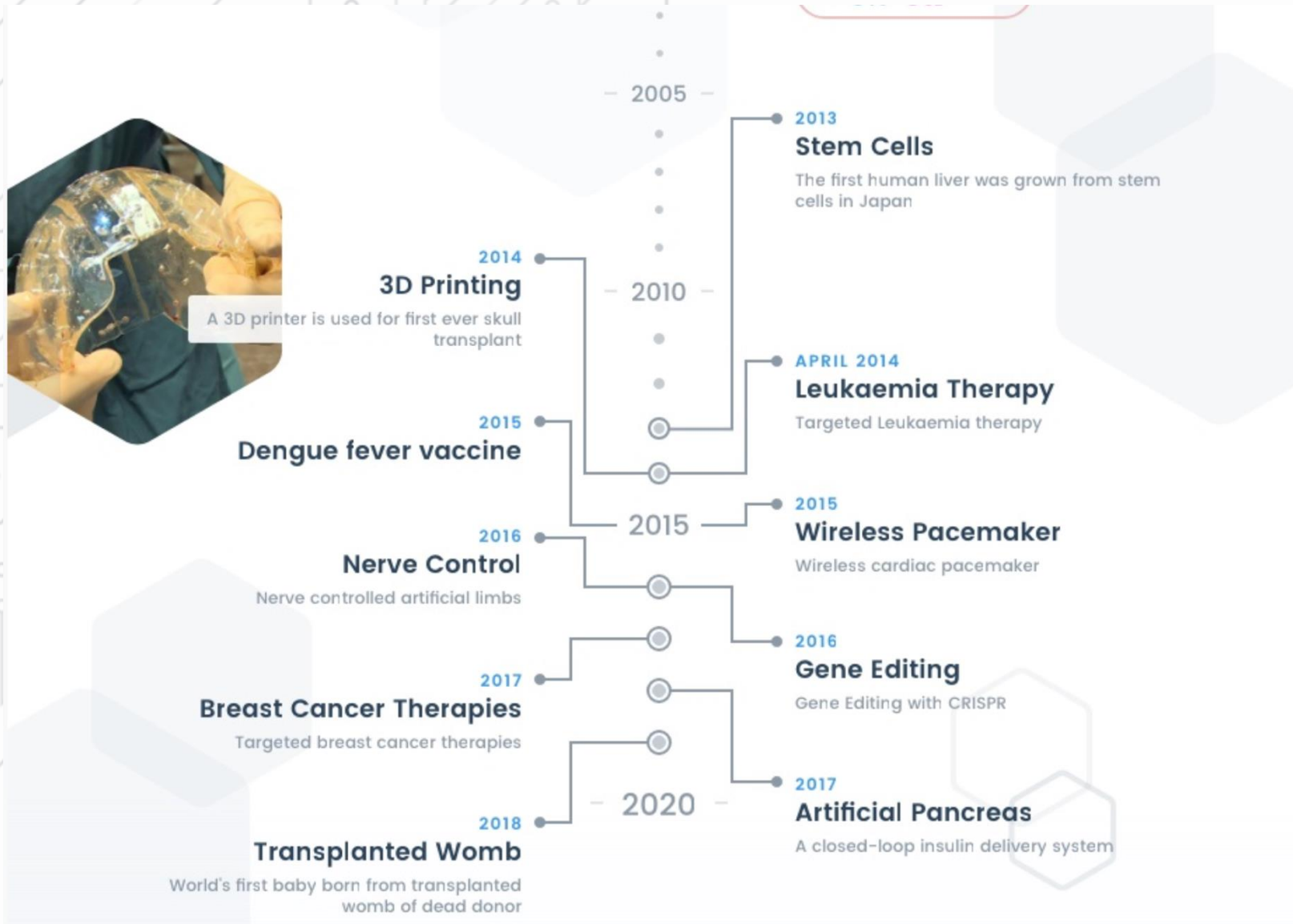


Medical innovation in the last 100 years



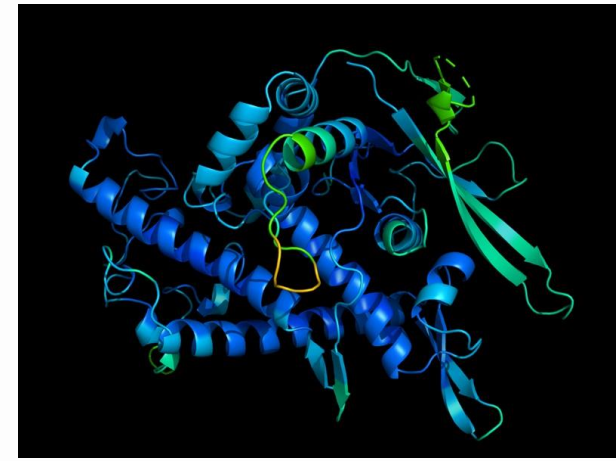
Medical innovation in the last 100 years

<https://coolinfographics.com/blog/2019/4/5/5000-year-timeline-of-medical-technology>



DeepMind

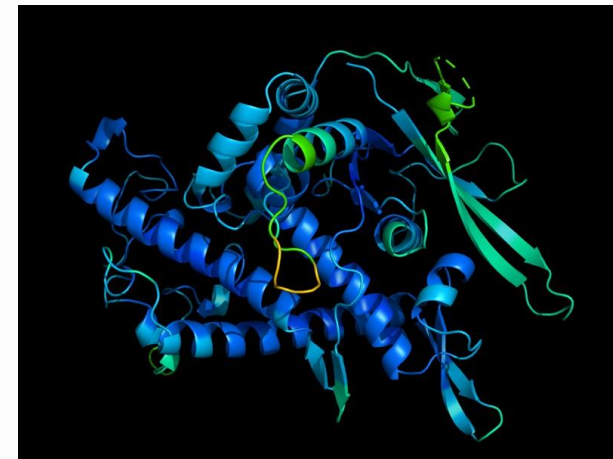
- Proteins are the building blocks of life, responsible for most of what happens inside cells.
- How a protein works and what it does is determined by its 3D shape — ‘structure is function’ is an axiom of molecular biology.
- Proteins tend to adopt their shape without help, guided only by the laws of physics.



DeepMind

- An artificial intelligence (AI) network developed by Google's DeepMind has solved one of biology's grandest challenges — determining a protein's 3D shape from its amino-acid sequence.
- It's called "AlphaFold".
- This solution will affect our understanding of diseases and drug discovery.
- "This will change medicine. It will change research. It will change bioengineering. It will change everything" Dr. Andrei Lupas

<https://www.nature.com/articles/d41586-020-03348-4>



CRISPR

- **Genetically Modified Organism (GMO):**
“organism whose genome has been engineered in the laboratory in order to favor the expression of desired physiological traits or the generation of desired biological products.”
- **Clustered Regularly Interspaced Short Palindromic Repeats (CRISPR):** is a technology that can be used to edit genes and, as such, will likely change the world.

GMOs

Technique: a foreign gene is inserted into the DNA strand.



Result: the crop takes on improved characteristics associated with the new gene and the genetic modification can be detected through tests.

CRISPR gene editing

Technique: gene is cut and its DNA is modified.



Result: the crop's DNA is changed, but tests cannot distinguish the genetically engineered crop from traditional techniques.

Session Layout

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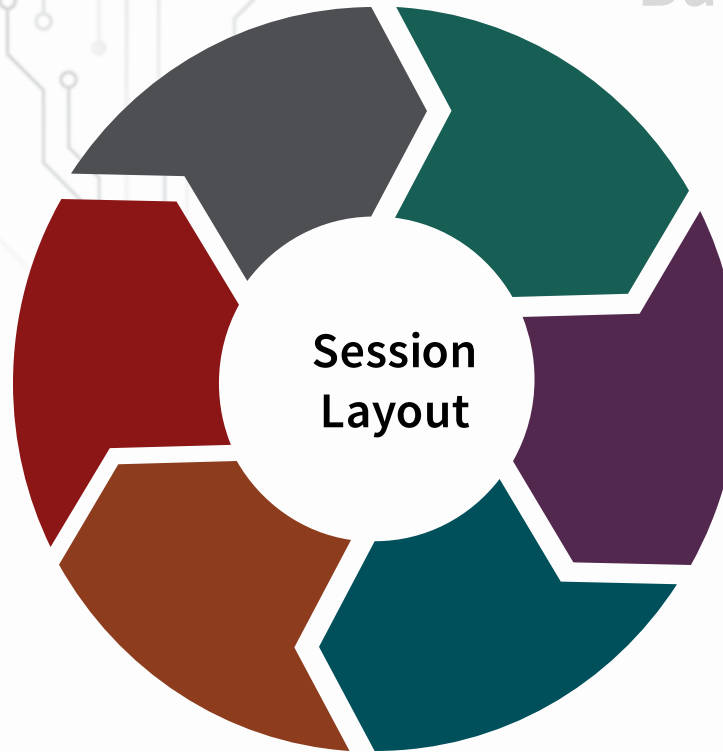
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Future of Reality with Metaverse



How emerging technologies in Metaverse will impact our day to day lives



How we often look up information on our phone while we are out in the world

Ready Player One movie



Privacy concerns



Metaverse is the idea of a massive communal cyberspace (AR + VR)

Session Layout

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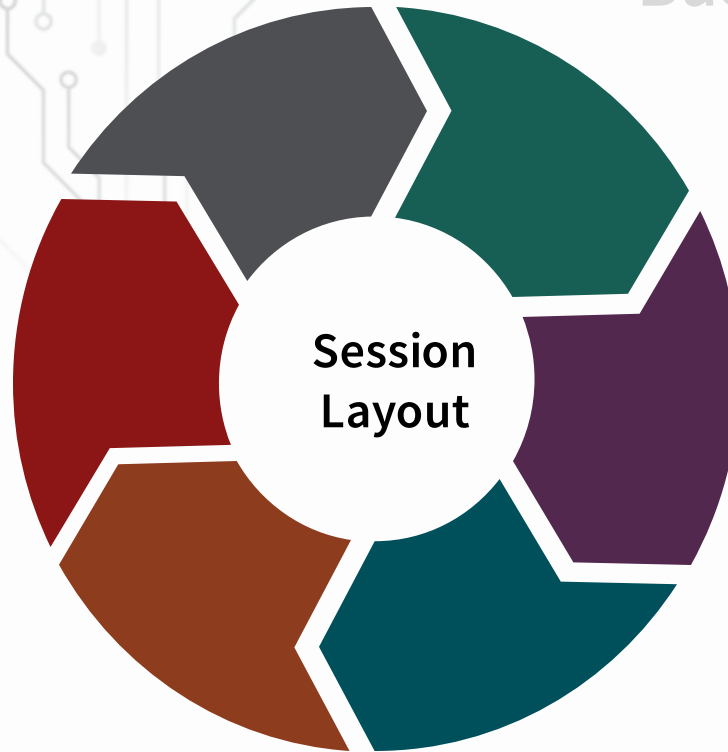
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Concluding Thoughts



Digital innovation will be the driving force behind the most significant changes in our society



These changes will affect every industry and facet of life, from how we communicate, to how we experience our surroundings, to how we interact with healthcare, work, manufacturing, etc



Along with these technological developments come serious ethical and policy questions and answering those will fundamentally shape these emerging technologies and how they are deployed

Session Learning Outcomes

01 Understand the extremely broad scope of impact that emerging digital trends and frontier technologies will have on every aspect of our lives.

02 Learn of a few specific socio-technical trends or notions, such as smart cities, personalized medicine, and the metaverse.

03 Have a good grasp on the logistics and structure of the course.

Next Class

Class 2: Mindsets and Practice of Technology Innovation

Pre-Class Readings:

- **E-learning module: Mindsets and Practice of Technology Innovation** Lecture and interview on Stanford Online
- **Experience Prototyping** by IDEO

Study Questions:

Consider these questions as you complete the pre-class readings.

- What are examples of innovative products that you use everyday? How do these products help you? What do you find innovative about them? How would you improve one of the products you listed? How many people do you estimate would be interested in the improvement you envision?
- How can you tell whether an idea is suitable to pursue turning into a business?
- Reflecting back on the journey delay in the previous class (class 1), what mindset change(s) are needed to make a better traffic system possible?

Wrap Up

- You should know your group's members.
- You will work in groups of 3-4 outside of class every week to answer the study questions (if any).
- Watch and read the assigned pre-class readings.