Some History

1922 The term “robot” is introduced into our vocabulary through the play *Rossum’s Universal Robots.,* by Czech playwright Karel Capek (1890-1938). “…human-like machines, devoid of emotions and souls, who were strong, obeyed their masters, and could be produced quickly and cheaply.”

1938 Americans Willard Pollard and Harold Roselund design a programmable paint-spraying mechanism for the DeVilbiss Company. It is considered to be the first parallel industrial robot.

1941 Isaac Asimov coins the word “robotics” for the science of studying robots and writes a series of novels on robots, beginning with *Runaround*. He also establishes the Three Laws of Robotics. His book “I, Robot” was the inspiration for the 2004 movie with the same name.

1946 George Devol patents a general purpose playback device for controlling machines. The device uses a magnetic process recorder.

1946 ENIAC (electronic numerical integrator and computer) is introduced as the first digital computer.

1

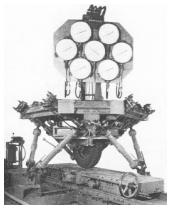
Some History

1947 Electric teleoperator developed by Raymond Goertz *et al* at Argonne National Labs for manipulation of radioactive materials at a safe distance.

2

Some History

1947 Erich Gough develops “Gough-Stewart Platform” for tire testing. Klaus Cappel later reinvents mechanism and files patent in 1964 for use in motion simulators (patent awarded 1971). In 1965, D. Stewart publishes an analysis of these parallel mechanisms for flight simulators so today it is most commonly referred to simply as the “Stewart Platform”.



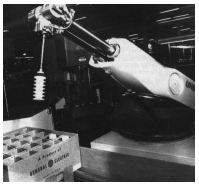
3

Some History

1953 MIT demonstrates first CNC (computer-numerically controlled) milling machine (storage on paper tape).

1954 The first programmable robot is designed by George Devol. Joseph Engelberger buys the rights and founds the Unimation Company.

1955 Denavit and Hartenberg develop a theory of homogeneous transformation matrices for modelling forward kinematics of robotic manipulators.



4

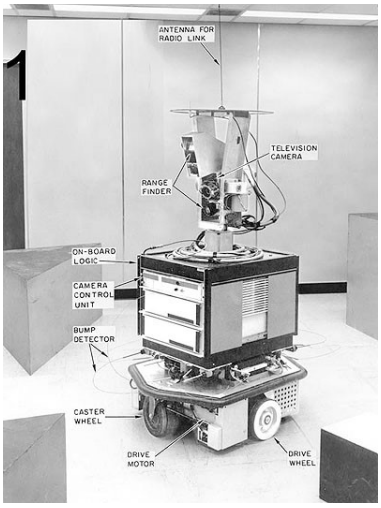
Some history

1959 Planet Corporation markets the first commercially available robot.

1961 U.S. patent 2,988,237 issued to G. Devol for “Programmed Article Transfer,” a basis for Unimate robots.

1962 General Motors installs the first industrial robot (the Unimate) on a production line (transport, welding).

1968 Stanford Research Institute (SRI) builds and tests a mobile robot with vision capability, called Shakey, commonly, referred to as the first ‘intelligent’ robot.



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1970 The Stanford arm, an electrically powered robot arm is developed which becomes a standard for many research projects.

1970 The first commercially available minicomputer-controlled industrial robot is developed by Milacron Corporation. The robot is called the T^3, The Tomorrow Tool.

1974 The Stanford Arm is developed into a commercial product by Vicarm Inc. The new arm is controlled by a minicomputer. This arm was used on the Viking 1 and 2 space probes in 1976.

6

Some history

1974-84 Industrial robot market increases (ASEA, Cincinatti Milacron, FANUC). Many academic institutions introduce programs in robotics.

1986-92 Many robotics companies consolidate as industrial robots market drops.

1987-present Medical Robotics grows rapidly (e.g., Integrated Surgical Systems' Robodoc for robot-assisted hip replacement, Intuitive Surgical's da Vinci Surgical System, Computer Motion's Zeus laparoscopy assistant. (Latter two companies merged in 2003.)

Computer Motion's Zeus system

Zeus Robot Arms

A Zeus System in "Operation"

Intuitive Surgical's da Vinci system

http://www.youtube.com/watch?v=x9Bjs99A0k0

- Prostatectomy
- Nephrectomy
- Heart bypass

Some history

1986- Multiple projects demonstrate various levels of driving autonomy: early example from Germany:

https://www.youtube.com/watch?v=I39sxwYKIEE

and recent one from Stanford

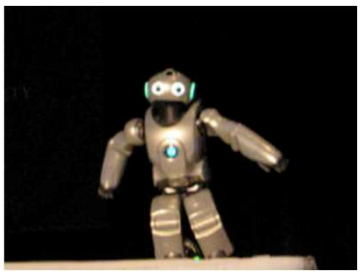
https://www.youtube.com/watch?v=joIsgP9StAY

1996 - Honda introduces first autonomous "humanoid" robot. These earlier prototypes later evolve into ASIMO (Advanced Step in Innovative Mobility https://www.youtube.com/watch?v=SARB9OI_Wz4), introduced in 2000.

1999 - Sony introduces Aibo (Artificial Intelligence roBOt) for entertainment robotics. Others, like Necoro, are quite realistic. More recently, Sony has showcased Qrio (Quest for cuRIOsity).

2005- DARPA Challenge to cross Mojave desert has 5 successful vehicles

2009-2019 – Google (then Waymo), Tesla, Uber, Lyft, Ford, GM, etc all are pouring money into self-driving cars projects



http://www.youtube.com/watch?v=ICgL1OWsn58
http://uk.youtube.com/watch?v=iMM_XQXJUUc
https://www.youtube.com/watch?v=NFNEOooEQX4&t=321s

Some history:

Caution: Spectrum magazine cover predicted self-driving cars within 5 years - 30 Years ago!

https://spectrum.ieee.org/transportation/self-driving/the-big-problem-with-selfdriving-cars-is-people

Company	Autonomous miles	Disengagements	Rate per 1000 miles
Google	635868	124	0.20
Cruise	10015	284	28.36
Nissan	4099	28	6.83
Delphi	3125	178	56.95
Bosch	983	1442	1466.94
Mercedes	673	336	498.95
BMW	638	1	1.57
Ford	590	3	5.08
Tesla	550	182	330.91
Honda	0	0	0.00
VW	0	0	0.00

Image: Mark Harris; Source: California DMV

Some history

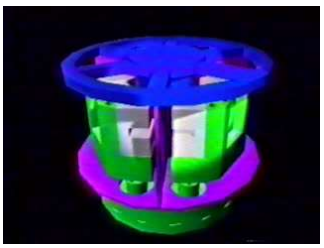
Much research in “Biomimetic Robotics”, or solutions through biological inspiration (e.g., Spot, RHex and Serpent).

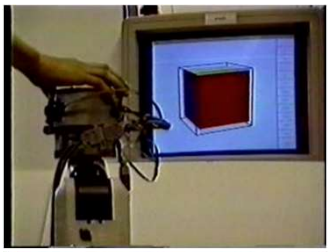
https://www.youtube.com/watch?v=wlkCQXHEgjA
https://www.youtube.com/watch?v=uhND7Mvp3f4
Some cool history here:
https://www.youtube.com/watch?v=jn5CDFeWuz8

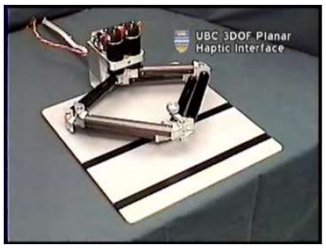
13

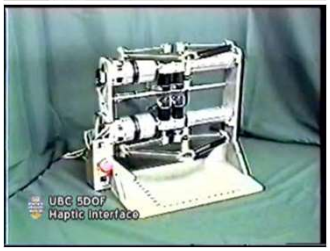
Some history

1990 - present Much research goes in “Haptic Interfaces”, input-output devices for users to interact with virtual or remote environments.









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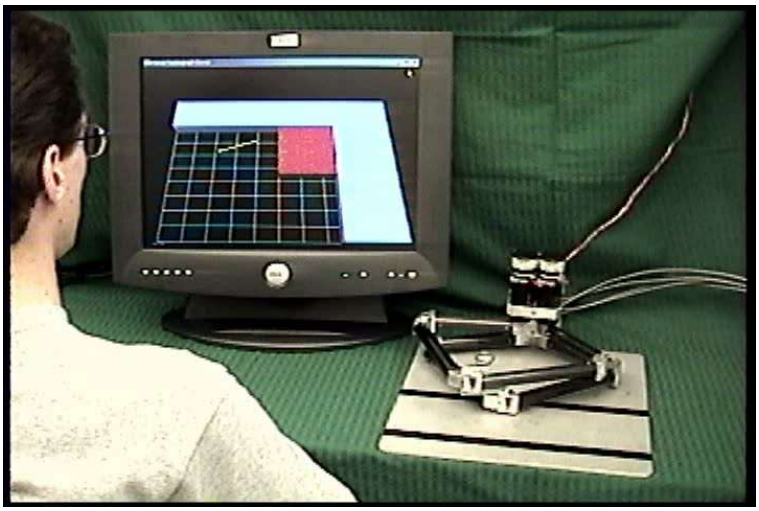

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