Green Robotics, Automation, and Machine Intelligence; a new Engineering Course in Sustainable Design

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2013 International Symposium on
Green Manufacturing and Applications
Honolulu, Hawaii

Part of engineering program in Sustainable Design at a US Liberal Arts college in Pennsylvania

Program is mix of environmental engineering and environmental design including high-tech-green

Diverse student interest

Course also required for

BS Industrial Engineering Management,

BS Computer Engineering,

and Cognitive Science Minor

Course Outline

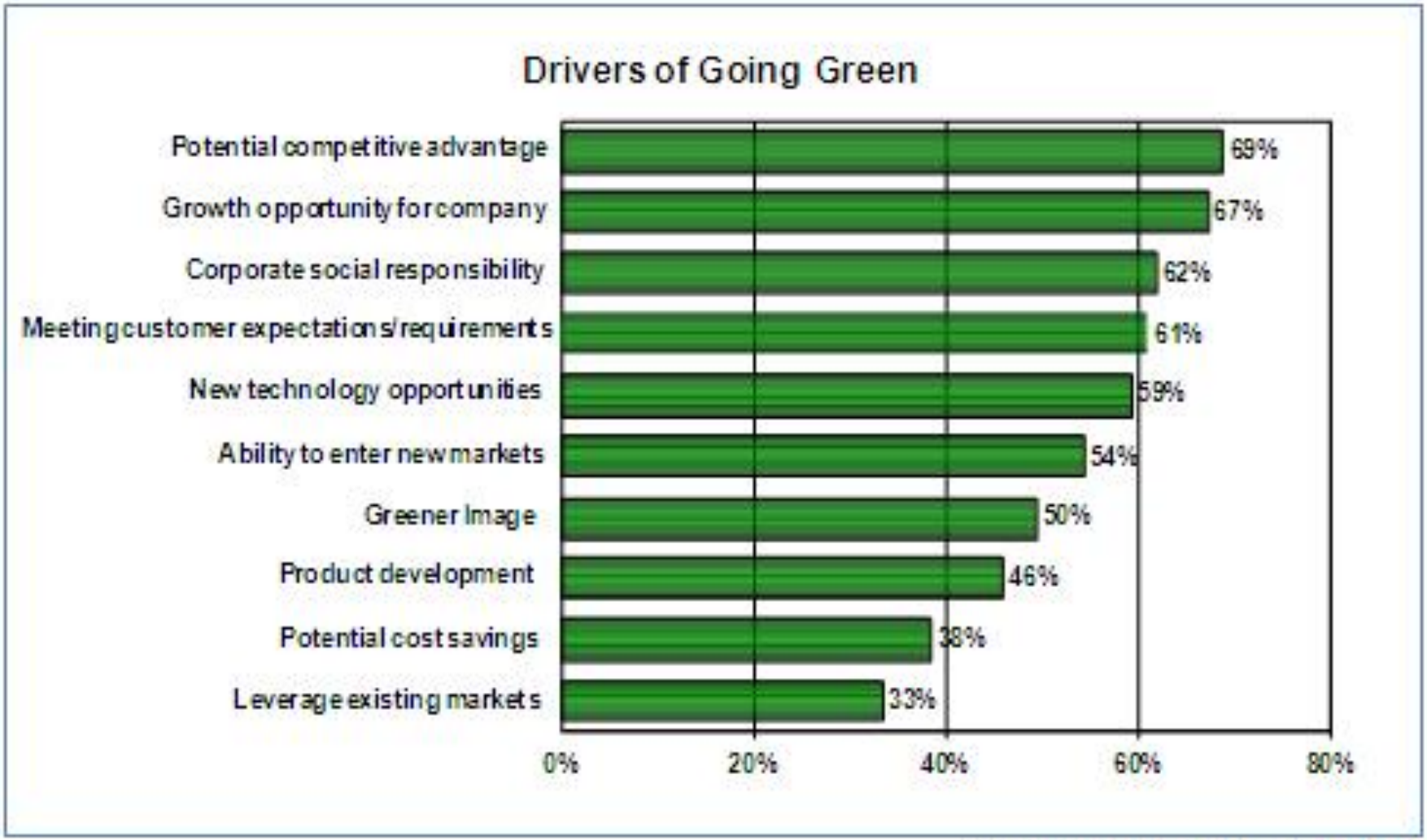
i. International green trends
ii. Green standards
iii. Green manufacturing
iv. Introduction to mobile robots
v. Introduction to robotic arms
vi. Introduction to symbolic AI
vii. Introduction to connectionist machines
viii. Concurrent Simulation and real-time code
ix. Biomimicry
x. Applications
xi. Merging forms of machine intelligence
xii. Ethical Issues

International green trends

United States
Japan
European Union

Green standards

Green manufacturing



Source: Frost & Sullivan

Introduction to mobile robots

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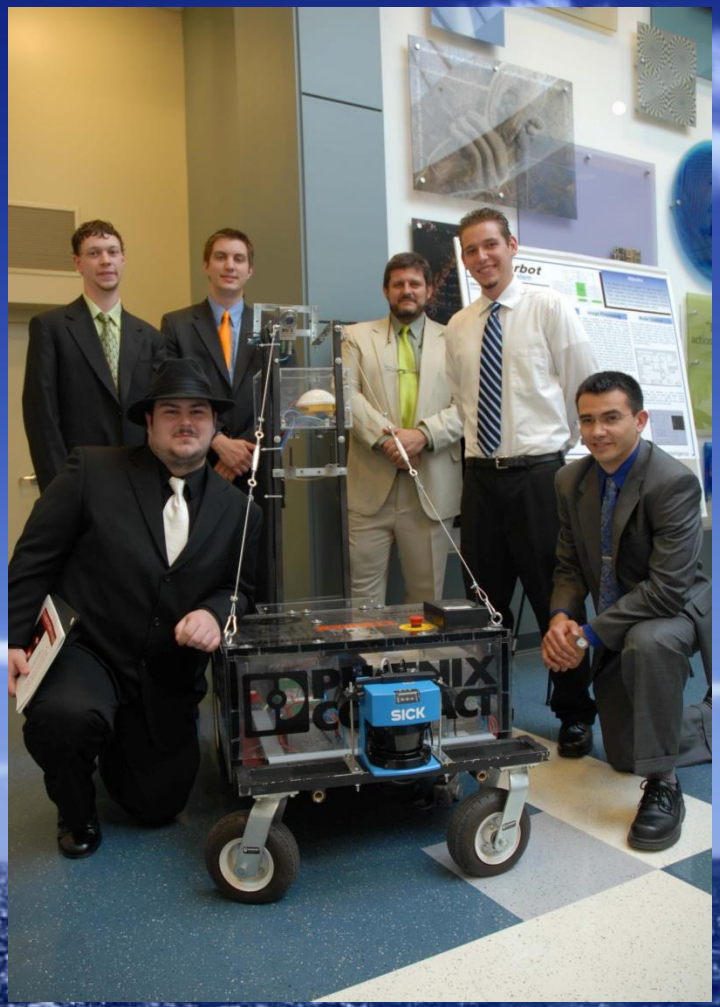
Path-planning, obstacle avoidance, real-time sensor fusion, vision, laser range finders, ultrasonic sensors, GPS navigation, digital compass, motor types, wheel configurations



Introduction to robotic arms

Kinematic controls schemes (position, velocity, acceleration)

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Introduction to robotic arms

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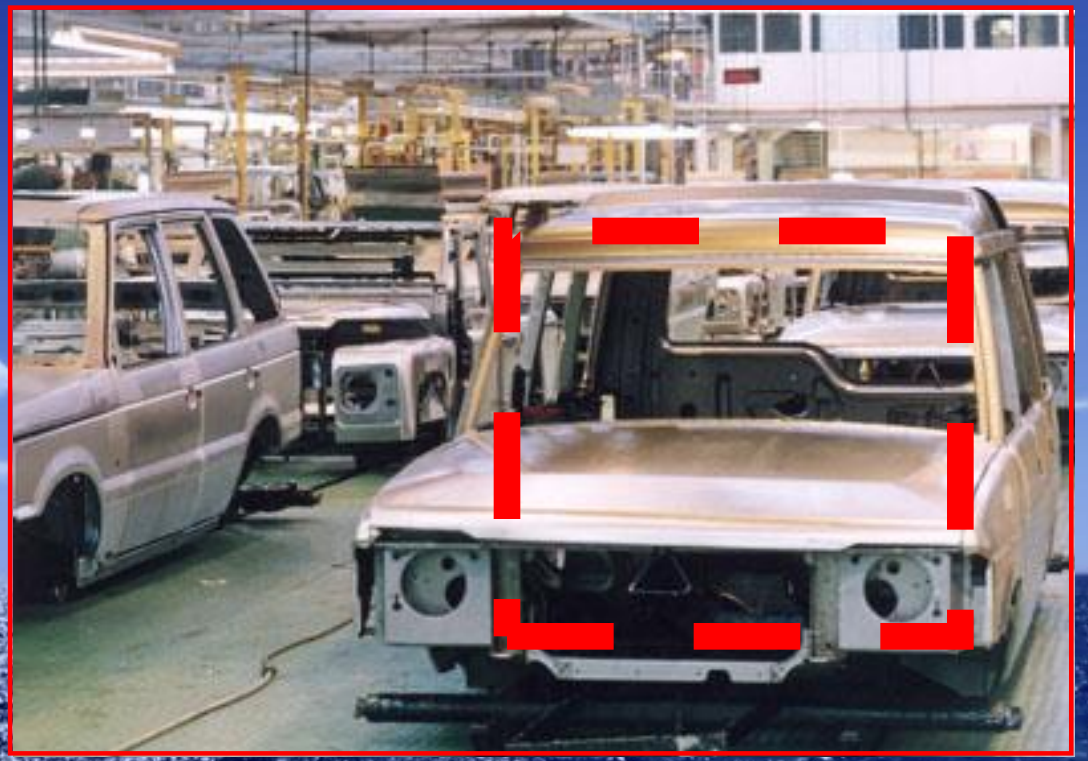
constrained workspaces, industrial arms



Introduction to robotic arms

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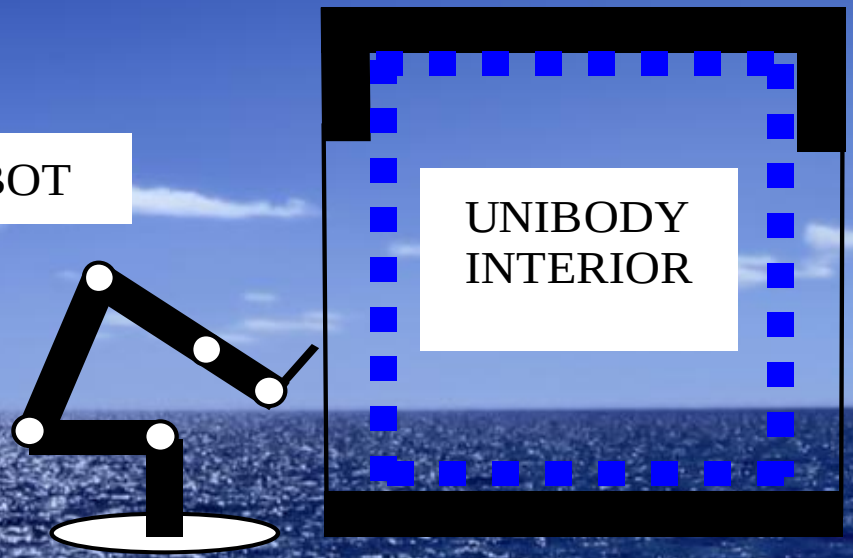
constrained workspaces, industrial arms



Introduction to robotic arms

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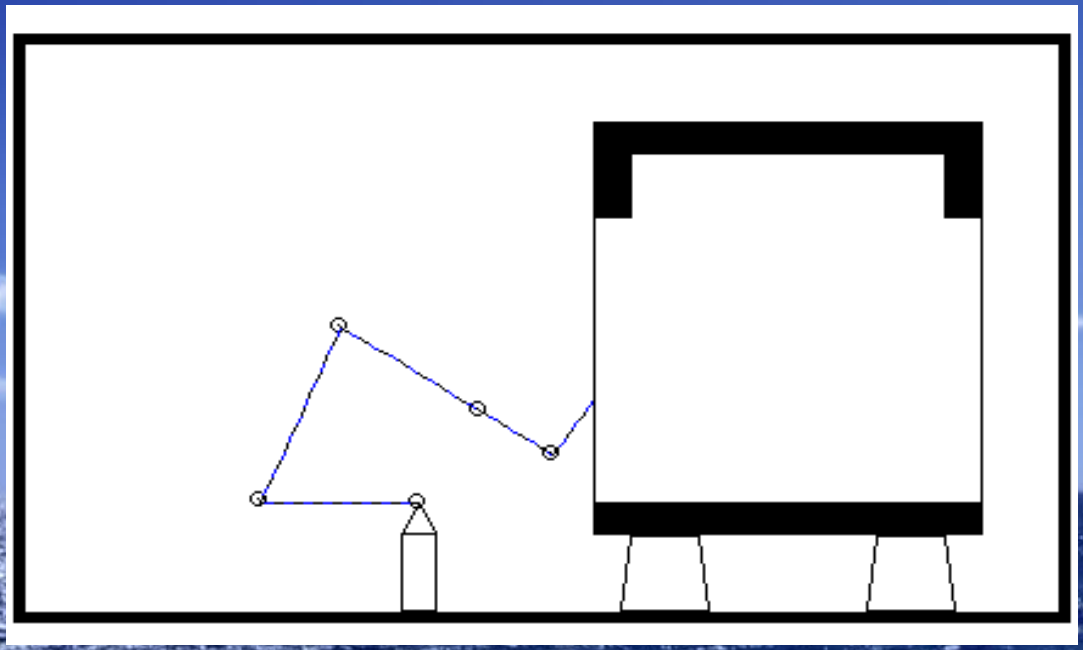
constrained workspaces, industrial arms



Introduction to robotic arms

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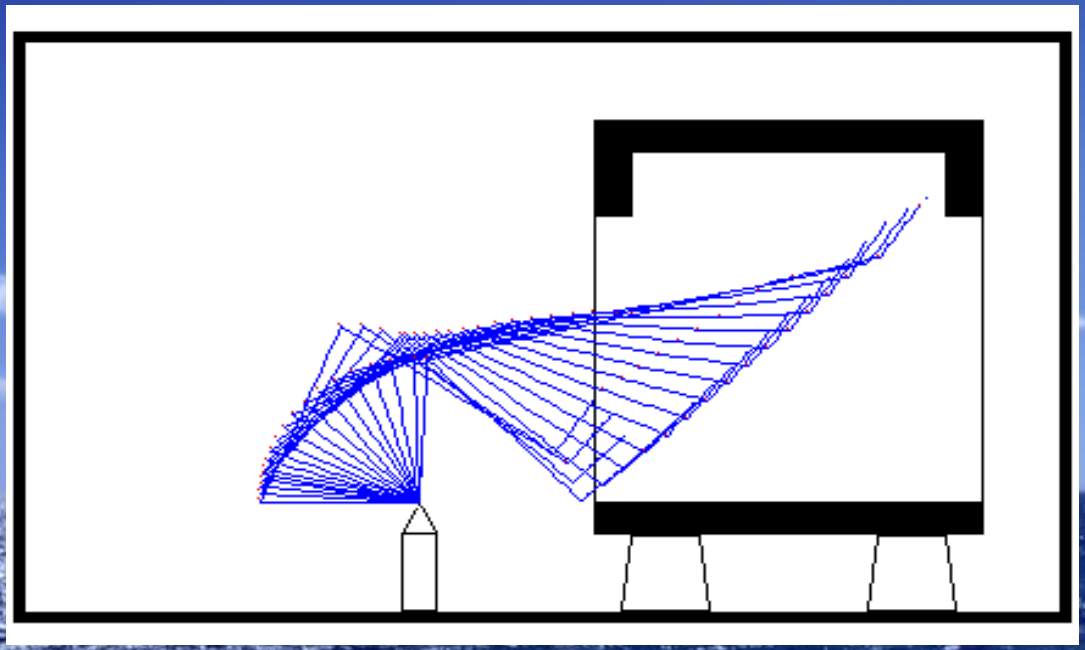
constrained workspaces, industrial arms



Introduction to robotic arms

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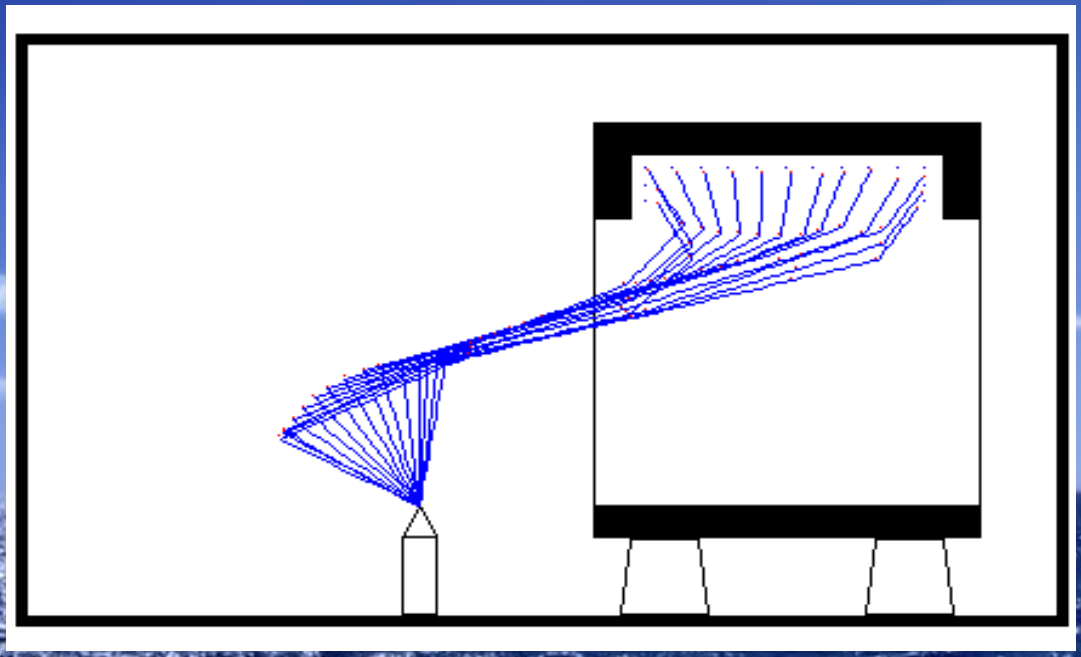
constrained workspaces, industrial arms



Introduction to robotic arms

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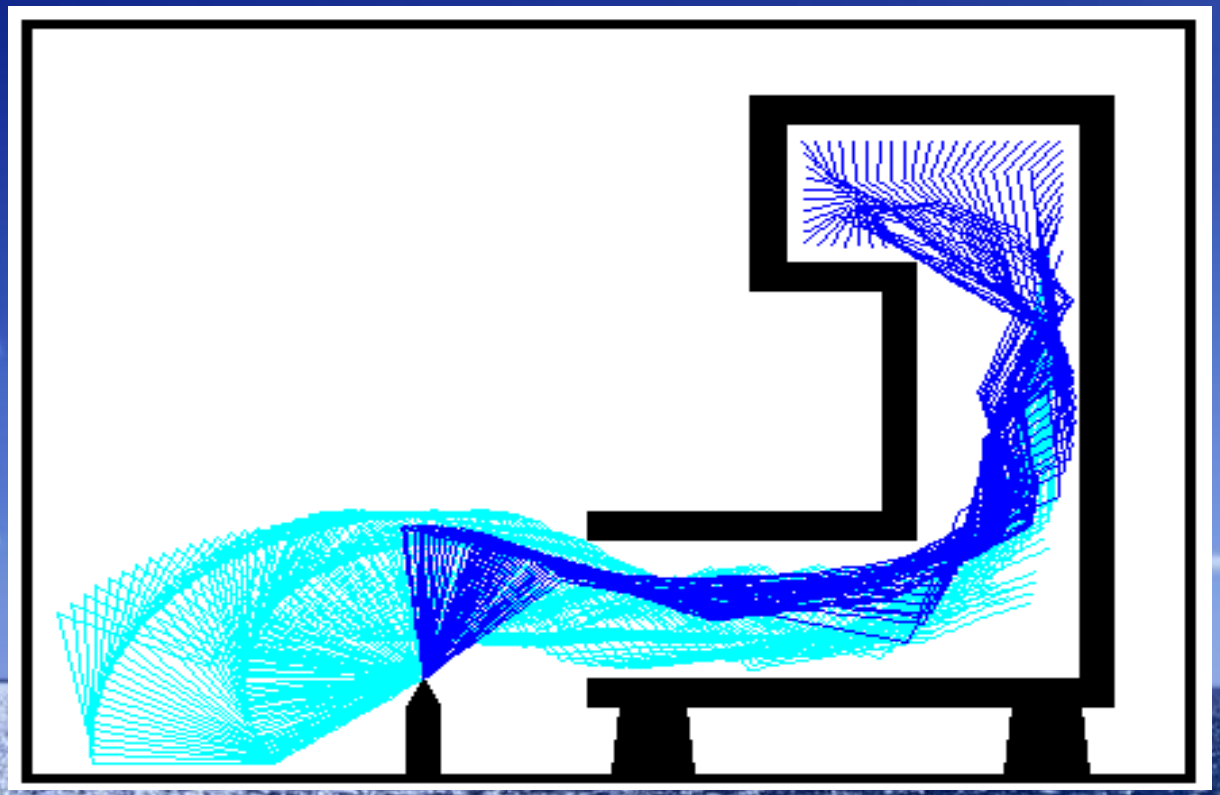
constrained workspaces, industrial arms



Introduction to robotic arms

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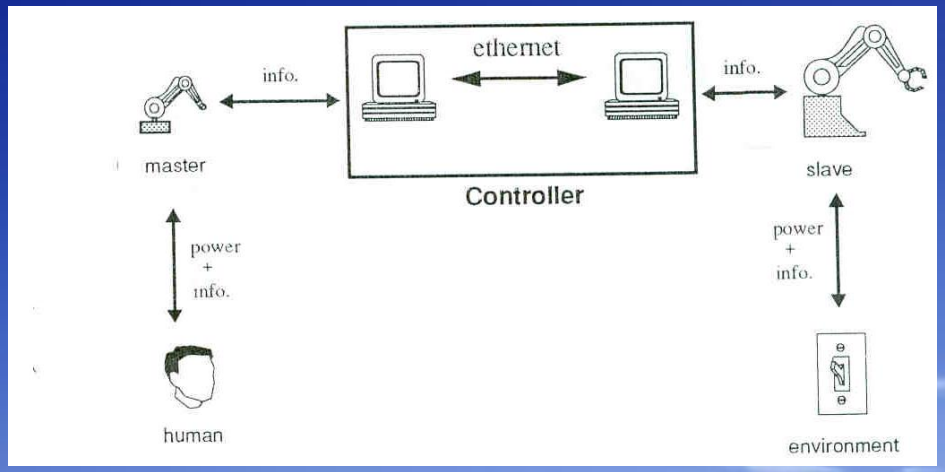
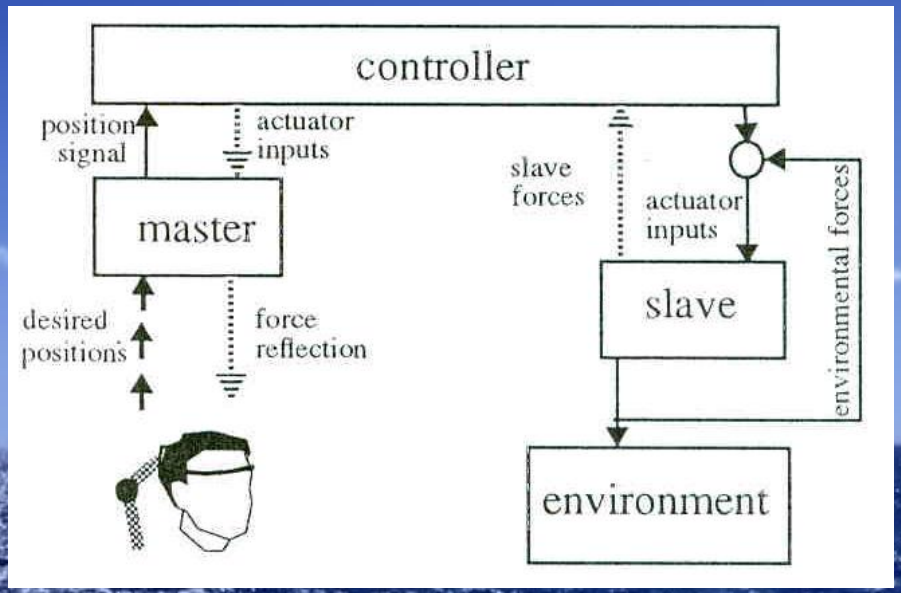
rehab robotics





Introduction to robotic arms

robotic surgery

Introduction to symbolic AI

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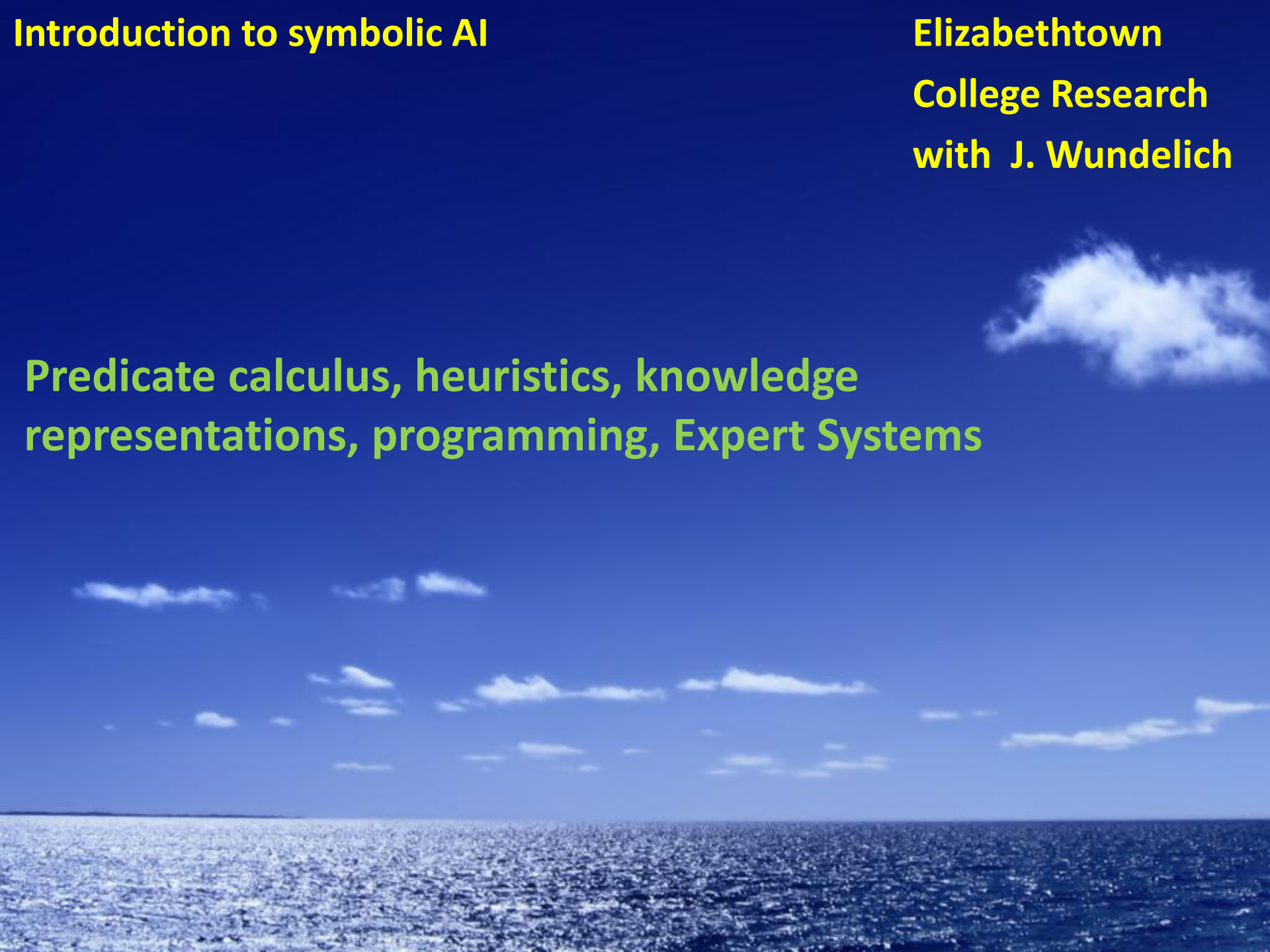

Predicate calculus, heuristics, knowledge representations, programming, Expert Systems

Introduction to connectionist machines

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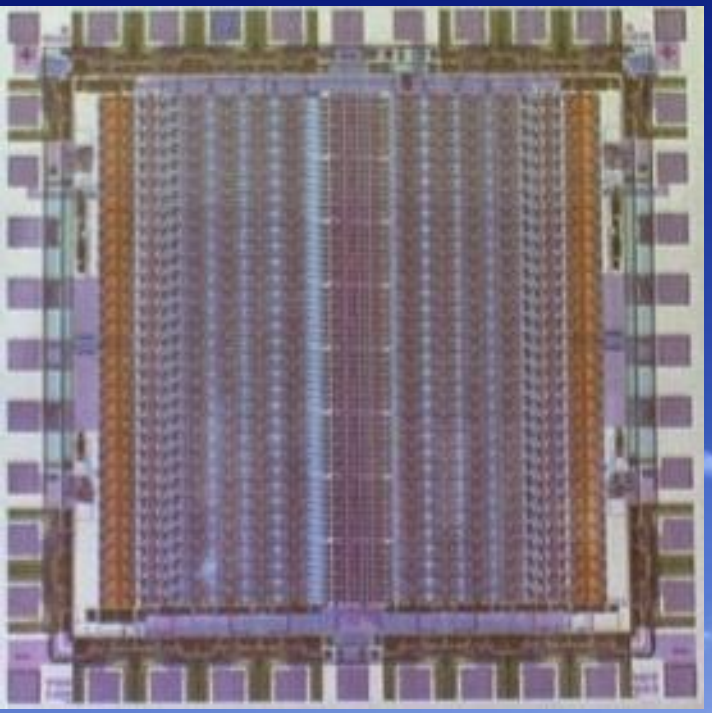
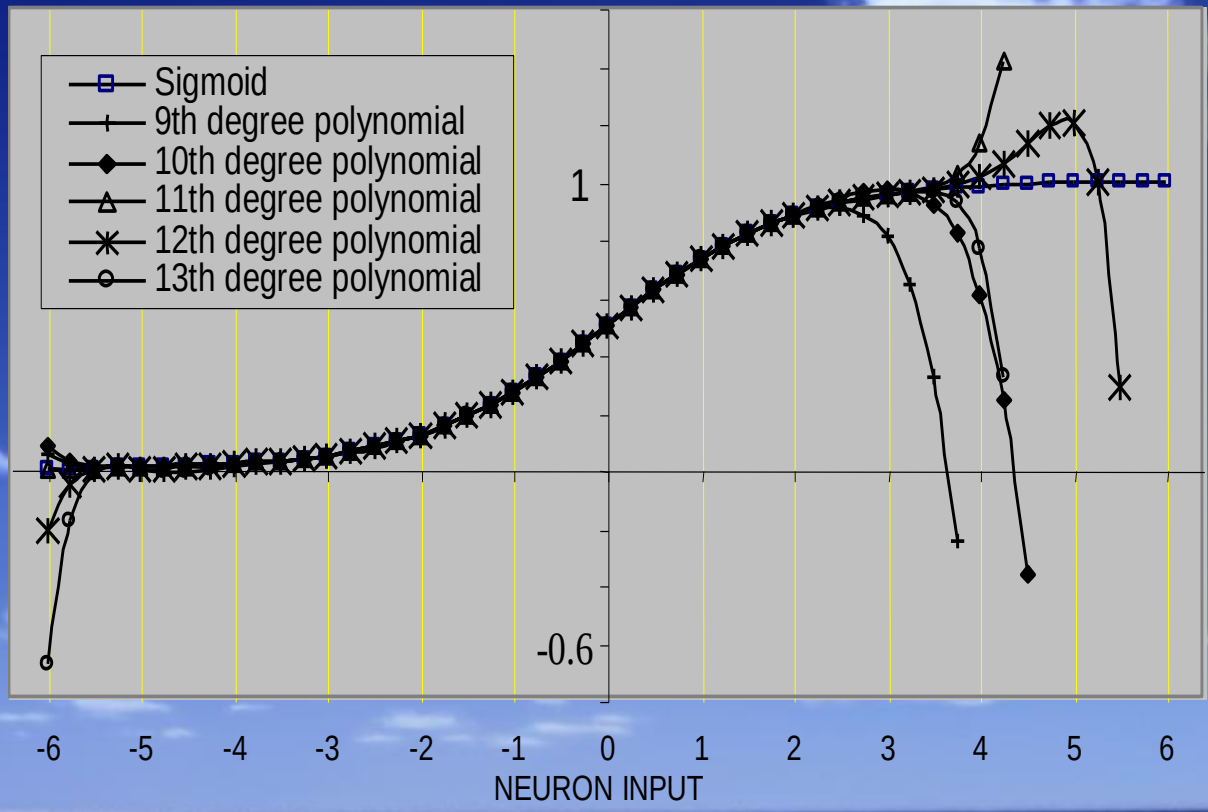
"Bottom-up" *biological* brain models vs.
"Top-down" *psychological* models, Mathematical theory





Concurrent Simulation and real-time code

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Biomimicry

Applications

Environmental mapping
- wetlands, terrain, buildings, planets

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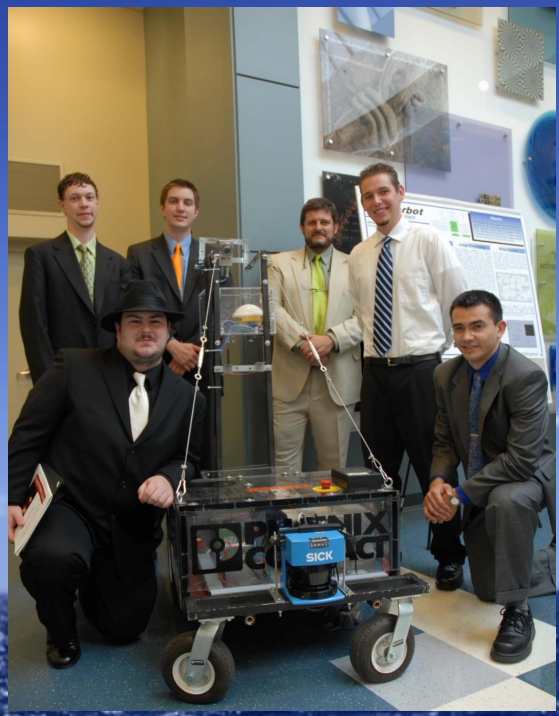

Applications

Environmental probes

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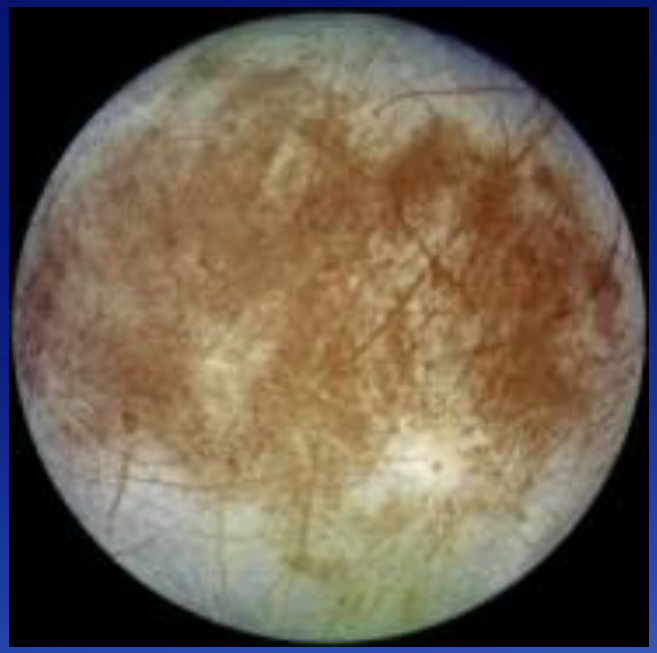
Applications

Hazardous waste clean-up

Applications

Space exploration



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Applications

Search & rescue

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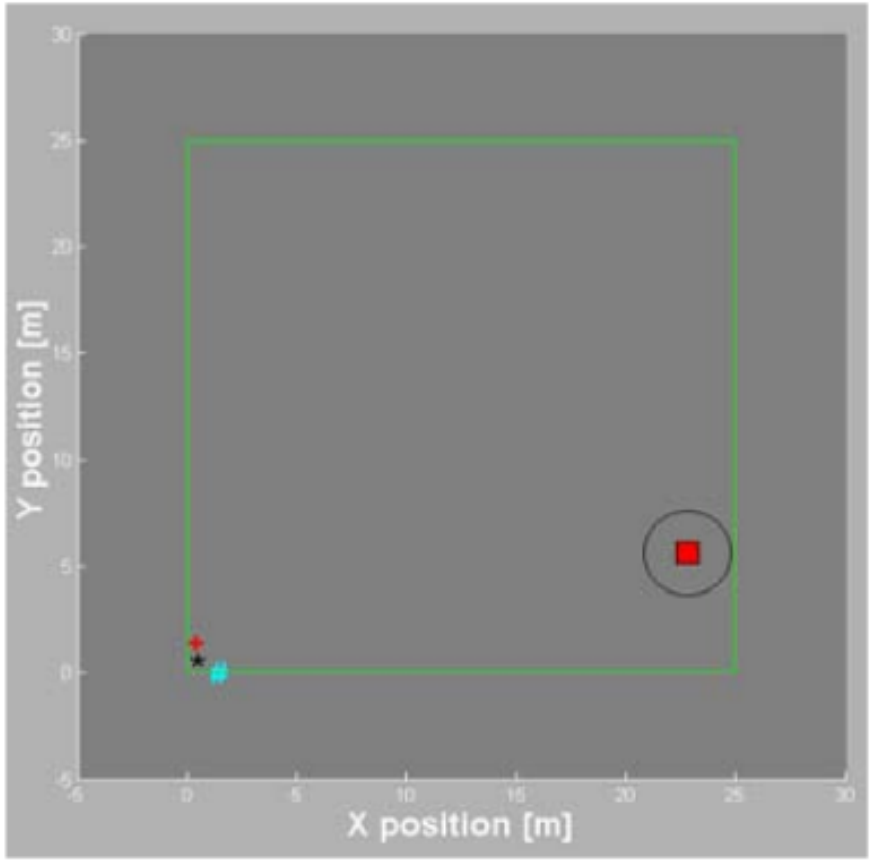

Figure 1: Simulation Output Window. Grey designates unknown area, robots shown: scout (black), medic (blue), fire-suppressant (red), and a light source (red).

Applications

Smart-house design

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Applications

Active solar

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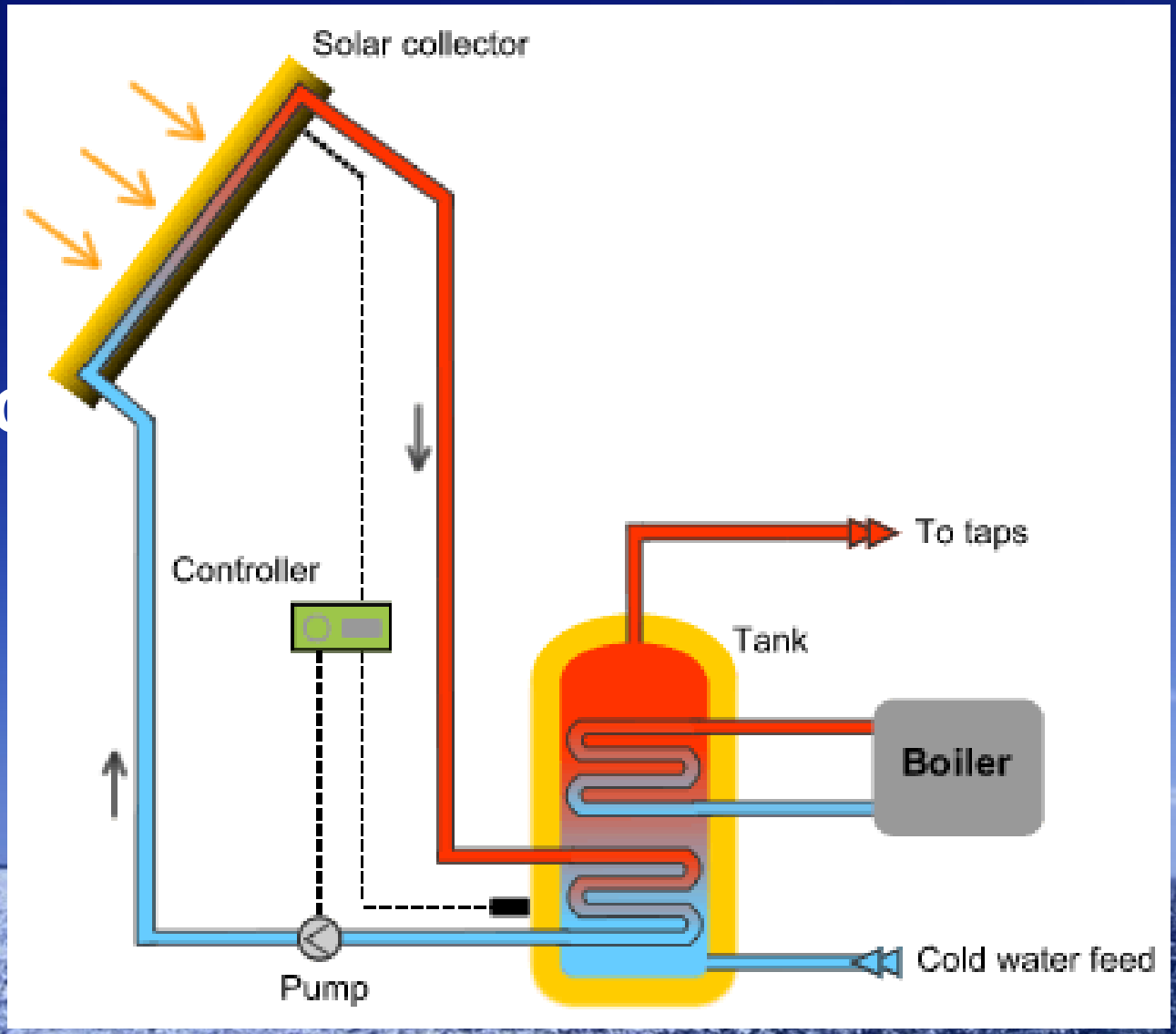

Applications

Solar harvesting

C

Applications

Wind turbines

Applications

Automated agriculture

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Applications

Automated agriculture

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Applications

Automated agriculture

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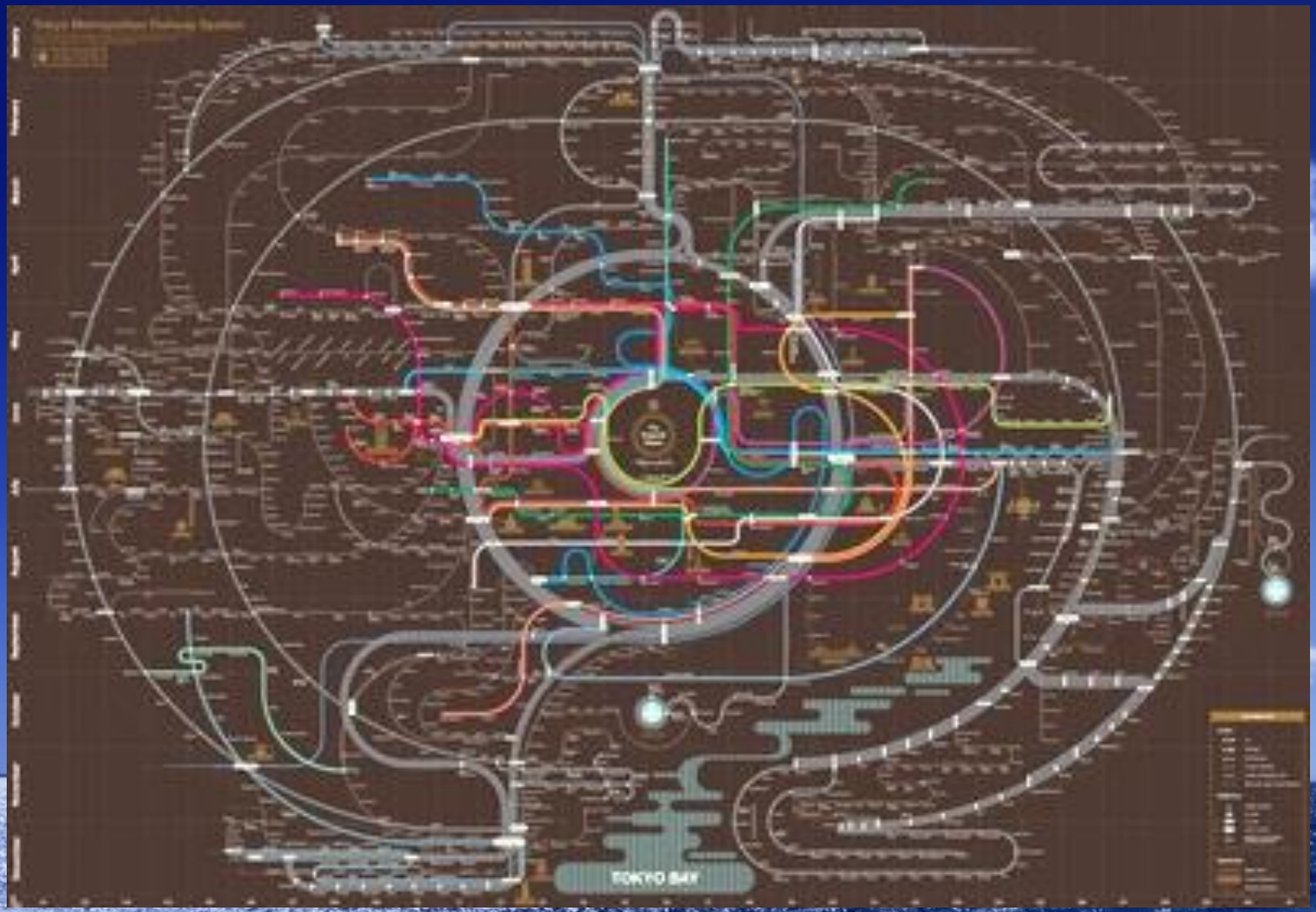
Applications

Intelligent rapid transit systems



Applications

Intelligent cars (including solar)

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Applications

Intelligent energy generation and distribution

Applications

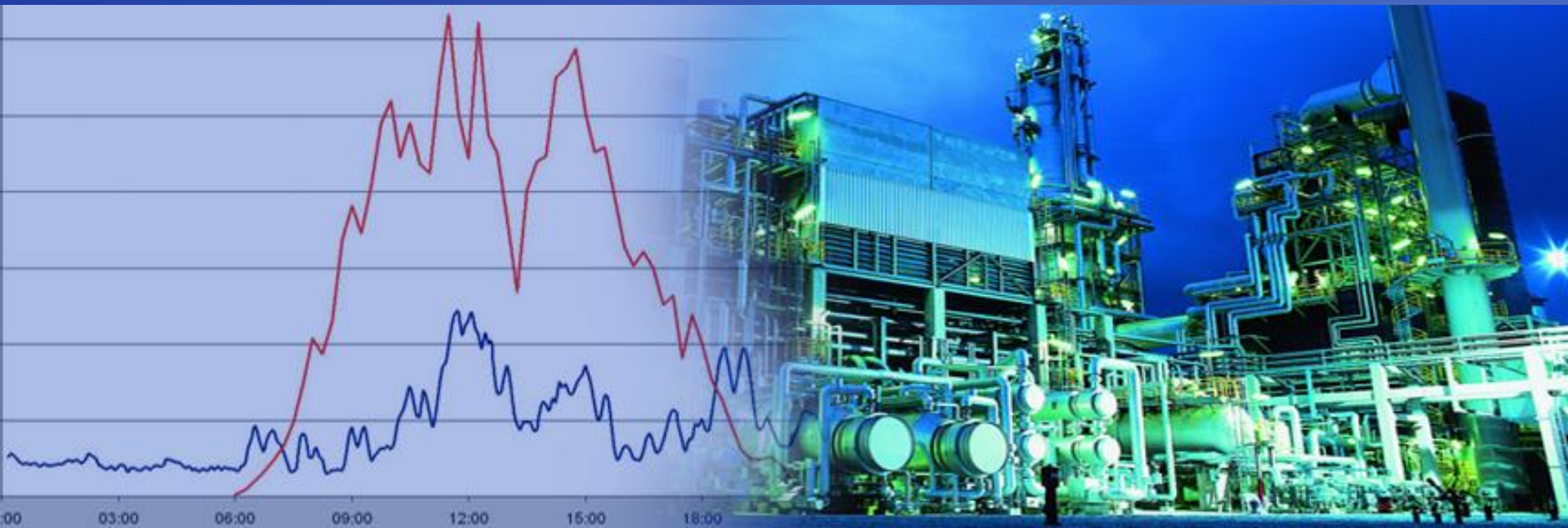
Intelligent energy storage

Elizabethtown College Research with alumnus Dr. Dax Kepshire

Applications

Energy load-shedding

Elizabethtown College Research with alumnus Dr. Dax Kepshire



Merging forms of machine intelligence

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IBM *"Watson"* vs. IBM *"Deep Blue"*

Ethical Issues

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Replacing humans vs. aiding humans
Artificial humanoids
Workers, entertainers, companions
Designing autonomy (Safety of life and property)
Autonomous military drones

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Machine Intelligence Lab

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