# INTRODUCTION TO ROBOTICS

## (Kinematics, Dynamics, and Design)

## SESSION # 3:

## APPLICATIONS OF ROBOTICS
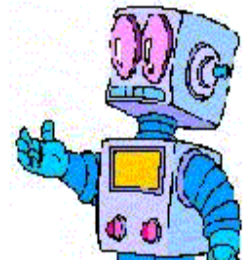
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**School of Mechanical Engineering**

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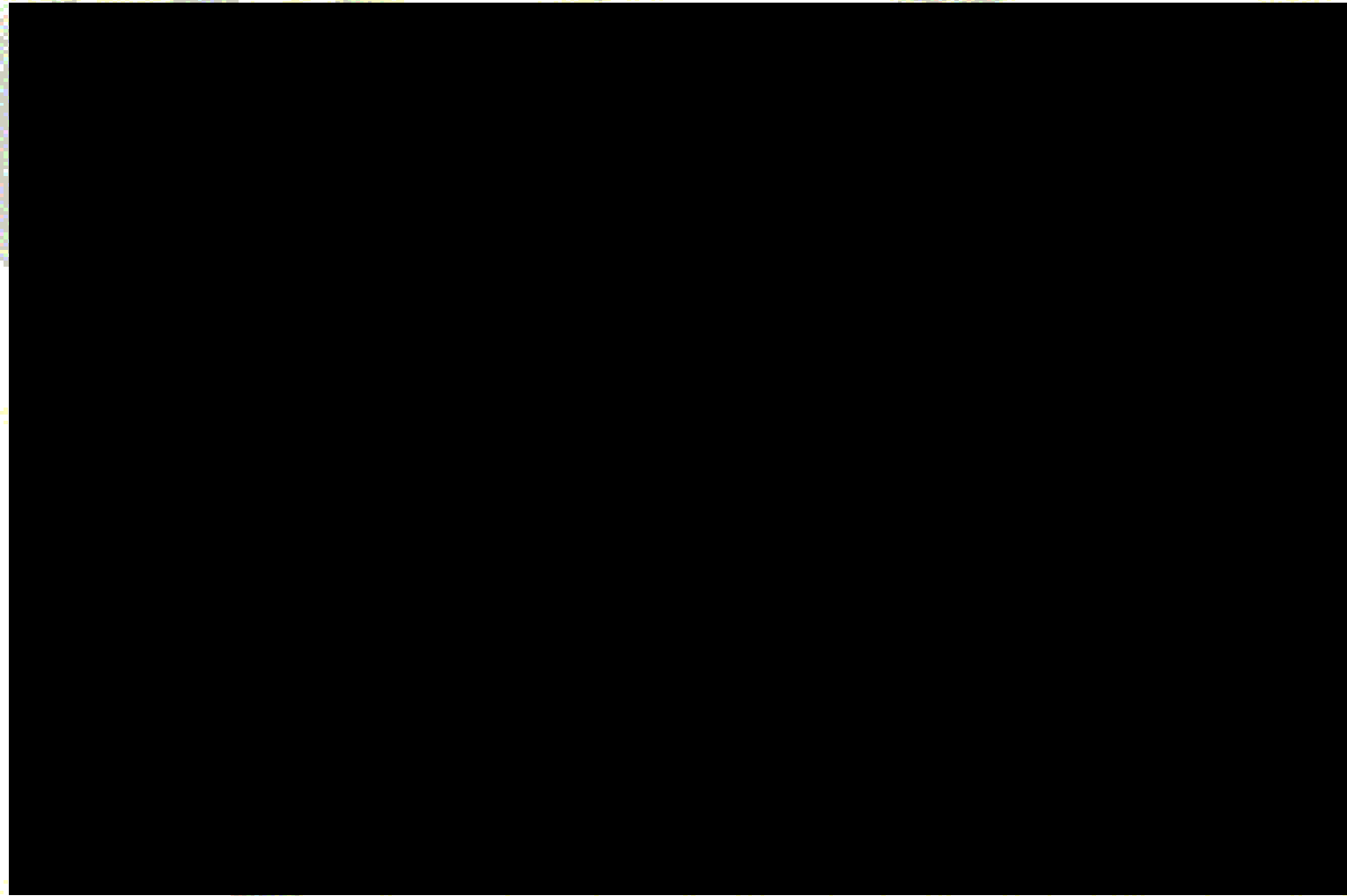
**Homepage: http://meghdari.sharif.edu**

# Robotics Applications in Medical & Health Environments

## (i.e Prosthetics, Hospitals, Nursing Homes, etc.)
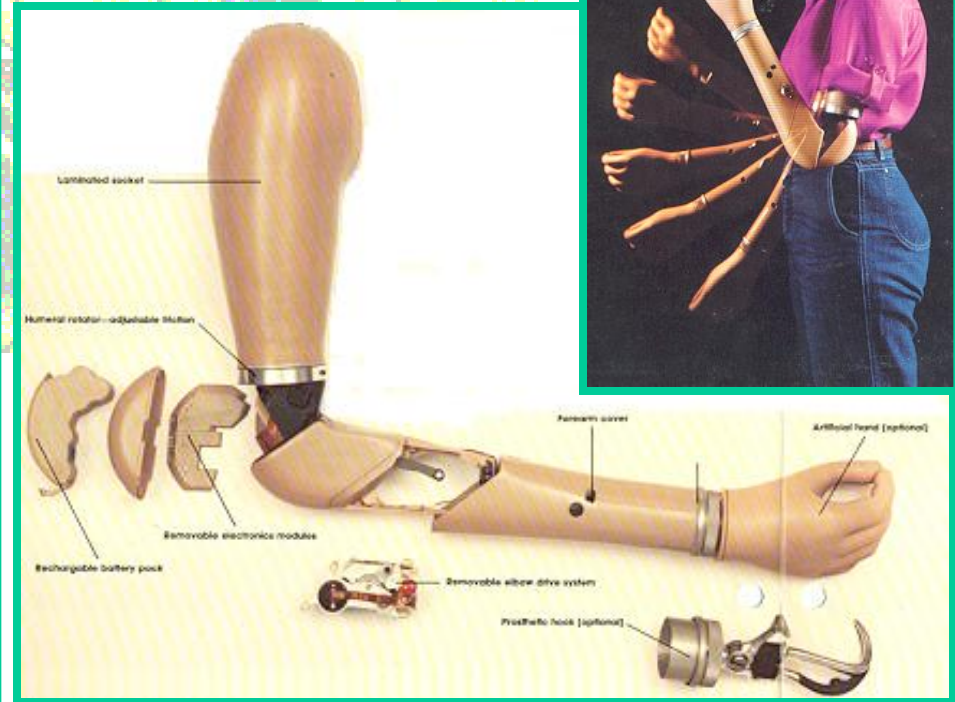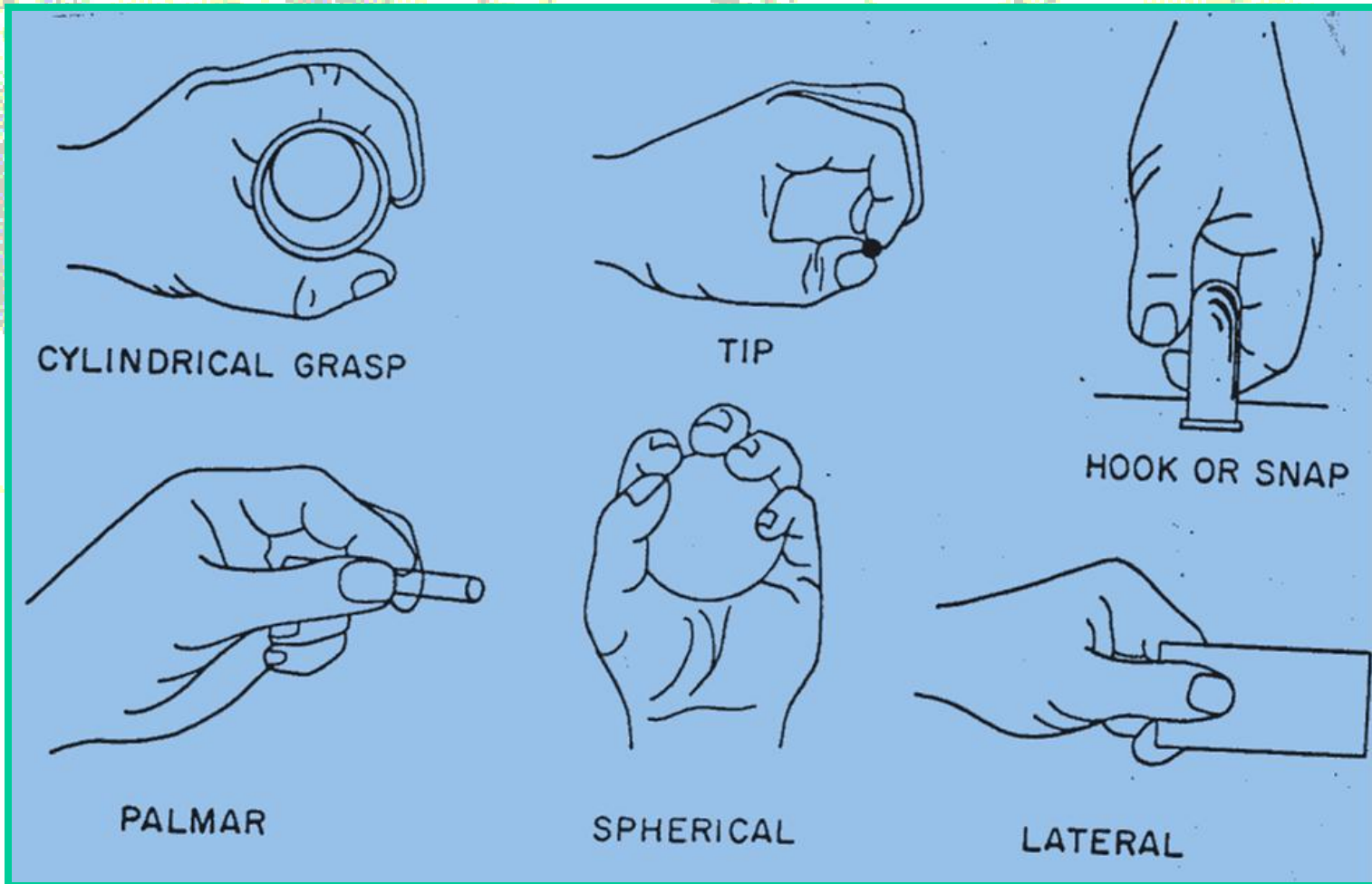
# The Robotic Nurse Project

# The Robotic Nurse



real robonurse.mpv

# Bio-Robotics:
# Robotics Application in Medical World



Prosthetic Arm & Hand

# The Six Grasping Features of a Natural Hand



CYLINDRICAL GRASP

TIP

HOOK OR SNAP

PALMAR

SPHERICAL

LATERAL

# Laboratory Model of the Sharif Artificial Hand
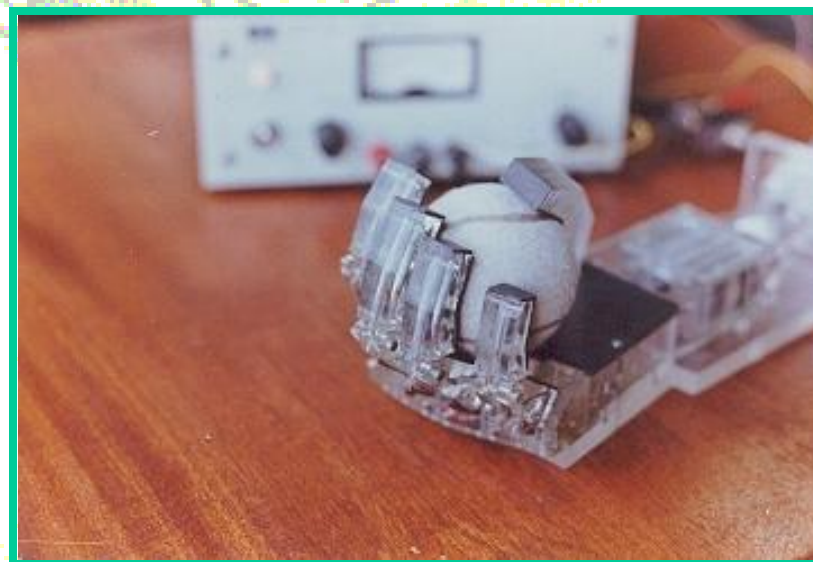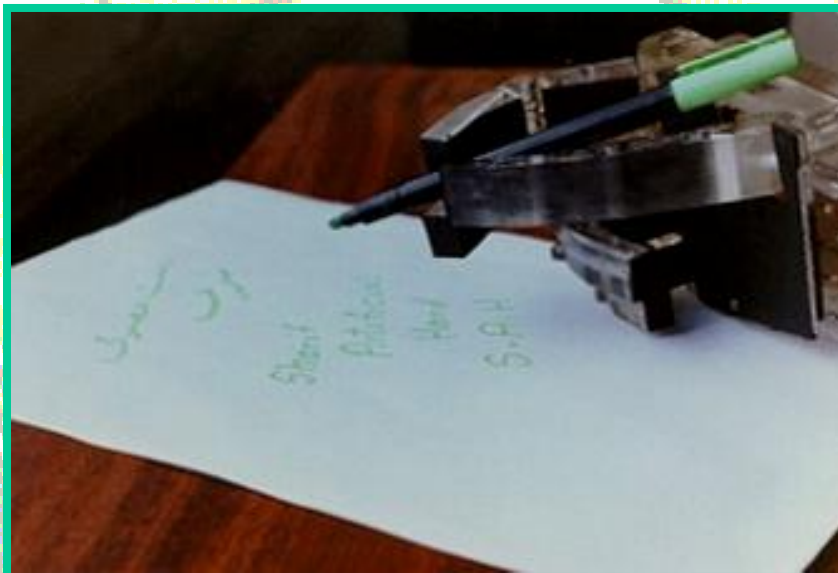
# Geometric Adaptability: The ability of the hand's multi-jointed fingers to curl around unknown shaped objects being held or grasped.
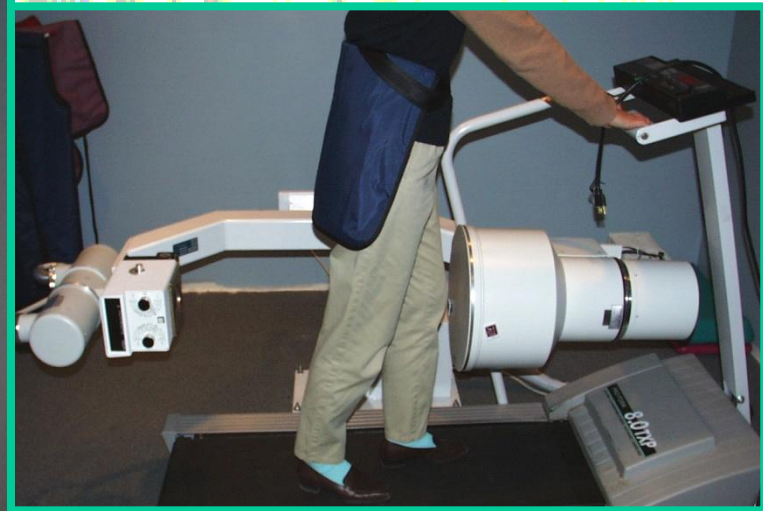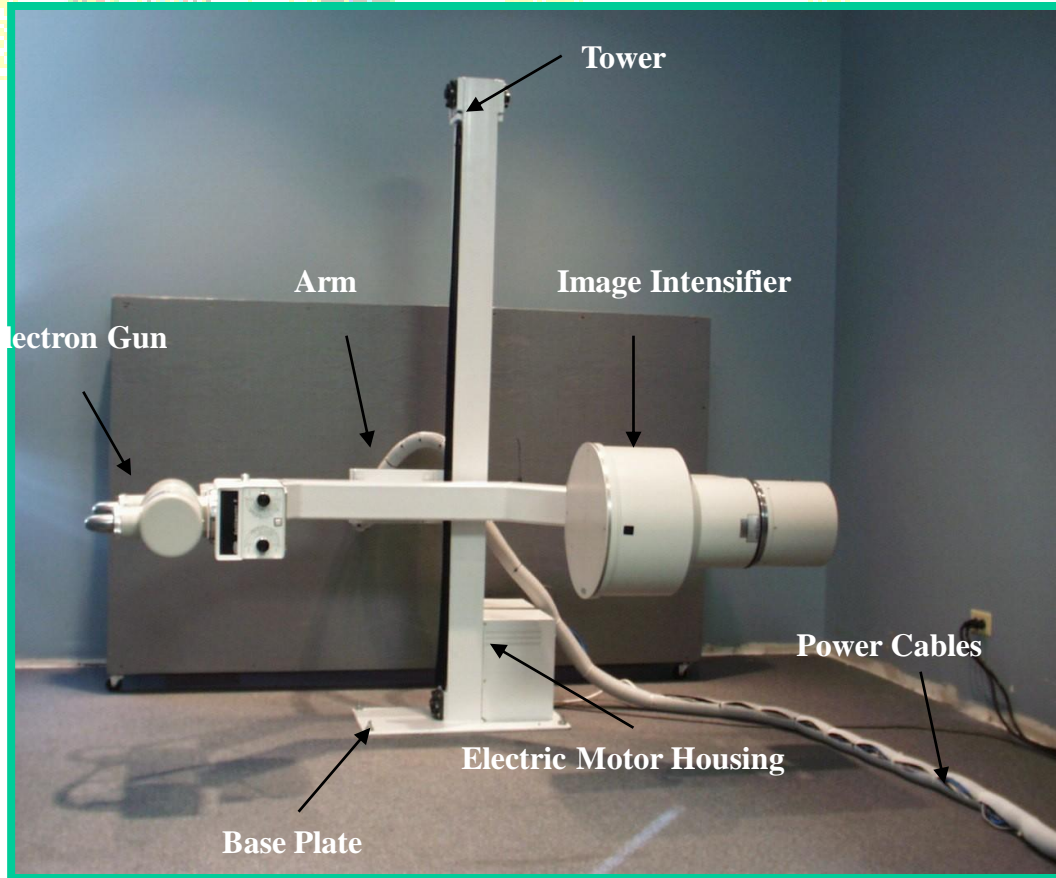


meghdary0.mpv





meghdary1.mpv

# Bio-Robotics: Robotics in the Medical World



Robotic Revolution - Device works wonder in prostate cancer surgery.
New York Daily News ⊙ read more



(Robots in Pharmaceutical Industry)

(Robotics Assisted Surgery) *Sharif University of Technology - CEDRA*

# Bio-Robotics: Robotics in the Medical World



Tower

Arm

Image Intensifier

Electron Gun

Power Cables

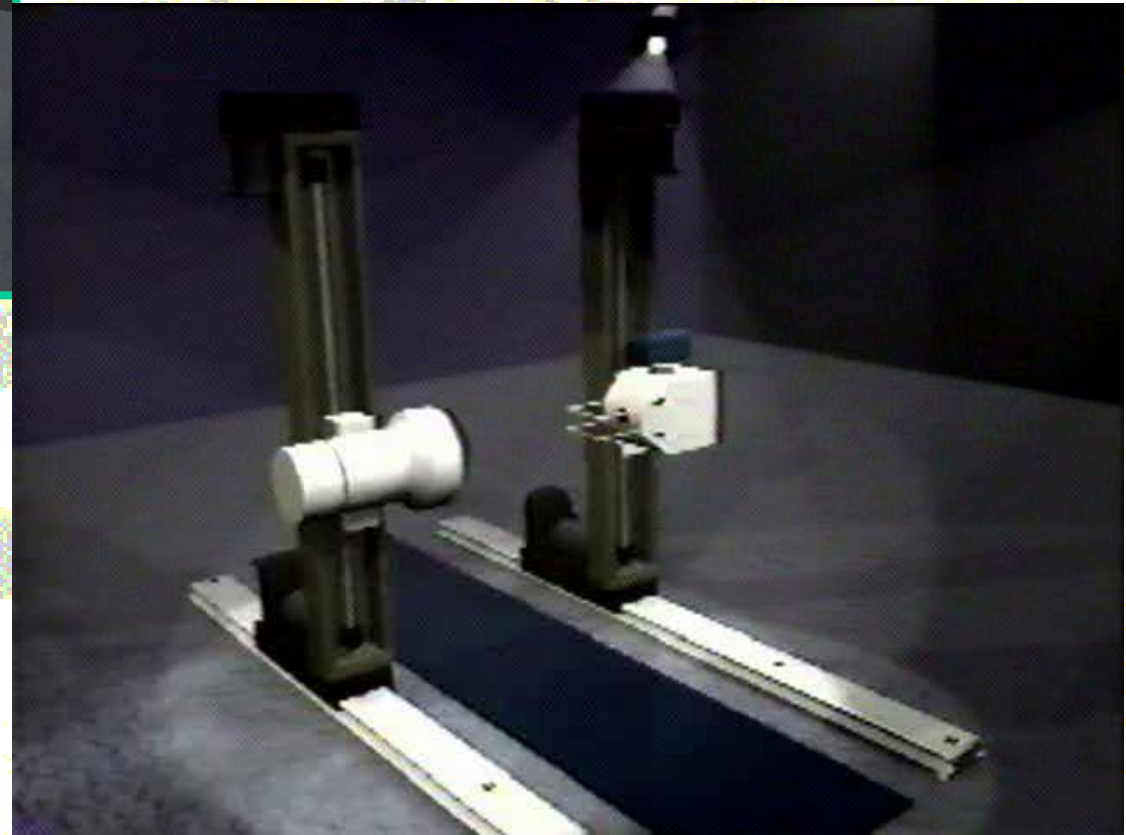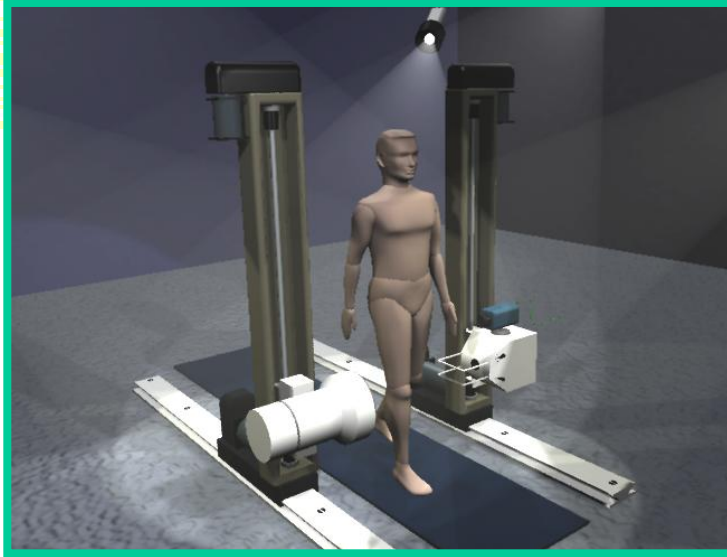Electric Motor Housing

Base Plate

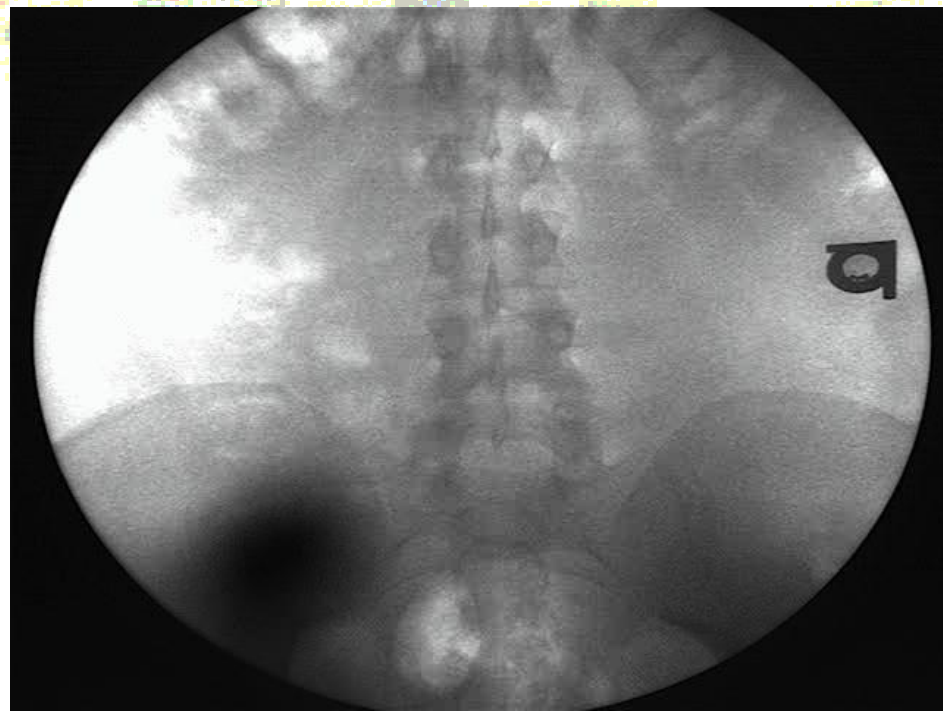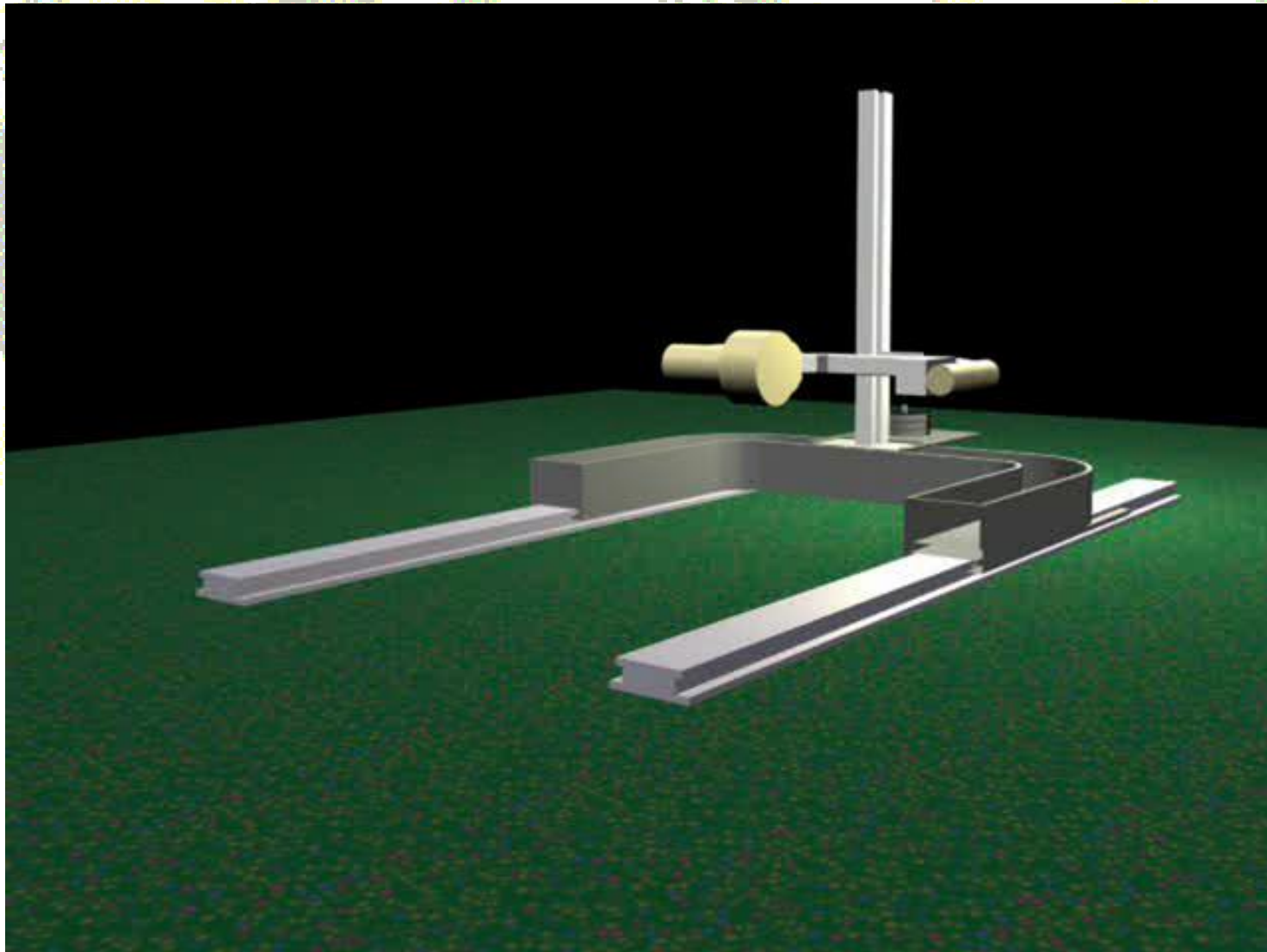## (A Conventional X-Ray Fluoroscopy Unit)

# X-Ray Fluoroscopic Video of a TKA Knee

# A Motion Tracking X-Ray Unit

# X-Ray Fluoroscopic Video of a TKA Knee

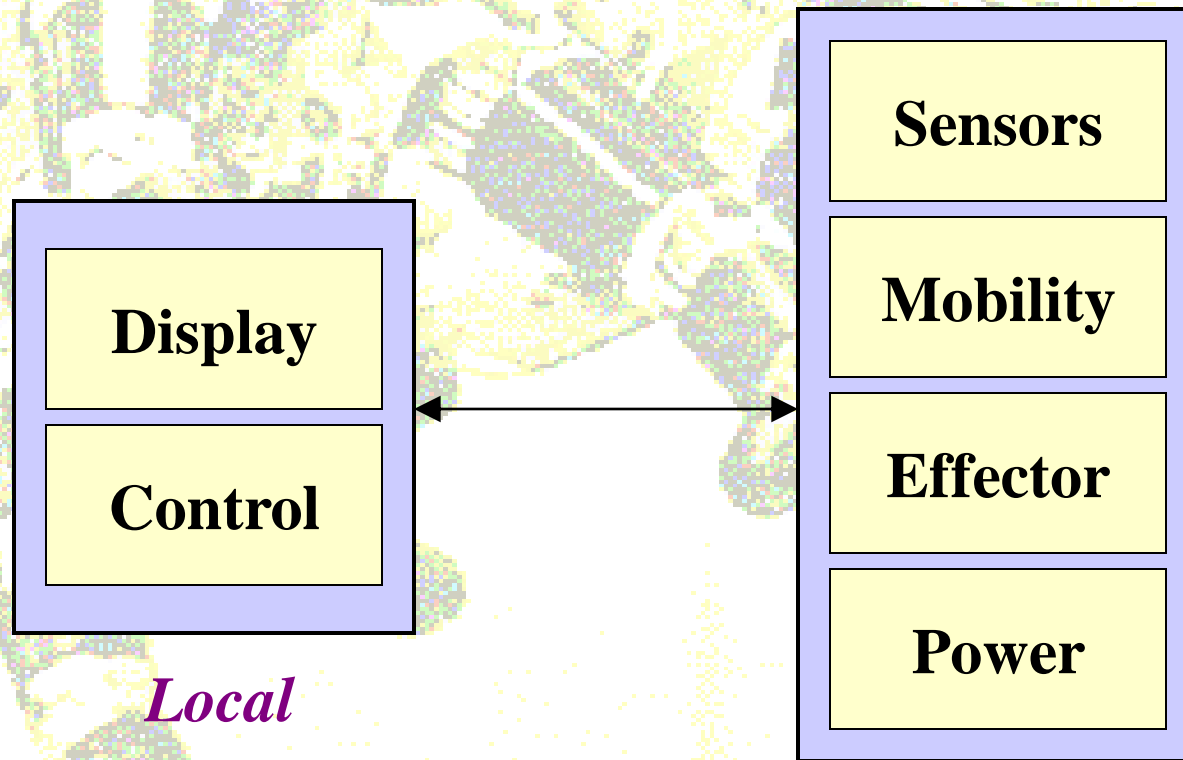# A Motion Tracking X-Ray Unit

# From Teleoperation to Autonomy

*Telesystem is useful when:*

the task is unstructured and not repetitive

# Components of a Telesystem

*A human operator controls the robot from a distance.  In Tele-operation the human provides the intelligence!*

| Display |
|---------|
| Control |

*Local*

| Sensors |
|---------|
| Mobility |
| Effector |
| Power |

*Remote*

# Urban Search and Rescue

(Earthquake and Bombing Scenarios)



"Local" operator

"Remote" robot

"Local" feedback

# Degrees of Autonomy

- *Self Contained*
  - No external power supply or computation.

- *Automatic*
  - Follows pre-determined rules and commands.

- *Semi-autonomous*
  - Can move from A to B following a sequence of rules. No "decision-making" capability.

- *Semi-Autonomous (Supervisory) Control*
  - *Human operator does the "difficult" part* : Planning/Recognition
  - *Remote system does the "easy" part* : Moving/Following orders.

- *Autonomous*
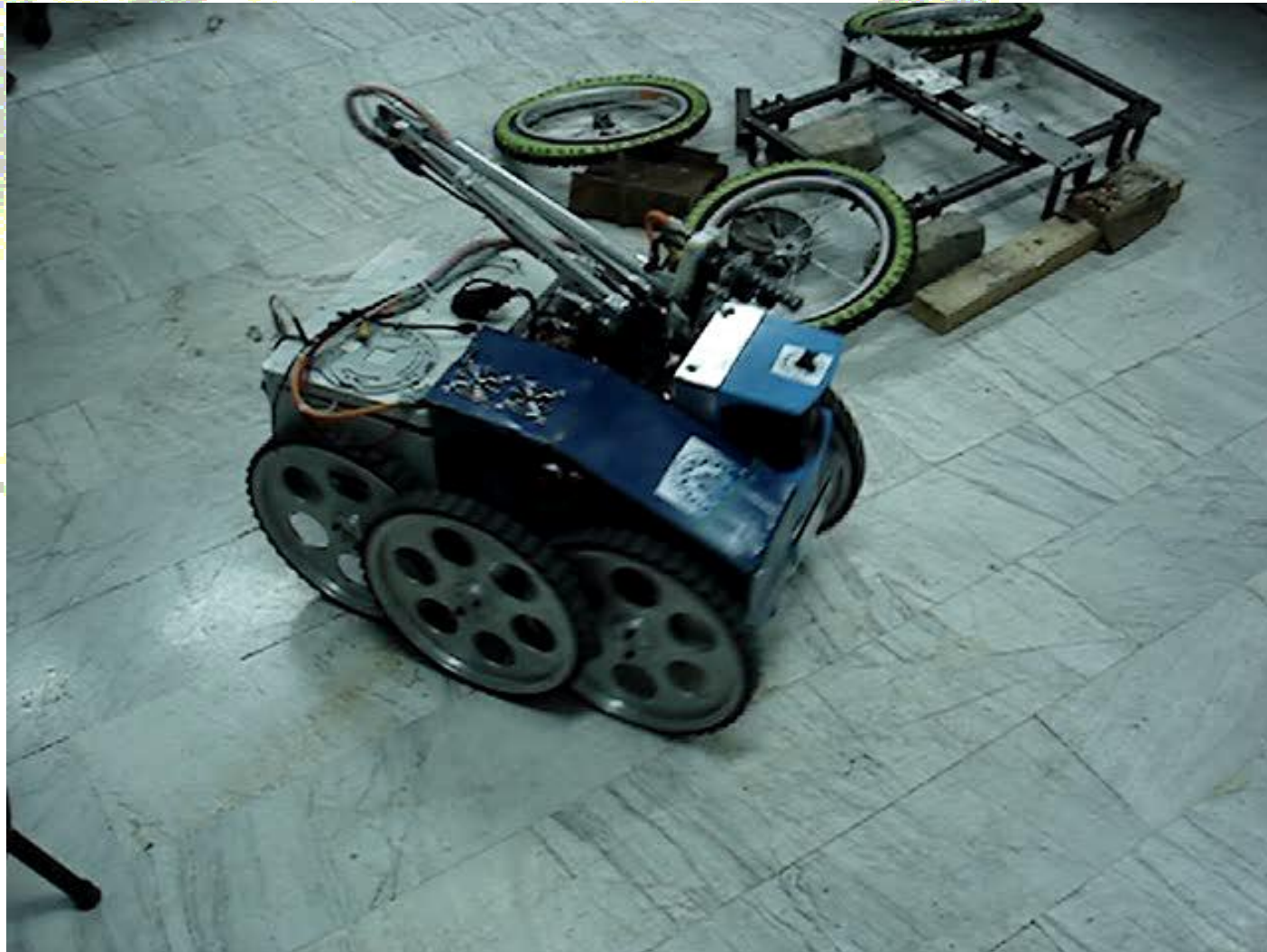  - Can plan and execute tasks in an unstructured environment.

# Urban Search and Rescue
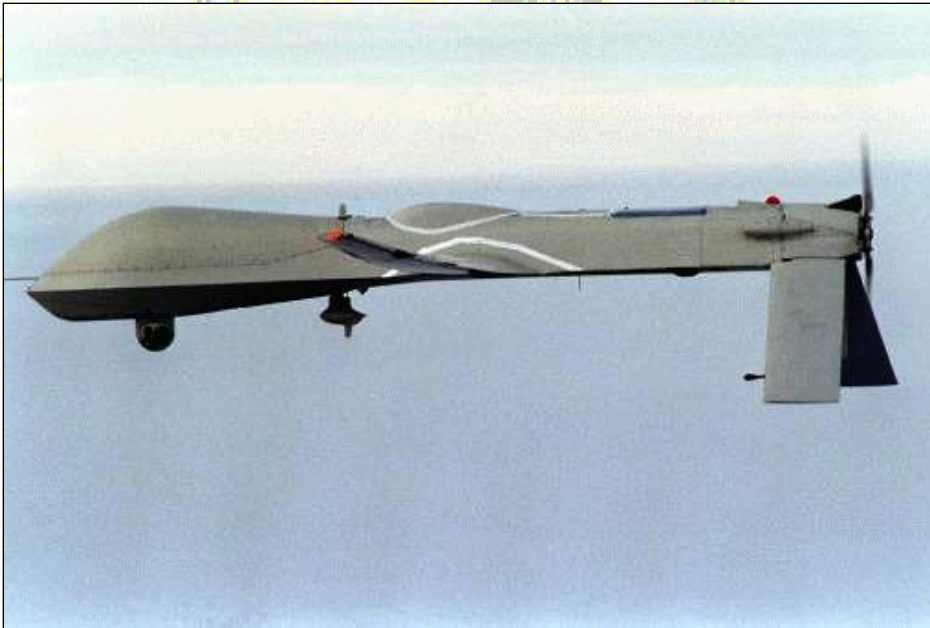
(Earthquake and Bombing Scenarios)
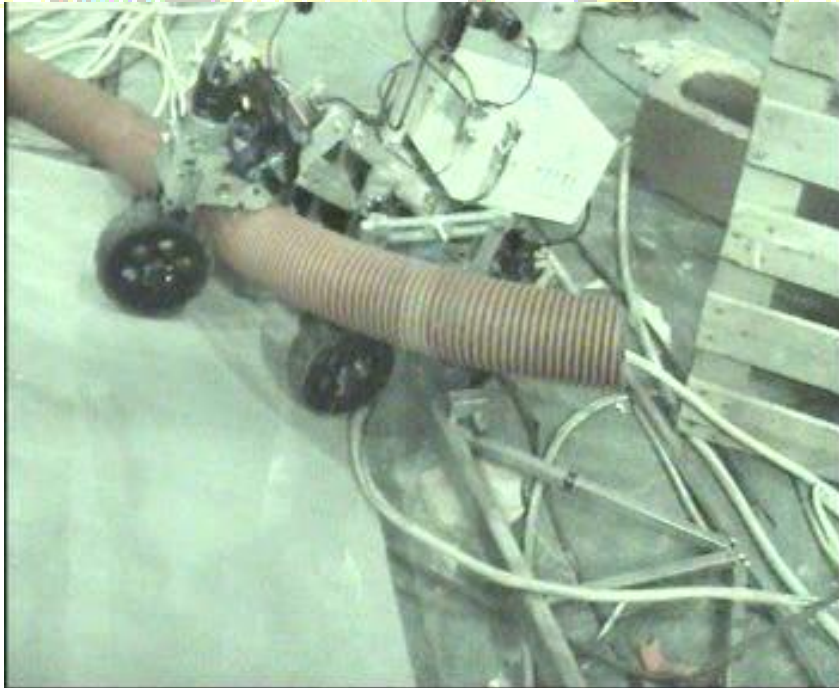
# Urban Search and Rescue

(Earthquake and Bombing Scenarios)

# RQ-1 Predator



RQ-1A Predator is a long endurance, medium altitude unmanned aircraft system for surveillance and reconnaissance missions.

Requires 4 people to control: One for flying, two for monitoring onboard instruments, one for landing and takeoff.
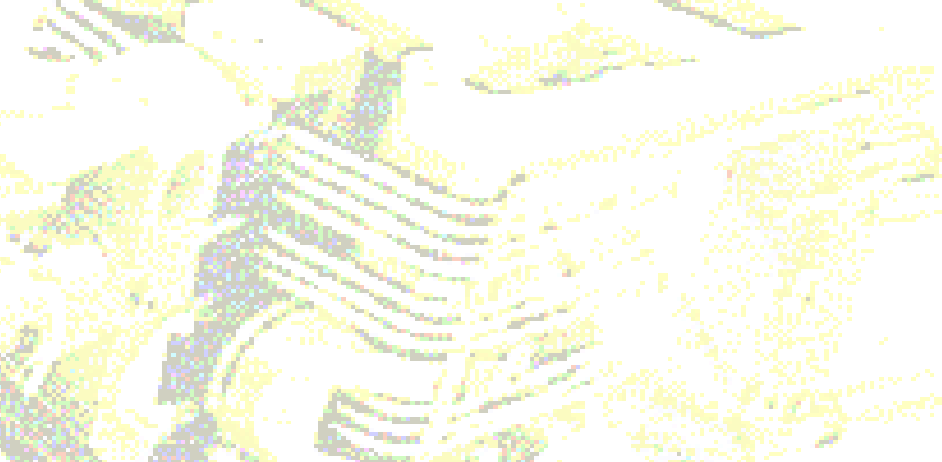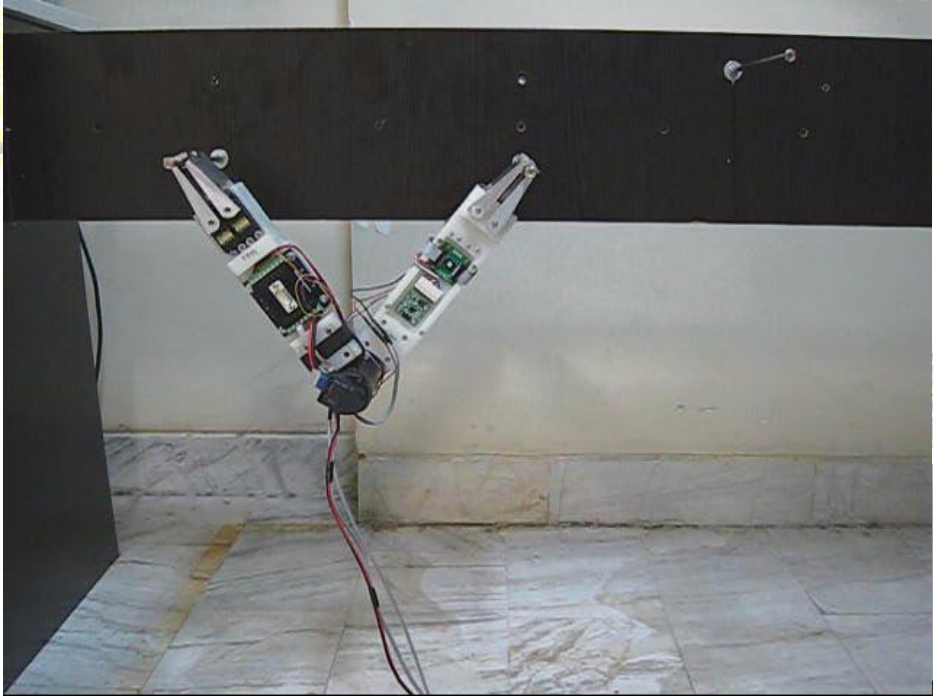
# Robot Demos-Humanoid



LEAD MCMPJMJPEG Decoder Eval

Walking.avi

# Robot Brachiation

# Robot Brachiation (Modified)

# Robotic Insect