IST Robots Notes

7.1 Robotics
Introduction
- A robot is a machine that can perform physical tasks with little or no outside help.
    o Usually can perform a few preset tasks
- Robotics is the study of robots

Robots and Seeing Robots
- Usually 'bad guys' in science fiction

Laws of Robotics
- Isaac Asimov and the three imaginary laws of robotics
    o A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
    o A robot must obey the orders given to it by a human being except where the orders would break the first law.
    o A robot must protect its own existence as long as this does not break the first law.
- Also added another law, called "Zeroth Law" – would be placed first
    4. A robot must consider the overall safety of humanity to be more important than the safety of any individual human being.
- They share two features with humans: intelligence and consciousness (they are aware of their own existence).

7.2 Types, Purpose and Uses of Robots
Types of Robots
- Industrial Robots
    o Usually for manufacturing processes
        ▪ E.g. Creating Cars
- Domestic Robots
    o For home or entertainment
        ▪ Automated washing machine

Purposes and Uses of Robots
- Too complicated or delicate for humans
- Repetitive or boring to humans – too many mistakes
- Too dangerous
- Commonly used for assembly, exploration, maintenance and repair.

7.3 Function of Robots
Robot Technology
- Designed for physical tasks
    o Control of movement and sense of surrounding
- Degrees of Freedom
    o Movable joints and pivot points performed by a robotic arm

Hardware for Robots
- Sensors
    - o Detects conditions around themselves
        - ▪ Position of objects, obstacles, amount of pressure required on robot arms
    - o Can detect temperature, sound or light
- Actuators
    - o Makes the robot move
        - ▪ Electric motors, switches or valves, or pumps for hydraulic fluids
- Computer-control device are needed for robots to perform actions on its own
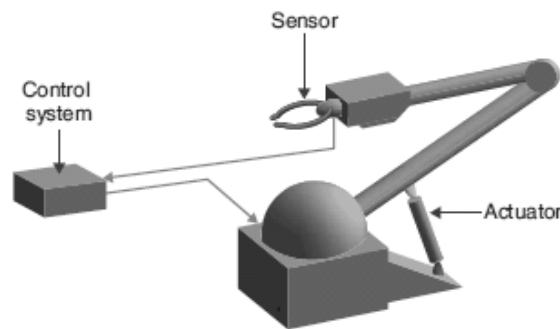
The hardware parts of a robot system

Software for Robots
- Robots that can perform actions by themselves operate under the control of software
- need programming languages that can handle their sensors and actuators
- Software is usually:
    - o Process Control Languages
        - ▪ Used with automated production machines
        - ▪ use a variety of different graphic displays
    - o Numerical Control Languages
        - ▪ Used with lathes, milling machines, metal cutting technologies
   - ▪ Accurate co-ordinates for every movement

7.4 Automated Control
Control Systems
- Control systems is a device that alters the operation of another system
    - o Light Switch
        - ▪ Manual control system
        - ▪ Human operator makes decisions
    - o Switches and dials are common manual controls

Automated Systems
- Automated systems are controlled by automated control systems
    - o Can operate without help of human
        - ▪ Fire Alarms,
    - o Rely on sensors to detect changes, and actuators make these changes
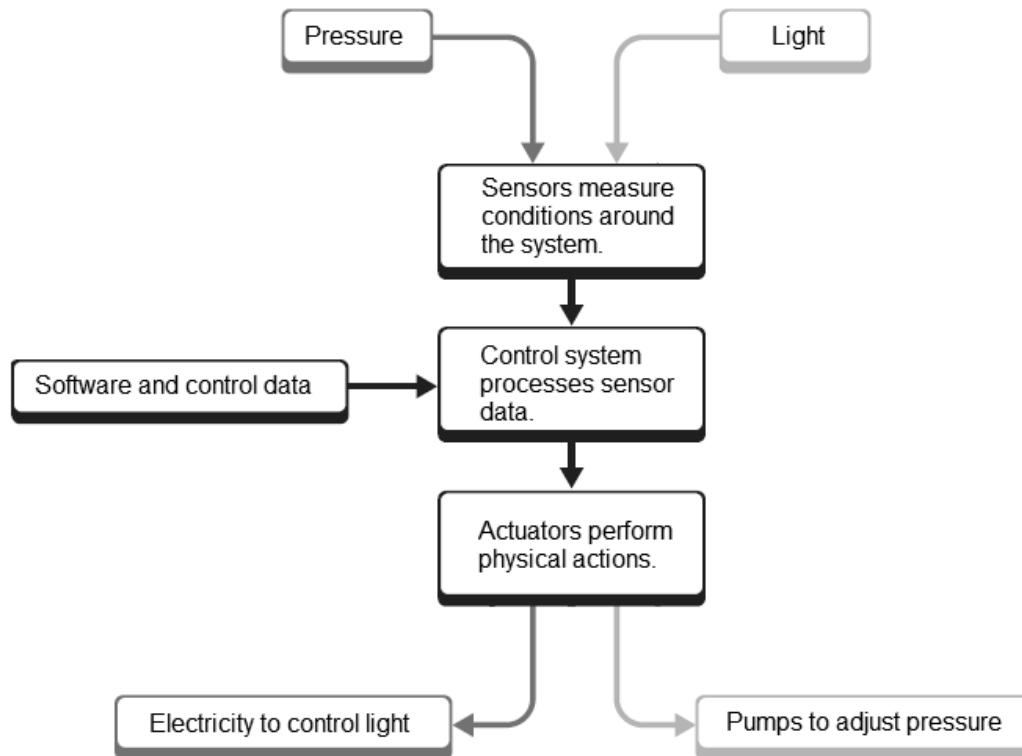
7.5 Sensing Devices
Types of Sensors

Common electronic and human sensors

SENSOR	EXAMPLES AND USES	EQUIVALENT HUMAN SENSORS
Temperature	Thermostats, thermistors and thermocouples are used in ovens, airconditioners, refrigerators, fire alarms and temperature-measuring instruments.	Heat-sensitive nerves in the skin
Light	Charge-coupled devices (CCDs), photoresistors and phototransistors are used for cameras, security systems and optical measuring instruments.	Eyes
Chemical	Gas chromatographs, pH meters and biosensor chips are used for pollution detectors, and quality- and purity-measuring instruments.	Tastebuds on the tongue, olfactory (smell) organs in the nose
Motion	Accelerometers and Doppler detectors are used for motion-measuring instruments.	Semicircular canals in the inner ears
Pressure	Strain gauges and piezoelectric detectors are used for sound-, pressure-, depth- and force-measuring instruments.	Eardrums and pressure-sensitive nerves in the skin

Sensors used in robots and automated systems
- Traffic Lights
    - o Magnetic sensors detecting presence of cars
- Cars
    - o Fuel levels, engine temperature
- Security and Safety Alarms, Lifts
    - o Invisible beams
    - o Pulses sent forward and back

7.6 Actuators and Controlling Devices

Actuators

- Actuators perform physical work of systems
- Usually electric motors, switches, pumps or valves
    - Electric motors controlled by autopilot to move rudder, etc.

Control Devices

- Automated systems have a microprocessor
    - Single purpose processor with software
    - Responsible for:
        - collecting data from the sensors
        - processing the sensor data
        - making decisions based on the data
        - sending data (instructions) to the actuators
- Feedback
    - If there is no automated system, then automated systems use feedback
    - Uses the signals from sensors, and these signals are sent to the actuators
        - Air-conditioners check the temperature from sensors and send feedback to heat or cool the air

Simple IST Robots Notes

- Robot = a machine that can perform physical tasks with little or no outside help
    - Robotics = study of robots
- The Three Laws of Robotics by Isaac Asimov + Zeroth Law
    - A robot may not injure a human being, or, through inaction, allow a human being to come to harm.
    - A robot must obey the orders given to it by a human being except where the orders would break the first law.
    - A robot must protect its own existence as long as this does not break the first law.
    - A robot must consider the overall safety of humanity to be more important than the safety of any individual human being. (Zeroth)
- Two types of robots – industrial and domestic
- Used if task is too delicate or complicated, too repetitive or too dangerous for humans
- Robots have sensors and actuators
    - Sensors detect the environment it is in
        - Common sensors include temperature, light, chemical, motion and pressure
        - Traffic lights and lifts use beams
    - Actuators do the actions – performs physical tasks
        - Usually electric motors, switches, pumps or valves
    - Control System - a device that alters the operation of another system
        - Manual – need a human operator to make decisions
        - Automated – can be done without the help of a human (fire alarm)
- Automated Systems
    - Microprocessor is responsible for:
        - collecting data from the sensors
        - processing the sensor data
        - making decisions based on the data
        - sending data (instructions) to the actuators
    - If there is no microprocessor, the automated system uses feedback from sensors