

MOBILE CLIENT DEVICES AND PERVASIVE COMPUTING

Lesson 05

Sensors, Actuators, Robots, Smart Home Appliances

SENSORS

- Electronic devices that sense the physical environment
- For example, sensors for temperature, pressure, light, metal, smoke, and proximity to an object
- Sensor sends the signals to a computer or controller
- Facilitate interaction of the mobile device with the surroundings

SENSORS

- A CCD (charge-coupled device) camera to identify various objects or a microphone to recognize voices
- Sensor for background noise to control voice amplification during a call.
- Sensor for surrounding light used to control the brightness of the LCD screen.

SENSORS

- A microphone senses voice
- Sends the voice signals to a speech processing system (SPS)
- The SPS authenticates the mobile owner. Then, the SPS can also be used to dial a spoken number and interpret and execute spoken commands.

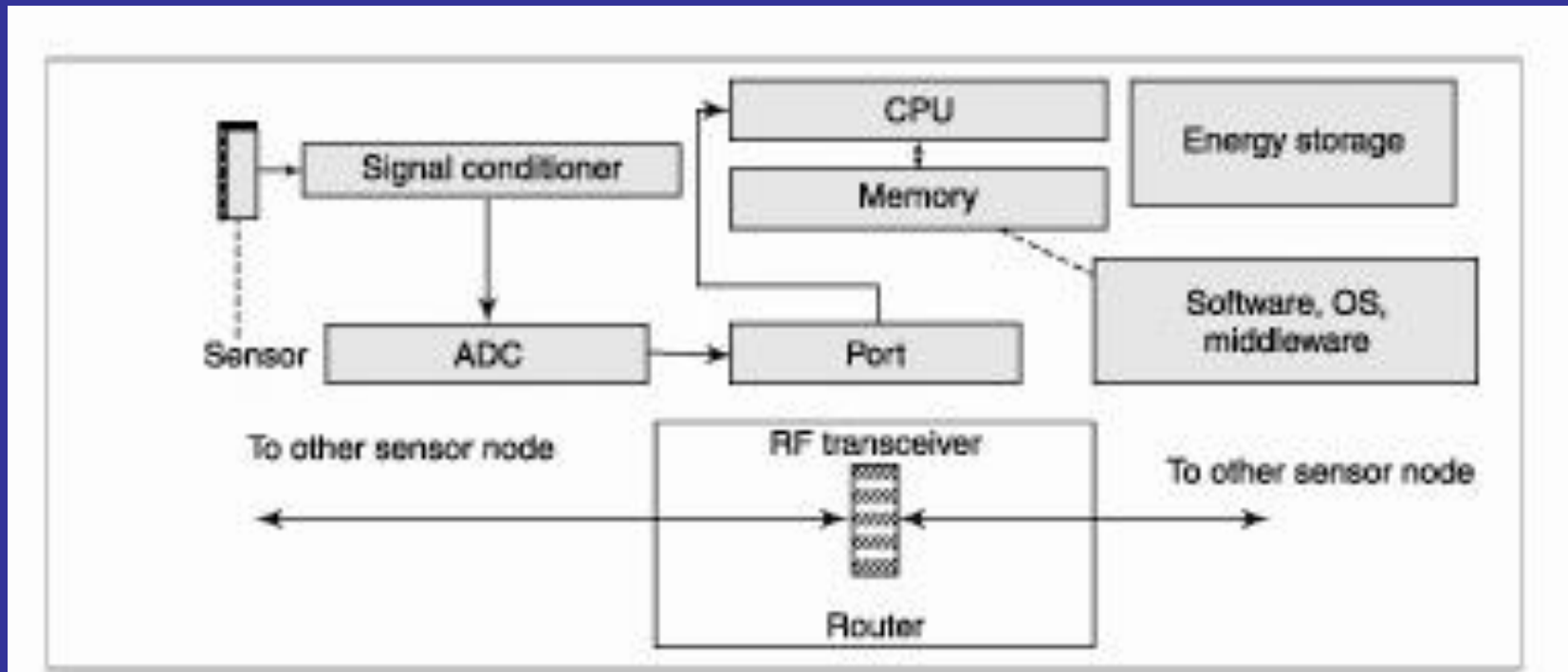
SENSORS

- A sensor for measuring the strength of the signal received controls the amplifications of received signals

SMART SENSORS

- Consists of the sensing device, processor, memory, analog to digital converter (ADC), signal processing element, wireless or infrared receiver and transmitter

MICA MOTE SMART WIRELESS SENSOR NODE AND ATMEL MICOCONTROLLER ARCHITECTURE



SMART SENSORS

- Computational, communication, networking capabilities
- Deployed to communicate information to a network, a central computer, or a controller
- A robotic system or an industrial automation system— multiple smart sensors embedded in it.

SMART SENSOR

- Performs communicational as well as computational functions
- Generally programmed using assembly language or C

ACTUATORS

- Actuator receives the signals from a controller or central computer and accordingly activates a physical device, appliance, or system

ACTUATOR EXAMPLES

- Servomotor in a robot's hand, loudspeaker, power transistor supply current to an oven, solenoid-valve actuator, a transmitting device in a sensor network, etc.

SMART ACTUATOR

- Receives the commands or signals from a network, mobile device, computer, or controller and accordingly activates the physical device or system

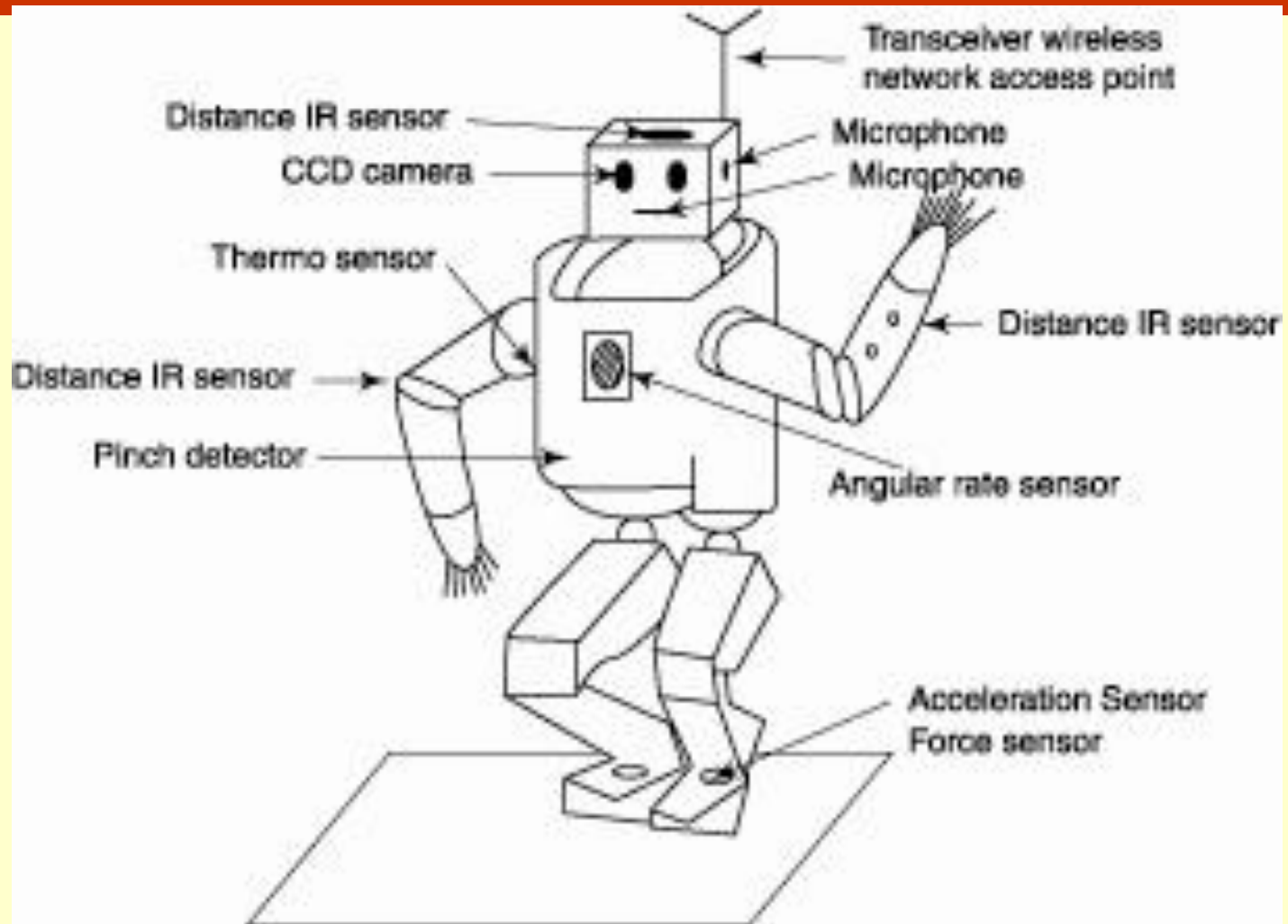
SMART LABEL SENSOR-ACTUATOR PAIRS

- Used in control systems
- For example, a temperature sensor and current actuator pair controls the oven temperature
- A light sensor and bulb current actuator pair controls the light levels
- A pressure sensor and valve actuator pair controls the pressure

SMART LABEL SENSOR-ACTUATOR PAIRS

- Industrial plants have large numbers of pairs of sensors and actuators.
- A set of smart sensors and actuators networked using a control area network bus (CAN bus), for example, in an automobile or industrial plant.
- Smart sensors programmed in assembly language or C using development tools.

ROBOTIC SYSTEMS



ROBOTIC SYSTEMS

- Robotic systems incorporate a variety of overlapping technologies from the fields of artificial intelligence and mechanical engineering.
- Robotic systems essentially programmable devices consisting of mechanical actuators and sensory organs— linked to a computer embedded in them

ROBOTIC SYSTEM MECHANICAL STRUCTURE

- Might involve manipulators
- or might concern the movement of the robot as a vehicle

SENSORS IN ROBOTS

- Acceleration and force sensors in the right and left feet
- Infrared distance sensors at the head and hands
- CCD camera in eyes
- Angular rate sensor at the middle
- Microphones at mouth
- Pinch detection at the belly
- Thermo sensors and touch sensors at shoulders, hands, and head

ACTUATORS IN ROBOTS

- At the mouth, there can be speaker to let a robot issue commands to other robots or relay sensed information via spoken messages
- At each moving joint—feet, knee, waist, neck, shoulder, hand, and gripper palm, there are actuators and motors

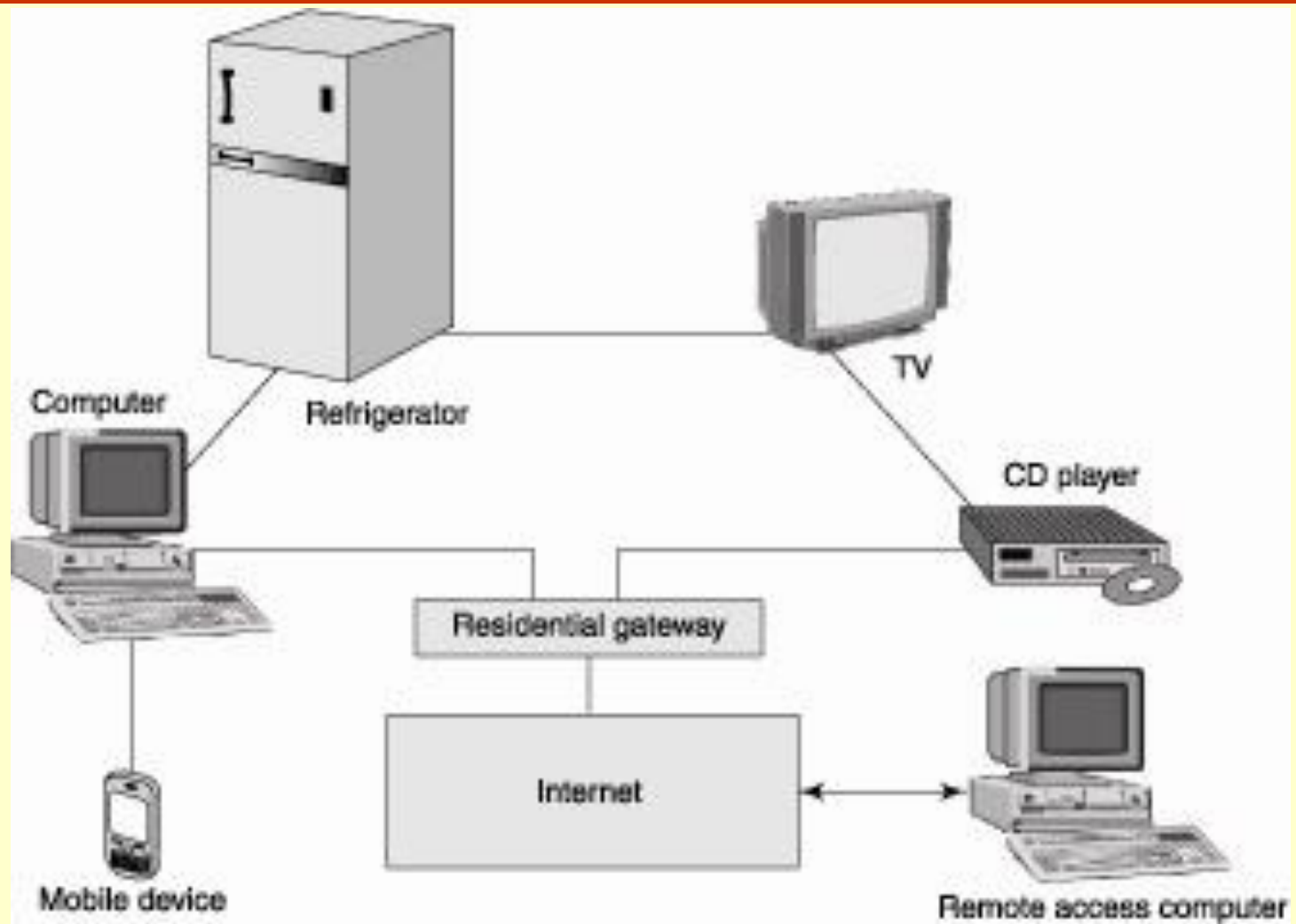
SMART APPLIANCES

- Possible to control home appliances and security systems using a cell phone or computer.
- Home appliances networked using power lines.
- Signals of frequencies up to 525 kHz can be induced in such lines communicate from one appliance to another, thus forming a network

SMART APPLIANCES

- The devices also communicate through a central server.
- Home appliances can be also networked using very short-range wireless protocols, such as Bluetooth or ZigBee

SMART APPLIANCES



SET-TOP BOX

- A sophisticated computer-based device
- Data, media, and network processing capabilities
- Interconnects the home TV and the broadcasting service network

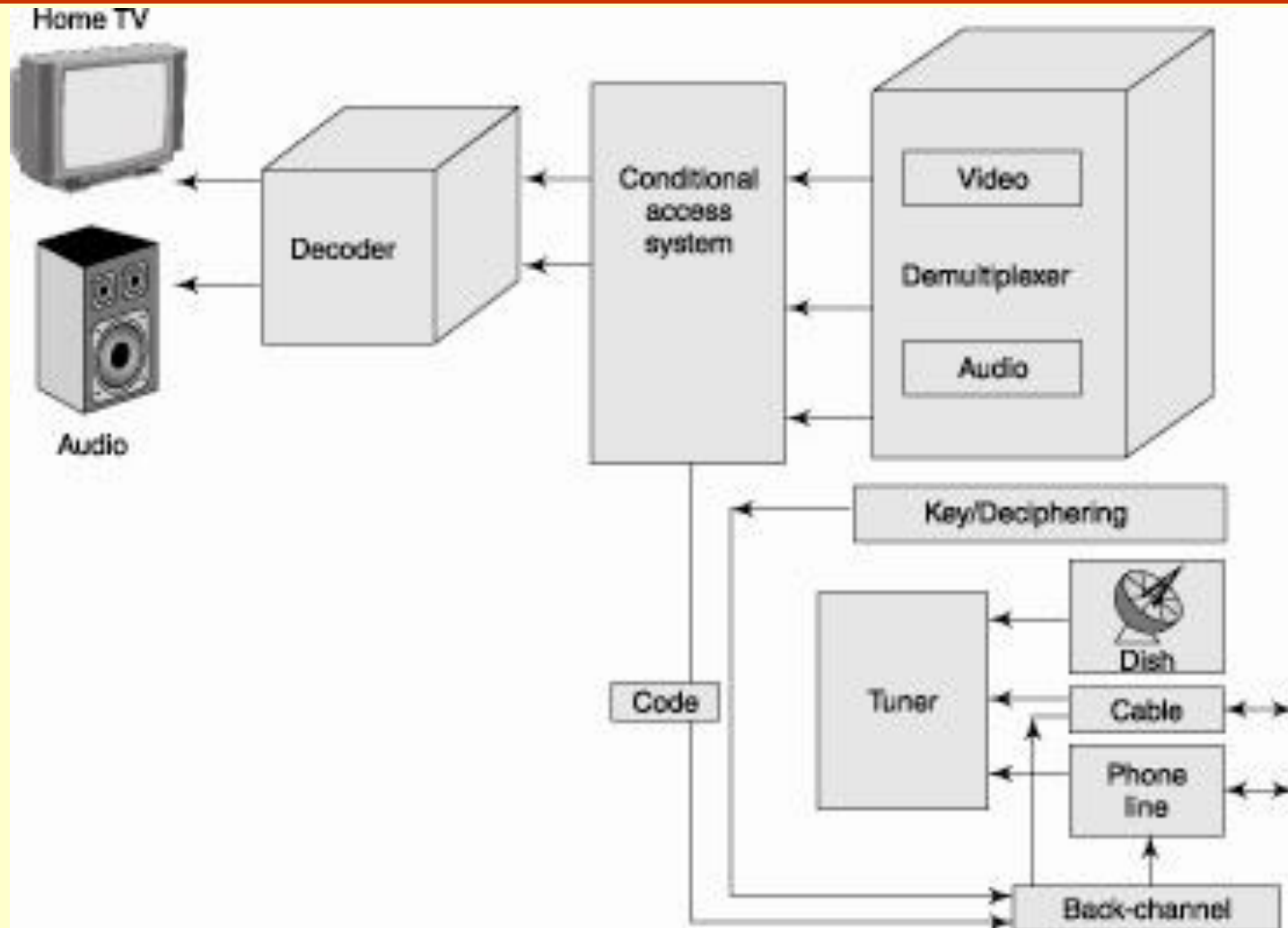
PROGRAMMING LANGUAGE IN A SETUP BOX

- Java most commonly used.
- Set top boxes run deciphering and encrypting software
- Software component, called a device agent, which administers the device on behalf of the service provider.

SOFTWARE COMPONENT IN A SETUP BOX

- Mechanism of operation is similar to that of a mobile phone device, where the server of mobile service provider manages and administers the operation of the device.

SET TOP BOX



SUMMARY

- Sensors
- Actuators
- Sensor-actuator pairs
- Mobile Robots
- Smart Application controlled by mobile device
- Set-top box for video, audio reception from cable, phone line, satellite and Internet

End of Lesson 05
**Sensors, Actuators, Robots, Smart Home
Appliances**