

Sensors

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Objective

- Robots in the past? Current? Future?
- Why we need sensors?
- What are sensors?
- Various Types of sensors
 - Strain Gauges

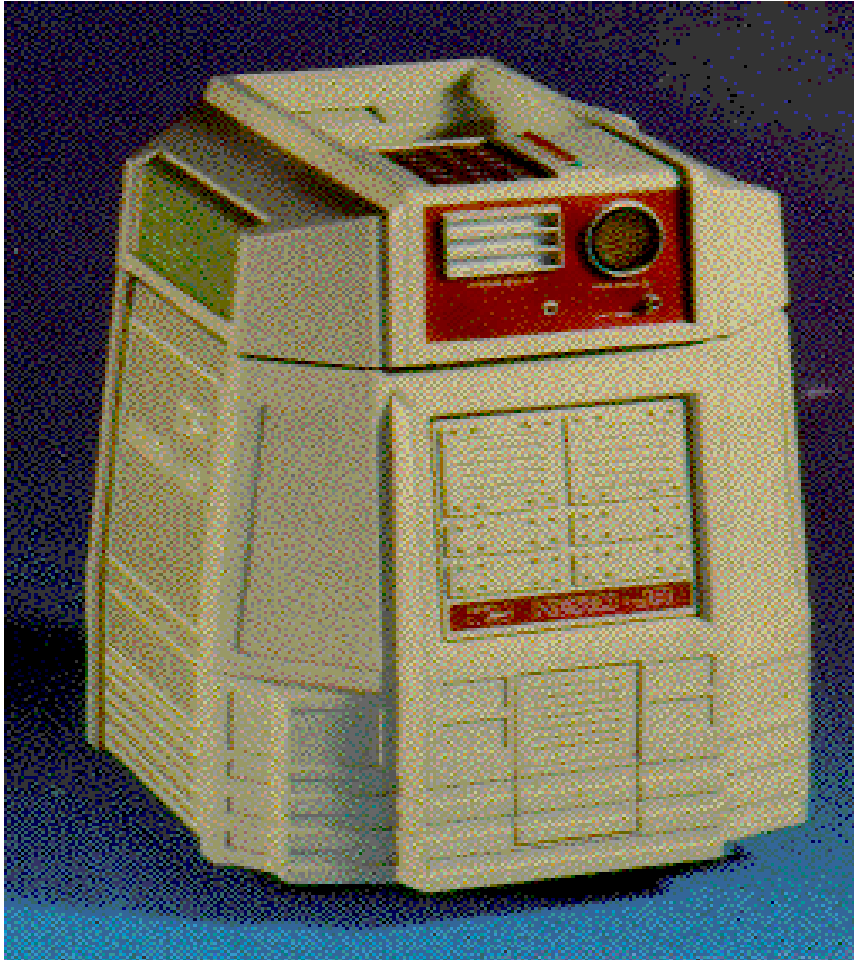
Robots in the Past



- Used User Input
- No input feedback between the processor and an output function.
- Not very dynamic



RT-1 HERO JR

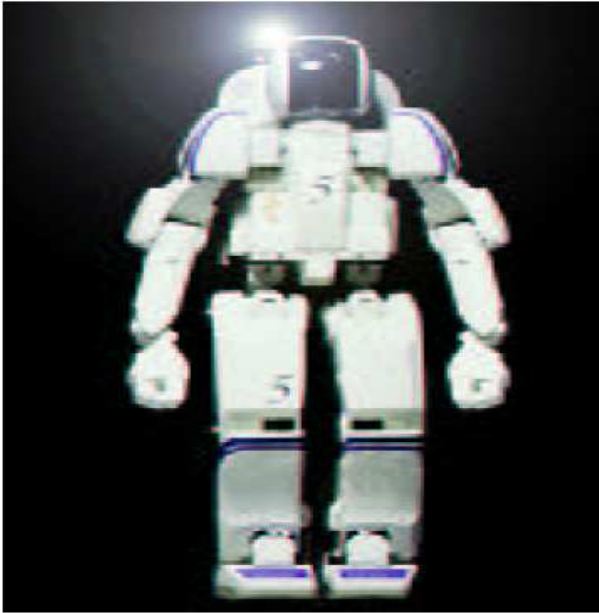


- Meet the **first affordable, personal robot** with a **dynamic personality**
- All routines are stored in 32k ROM.
- See, hear, speak, tell time and move
- *light sensor, ultrasonic sonar, sound detector, speech synthesizer* and an internal clock controlled using a Motorola 6808 microprocessor.

Modern Robots/Machines



- Assigned critical tasks
- Weak Autonomy
- Introduction to bio-sensors

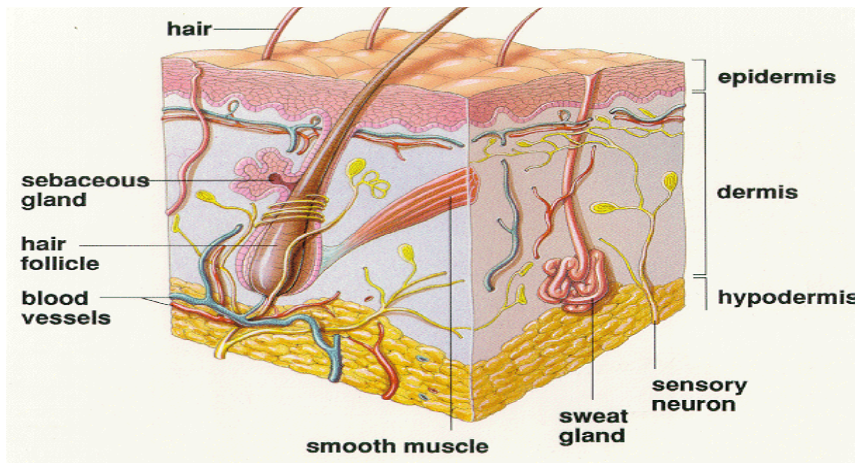


Honda Robot

The Future



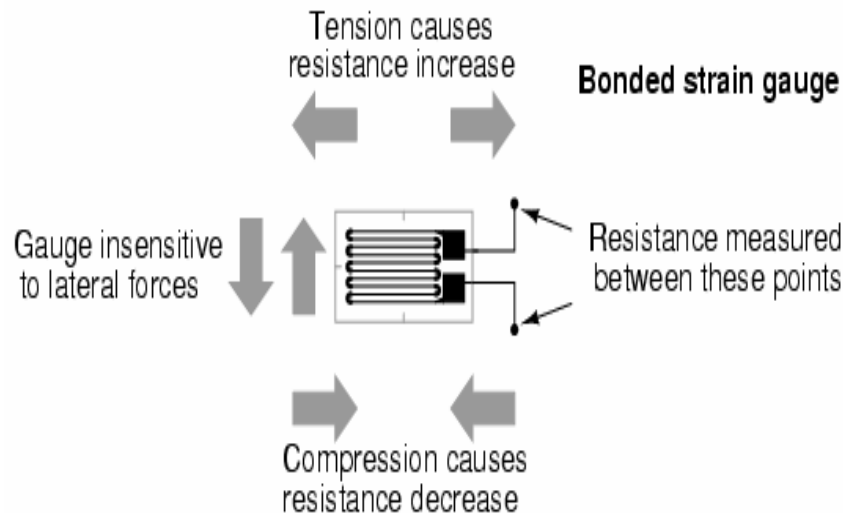
- Involves a lot of sensor integration
- New technology/discoveries



Types of sensors

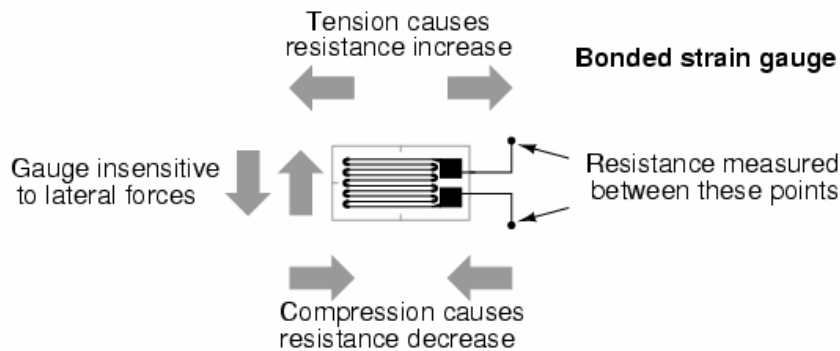
- Accelerometers
- Position Sensing
- Range Sensing
- Vision Sensing
- Force Sensing
 - **Strain Gauges**
 - Load Sensors
 - Quantum Tunneling
 - Pressure Sensors

Strain Gauges



- Frequently used in Mechanical Research
 - Measure stress generated by machinery
- Strain Gauges are smaller than a postage stamp.
- Very thin conductors (1/1000 inch diameter)

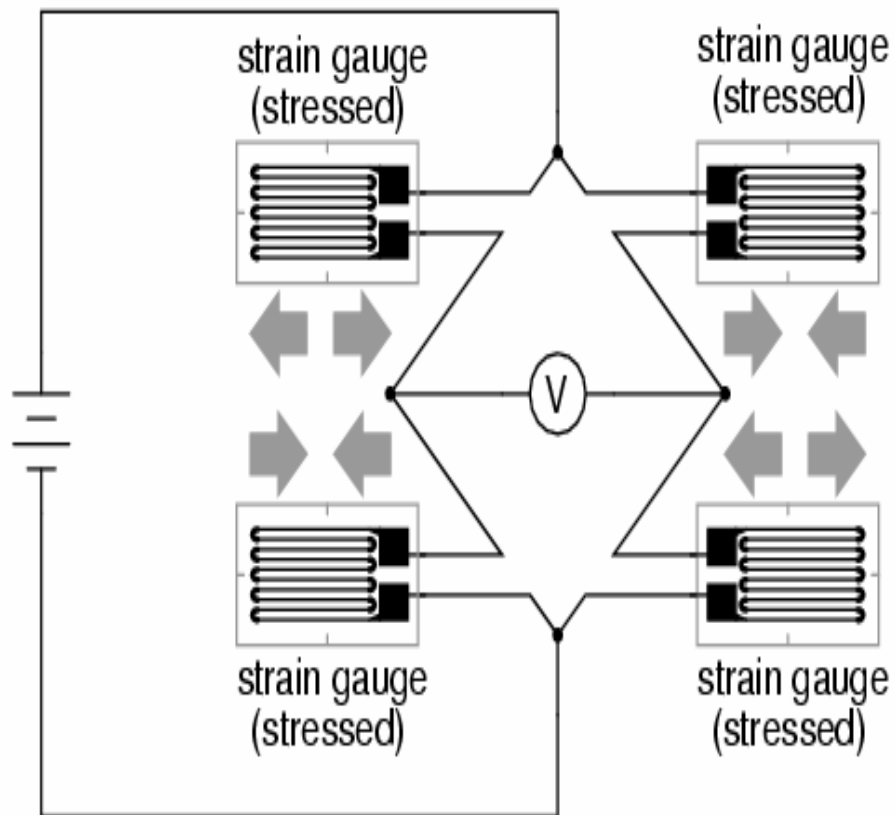
Strain Gauges



- Device that changes resistance when it is stressed.
- With contact the wires stretch or compress changing their resistance proportional to the applied load.
- One or more strain gages are used in the making of a load cell.

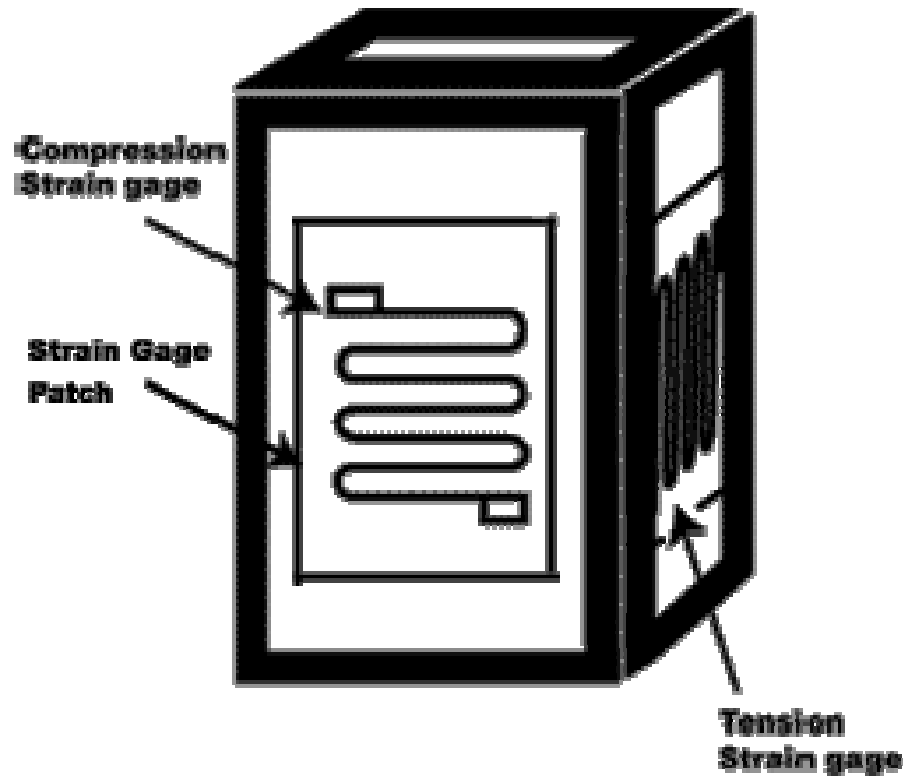
Strain Gauges

Full-bridge strain gauge circuit



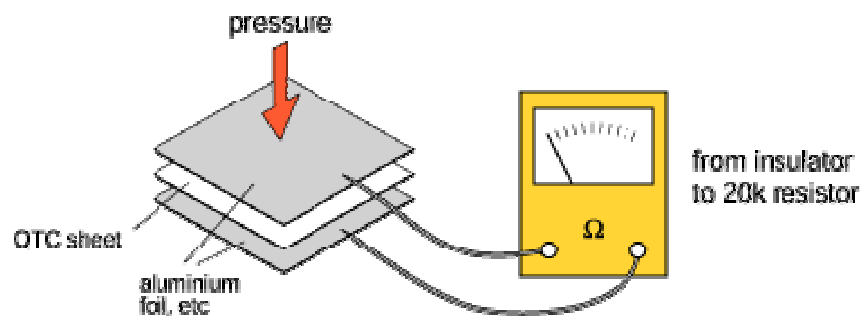
- For practical instrumentation
 - Monitor resistance change with high accuracy
 - Bridge measurement circuit (provides precision)
 - Circuit indicates measured strain by degree of imbalance
 - The imbalance is accurately read by a precision voltmeter at the bridge center.
 - Analog Voltage converted and used by various embedded systems.

Strain Gauge *(in action)*



Quantum Tunneling Composite (QTC)

- New technology (Quantum Theory)
- A flexible polymer
 - Exhibits extraordinary electrical properties
 - Perfect insulator (at equilibrium)
 - Perfect conductor (when compressed)
 - Can pass very high currents (≥ 10 amps)
 - Polymers loaded with carbon are, at best, only partially conductive.

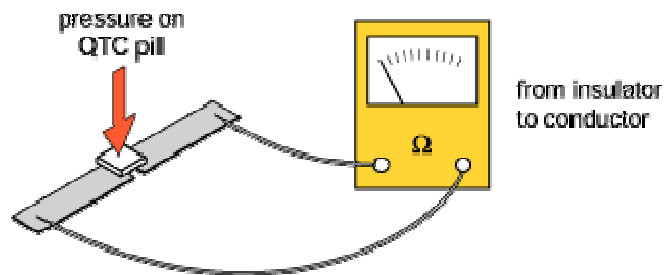


Applications of QTC

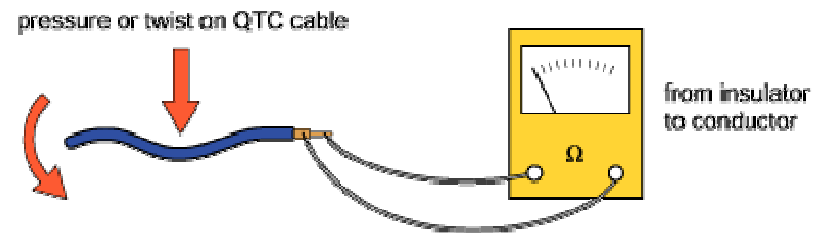
- Very promising to revolutionize product design.
- Currently
 - Smart garments that can be wired directly to electronic products such as an iPod.
 - Being retro-fitted, for conventional switches to eliminate arcing and electrical noise.
 - Advanced membrane panel switches, speed controllers and sensors.
- Can even sense small concentrations of organic molecules in liquid or gas form.

Variations of QTC

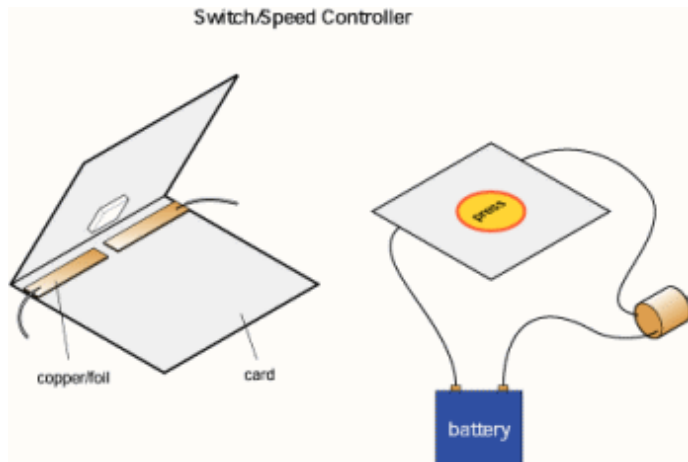
QTC Pill



QTC Cable



QTC Switch



Others:

- QTC Force Sensors
- QTC Textile Sensors

Questions ?

Thank you!

Resources

- Circuit Cellar Ink article, April issue, pp 48-51
- http://www.allaboutcircuits.com/vol_1/chpt_9/7.html
- http://www.tep.org.uk/millennium_smart_qtc.html
- <http://www.peratech.co.uk/>