Help

The **measurand** is a real world signal of interest like sound, distance, temperature, force, mass, pressure, flow, light and acceleration. Figure 14.5 shows the data flow graph for a data acquisition system or control system. The **control system** uses an actuator to drive a measurand in the real world to a desired value while the **data acquisition system** has no actuator because it simply measures the measurand in a nonintrusive manner.
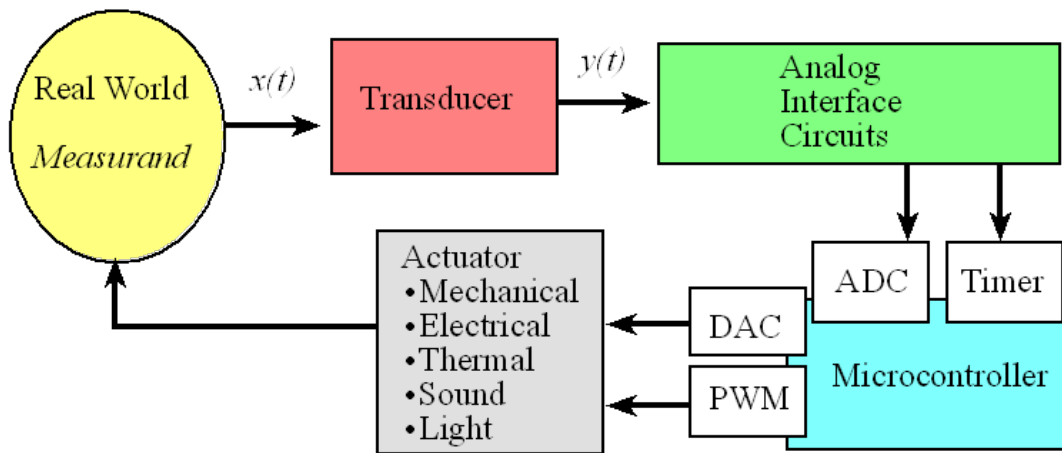

Figure 14.5. Signal paths a data acquisition system.

The input or measurand is x. The output is y. A **transducer** converts x into y. Examples include

- Sound   Microphone

- Pressure, mass, force   Strain gauge, force sensitive resistor

- Temperature   Thermistor, thermocouple, integrated circuits

- Distance   Ultrasound, lasers, infrared light

- Flow   Doppler ultrasound, flow probe

- Acceleration   Accelerometer

- Light   Camera

- Biopotentials   Silver-Silver Chloride electrode

A wide variety of inexpensive sensors can be seen at https://www.sparkfun.com/categories/23 (https://www.sparkfun.com/categories/23)

A **nonmonotonic** transducer is an input/output function that does not have a mathematical inverse. For example, if two or more input values yield the same output value, then the transducer is nonmonotonic. Software will have a difficult time correcting a nonmonotonic transducer. For example, the Sharp GP2Y0A21YK IR distance sensor has a transfer function as shown in Figure 14.6. If you read a transducer voltage of 2 V, you cannot tell if the object is 3 cm away or 12 cm away. However, if we assume the distance is always greater than 10cm, then this transducer can be used.
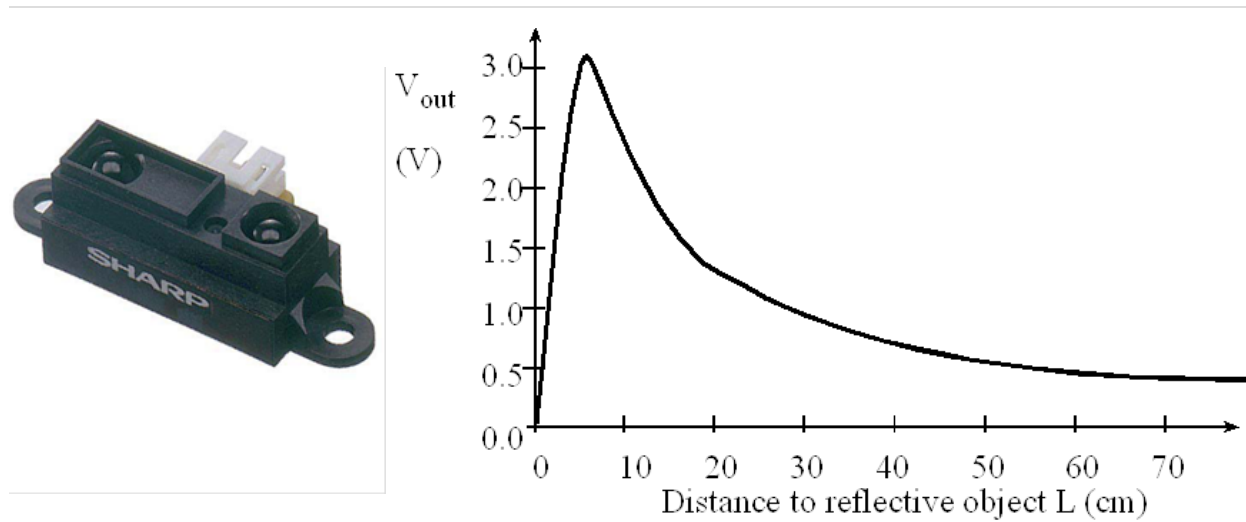

Figure 14.6. The Sharp IR distance sensor exhibits nonmonotonic behavior.

Details about transducers and actuators can be found in Embedded Systems: Real-Time Interfacing to ARM® Cortex™-M Microcontrollers, 2013, ISBN: 978-1463590154.