Speed and Distance Using Encoders
Wheel Encoders

- Two types of wheel encoders

reflectance sensor (Top Hat Sensor)  slot sensor
Encoder Library Functions

The `enable_encoder()` library function is used to start a process which updates the transition count for the encoder specified. The encoder library functions are designed for sensors connected to (digital) ports 8-15. Every enabled encoder uses a lot of the processor -- so don't enable an encoder unless you are going to use it, and never put an enable statement inside of a loop.

```c
enable_encoder(<port#>);
/* turns on the specified encoder (which are plugged into digital ports 8-15). This should be done only once - never enable an already enabled encoder. If an encoder is not enabled read_encoder will always return 0. */
```

```c
disable_encoder(<port#>)
/* turns off the specified encoder */
```

```c
reset_encoder(<port#>)
/* sets the specified encoder value to 0 */
```

```c
read_encoder(<port#>)
/* returns an int that is the current value of the specified encoder */
```
void main()
{
    int enc1, enc2;
    enable_encoder(8); // turn on the encoders; sensors
    // plugged into ports any of the
    // digital ports
    enable_encoder(15);
    while(!b_button())
    {
        enc1=read_encoder(8); /* read each encoder */
        enc2=read_encoder(15); /* and show values */
        printf("Enc1=%d Enc2=%d\n",enc1, enc2);
        sleep(0.1); /* wait a bit and do it again */
    }
}
Mounting a slot sensor encoder

Carefully align sensor with encoder wheel
Optical Encoders

• The encoder sensor consists of a light reflectance sensor and a paper disc:
  – As the disc rotates, the reflectance sensor can read the light and dark areas on the disc.
  – This particular disk would give six counts per revolution (6 transitions from light to dark or dark to light)
    • Wheels with more partitions for more accurate control can be found on page 136 of Robot Explorations
Measuring Distance

• Divide the circumference of the wheel by the resolution of the encoder (number of clicks per distance moved).
Recording Speed

- Speed can be measured by recording the distance traveled in a certain amount of time
  - 6 counts per revolution
  - each revolution covers a certain distance (based on the size of the wheel and the gear ratio between the encoder disk and the wheel)
  - Speed is distance per unit time
  - On the library functions `seconds()` returns the elapsed time in seconds
Last Word on Encoders

• Every enabled encoder uses a lot of the HB’s processor -- so don’t enable an encoder unless you are going to use it, and *never put an enable statement inside of a loop*

• Just because you count an encoder does not mean that the robot moved that distance
  – tires slip on the ground (and tires slip on the wheels)
  – Legos bend, gears skip, etc...