Society of robots: <http://www.societyofrobots.com/member_tutorials/book/export/html/71>

SensorMag (More focused on readings): <http://www.sensorsmag.com/sensors/acoustic-ultrasound/choosing-ultrasonic-sensor-proximity-or-distance-measurement-825>

PIXY: <http://cmucam.org/projects/cmucam5/wiki/Introduction_and_Background>

PING Ultrasonic: <https://www.parallax.com/product/28015>

The general idea with sensors is to understand what functionality is needed (i.e. proximity detection, distance measuring or specific object location). The PIXY CMUcam5 provides a strong locational functionality allowing users to differentiate between objects using RGB detection. In technical terms, the PIXY provides the user with SPI, UART, I2C, USB and basic analog/digital compatibility with a sampling rate of 50Hz. Each sample provides the user with coordinates of onscreen items based on their color so it is important to have notably different colors to make detection capable. On that note, it also appears that colors can be easily washed out by improper lighting causing the camera to become confused. While it is expensive ($70) it seems you get what you pay for, and if you account for possible interference, this device can perform exceptionally well. Let it be noted also that the range is dependent on the size of the objects.

For more basic proximity detection a simple IR LED can perform the desired task at a reasonable price (<$1). A TSOP17 IR receiver then allows for simple analog data gathering of the transmitted IR signal although some surfaces have trouble reflecting the IR rays. The key in this case is of course the price, but it should be noted that the range for proximity detection is <5cm so it is probably better to use this either to broadcast an item’s location or preventing accidental collisions. At a slightly higher price of $20, a series of Sharp IR sensor, such as the GP2D120, allow for more reliable results with the added ability of providing distance values. In this case the range is still only 4-30cm reliably so this may only be useful in support of an additional device. Both the simple setup and Sharp sensor are capable of communicating in a variety of manner ranging from I2C to UART.

To combat the relatively weak range and vulnerability to ambient UV rays of Infrared technologies, the Parallax PING Ultrasonic sensor serves as a viable alternative. With a price of $20-$30 the PING offers a range of 2cm to 3m which should be more than adequate. On top of that, the device communicates over a single ping making driving the device incredibly simplistic. The main weaknesses are issues with sound absorbing materials and rippled surfaces, both of which prevent the sound waves from giving an accurate measurement. On top of that, instances where the sensors is at an angle to an object trick the device into thinking it is further from an object than it is. For that reason it would probably be a good idea to have some sort of IR sensors on-board as well to act as secondary collision prevention devices as stated above. Nevertheless, the ultrasonic sensor is relatively affordable and can be easily calibrated to perform dependably stopping just short of RGB capability.

Ben:

In order to reliably provide information about the location of objects, an RGB camera is most appropriate. One option for such a camera is the PIXY CMUcam5 which runs out to about $70. This model boasts the ability to provide the user with raw coordinate values in frame for each of the specified objects based on their color makeup. A major downside, however, is the fact that areas of imperfect lighting (too bright or too dim) confuse the device into returning invalid data. Still, if the implementation is carried out correctly, the PIXY can provide dependable results for applications needing in-depth object tracking.

For cases where a simple distance is needed there are two main options. The first is an ultrasonic sensor such as the Parallax PING sensor which costs about $30. This device specifically has a range of 2cm-3m with some flaws at either end. The only downside is that viewing objects at angles or in noisy areas has the potential to skew results greatly outside of a small acceptance angle. It should also be noted that the implementation is fairly simple. On the other hand, there is the Sharp series of IR sensors which runs around $20 and is far less susceptible to ambient noise. Ambient sunlight does have a potential influence though, but indoor implementations should be fine. While the range is only 4cm-30cm this may be enough for our purposes as it does much better with angles.

One last to consider is basic proximity where it is only necessary to know if the rover is too close to an object. In this scenario a simple IR LED setup combined with receivers, such as the TSOP17 from sparkfun ($1 combined), would perform well enough. Although the range on this is only about 5cm, this may be more than enough for jobs like preventing collisions. The main downside here is that it is necessary to carefully manage the direction of receivers and transmitters to ensure they operate as desired.