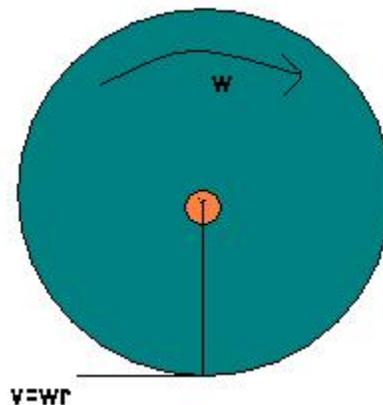


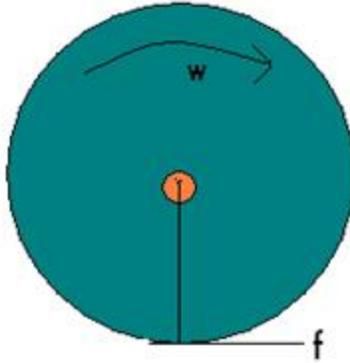
# WHEELS

In this tutorial we will discuss the appropriate diameter of a wheel and the number of wheels required for a bOt. After that I will introduce you to other methods of locomotion and in the second part of the tutorial I will discuss the methods to couple the wheel with a motor.

**Diameter of a wheel:** For selection of 'wheel diameter' you have to consider following important factors:

- ♣ **Speed of bOt:** We always wish that our bOt should move as fast as possible (if we are participating in any rObotic competition then it is necessary 😊), therefore I will suggest you that it is better to opt for wheels with large diameters, as it will increase the speed of bot. The speed of your bot is equal to speed of wheels (while you are moving straight). The speed of the wheel is,  $v = \omega * r$  (as shown in the figure). Therefore, as the radius increases, the speed of the wheel increases and ultimately the speed of your bOt.
- ♣ **Torque:** The other important factor is that as the diameter of the wheel increases the torque required to rotate the wheel also increases because the torque produced by friction opposes the torque of motor.
  - ♣ *Net torque = torque of motor - torque of friction*
  - ♣ The friction is the only external force that acts on system & takes the bOt forward linearly though the torque due to friction opposes the torque produced by motors.
  - ♣ *Torque of friction =  $f * r$*  which increases as the radius of wheels increase.
  - ♣ Related tutorial: [Calculation of Torque and RPM.](#)





### Additional Information

- ♣ 1. Always remember not to buy a wheel that has the diameter close to or less than the diameter of the motor and it should provide sufficient ground clearance.
- ♣ 2. **Traction of wheels:** It is a very important factor and needs to be considered for winning competitions. If your wheel is smooth it will not have much friction it will skid while accelerating or turning. If you wish to increase the traction (grip) of wheel you can make a rubber grip from an old cycle tube. If you need to travel on smooth surface like wet mud you can go for a chain drive.
  
- ♣ **Number of wheels?** We can opt for three wheels or more wheels for our bOt. The bOt needs to have a minimum three wheels which is required for static stability (in real life as you can see two wheelers need a stand while at rest in parking but three wheelers don't 😊). The other main choice that we generally use is four wheels. As the number of wheels increases the bOt will have improved mobility and better capability of obstacle negotiability but it also increases complexity and there is hardly any advantage of having more than four wheels. Still if you wish you can opt for 6 and maximum 8 wheels. Related Tutorial: Drive trains [Coming soon]

- ♣ **Locomotion:** Locomotion means movement. Just like we have legs, kangaroos jump, snakes crawl and fishes swim (the ways of locomotion that are generally found in nature); in robotics, we can have wheels, tracks & also legged bOts. Legged bOt are very unstable and it will take a lot of time, experience and research to build your own legged bOt, therefore it is generally preferred to make a wheeled or tracked bot.

(Caution: As a beginner never try making your own legged bot, though you can try making a legged bOt from a kit)

Each way of locomotion has its own pros & cons and therefore let's compare the different modes of locomotion:-

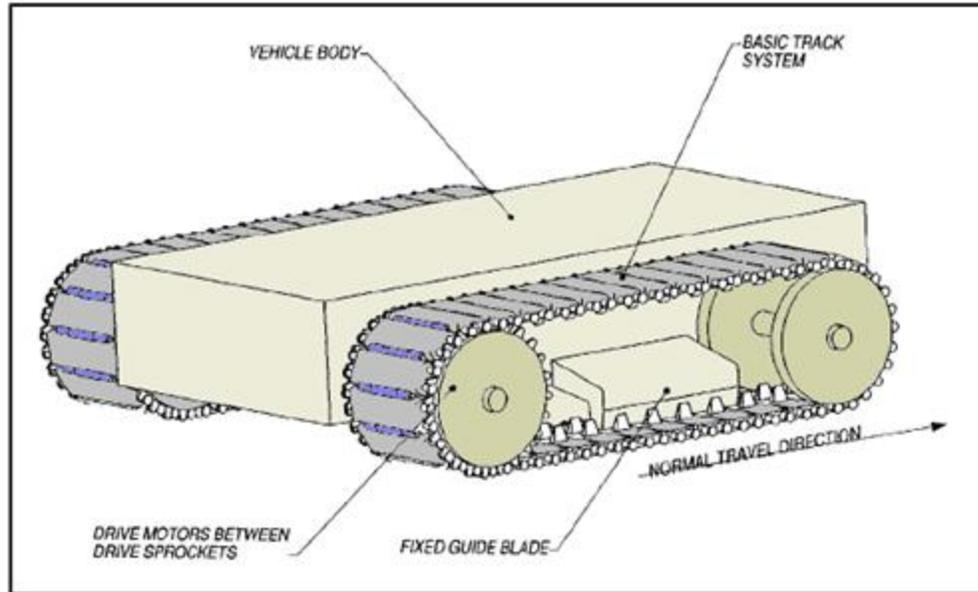
- ♣ **WHEELED:** They can be made easily and are the can be most easily controlled while making an autonomous bot. For turning you can use a differential drive or Ackerman steering.
- ♣ **TRACKED:** Tracked bot has improved mobility over the wheeled bots. For turning you can again make a differential drive.

♣ Pros:

- ♣ very soft terrain: loose sand, deep mud, and soft powder snow
- ♣ obstacles of a size that can get jammed between wheels
- ♣ crevasses
- ♣ tracks have better ability to climb stairs than wheeled

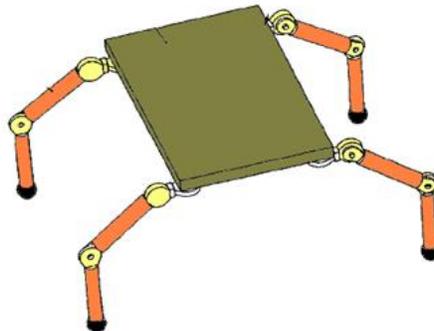
♣ Cons:

- ♣ increased rolling friction, lowers the efficiency



- ♣ **LEGS**: they have poor stability and are difficult to control without sensors. Stability is a major concern in walking robots, because they tend to be tall and top heavy.

Related Tutorial: Legged bOt [Coming Soon]



### Where can you find wheels?

Some places where you can find wheels easily are like old toy car, supporting wheels of cycle, roboshops, etc. It can cost anything between Rs 20 - Rs 100 per wheel and if you are going for a belt drive it will cost you around Rs 500 - 700.

Source : <http://www.botskool.com/tutorials/mechanical/wheels>