

Mobile Robot Locomotion

- *locomotion* - mechanism used to move
- common approaches - wheels, tracks, and legs
- considerations - terrain, mechanical complexity, and control complexity

Wheeled: Differential Drive



Key Features:

- two powered wheels
- one or two castor wheels for balance

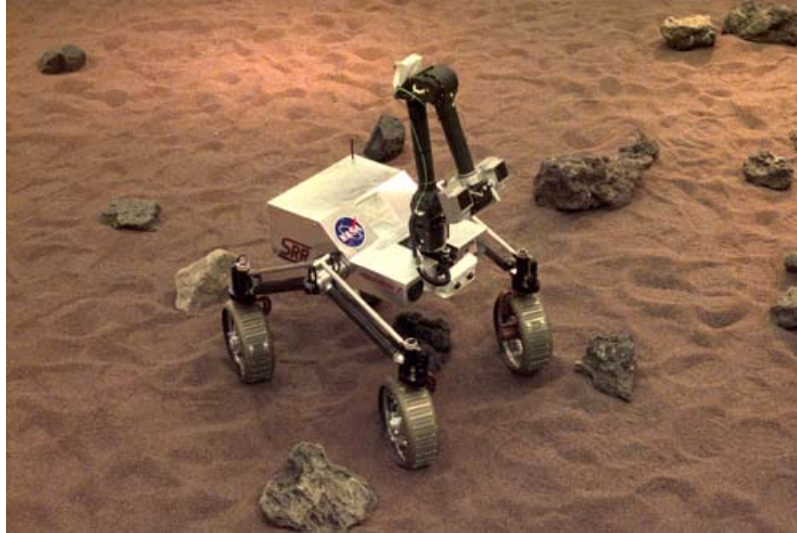


- mechanically simple
- turns in place
- two motors



- rough terrain troubles
 - potential for traction loss with two casters
 - tipping with one caster
- coupled speed and direction

Wheeled: Synchro Drive



Key Features:

- all wheels powered
- all wheels steer

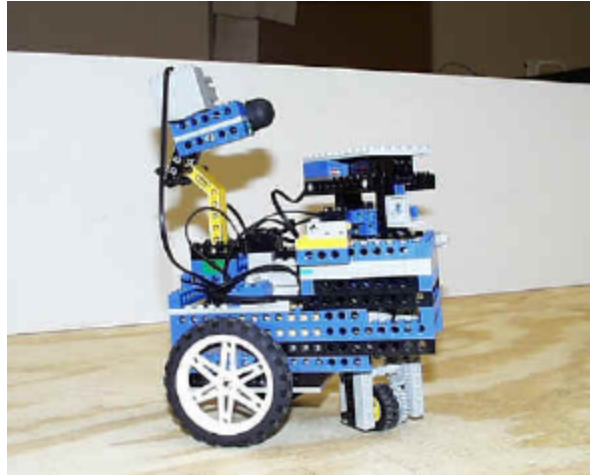


- “turns” in place by rotating wheels
- four or more wheels make it good for rough terrain



- mechanically complex
 - each wheel has steering and power motors
- complex to control
 - many motors to control
 - where’s the front?

Wheeled: Tricycle



Key Features:

- one motor powers (on front wheel or through rear differential)
- one motor on front wheel steers

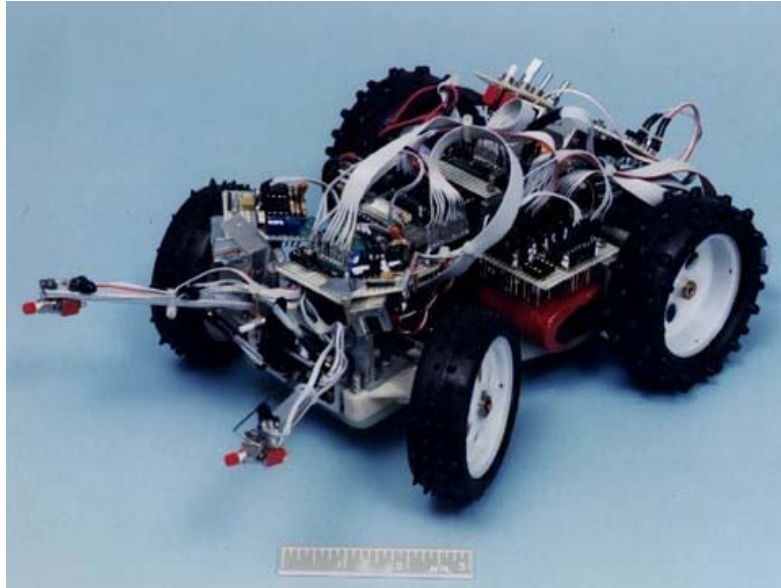


- easy to control
 - steering and speed decoupled
- two motors





- can't rotate in place
- prone to tipping on rough terrain
- slight mechanical complexity
 - need rear differential to eliminate slipping or
 - mount both steering and power motors on front wheel

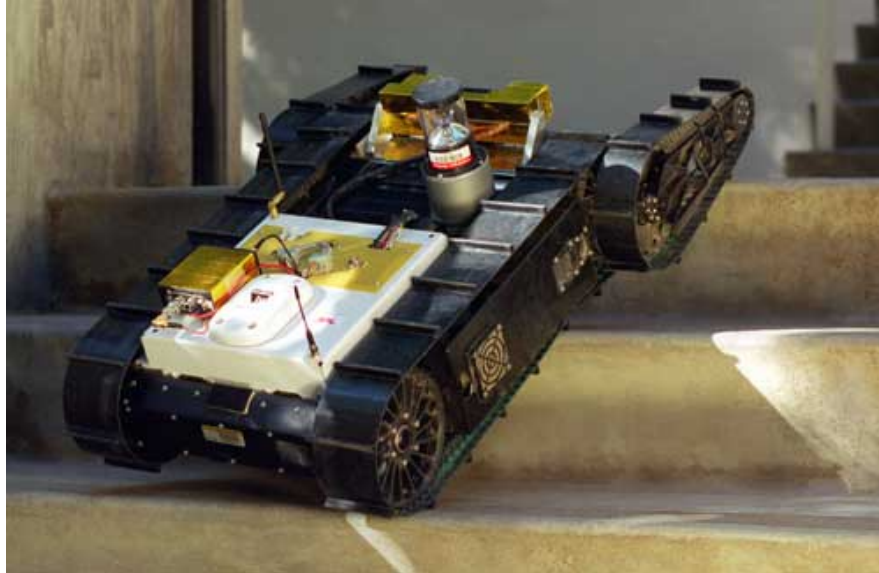
Wheeled: Car Type



Key Features:

- one motor powers through rear differential
 - one motor steers front two wheels
-  
- | | |
|---|---|
| <ul style="list-style-type: none">• good for rough terrain• easy to control<ul style="list-style-type: none">– steering and speed decoupled• two motors | <ul style="list-style-type: none">• can't rotate in place• mechanically complex<ul style="list-style-type: none">– need rear differential to eliminate slipping– need to steer front wheels same amount |
|---|---|

Tracked



Key Features:

- power two tracks independently

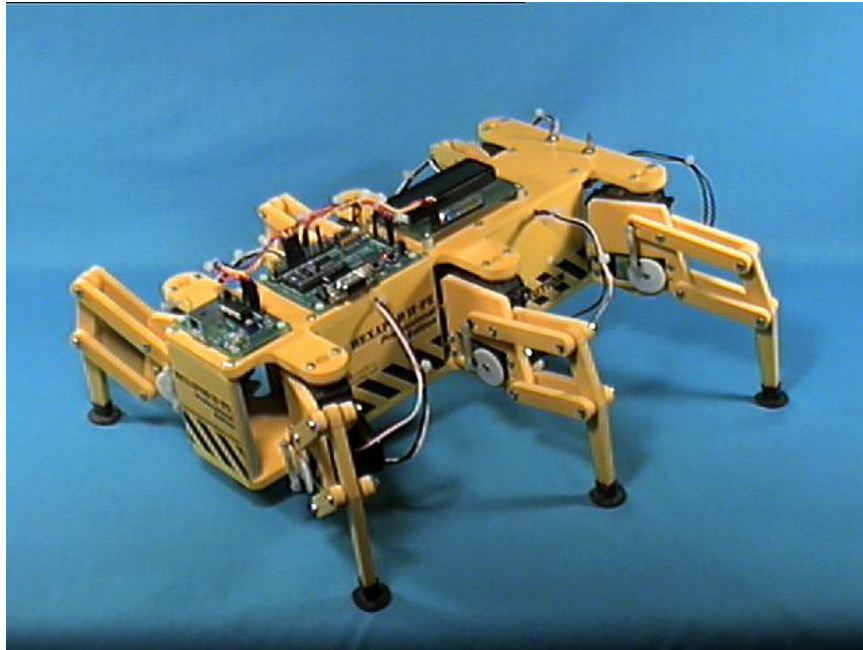


- turns in place
- good for rough terrain
 - stable
 - hard to high center
 - good traction
- one or two motors



- requires slipping to turn
- coupled speed and direction
- high friction, high loss
- mechanically complex
 - keeping track in tension difficult

Walking



Key Features:

- multiple legs work together for motion



- good for rough terrain
 - good articulation
 - stable
 - good traction



- can't turn in place
- slow
- complex to control
 - difficult to make move, much less steer
- mechanically complex
 - each leg requires actuation to lift and move forward/backward
 - potential for multiple motors per leg