ROBOTICS LECTURE SERIES
(Lecture 1 –Introduction)

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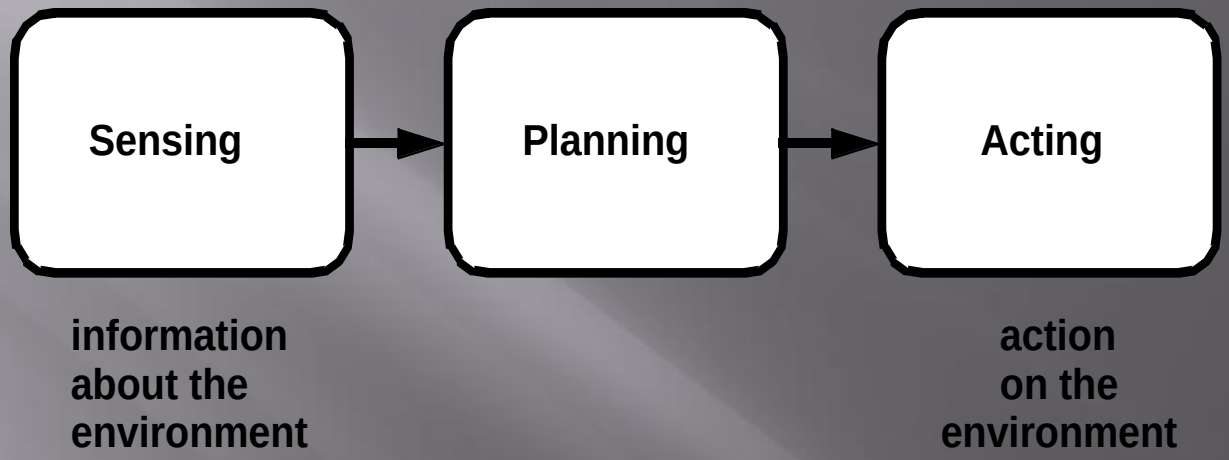
Machines v/s Robots



- Robots have feedback control systems, machines don't.
- A robot is a machine that could be re-programmed to do many different functions and operations.

Basic parts of a robot

- Chassis – To provide a frame for the robot
- Motors – Locomotion
- Sensors – To interact with the surrounding
- Microcontroller- Brain of the robot
- Other Circuits –Motor Drivers etc.
- Batteries

WHEELS

CASTER WHEELS

OMNIDIRECTIONAL WHEELS

ACTUATORS

1. Motors
2. IC Engines
3. Pneumatics
4. Hydraulics

MOTORS

- DC MOTORS
- STEPPER MOTORS
- SERVO MOTORS
- WORM GEAR MOTORS

DC MOTOR

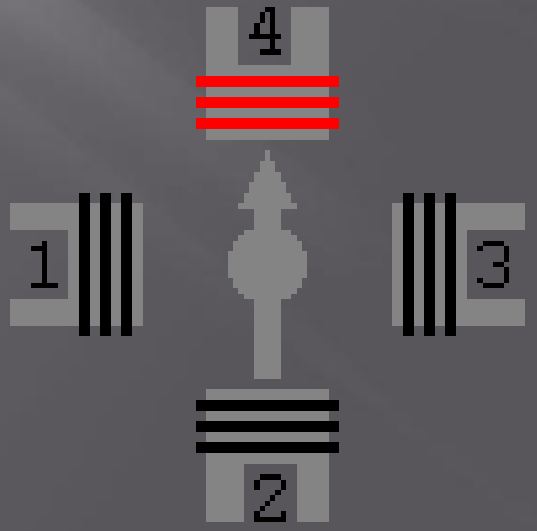
- High power to weight ratio
- No inbuilt control mechanism
- Control system requires feedback

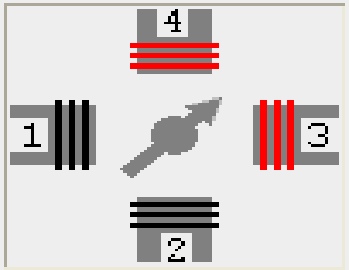
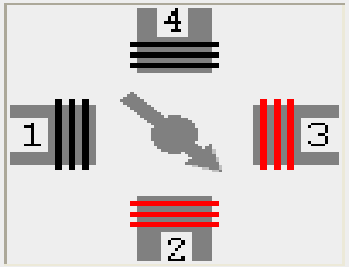
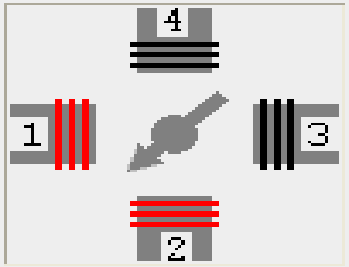
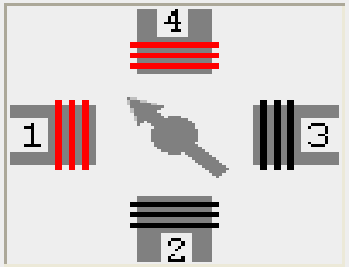
Using gears, the high speed of the motor is traded off into torque

Control system require encoders or other methods.

Stepper Motor

- Angle control
- Slow
- Accurate positioning
- Easy to control



Step	Coil 4	Coil 3	Coil 2	Coil 1	
b.1	on	on	off	off	
b.2	off	on	on	off	
b.3	off	off	on	on	
b.4	on	off	off	on	

SERVOS

Servos are DC motors with built in gearing and feedback control loop circuitry.

- It is used to rotate a specific angle.
- It cannot rotate more than 180 degrees.
- Feedback ensures that the shaft rotates accurately.

WORM GEAR MOTOR

- A worm drive can reduce rotational speed or allow higher torque to be transmitted.
- Used by us to lift heavy loads.

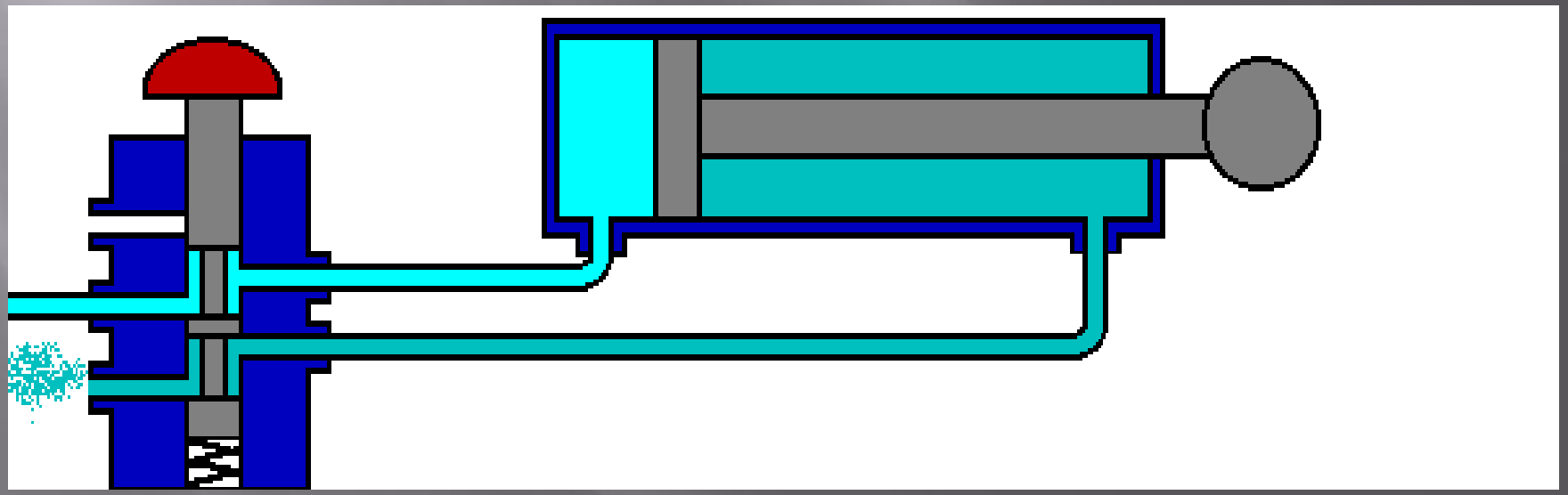
Hydraulic Actuators

- Energy of the fluid is used to cause motion.
- It can be used for linear as well as rotatory motion.

Pneumatic Actuators

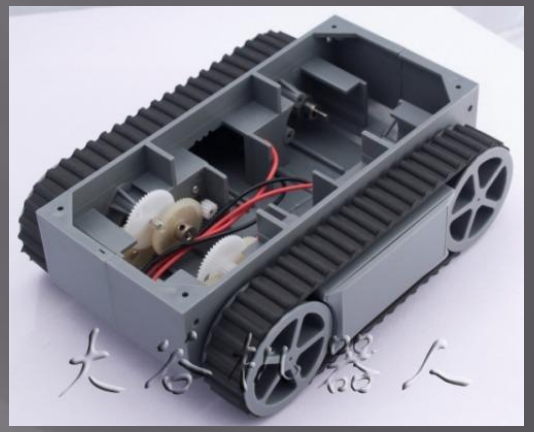
- A **pneumatic actuator** converts energy (typically in the

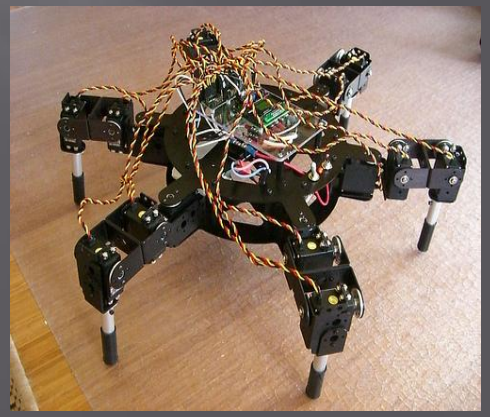
form of compressed air) into motion.



DRIVES

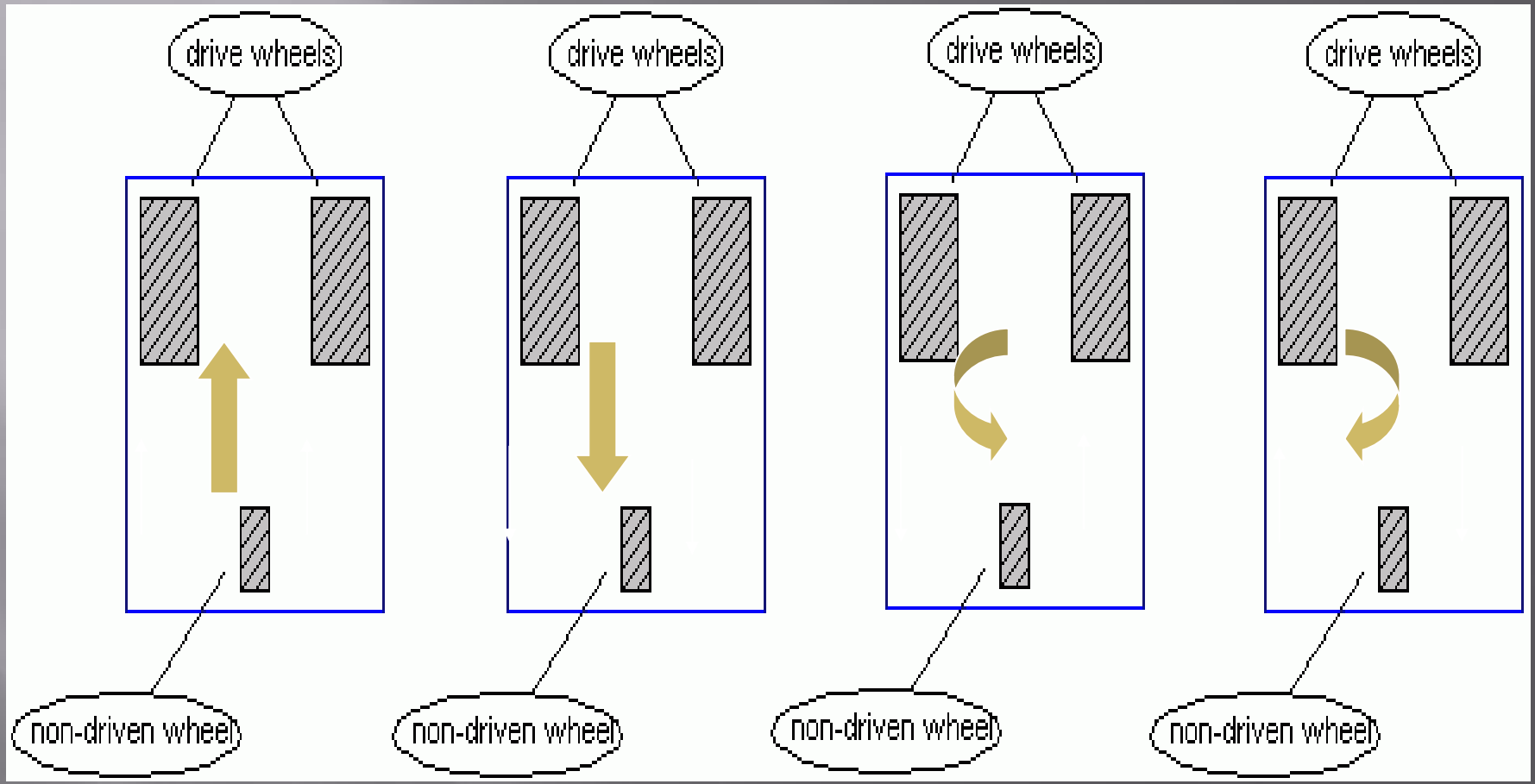
- Differential Drive
- Steering Drive
- Omni Drive
- Skid Steer Drive
- Synchronous Drive
- Pivot Drive





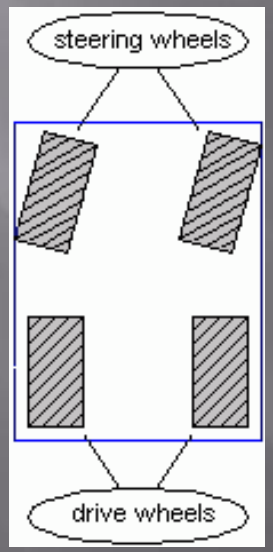
Differential Drive

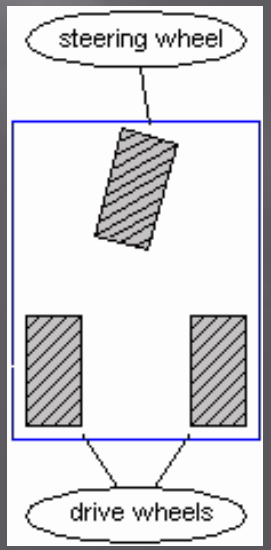
- Simplest and easiest to implement.
- It can also be 3 or 4 wheel drive.
- 3 wheel drive has a free moving wheel accompanied with a left and right wheel. The two wheels are separately powered.
- Generating a couple.
- Independent drives makes it difficult for straight line motion

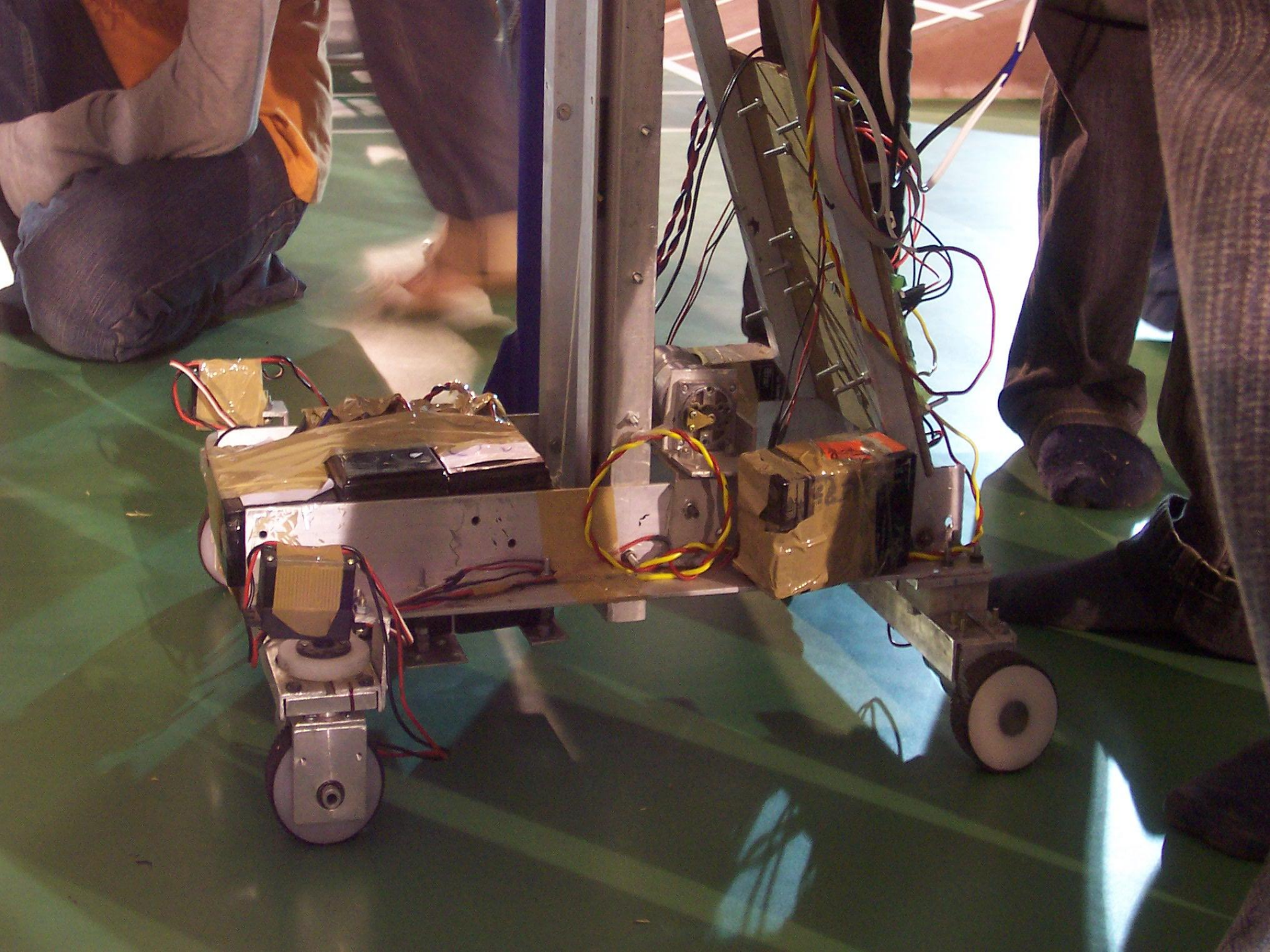

drive wheels
drive wheels
drive wheels
drive wheels
non-driven wheel
non-driven wheel
non-driven wheel
non-driven wheel

Steering

- Can be 3 or 4 wheel.
- Using guiding wheels to steer the bot
- Generally used in three wheel drive
- Not effective to take a very sharp turn

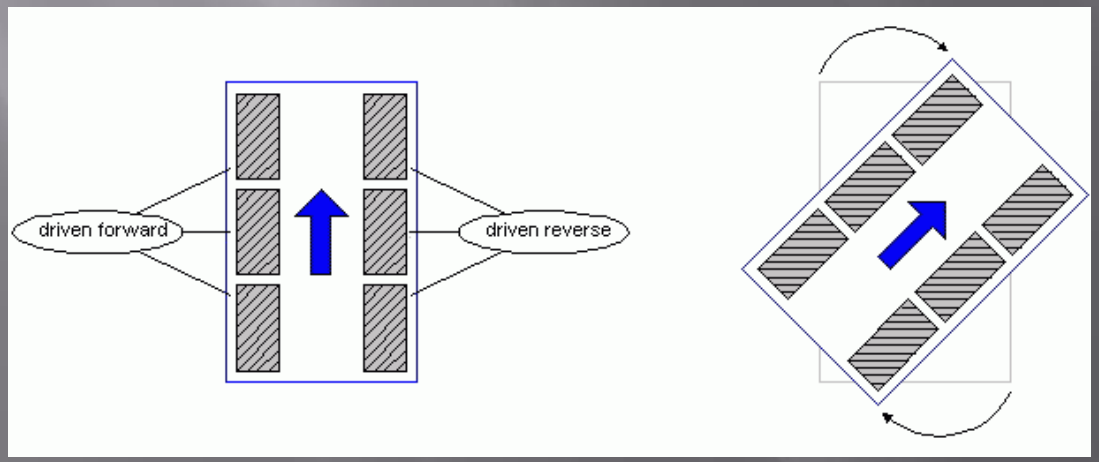






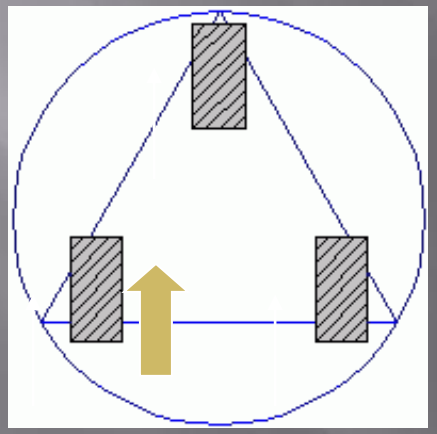
Skid Steer Drive

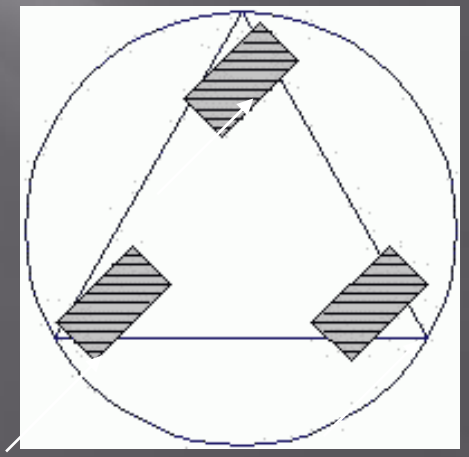
- It is mostly used in tracked machines e.g. tanks. Also finds application in some four / six wheeled robots
- The left and right wheels are driven independently
- Steering is accomplished by actuating each side at a different rate or in a different direction, causing the wheels or tracks to slip, or skid, on the ground



Synchronous Drive

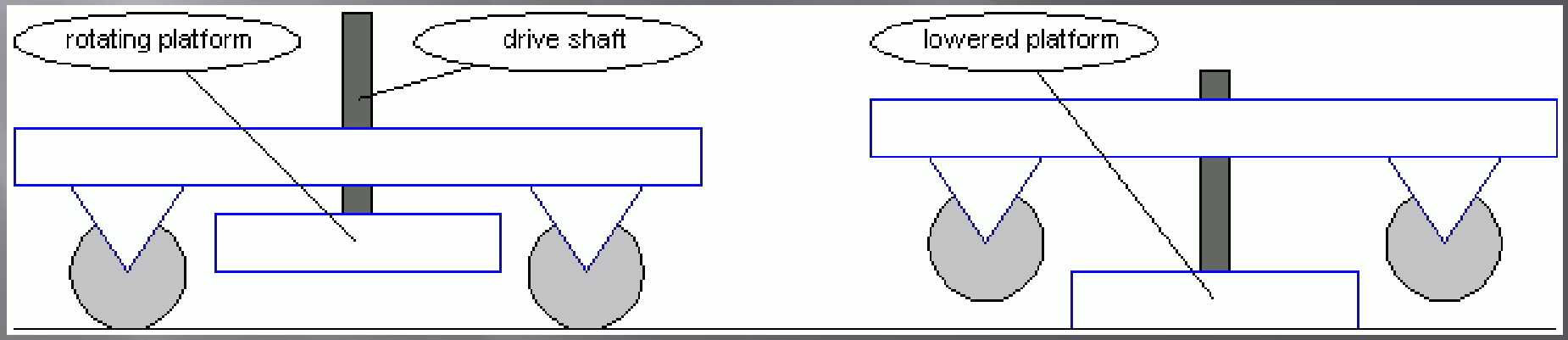
- It is made up of a system of motors. One set of which drive the wheels and the other set turns the wheels in a synchronous fashion





Pivot Drive

- It is composed of a four wheeled chassis and a platform that can be raised or lowered and rotated.



Types of gears

- Spur Gear
- Helical Gear
- Bevel Gear
- Worm Gear

Spur gears

- Used to modify output power from source (motor)
- Main component of many gearboxes
- Relatively lossy in comparison to helical gears ; upto 15% power loss for each gear pair

Helical gears

- Similar to spur gears but shape and orientation of teeth are different
- Provide smooth and noise free operation as compared to spur gears
- Transmission losses are lesser due to proper teeth engagement
- Costly to manufacture

Bevel gears

- Main purpose of use is to transmit power at an angle (90 in most cases) with or without reduction
- 2 types :- straight and helical

Worm gear

- Good for high torque transmissions though bit slower operation
- Unidirectional in terms power transfer.
- Power transmitted from worm to the spur gear

Reduction ratio

- The ratio of the angular speed of the two gears in engagement is equal to the inverse ratio of their diameters.
- If the rpm is reduced the torque gets increased and vice-versa in a transmission
- Reduction ratios as high as 512:1 can be achieved..

Thank You

Queries???