

TIPS ON MECHANICAL DESIGN

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Design Approach

- ① Theme of the Game
- ① Basic motions
- ① Structural and dimensional constraints
- ① Strategy
- ① Local market availability and manufacturability

Design of Mechanical structure

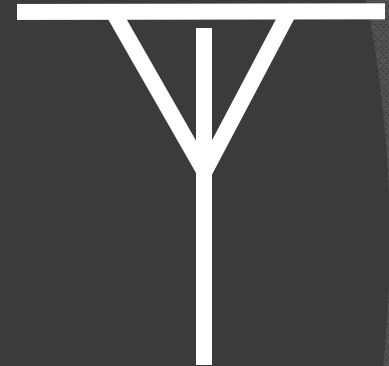
- ① Begin with rough calculations and sketches
- ① Use AUTOCAD or other software for a detailed designing
- ① Select different types of materials which are available in the local market and could be used for the robot fabrication.

Design of Mechanism

- ① Identify the tasks to be performed by the robot
- ① Find out the way to complete the task
- ① Design the simplest possible mechanism to tackle the problem (KISS – Keep it Simple and Straight)
 - Simple is reliable
 - Easy to find out the fault in the robot and repair them quickly

Design of Base

- May be of any shape and size unless it exceeds the limitation



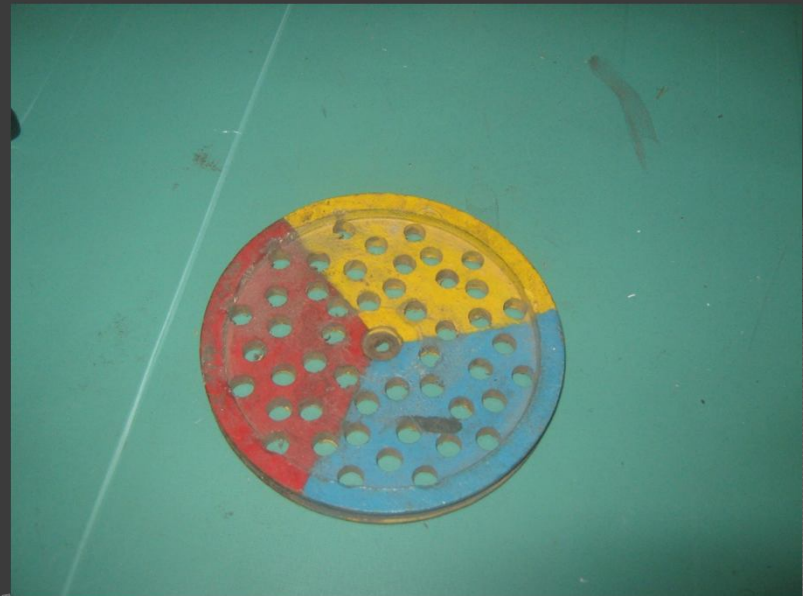
- The center of gravity of the machine should always lie within the base
- Heavy and fragile parts should be fixed on the base

Arms of Robot

- Specifically designed for grabbing objects
- Material must be light and strong
- Heavy parts should be avoided as far as possible
- Motors should be used only for actuating purpose

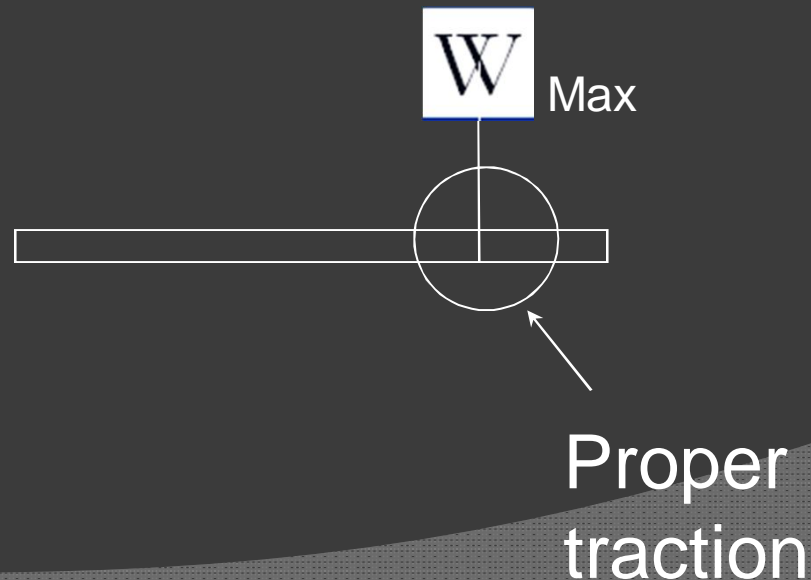
Wheels

- ⦿ Both readymade or fabricated wheels can be used
- ⦿ Nylons and woods are generally used to fabricate wheels



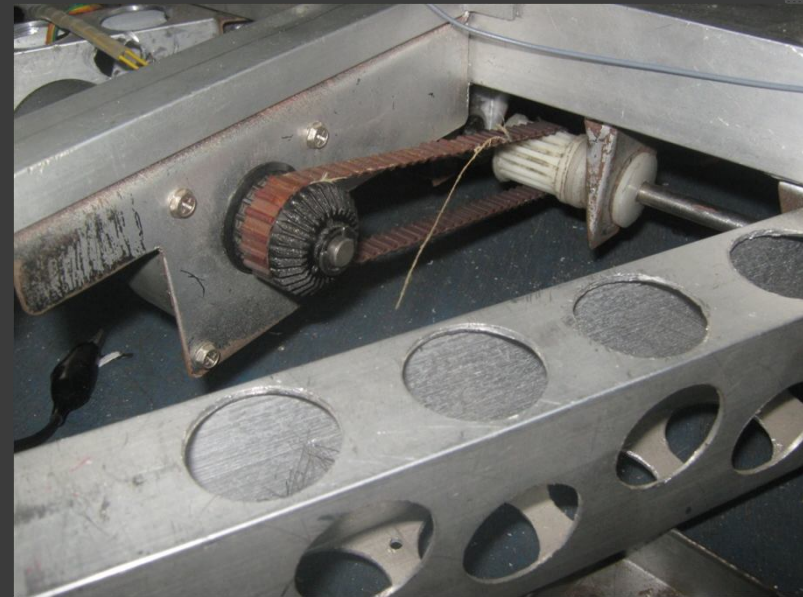
Wheels cont...

- Suitable material can be used around the wheel circumference to increase the traction
- Problem may arise due to the wrong position of the wheel
- Place heavy parts above the wheel axis



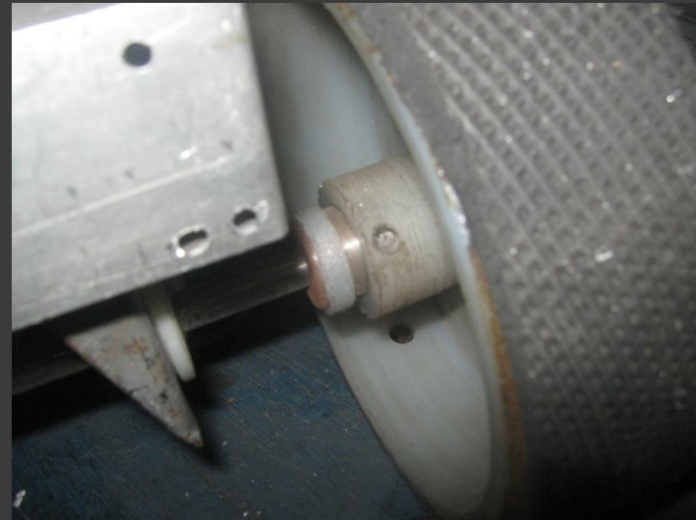
Wheel Coupling

- May be direct coupled or transmitted through belt



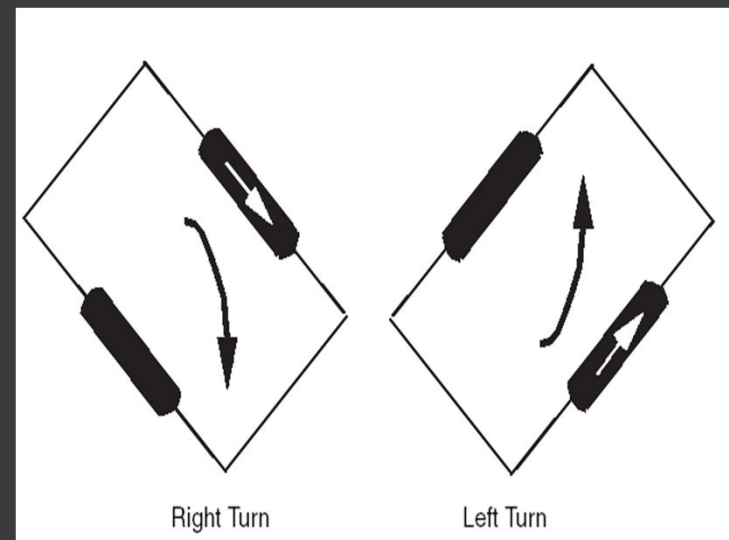
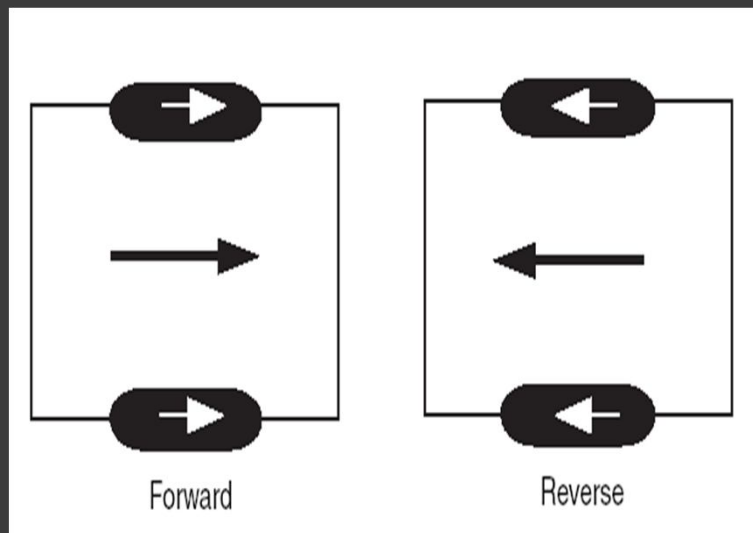
Backlash Problem

- ⦿ Occurs due to loose coupling or some may be due to the motor itself
- ⦿ Leads to problem in direction control and late response
- ⦿ Can be solved either by fastening bolts or introducing keyways in the shaft



Steering Robot

- Obtained by the RPM difference of the driving wheel



Robot Steering

- Base should be equipped with Omni wheels

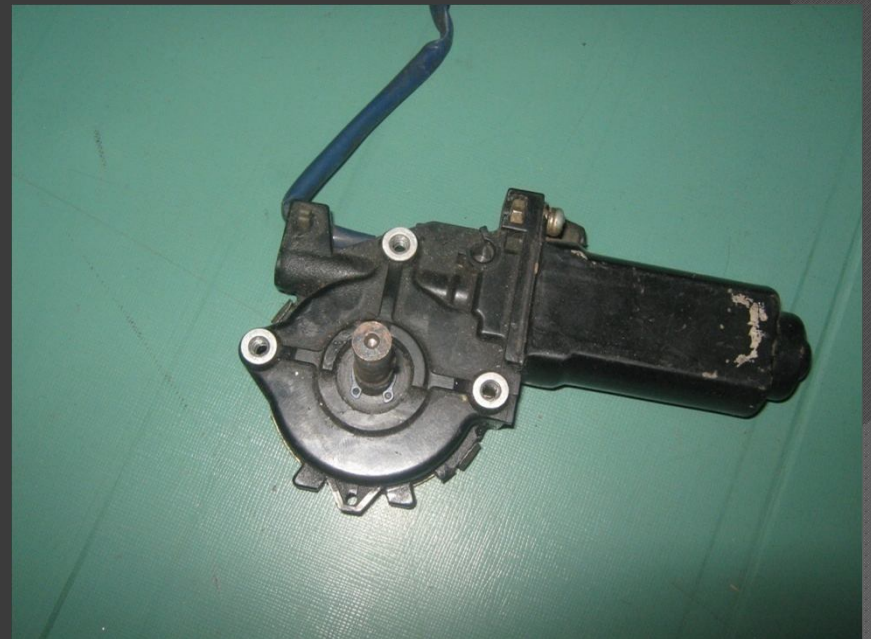


Sensors Placement

- ① Most of the problem are related to sensor placement
- ① The sensors must be isolated from any ambient light
- ① As far as possible ,the sensor holder should not be fitted rigid with the robot base.
- ① The holder should be aligned with the ground

Motors

- ⦿ Wiper motors are locally available
- ⦿ Suitable for driving wheels



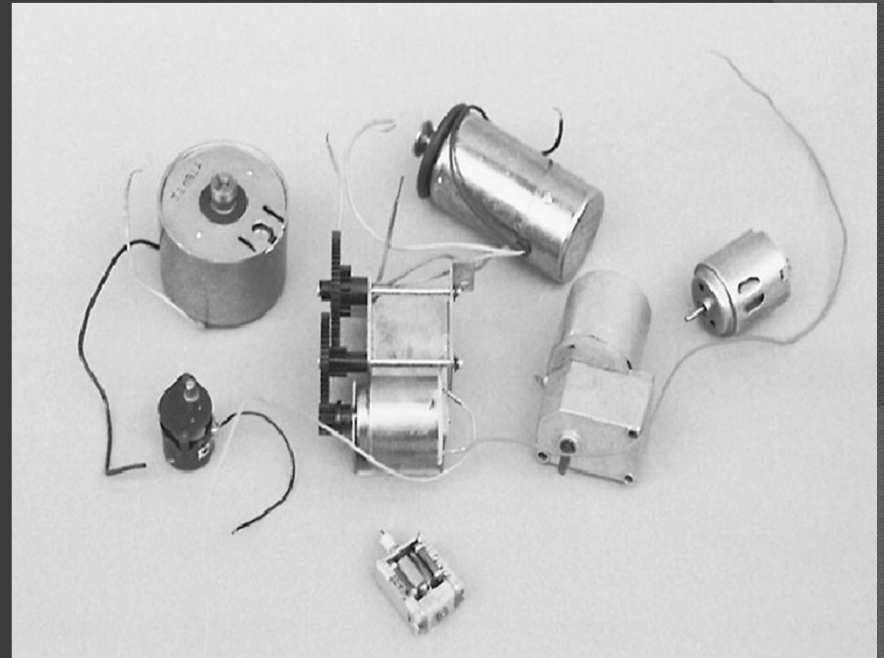
Light Motors

- Some of the light motors are available in Nepalese market
- They are light weight but not quite reliable
- Suitable for low torque requirement



High Performance Motors

- ⦿ Motors of different RPM and torque are available through



Weight Limitation

- ④ Weight of the robot should be carefully controlled
- ④ Use aluminum sections



Use of Fasteners

- Pop-up rivets are best solution
- Angle plates may be made of either aluminum or mild-steel



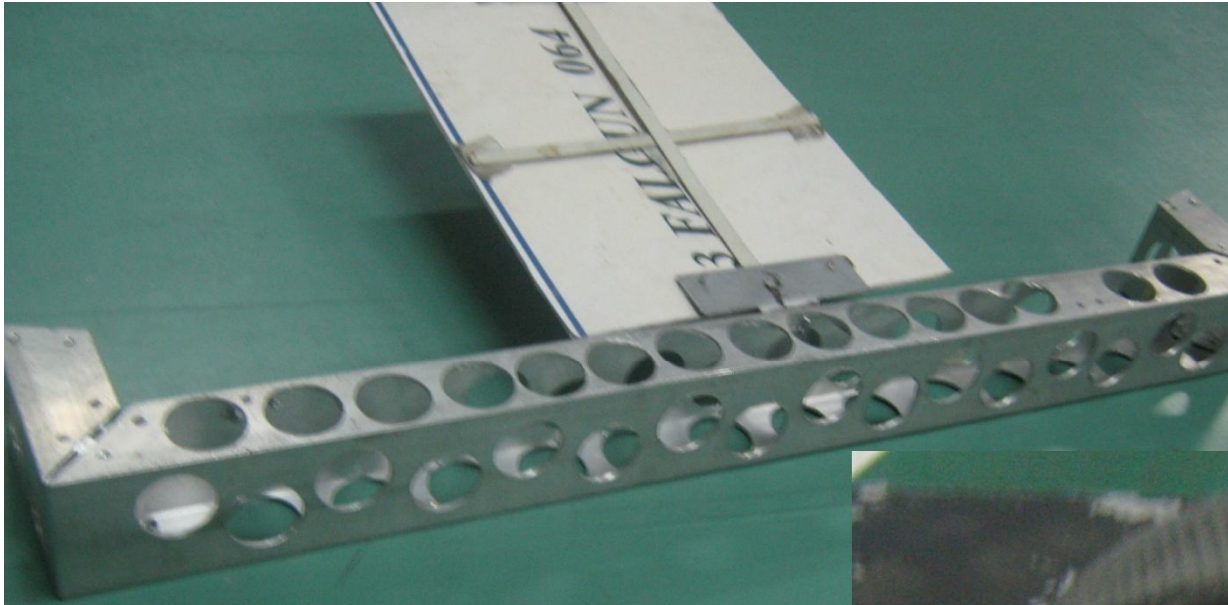
Weight Limitation

- ① Use nylons and wood stocks instead of mild-steel for parts like pulley, bush etc.
- ① Strength should be considered



Weight Limitation

- ⦿ Remove any un-necessary materials
- ⦿ Drilling may be useful to reduce weight
- ⦿ Mechanisms should light
- ⦿ Use of strings may be helpful



Decoration and Protection

- ① Robot parts must be well protected while storing
- ① Metallic parts are to be oiled and greased properly
- ① Spray and enamel paints may be helpful for protection and outlook of the machine

Power Sources

- Most of the battery used are of 6V or 9V
- Sealed lead acid batteries are durable but are heavy and charging takes time
- Nickel- cadmium batteries are light, handy and are charged within a short time but are expensive
- Use of low quality battery may be a source of electrical noise
- If possible batteries are to be placed above the wheel axis



Tools For Workshop

- Portable Drilling Machines
- Hack-shaw
- Pliers
- Mallets & Hammers
- Bench-Vice

Safety in Workshop

- Safety Gloves and Goggles
- Ear-plugs

Shopping of materials

- ⦿ Mechanical
- ⦿ Electrical
- ⦿ Electronics
- ⦿ Accessories

Buying Mechanical Parts

- ◎ TEKU may be the best destination for buying mechanical parts
- ◎ Shops which sell hardware or automobile spare parts
- ◎ Junkyards may be a good option for inexpensive parts but do not use bearings like parts obtained from there
- ◎ Small bearings are often used while fabrication of the robots.

These bearings are available in some of the specific shops around Teku and 'Pacific Enterprises' Mahaboudha

Buying mechanical parts cont...

Some shops

Nuts, Bolts: Amit Auto Traders, Teku

Bearings: Macto Enterprises, Teku

Aluminum and other sections: Rajesh
Trade Link, Teku , Girish Enterprises,
Putalisadak

Used parts: Junkyards , Teku

Tools: Pashupati Traders, Teku

Documentation

Thank You!!