Assignment 1
ME 639 - Introduction to Robotics

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Tasks:

1. Chapter 1 of the textbook read.

2. Examples of each of the seven categories of robots mentioned in the class:
    a. Manipulators:
        i. SCARA - Selective Compliance Assembly Robot Arm: link
        It is an industrial robot specialized for pick and drop tasks. It has the ability to fold itself up and contract back from small passages too. It has a parallel axis joint layout.
        ii. Canadarm - Shuttle Remote Manipulator System (SRMS): link
        It was made for the purpose of repair satellites, move cargo, and also position astronauts. There are three joints - wrist, elbow, and shoulder, and each of these joints has one degree of freedom.
    b. Mobile robots (ground):
        i. Cargobot XS - Sterela Robotics: link
        It is designed for the industrial environment. It has person tracking as well
        ii. KUKA youBot: link
        It is a mobile robotic arm. It has five degrees of freedom as well as a linear gripper.
    c. Aerial robots (Unmanned Aerial Vehicles - UAV):
        i. CyberQuad: link
        Remote-controlled UAV. Foru rotors to provide it with helicopter-type UAV stability. VTOL (Vertical take off and landing) capability along with hovering capability.
        ii. NASA's Global Hawk: link
        The Armstrong Flight Research Center has two unmanned aircraft, known as Global Hawk, that roam for high-altitude, long-duration missions.
    d. Underwater robots (Autonomous Underwater Vehicle - AUV):
        i. BPAUV - Battlespace Preparation Autonomous Underwater Vehicle: link
        The main aim of this underwater robot is to map the ocean floor near the shore and detect any changes that might occur. It is also used for hunting down underwater mines.
        ii. Blackghost AUV: link
        The design of this AUV is aimed at allowing it to be deplyoyed through holes in the ARtic ice sheet.

e. Soft robots:
    i. Meshworm (MIT earthworm robo)t: link
    It still moves when it is hammered or stepped upon. It is made of soft materials. Thebody is made of meshlike structure and is named after that.
    ii. MIT origami robot: link
    It is controlled by magnetic fields. The robot is almost a centimeter ling and can carry weight twice its own. Also, it can clim and swim.
f. Microrobots:
    i. Micro-scallops: link
    They are able to swim through body fluids (including blood and eyball fluids, that are non-Newtonian fluids).
    ii. RoboBees - Autonomous Flying Microbots: link
    Their potential use is in crop pollination, weather monitoring, search missions. It is of the size of a half paper clip.
g. Hybrid:
    i. Snake Monster - Roller-walker robot: link
    It is capable of mulit-modal mobility and in the provided link it is capable of two modes - walking and roller skating. The wheels of the robot are capable of both the types by only changing their orientation.
    ii. Robot Epi. q-1: link
    When it encounters an obstacle, it climbs it after bumping into it. The legs of the wheels can open and close depending on the requirement. ALso, the three wheels can acts as one unit.

3. Most common types of motors:
    a. Brushed DC motor: They are designed to run on DC current. When the current passes through the coil around the soft iron core, the positive pole side experiences an upward force. And the negative pole experiences a downward force. And then the direction of the current through the coil changes and the magnetic field is reversed to complete the cycle.
    b. Brushless DC motor: Works on DC current and uses a controller that adjusts the phase as well as the amplitude of the incoling DC current (in contrast to the brushes in above motor type).
    c. Stepper motor: This is a special type of brushless DC motor that has different steps (parts of a full rotation). The position of the motor can be controlled and it can be held still at these steps.
    d. Synchronous AC motor: It is designed to work on AC current. In this motor, the rotation of the shaft becomes synchronous to the frequency of the incoming AC current (rotation period = number of AC cycles). The electromagnets on the stator of this motor create a filed (magnetic field) that rotates with the oscillating current.

e. Asynchronous AC motor: In this morot, the required current for torque production is made form the electromagnetic induction from the stator winding magnetic field. The motor can be thus, amde without tany electrical connections to the rotor.
f. Servo motor: It can control the angular (or linear) position, velocity as well as acceleration. A suitable motor is coupled with a sensor. It sends feedback to a controller that is designed for this sole purpose. It is a closed-loop mechanism. There is an encoder that relates the position of the motor for controlling it.

4. Reviewed kinematic principles.

5. Reviewed given information in the link.

References:

1. The Canadian Encyclopedia - link
2. Sterela Robotics - link
3. MIT news - link
4. IEEE Spectrum - link
5. Wikipedia