Intro. To Robotics Midsem

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Ans-2a A compliant/soft gripper will be more suitable for pill picking as compared to a hard gripper. The gripping force range that can be used to pick the pill without damaging it can be determined analytically. The force value outside this range may either not provide an effective grip to pick the pill or may damage the shape of the pill. When an object is gripped then there is some shape change associated with both object and gripper which increases the friction between them. This shape change must be within elastic limits. Pills are very delicate and can only undergo a very negligible deformation. Hard grippers also do not undergo deformation and thus it becomes very difficult to apply an exact gripping force to pick the pills. On the other hand, compliant/soft grippers change their shape to enhance the gripping of the object without any additional normal force. The gripping in soft grippers can be achieved by actuation or by controlled stiffness or controlled adhesion. Hard grippers with adaptive fingers need more actuation as their fingers have multiple links. Increasing the number of motors in the gripper will make it larger and heavier. Underactuation can be effectively dealt with in soft grippers. Soft grippers with small size and high dexterity have also been developed recently.

2b- Paper grippers and soft grippers can be the possible solution for the pill picking robot. Paper grippers are light, easy to actuation, cost-effective, avoid grasping damages and easy to fabricate. But it is difficult to achieve dexterity with paper grippers which restrict their use for many geometries. The paper gripper provides a good solution for the picking of soft, small and light objects. Two paper grippers have been proposed in the link, the 3D-folded paper for the objects requiring high grasping and flat shaped gripper for easy to grasp objects,

Most soft grippers are generally actuated by pneumatic pressure. This requires the use of more equipment and also hinders the dexterity and miniaturization of the gripper. A cabled driven approach has been used in the smart soft gripper that solves these problems and provides a good solution for the pill picking robot.

Ans-3a hip-to-knee distance = 47 cm
Knee-to-ankle distance = 40 cm
(Approx. distances by measurement)

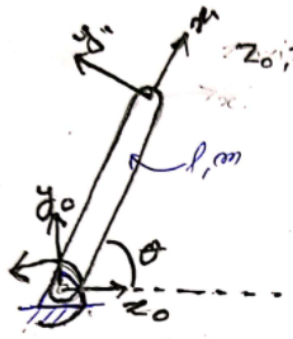
Gait trajectory- The trajectory followed by the lower limbs and segments during locomotion.

Step Height- the maximum vertical displacement of the foot while walking.

Step length- Distance between the initial positions of the footsteps of right and left foot while walking.

Ans-4a

Single link Robot –



DH parameters

link	θ_i	d_i	a_i	α_i
1	θ	0	l	0

Ans-5 Yes

Ans-6 No, the origin can be taken anywhere on the respective z-axis

Ans-7 Yes, a homogeneous transformation matrix is a 4*4 matrix, and written as H=[[R,d],[0,1]]. R is the rotation matrix and d is the translation along x,y and z.

Ans-8 Yes, when the rotations are performed wrto to the current axis, the rotation matrices for each individual rotation can be multiplied together to form the overall rotation matrix. In case of rotation about the fixed axis, the individual rotation matrices are multiplied in reverse order to give the overall rotation matrix.

Ans-9 Yes