SCARA

What have we done?

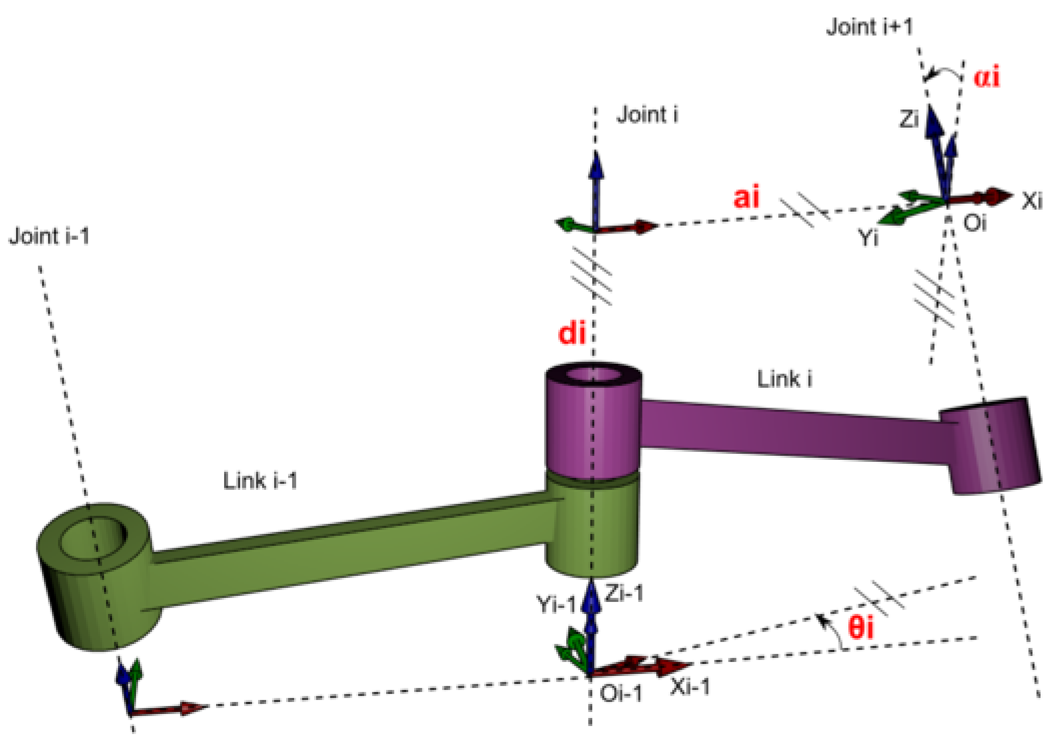
1. Study about the various methods of representations of rotations and transformation matrices.Introduced to the concept of 'groups' .
2. Learn and code for on MATLAB for the multiplicity of quaternions and rotation matrices.Also to operate Arduino through Matlab Arduino support.Learn and use 'GUIDE' tools from Matlab and make an interactive UI for the system so that the Arduino and hence the SCARA can be controlled using a GUI.
3. Learn the appropriate placing of origins and their orientations in links.
4. We have made a detailed report on servo motors and stepper motors then, compared both the motors and then decided which kind of motor are best for our application .
5. We understood the working principle of servo and stepper motor and controlling them through arduino

Notes:

1. Understood the forward kinematics of a robot using the Denavit-Hartenberg method

   We can note constraints on the relationships between the axes:

   - the x_n-axis is perpendicular to both the z_{n-1} and z_n axes
   - the x_n-axis intersects both z_{n-1} and z_n axes
   - the origin of joint n is at the intersection of x_n and z_n
   - y_n completes a right-handed reference frame based on x_n and z_n
2.



3.
4. Theta is measured with respect to previous axis, all other parameters with respect to new axis.

SCARA

5. Got to know how to find the degrees of freedom for a system using Grubler's criterion.
   $DOF = \lambda(n - j - 1) + \Sigma fi$
   λ = no. of DOF in space (3 for planar and 6 for 3d space)
   n=no. Of links in the system (base considered as link 0)
   j = no. of joints
   f_i = no. of DOF permitted by joint j_i
   Or
   $DOF = \lambda(n - 1) - \Sigma Ci$; *where Ci is no. of constraint per joint*
6. Only two DH parameters can be variable (Θ *and* d) , but in special cases theta and d may be inter-related.

Mistakes

1. Realise further in the week that we initially thought a SCARA arm is of type PRR, later realised that it is RRP
2. The orientation of the z axis is always along the link, is incorrect. It will always be along the orientation of the motion/
3. Thought that all servo motors can only rotate only about 180 degrees later realised that , those are a specific kind of servos motors.
4. Started to code for specific case of forward kinematics only, did not start to design the system according to inverse kinematics.
5. We failed to note the four rules of Denavit-Hartenberg parameters as below

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Hardware made/ Acquired:

1. We are using an arduino board, servo, stepper motor and getting used to the interface.

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