**Aim:**

The major defect of an Industrial Manipulator or geometrically operated manipulation devices are their inability adjust to the environment and their deficiency in thinking. However, when a machine is taught the knowledge of their geometrical position in 3-dimensional space and position of their target, they can manipulate with utmost precision. The aim of this project is to test the ability of machines to think based on this geometric coordinates.

A manipulator fitted on the back of a mobile robot will be used for testing the experiments. The aim of this mobile robot manipulator is to locate their target in a cluttered space and pick their target avoiding collisions with environment using feedback data from required sensors.

(Insert a diagrammatic image of the idea)

However, achieving the required task requires the following tasks to be accomplished.

1. Development of an accurate localization scheme based on odometric data for a mobile robot who can position themselves in a 2D space
2. Development of an accurate IK scheme who can estimate the joint co ordinates based on the geometrical location of their base and the target.
3. Detection of collision and recalculating Inverse Kinematics based on feedback from sensors.
4. Improving the accuracy of manipulation.
5. **Development of an accurate localization scheme based on odometric data for a mobile robot who can position themselves in a 2D space:**

The theoretical formulas to estimate the current position of the dynamic system in a 2D workspace who has their knowledge of the starting position in 2D and orientation with reference to Z-axis is obtained from [1]. Calculations were made using the formulas presented in the research paper and a simulation model was developed to validate the calculations. The plot showing the actual trajectory against the calculated trajectory is as shown in fig..

The reason for the huge variation in the calculations can be interpreted with a small analysis of the formulas.

Where

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The above stated errors are added for every time step thus leading to abnormal position tracking.

However, the calculations need to be improved to reduce the error caused due to the variation in the above calculations. From the plot, it is observed that major error factor contribution is due to the miscalculation in determining the orientation of the body.

Assuming a magnetic compass fitted with the body of the mobile robot, and calculating the orientation of the robot with reference to the world, based on the output from the magnetic compass calculations were performed and an improved trajectory plot for absolute vs calculated values were observed as shown in fig..

The difference in the calculations were due to the approximation of the diameter values and calculations for every time step.

The model was extended for navigation to a required target position from the current home position. This is performed by calculating the following steps

* The initial position and the target position are defined before the start of simulation to calculate the required orientation.
* The orientation of the robot body is aligned with the target orientation using the trajectory formulas.
* The orientation is corrected for every time step since, the position of the robot also changes during the adjustment of the orientation.

When the orientation is matched with the target orientation, the robot is accelerated in the target direction till, the current position match the target position in x or y direction.