SC627
Assignment-2

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The path will be generated by combining attractive potential gradient and repulsive potential gradients.

Attractive gradient is given by (attraction by the goal)

$$\nabla U_{\text{att}}(q) = \begin{cases} \zeta(q - q_{\text{goal}}), & d(q, q_{\text{goal}}) \le d^*_{\text{goal}}, \\ \frac{d^*_{\text{goal}}\zeta(q - q_{\text{goal}})}{d(q, q_{\text{goal}})}, & d(q, q_{\text{goal}}) > d^*_{\text{goal}}, \end{cases}$$

Where d^*_{goal} is given as 2 and ζ is given as 0.8. $d(q, q_{goal})$ is the distance between goal and the current location of robot. $q-q_{goal}$ will be the difference between the respective x dimension and y dimension (displacement vector)

Repulsive gradient due to any obstacle is given by

$$\nabla U_{\text{rep}}(q) = \begin{cases} \eta \left(\frac{1}{Q^*} - \frac{1}{D(q)} \right) \frac{1}{D^2(q)} \nabla D(q), & D(q) \le Q^*, \\ 0, & D(q) > Q^*, \end{cases}$$

Where

$$\nabla d_i(q) = \frac{q - c}{d(q, c)}.$$

Where c is the nearest point of obstacle to the robot, Q* is given as 2 and η is given as 0.8. D(q) is distance between robot and the obstacle (equivalent to the nearest point to the robot).

Hence the next step direction of the robot is decided by attractive gradient + Σ repulsive gradients of all obstacles. This direction vector is then normalised to unit vector.

This multiplied with the step size gives the coordinate of upcoming step when added to the previous step.

The resultant path is plotted with obstacles shown as in figure below.

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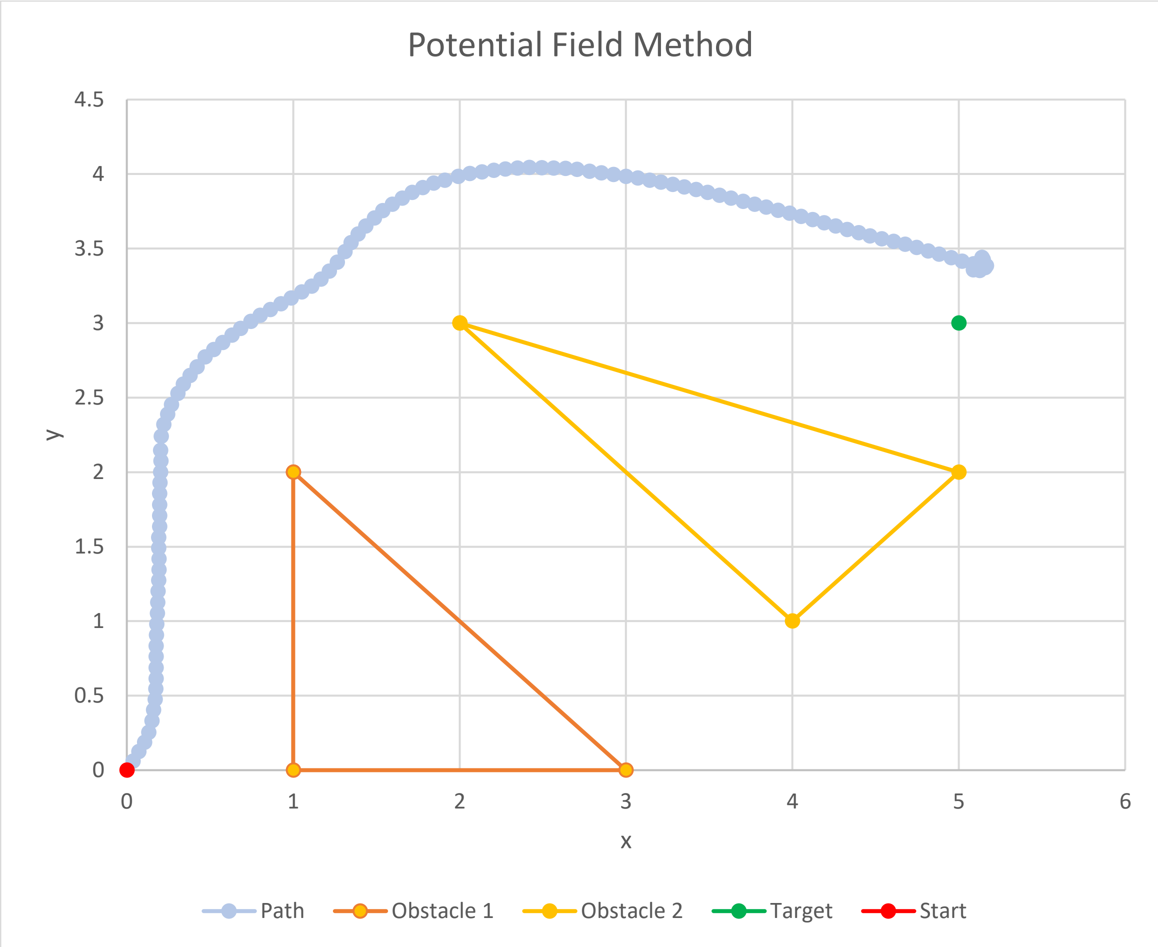

Result:

The path followed is similar to the planned path but the attractive gradient falls shorter than the repulsive gradient at end point because of which the robot keeps rotating around it's axis at a point near to the goal but does not completely reach the goal.