Documentation of Localization

This technique is used to determine position from 3 lights aligned upon a wall.The diagram below shows a possible scenario in which the robot could find itself. The robot is the point of the triangle in the middle of the box.

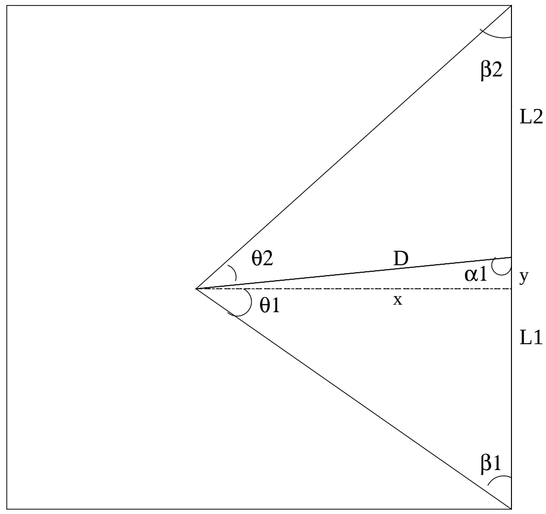

Figure 1: Example of possible robot location

We know that the robot will be between the top-most light and the bottom-most light. The distance between the top light and the middle light is the same as the distance between the middle light and the bottom light. The robot can be anywhere to one side of these lights. The program returns an x y coordinate. Y is negative it the robot is below the middle light and positive if it is above. The following math was used to discover the location of the robot.

$$\frac{\sin\theta_1}{L_1} = \frac{\sin\beta_1}{D}$$
$$\frac{\sin\theta_2}{L_2} = \frac{\sin\beta_2}{D}$$

Using the knowledge that

$\beta_2 = 180 - \theta_3 - \beta_1$ $\sin\beta_2 = \sin(180 - \theta_3)\cos\beta_1 - \cos(180 - \theta_3)\sin\beta_1 = \sin\theta_3\cos\beta_1 + \cos\theta_3\sin\beta_1$

Now we can find that $\frac{\sin\theta_2}{L_2} = \sin\theta_3\frac{\cos\beta_1}{D} + \cos\theta_3\frac{\sin\beta_1}{D}$

We solved for $\frac{\sin\beta_1}{D}$ and $\frac{\cos\beta_1}{D}$

We can then solve for D since: $(\frac{\sin\theta_2}{D})^2 + (\frac{\cos\beta_1}{D})^2 = \frac{1}{D^2}$

Now we can find the x and y coordinates.

$\alpha_1 = 180 - \beta_1 - \theta_1$ $x = D\sin\alpha_1$ $y = D\cos\alpha_1$

We now know the distance the robot is in respect to the middle light.