ROS for Engineers – Assignment 2

aka ros without programming

Steering

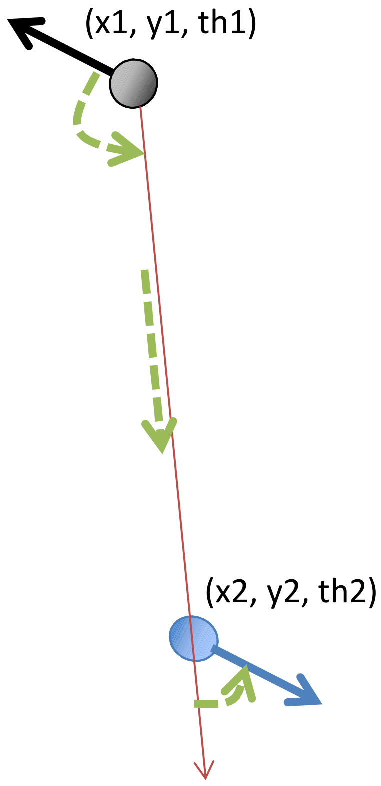
- How to move from current pose to a goal pose?

Point and Shoot

- Point
  - Turn (to point towards goal)

- Shoot
  - Move (to goal)

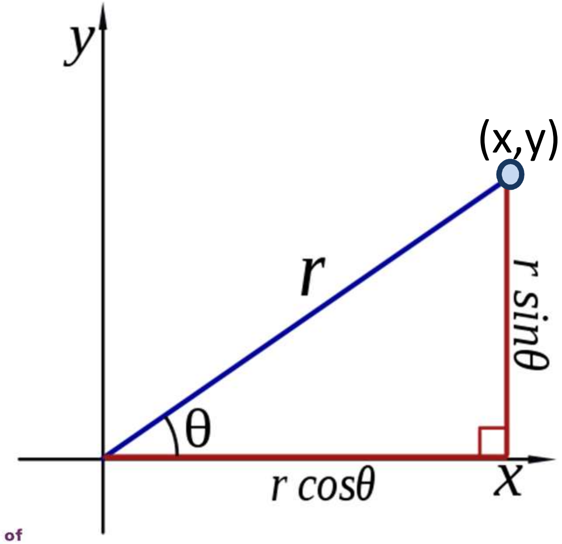
- Assume right heading (optional)
  - Turn (to correct heading)



Polar coordinates

http://en.wikipedia.org/wiki/Polar_coordinate_system

- Cartesian coordinates: (x,y)
- Polar coordinates: (r,θ)



$$r = \sqrt{x^2 + y^2}$$
$$\theta = \operatorname{atan2}(y, x)$$

$$x = r\cos\theta$$
$$y = r\sin\theta$$

Polar coordinates - ATAN2

- $\tan^{-1}(y/x)$ has multiple solutions

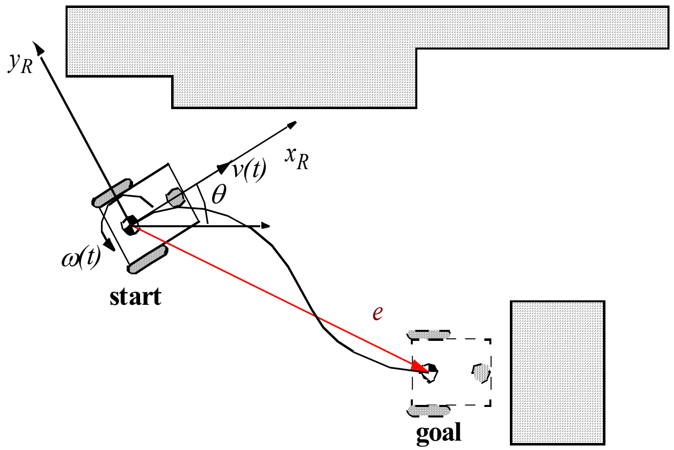
$$\tan(y/x) = \tan(y/x + k\pi)$$

- atan2 takes care of this

$$\operatorname{atan2}(y,x) = \begin{cases} \arctan(\frac{y}{x}) & x > 0 \\ \pi + \arctan(\frac{y}{x}) & y \geq 0, x < 0 \\ -\pi + \arctan(\frac{y}{x}) & y < 0, x < 0 \\ \frac{\pi}{2} & y > 0, x = 0 \\ -\frac{\pi}{2} & y < 0, x = 0 \\ \text{undefined} & y = 0, x = 0 \end{cases}$$

Smooth Trajectory

- Use feedback control ("Servoing")
  - Error: difference (linear and angular) between Goal Pose and Current Pose



Smooth Trajectory

- Control law:

$$v = k_\rho \rho$$
$$\omega = k_\alpha \alpha + k_\beta \beta$$

$$k_\rho > 0 \;\; ; \;\; k_\beta < 0 \;\; ; \;\; k_\alpha - k_\rho > 0$$

$$\rho = \sqrt{\Delta x^2 + \Delta y^2}$$

$$\alpha = -\theta + \mathrm{atan2}(\Delta y, \Delta x)$$

$$\beta = -\theta - \alpha$$