Pursuit Algorithms on Pioneer Robots
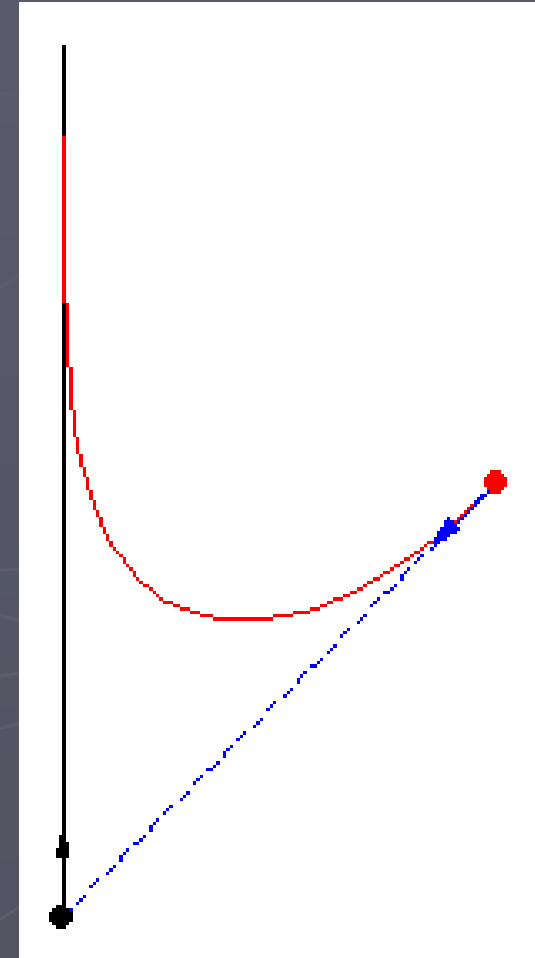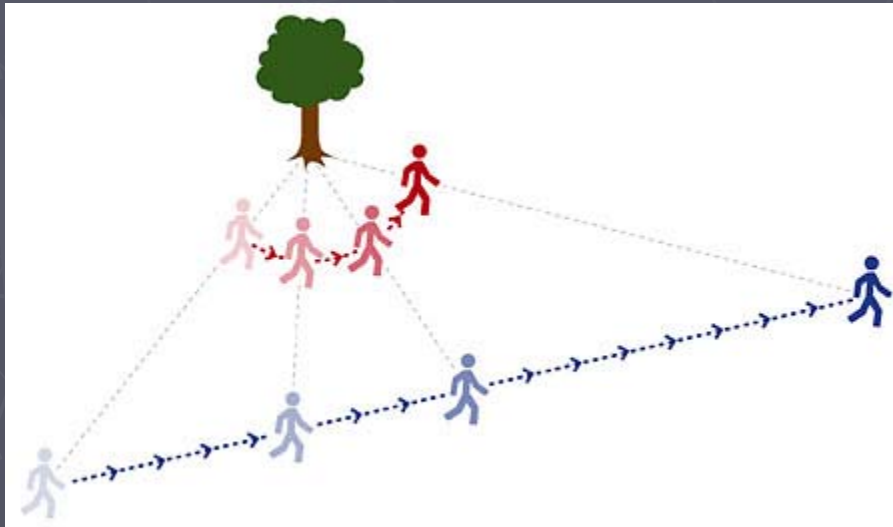
Jansen Sheng
Scott Watson
Advisor: Dr. P.S. Krishnaprasad
Collaborator: Tom Gehrels
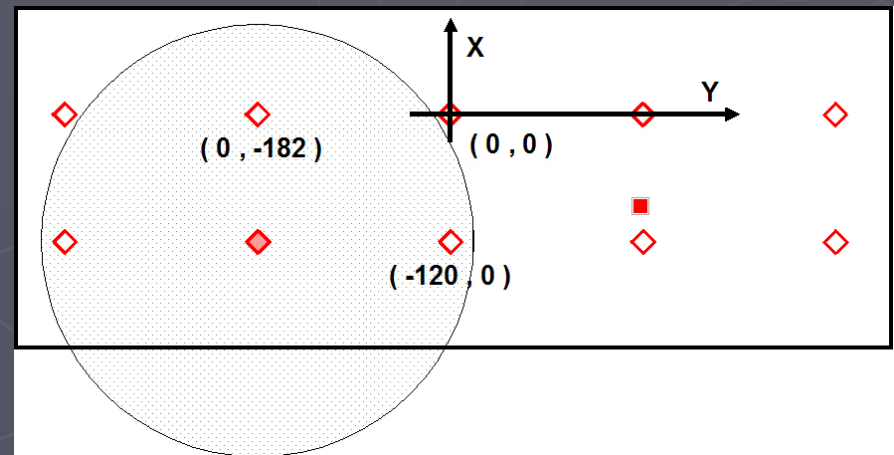
Pursuit

- ► Classical
- ► Constant Bearing
- ► Motion Camouflage

Cricket

► Invented at MIT

► Ten ceiling mounted beacons
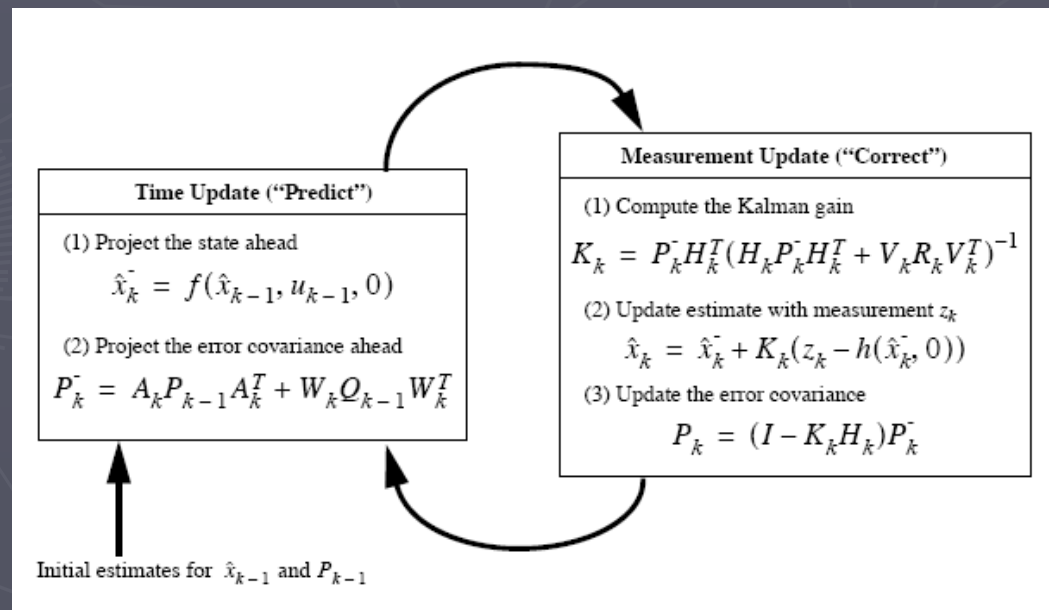
► Accurately detects within a 40 degree cone

Pioneer Robots

► ActivMedia Robotics

► Lola and Genghis

► 50cm x 49cm x 26cm

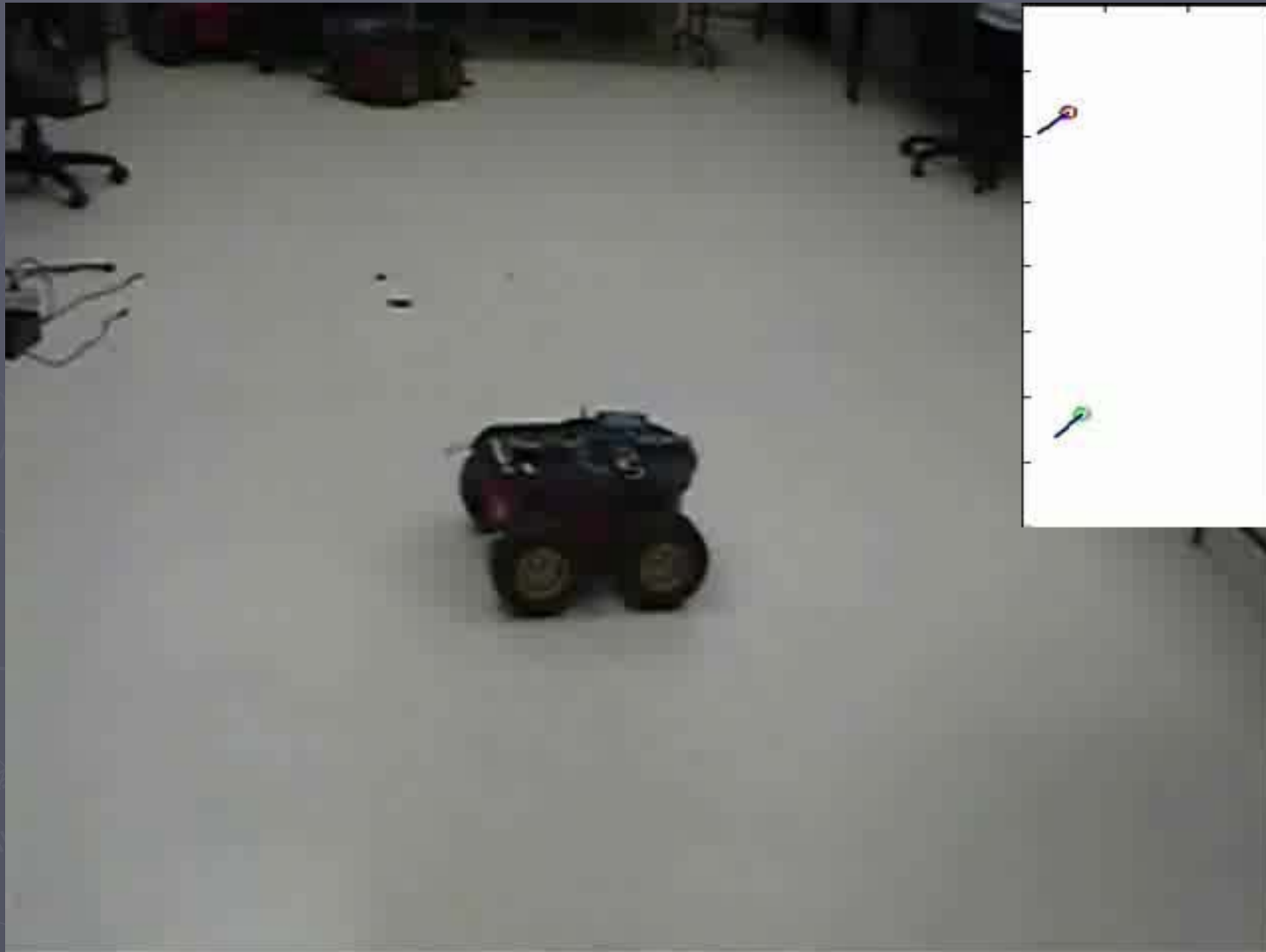► Wireless router, two Crickets, front sonar, bumper, and odometer

Kalman Filter

► Developed by Rudolf Kalman

► Recursive filter

► Combines noisy measurements from Cricket and odometer

Time Update ("Predict")

(1) Project the state ahead

$$\hat{x}_k^- = f(\hat{x}_{k-1}, u_{k-1}, 0)$$

(2) Project the error covariance ahead

$$P_k^- = A_k P_{k-1} A_k^T + W_k Q_{k-1} W_k^T$$

Measurement Update ("Correct")

(1) Compute the Kalman gain

$$K_k = P_k^- H_k^T (H_k P_k^- H_k^T + V_k R_k V_k^T)^{-1}$$

(2) Update estimate with measurement z_k

$$\hat{x}_k = \hat{x}_k^- + K_k(z_k - h(\hat{x}_k^-, 0))$$

(3) Update the error covariance

$$P_k = (I - K_k H_k) P_k^-$$

Initial estimates for $\hat{x}_{k-1}$ and P_{k-1}

Movie Clip

Questions?