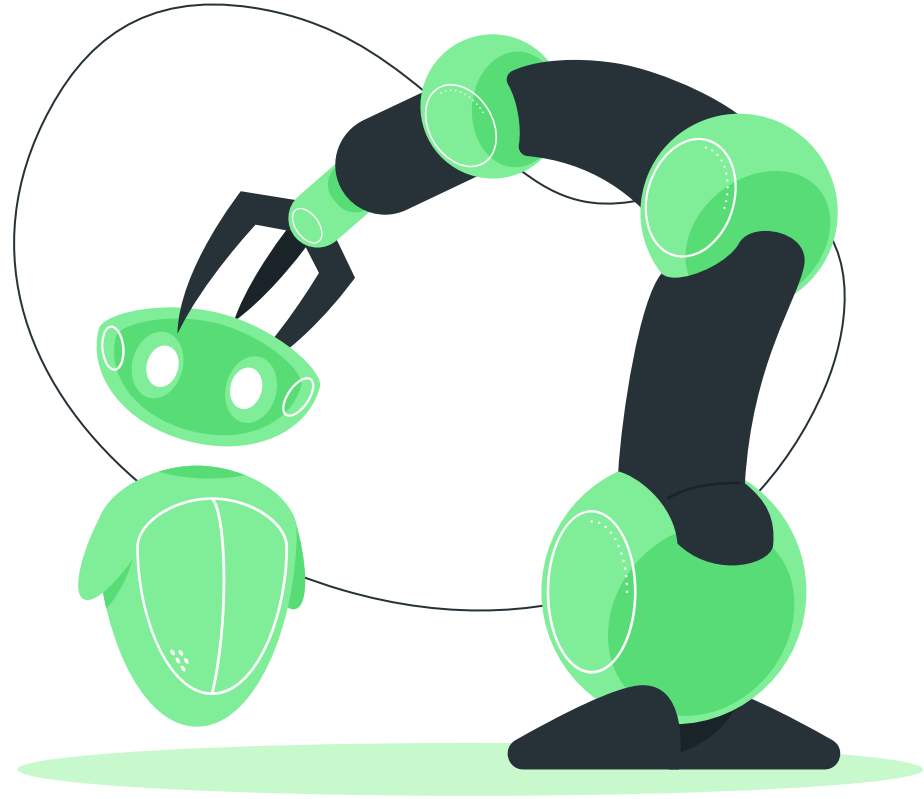
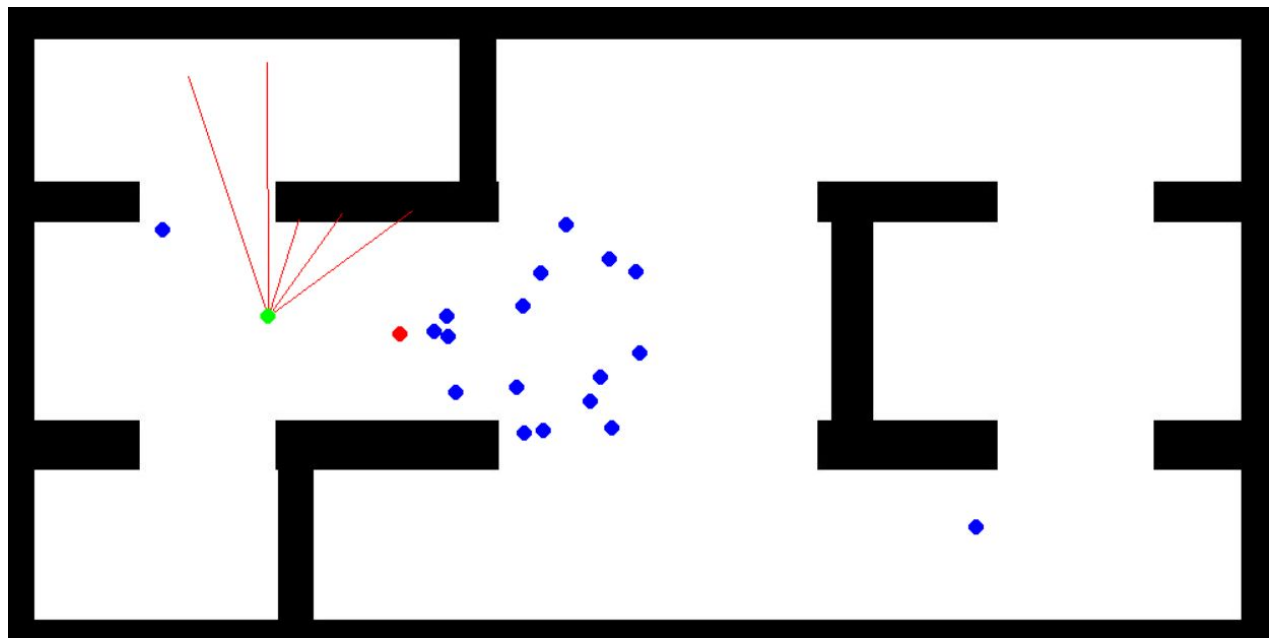


# Monte Carlo Localization

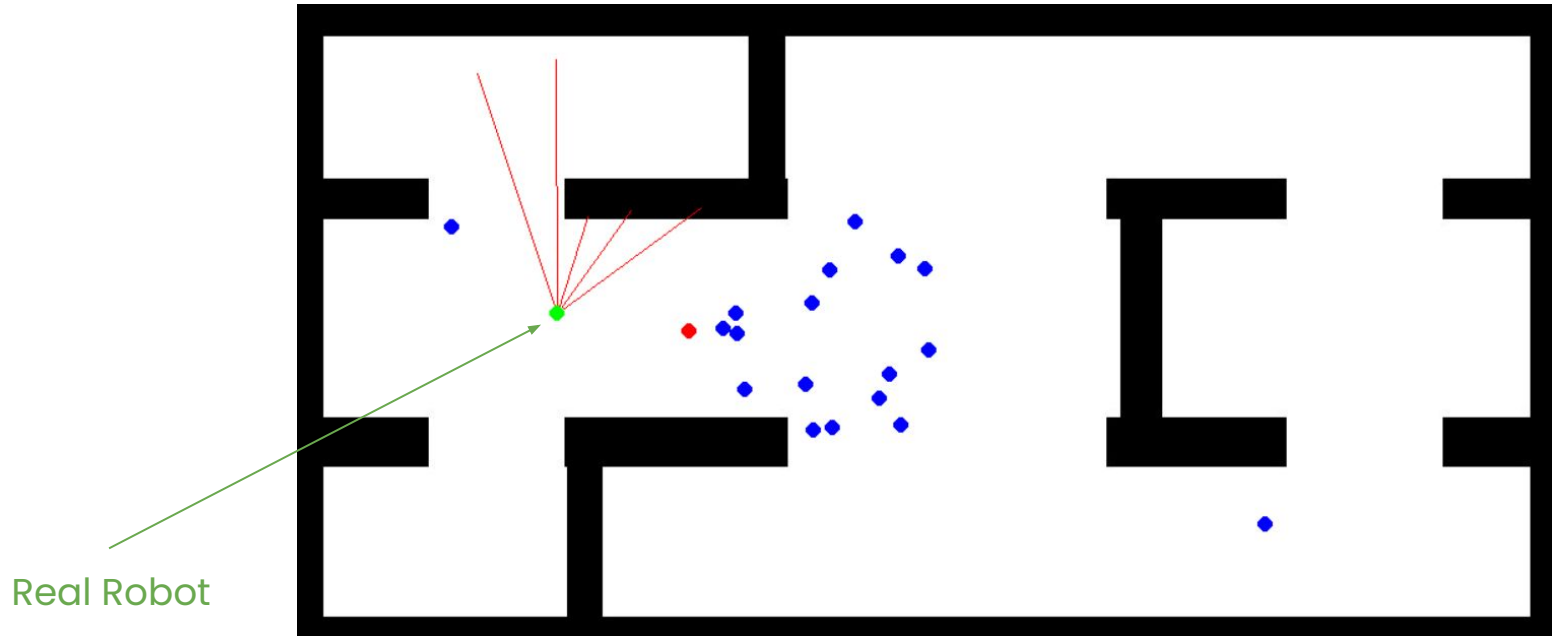
Roba 2022 – Kavinkumar THIRUNAVUKKARASU



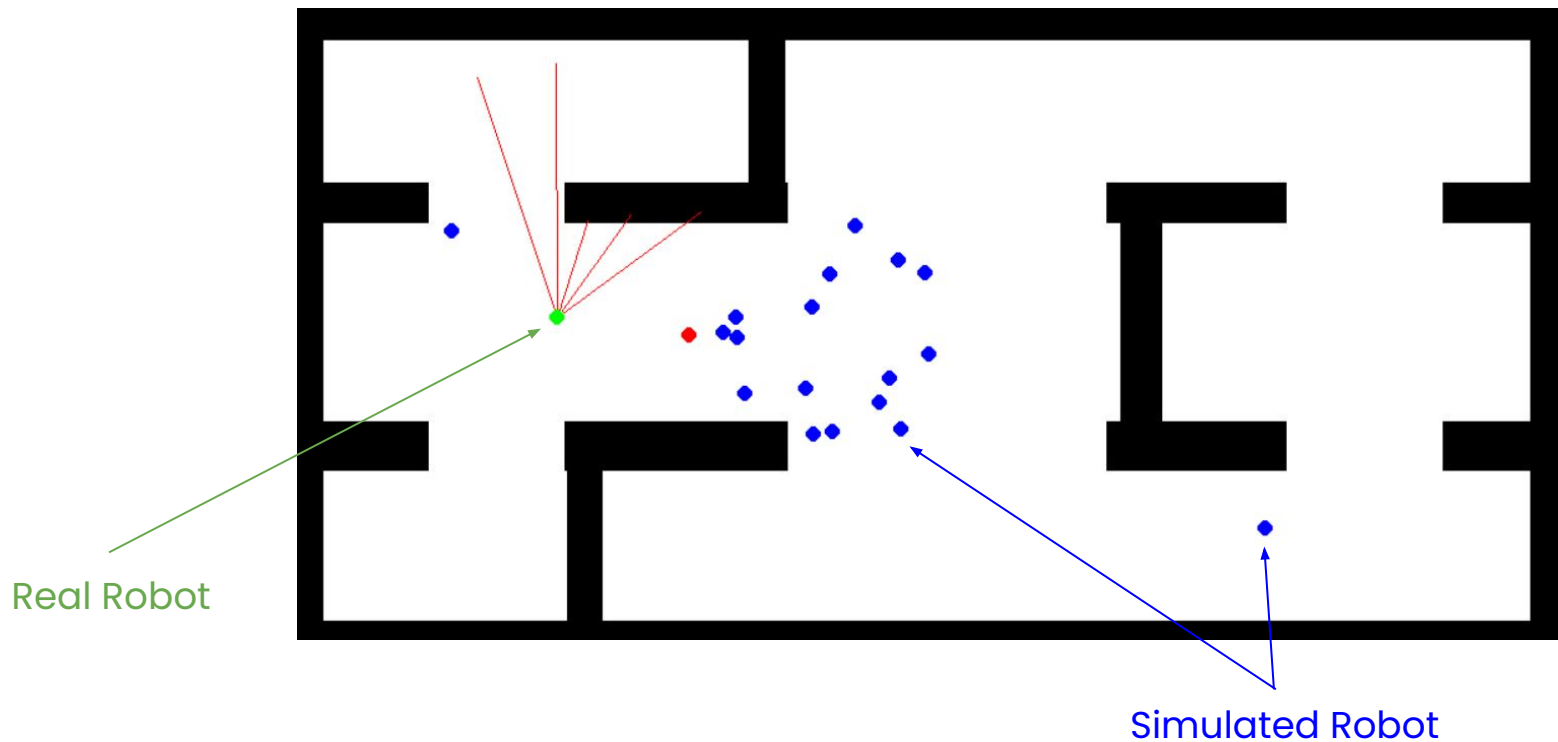
# Simulation Environment



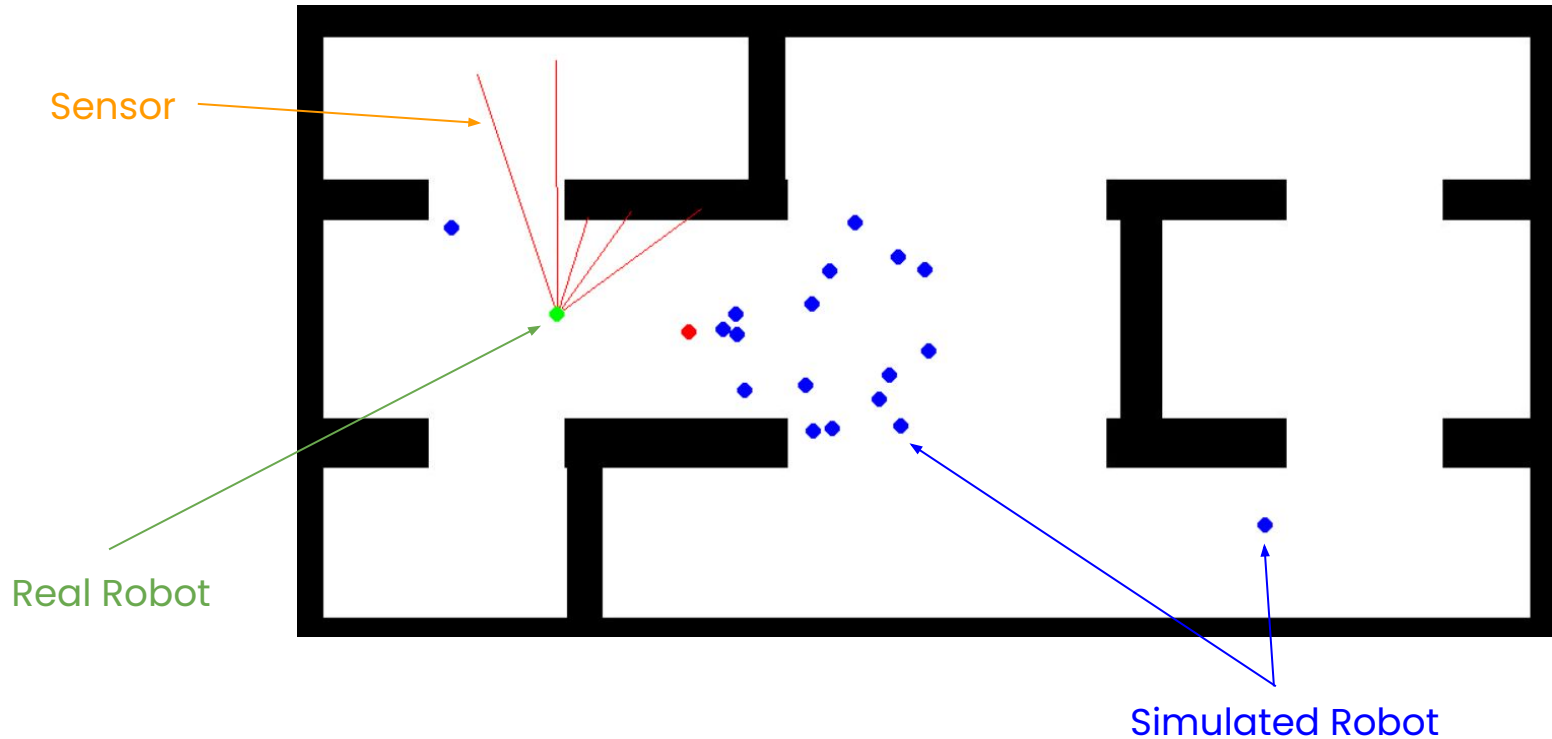
# Simulation Environment



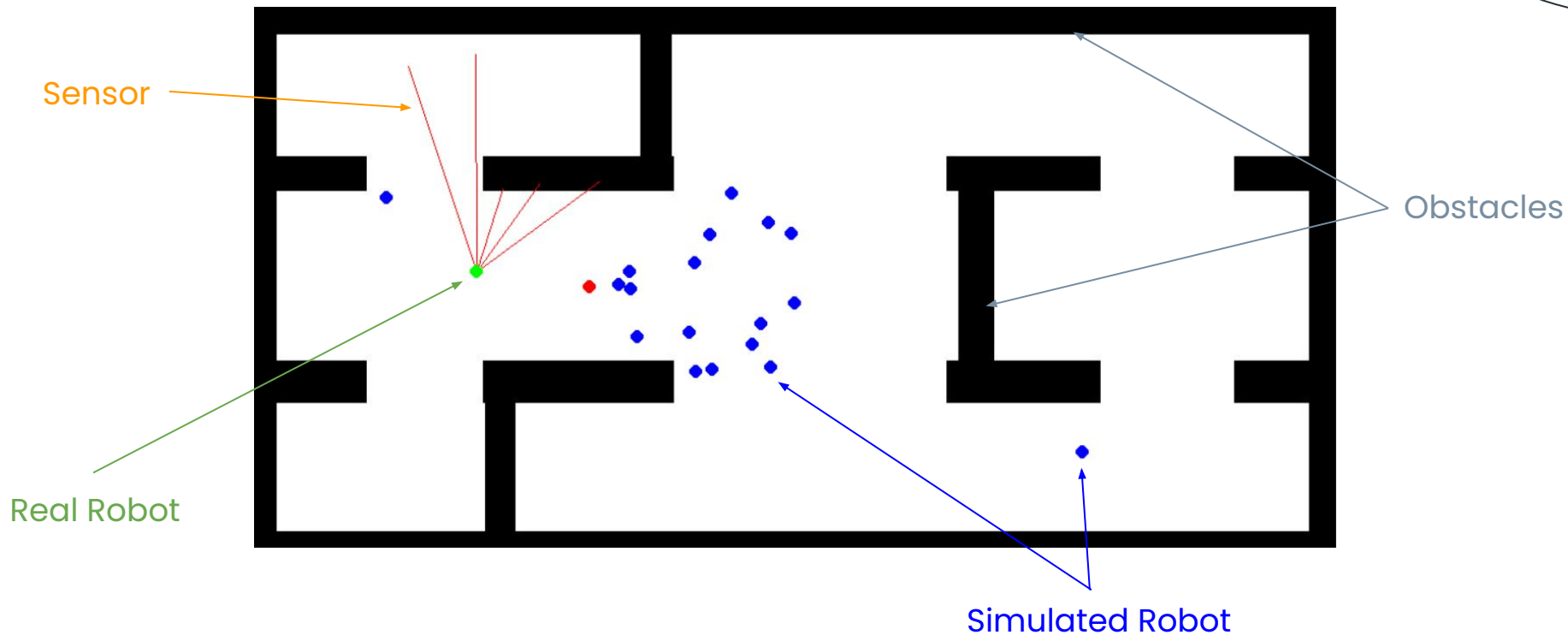
# Simulation Environment



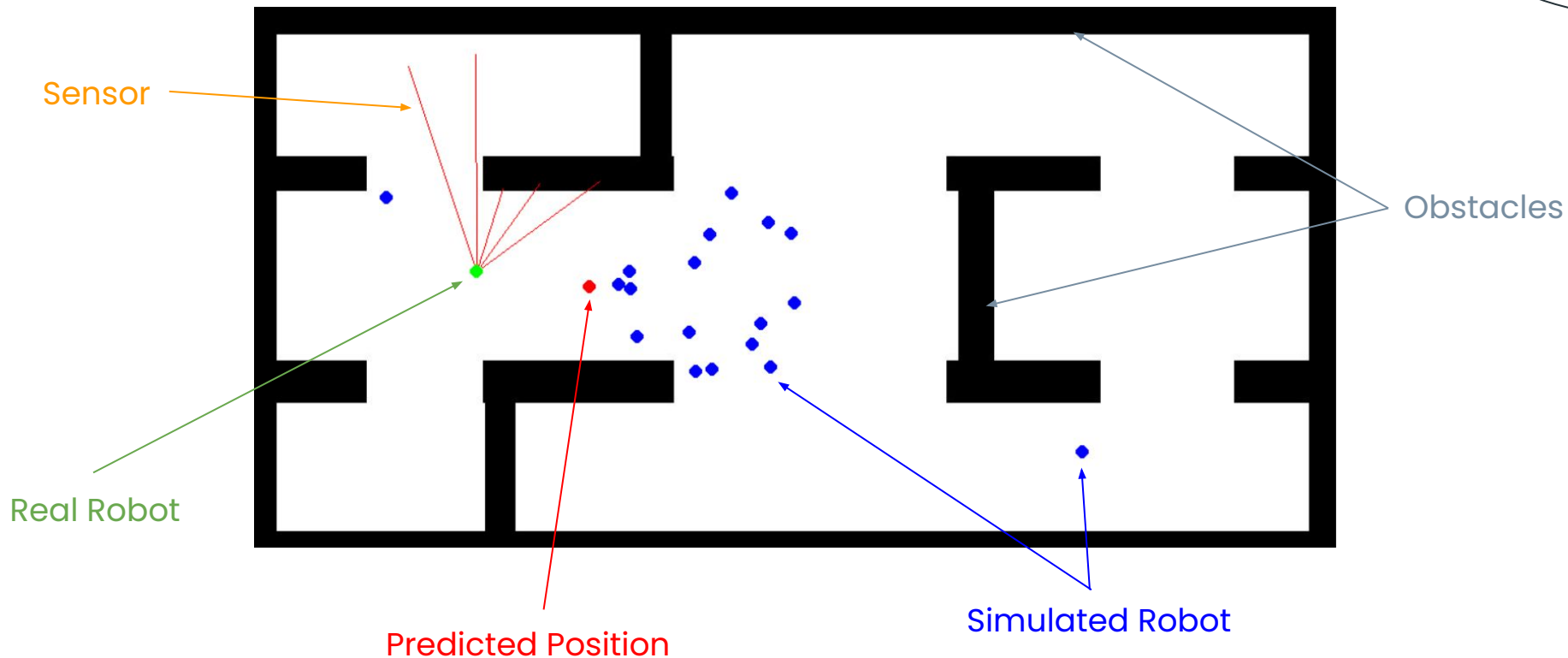
# Simulation Environment



# Simulation Environment



# Simulation Environment



# Sample Motion Model

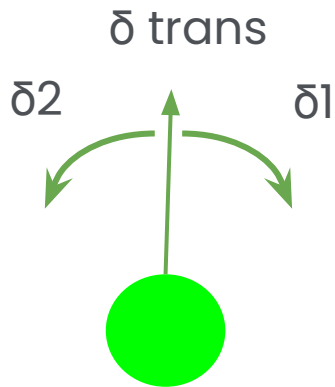


$$U = (\delta \text{ trans}, \delta 1, \delta 2)$$

$$U = (10, 10^\circ, 10^\circ)$$



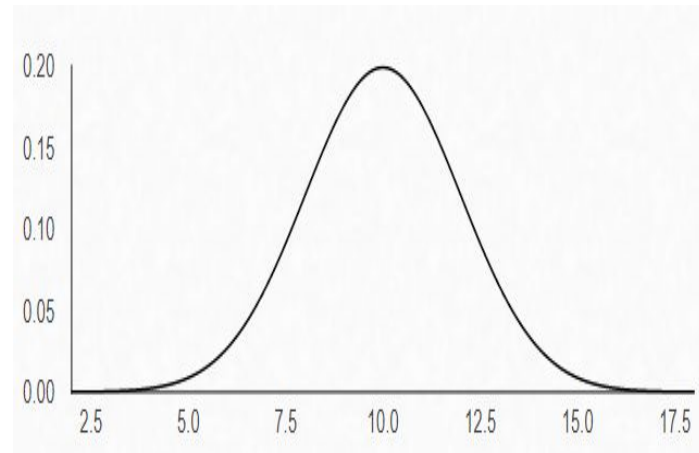
# Sample Motion Model



Imperfect  
Movement

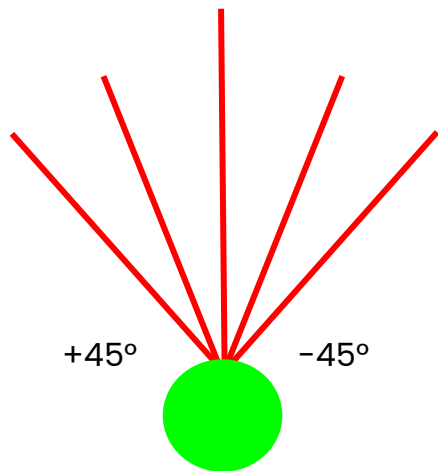
$$U = (\delta \text{ trans}, \delta 1, \delta 2)$$

$$U = (10, 10^\circ, 10^\circ)$$



$$\mu = 10$$
$$\sigma = 2$$

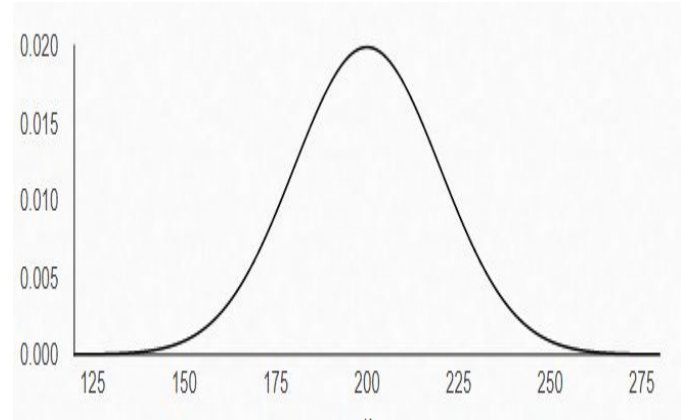
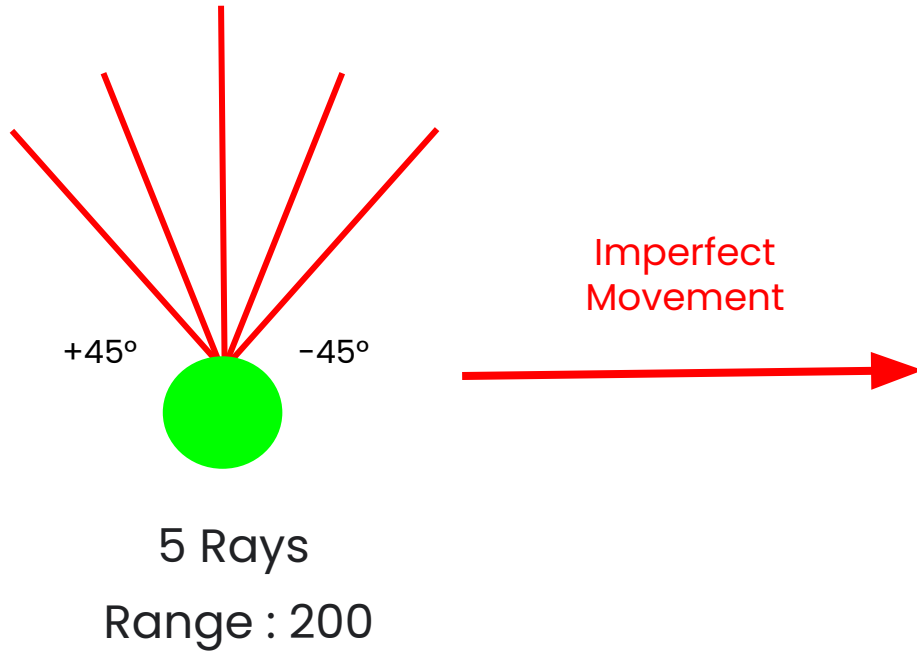
# Measurement Model



5 Rays

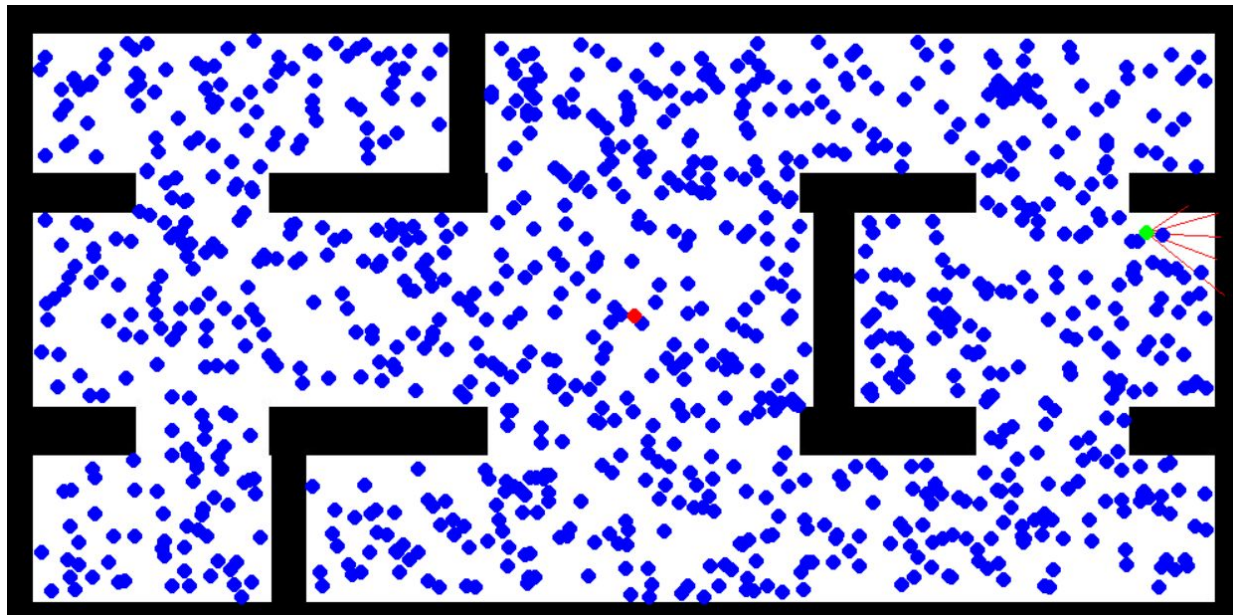
Range : 200

# Measurement Model



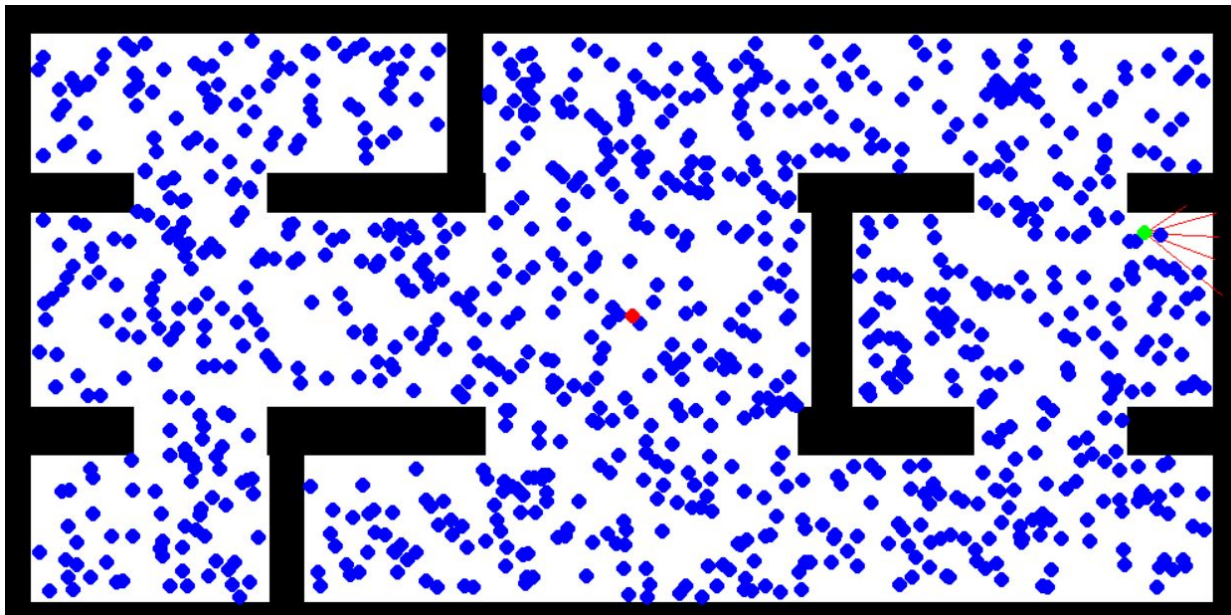
$$\mu = 200$$
$$\sigma = 20$$

# Initialization



500 Particles

# Initialization

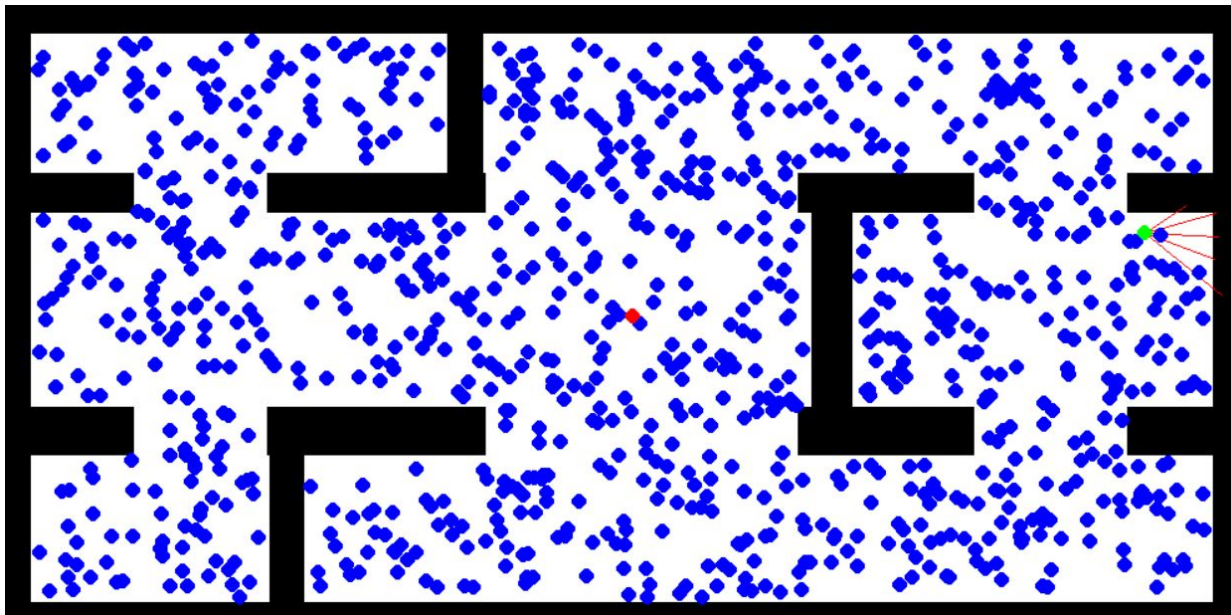


500 Particles

Weight :

$$\omega_i = 1/500$$

# Initialization



500 Particles

Weight :

$\omega_i = 1/500$

Resample Step : 5

# Update Weights

Current Weight

$$P(x | z) = \frac{P(z | x) P(x)}{P(z)} = \frac{\text{likelihood} \times \text{prior}}{\text{normalization}}$$

Sum(Weights)

The diagram illustrates the components of the posterior probability formula. A green label 'Current Weight' at the top has two green arrows pointing to 'likelihood' and 'prior' in the numerator of the second equation. A blue label 'Sum(Weights)' at the bottom has two blue arrows pointing to 'P(z)' in the denominator of the first equation and 'normalization' in the denominator of the second equation.

# Update Weights

Current Weight

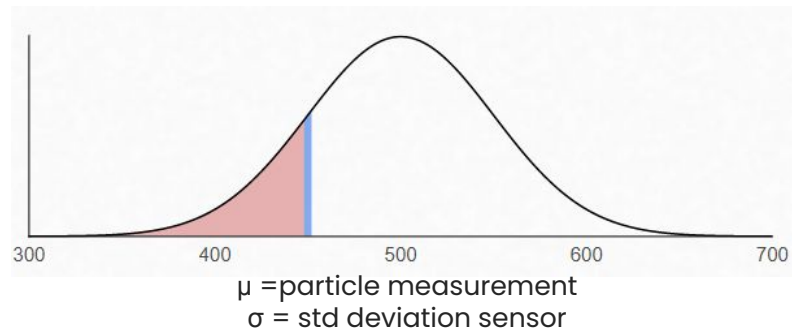
$$P(x | z) = \frac{P(z | x) P(x)}{P(z)} = \frac{\text{likelihood} \times \text{prior}}{\text{normalization}}$$

Sum(Weights)

## For example : Likelihood

Particle Measurement : 500  
Robot Measurement : 450

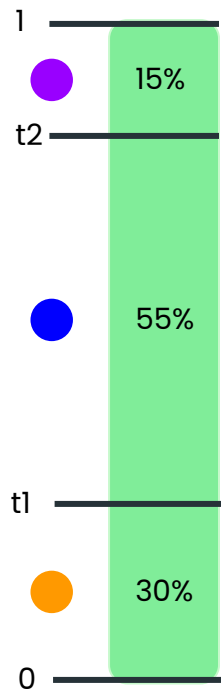
$P(x | z)$





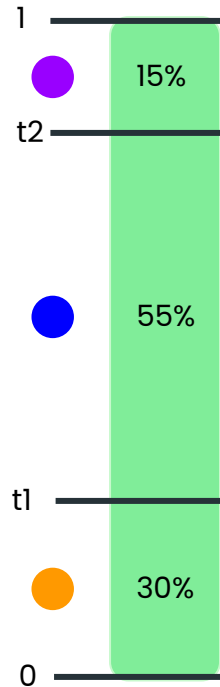
# Resample

Sum( Weights )



# Resample

Sum( Weights )

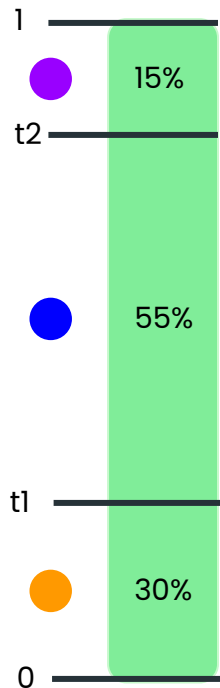


Random Number



# Resample

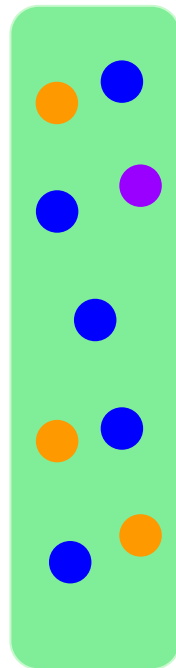
Sum( Weights )



Random Number



Particles Generation



# Video

