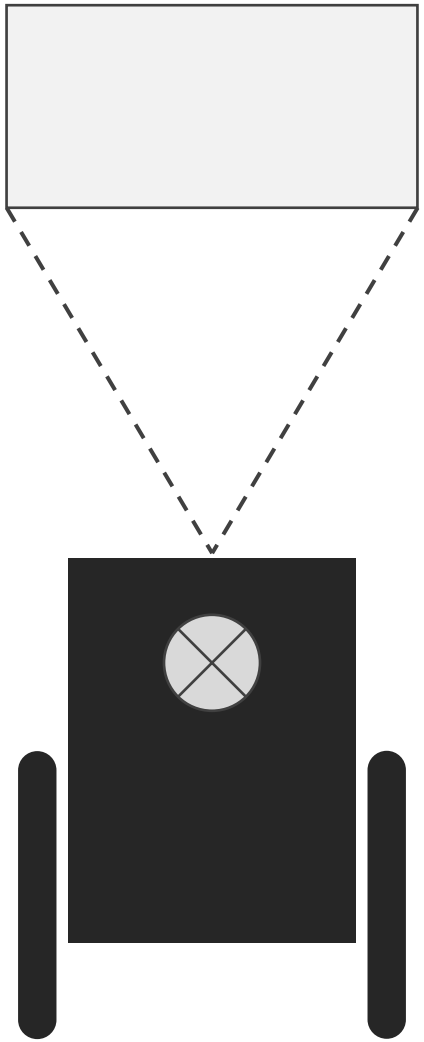
Dynamic Window Approach

to obstacle avoidance

Hlaing Min Oo



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- How robot move?
- How it work?

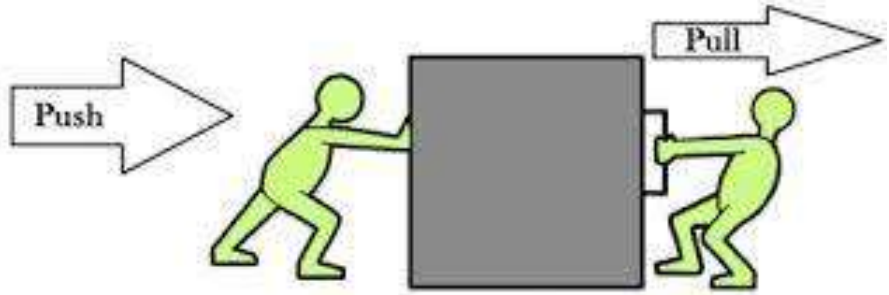
Introduction

Introduction

Derived From

Motion dynamic

- the study of forces and their effects on motion



Designed for Robots that have

Limited velocity and acceleration

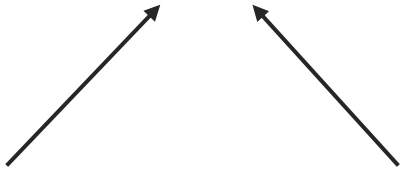
How robot move?

How robot move?

With

Translational & Rotational Velocity

(v, w)

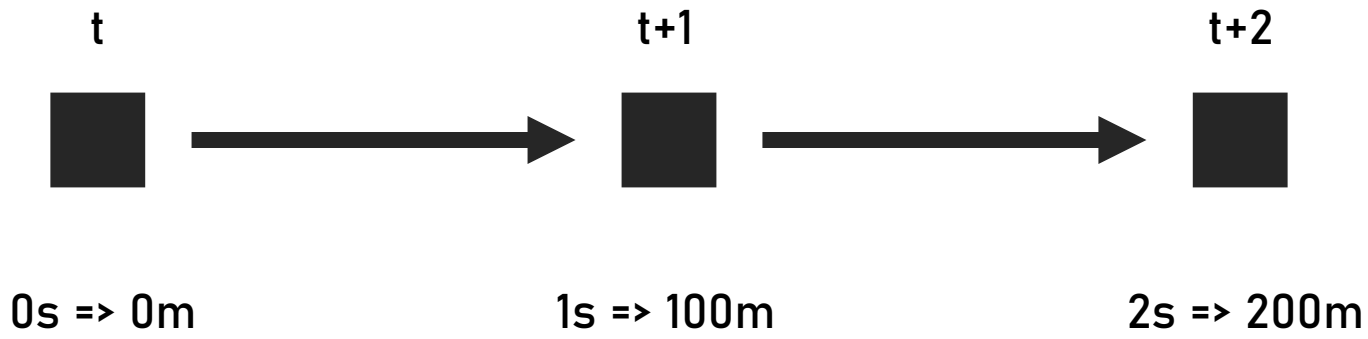


Translational velocity

Rotational velocity

Velocity: Translational

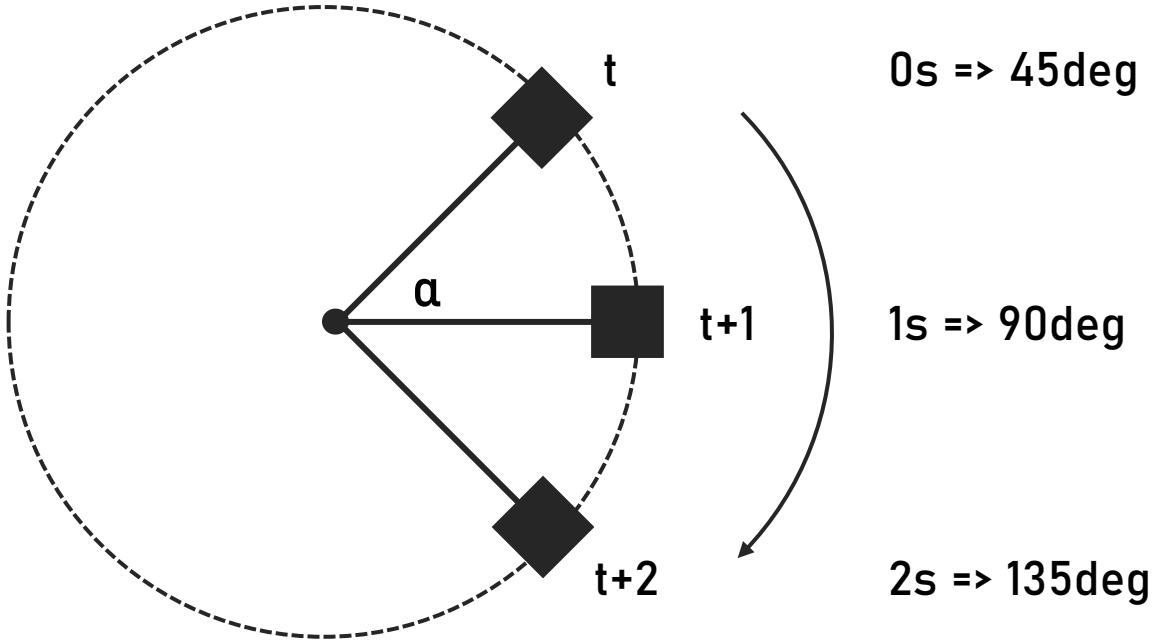
Rate of change of displacement



v = 100 m/s

Velocity: Rotational (Angular)

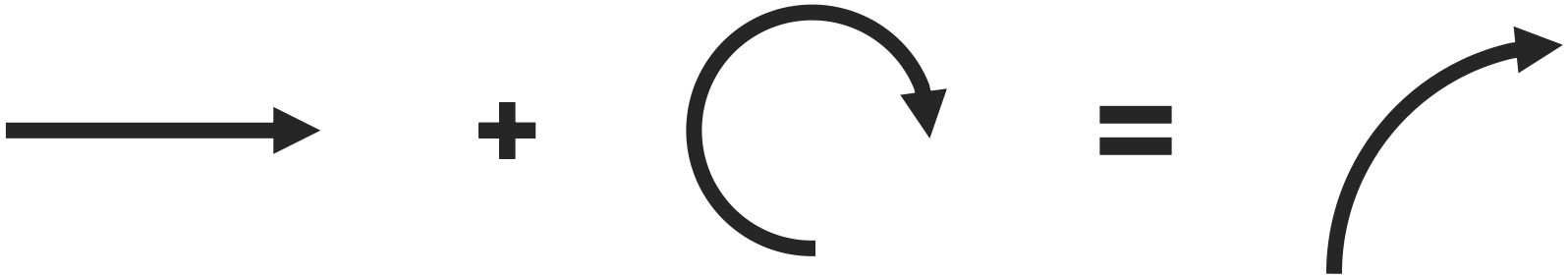
Rate of change of displacement (degree)



v = 45 deg/s

How robot move?

Combination of Translational and Rotational Velocity



Translation

(Straight)
(v)

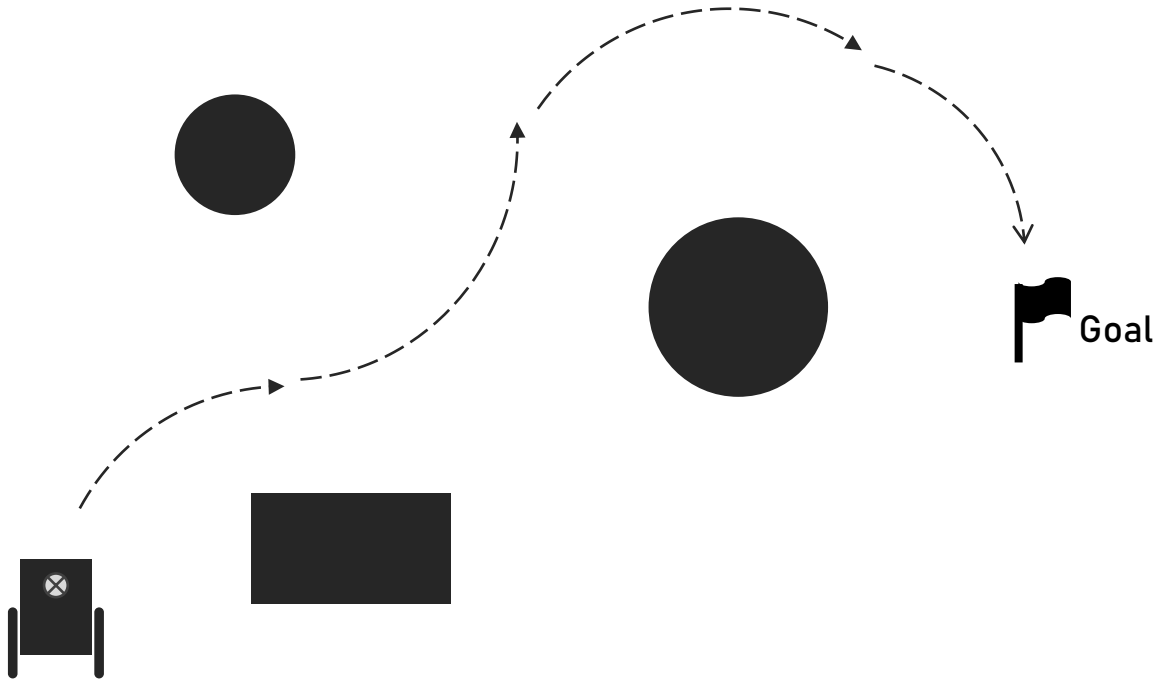
Rotation

(Circular)
(w)

Arc
(v, w)

So, the robot move by a sequence of circular arc.

How robot move?



So, the robot move by a sequence of circular arc.

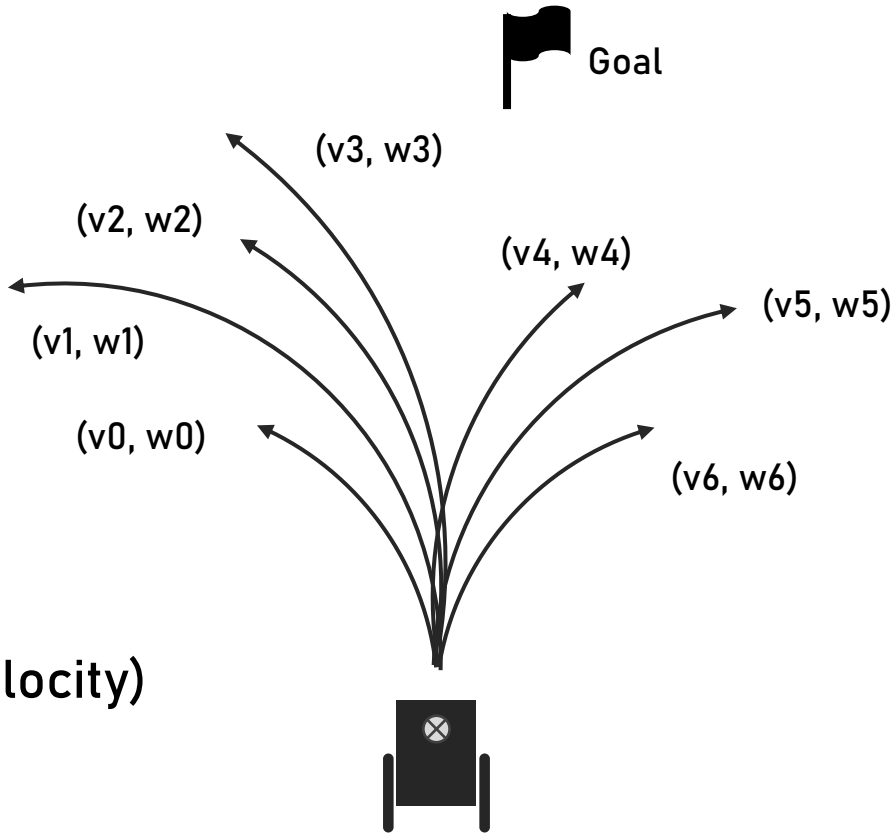
How it work?

How it work?

Find

the Best Velocity Pairs(v,w)

which consists of (translational velocity, rotational velocity)



How it work?

STEP 1: Generate All Possible Circular Trajectories

STEP 2: Choose Admissible Velocity

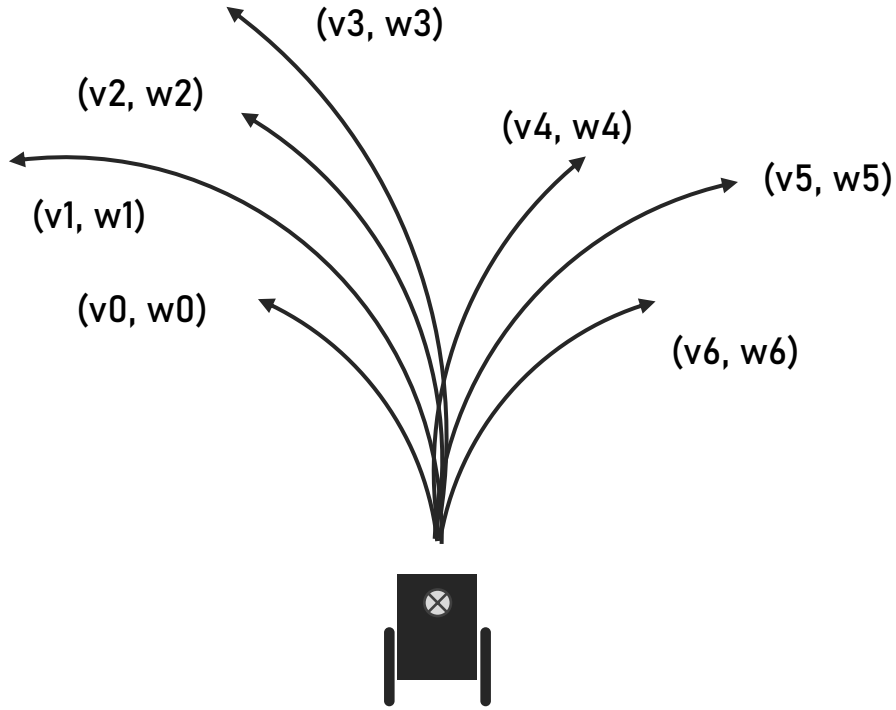
STEP 3: Choose Velocity in Dynamic Window

STEP 4: Maximizing the Objective Function

How it work?

STEP 1

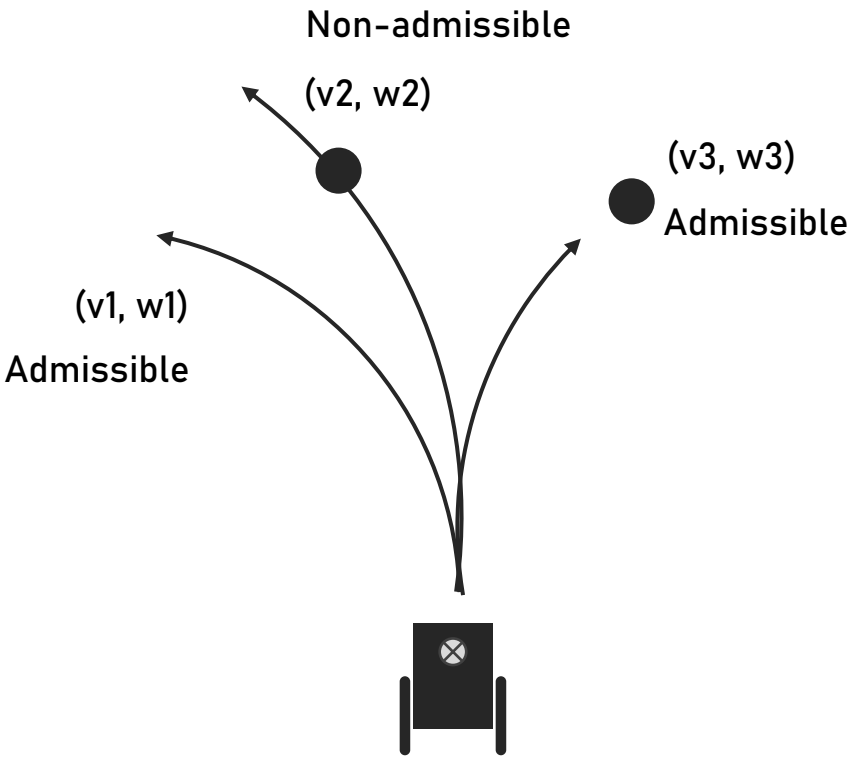
Generate All Possible Circular Trajectories



How it work?

STEP 2

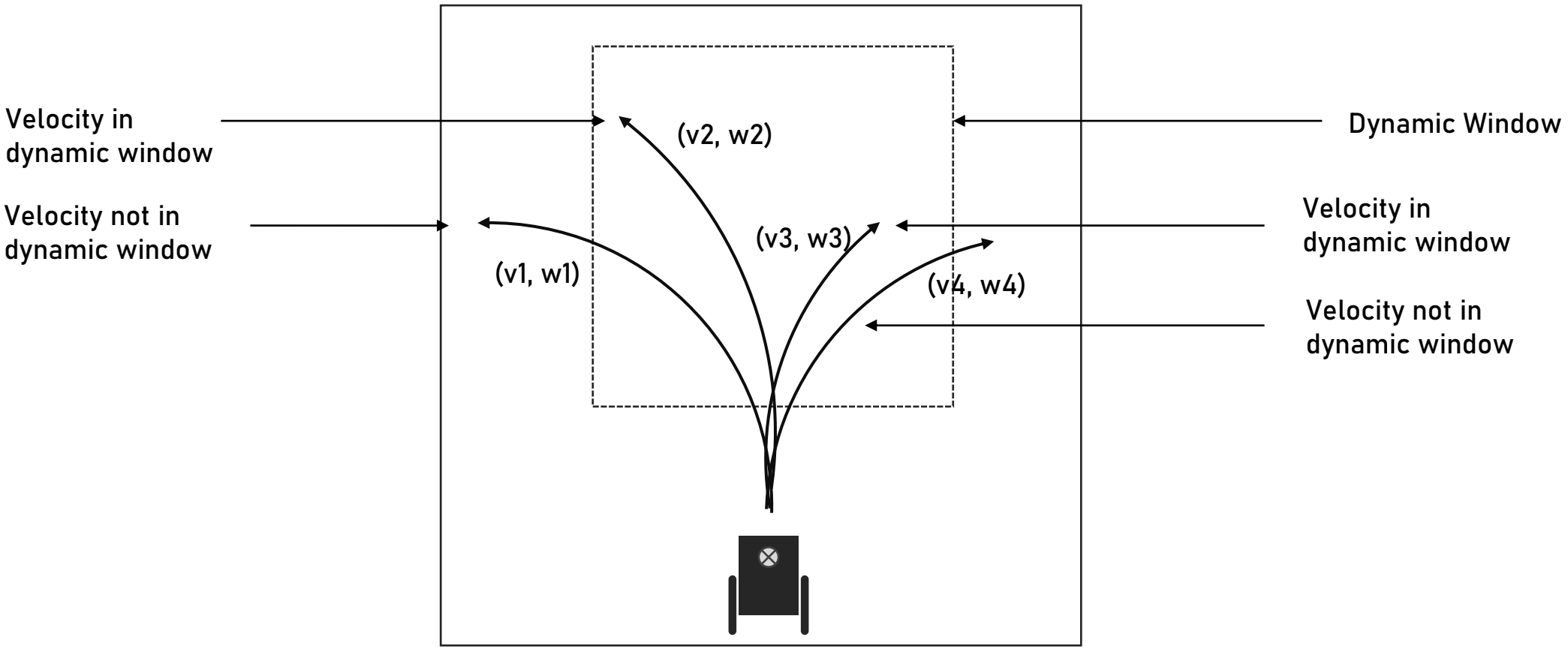
Choose Admissible Velocity



How it work?

STEP 3

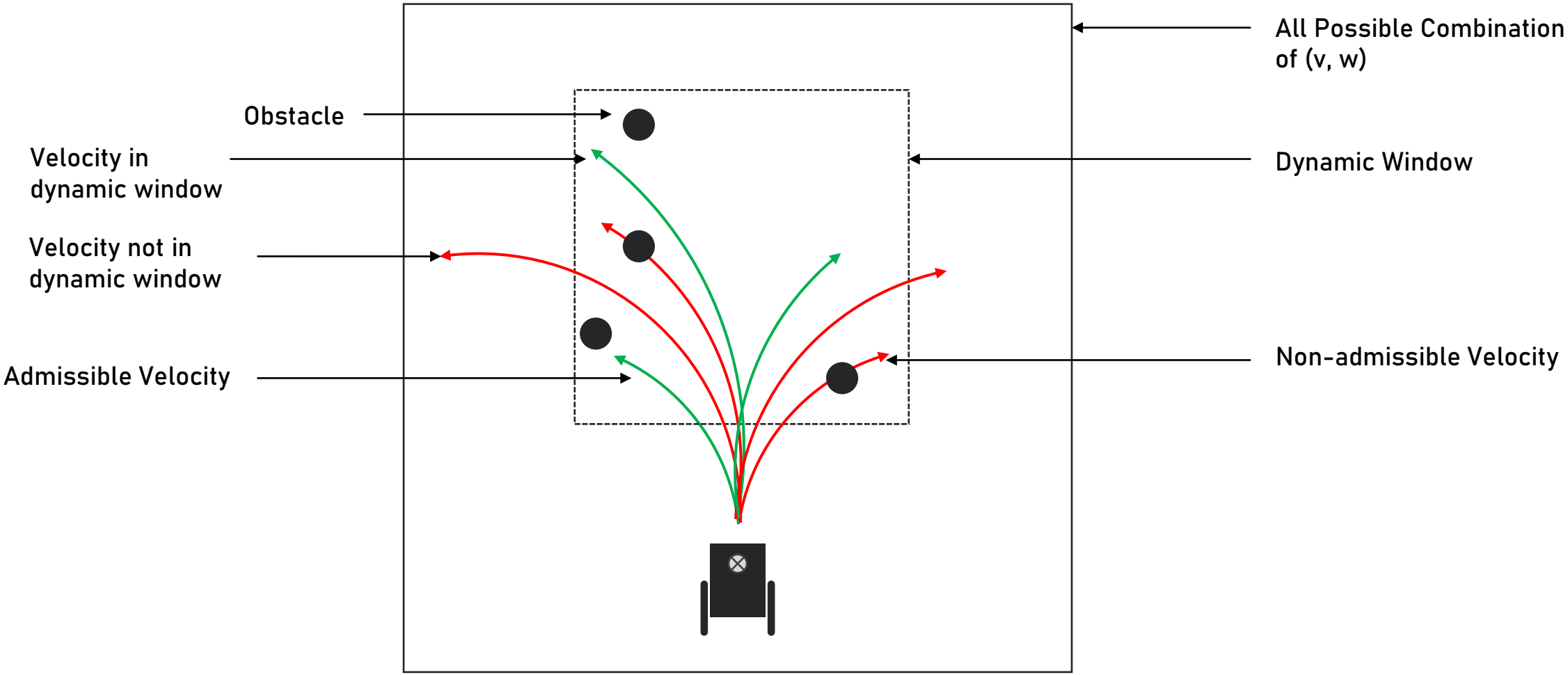
Choose Velocity in Dynamic Window



How it work?

STEP 1

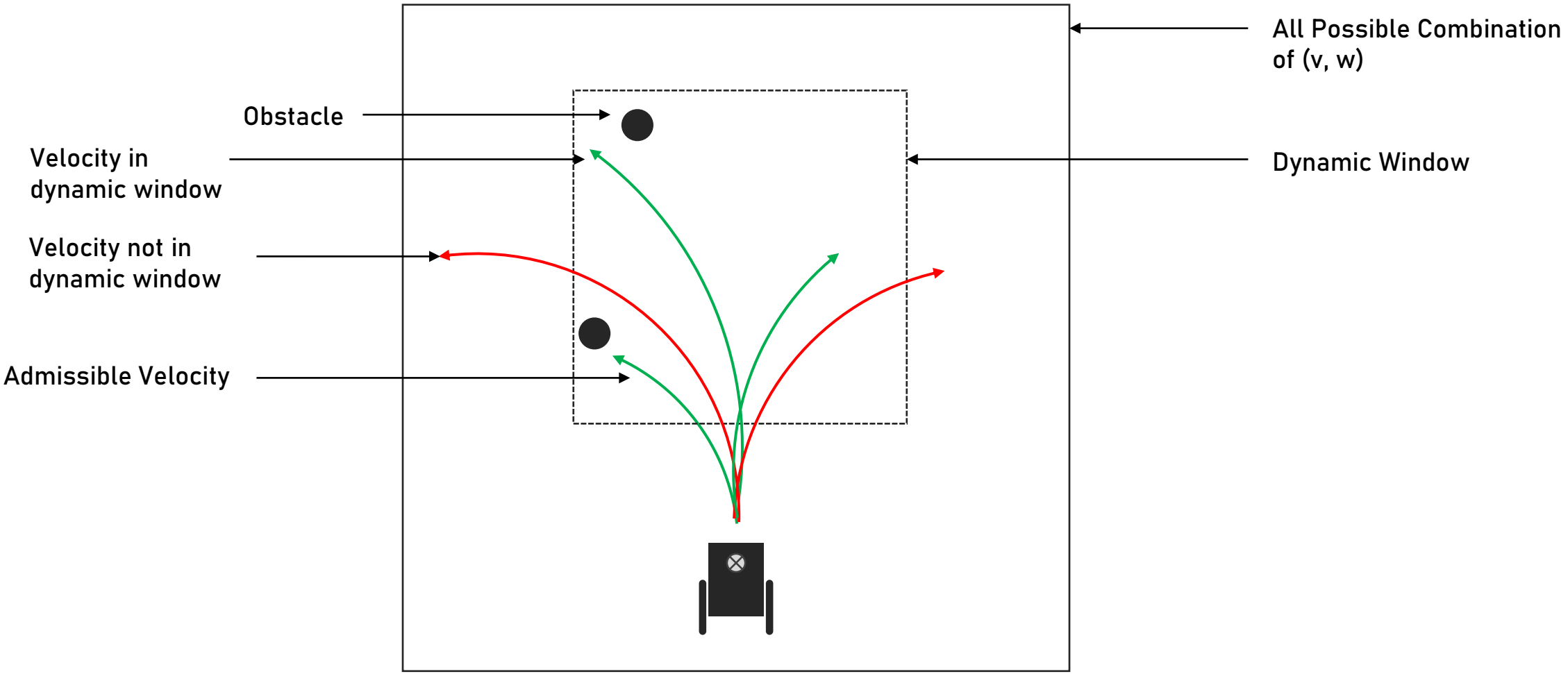
Generate All Possible Circular Trajectories



How it work?

STEP 2

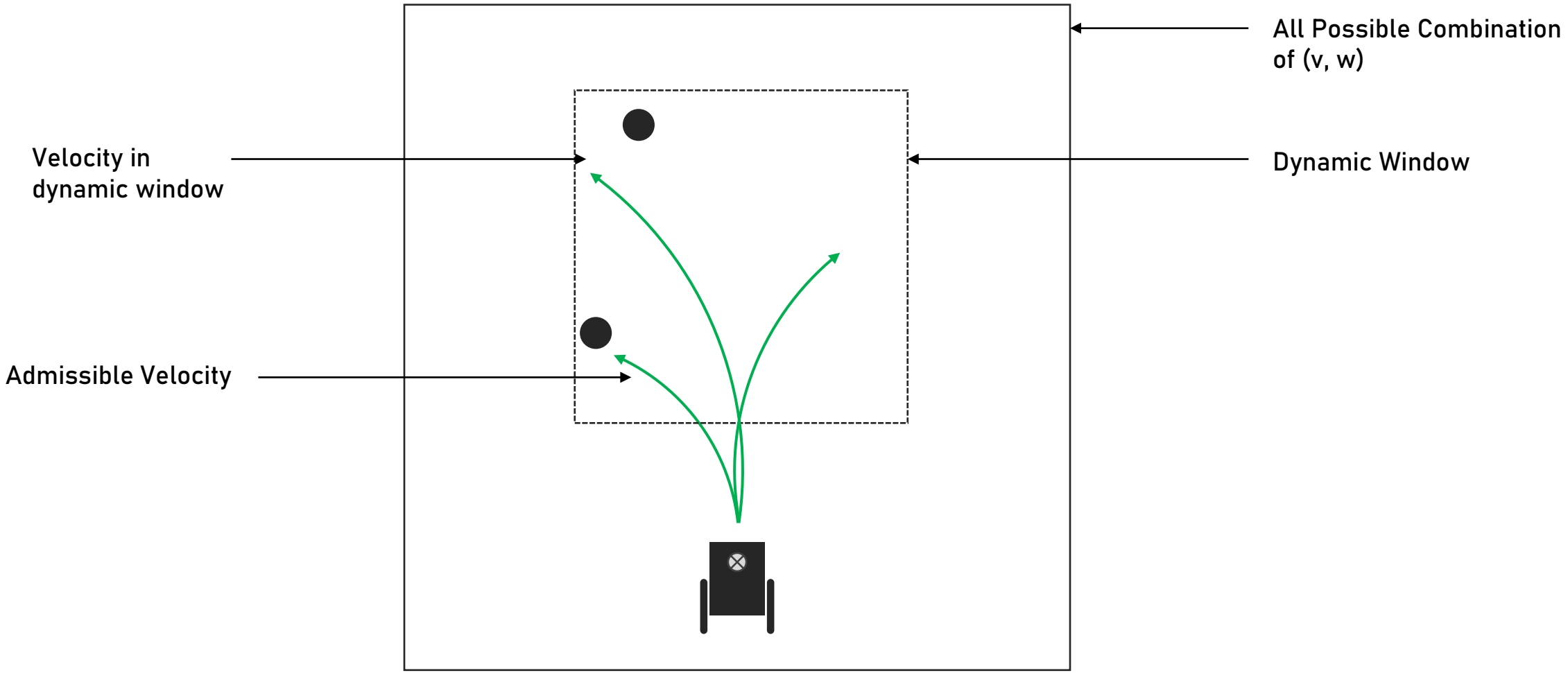
Choose Admissible Velocity



How it work?

STEP 3

Choose Velocity in Dynamic Window



How it work?

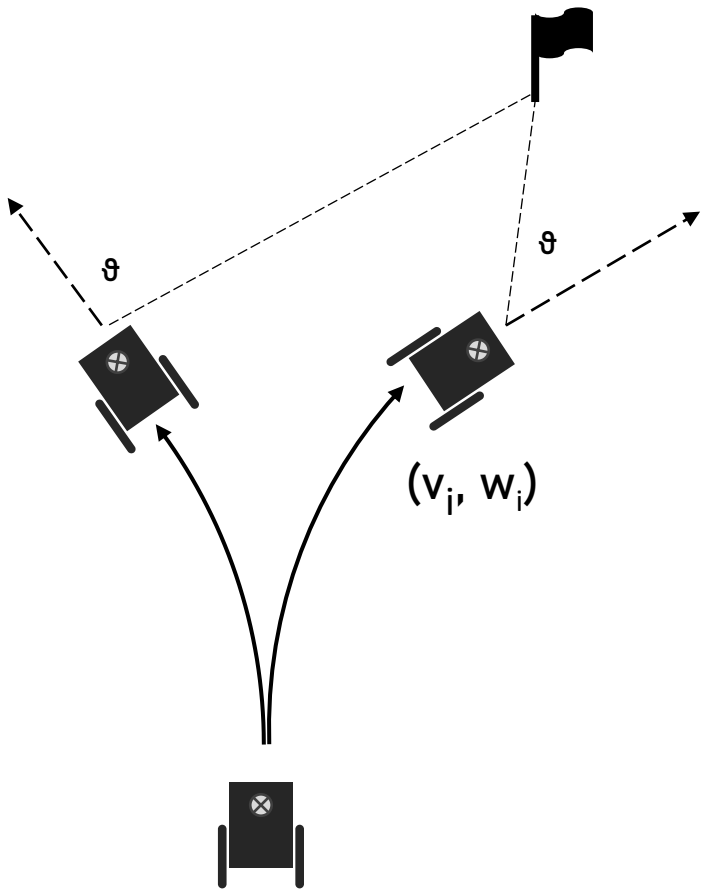
STEP 4

Maximizing the Objective Function

$$O = \mathit{heading}\,(v_i, w_i) + \mathit{velocity}\,(v_i, w_i) + \mathit{dist}(v_i, w_i)$$

How it work?

Heading (v_i, w_i)



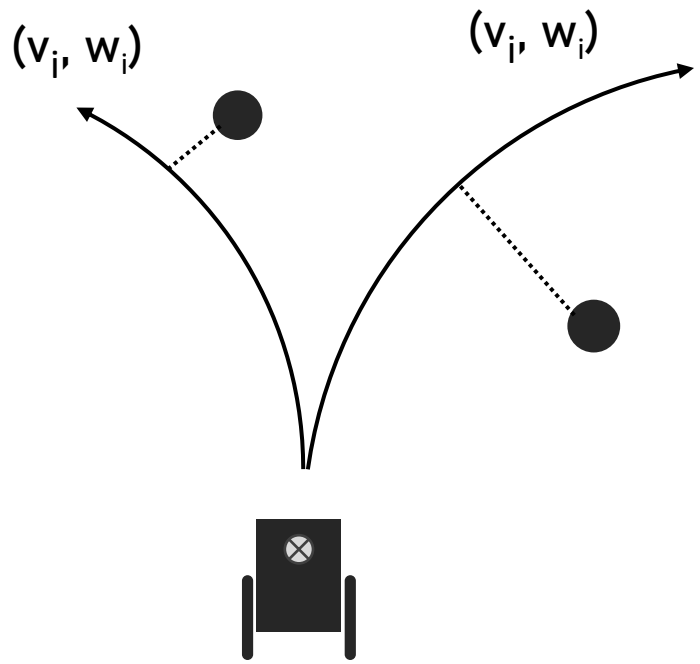
180 – ϑ

The smaller, the better

How it work?

Clearance (v_i, w_i)

The larger, the better

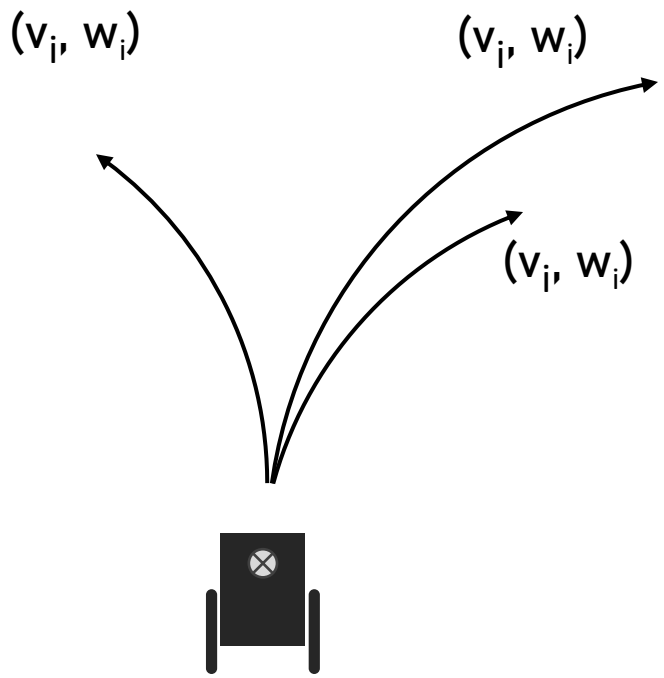


How it work?

Velocity (v_i, w_i)

Only take
translational velocity

The larger, the better



How it work?

STEP 4

Maximizing the Objective Function

$$O_i = \textit{heading}\,(v_i, w_i) + \textit{velocity}\,(v_i, w_i) + \textit{dist}(v_i, w_i)$$

$$\text{Best } (v,w) = \max(O_1, O_2, O_3, \ldots, O_{n-1}, O_n)$$

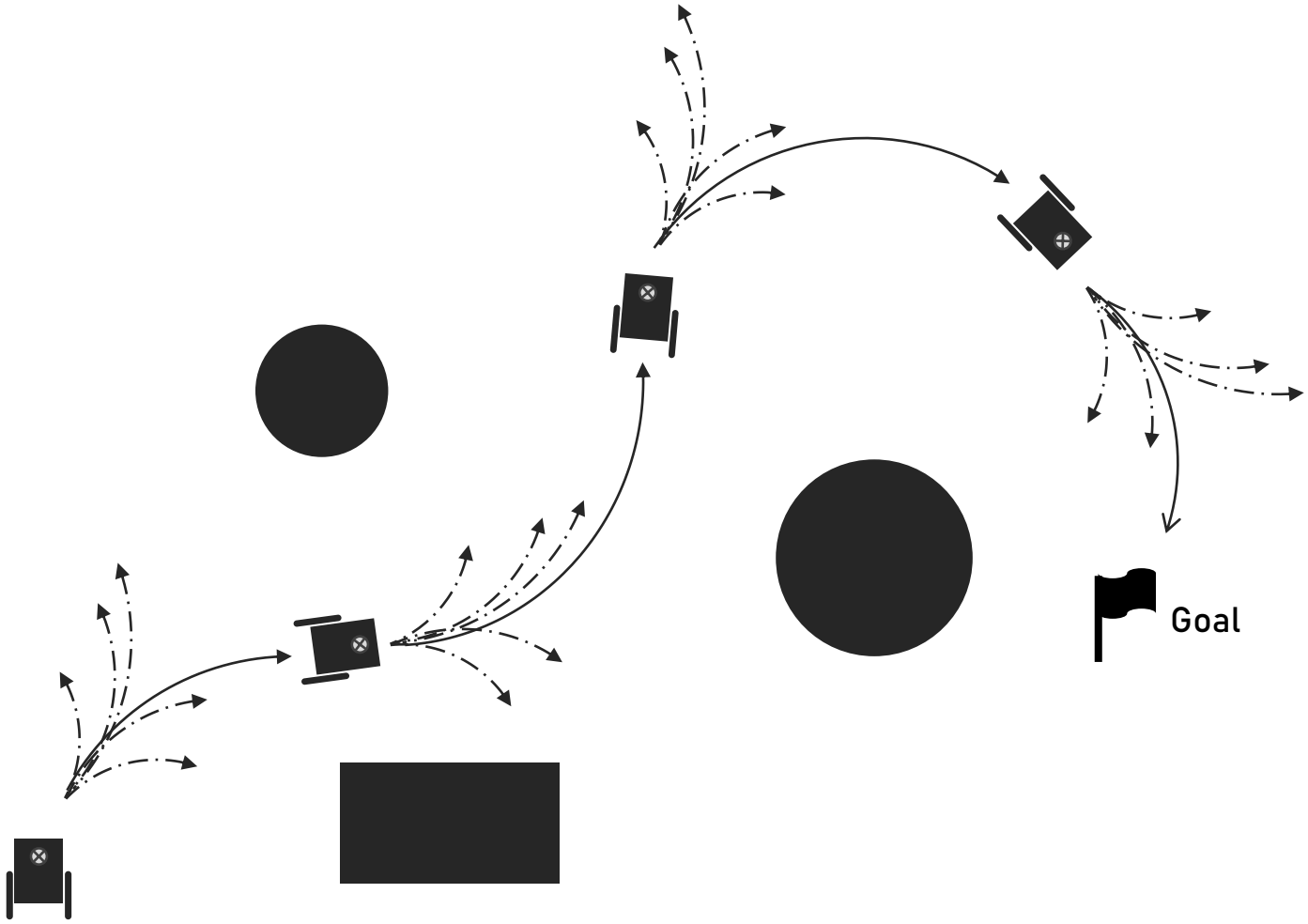
How it work?

```
Loop while currentPosition != goalPosition{

        // for each time-interval,
        // find best velocity (v, w)
        STEP 1: Generate All Possible Circular Trajectories
        STEP 2: Choose Admissible Velocity
        STEP 3: Choose Velocity in Dynamic Window
        STEP 4: Maximizing the Objective Function

        // go with (v, w)
        MOVE()
}
```

How it work?



Thank you.