# PARKING SERVICE
## With Pathfinding

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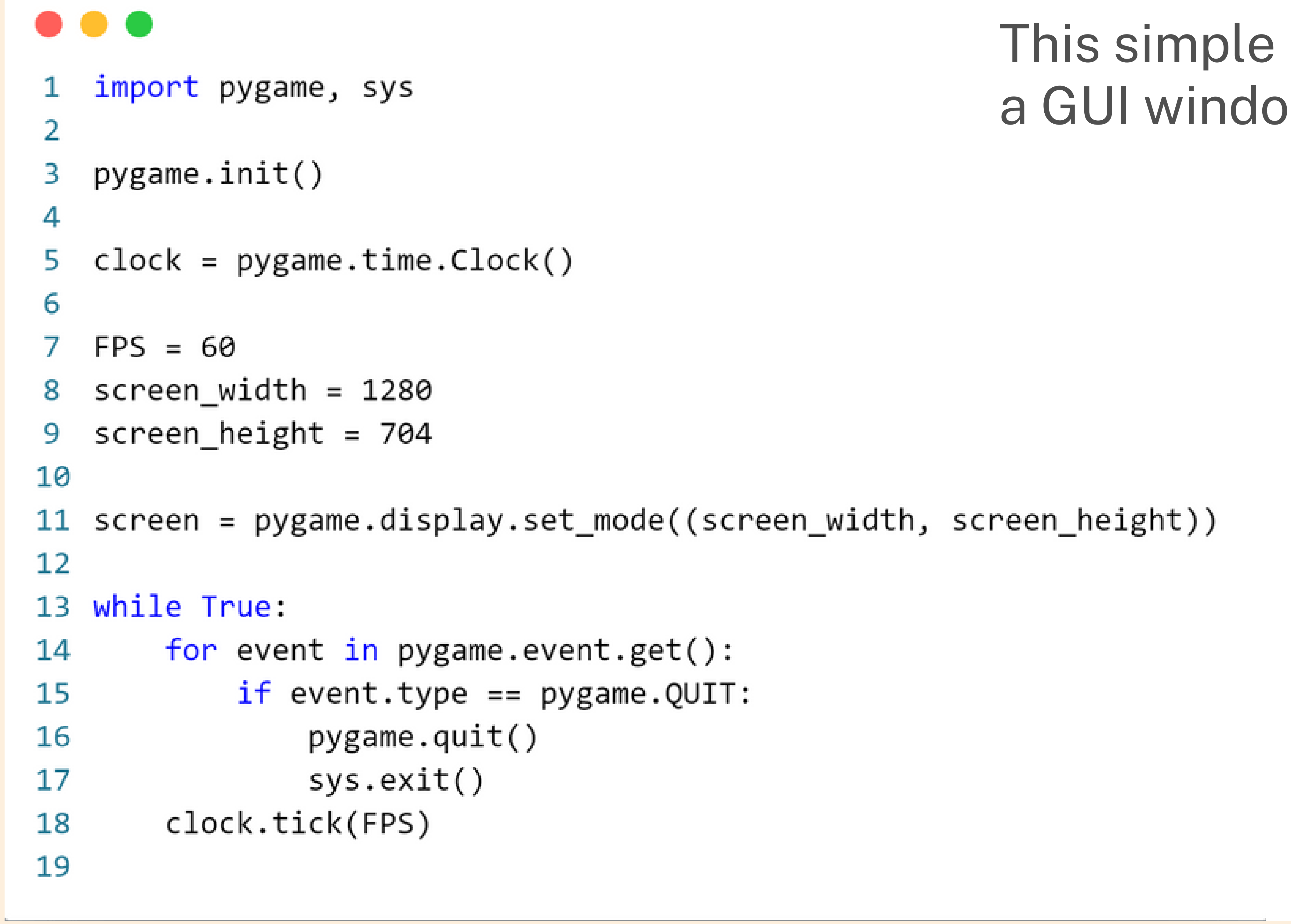
# Abstraction:

Nowadays finding a parking place in a busy day in the mall can be very frustrating, so we gathered ourselves as a team to come up with a solution. We have built a simulated program to help you find an empty parking slot that is closest to the gate you wish to enter.

# Methods:

***Basic setup:***



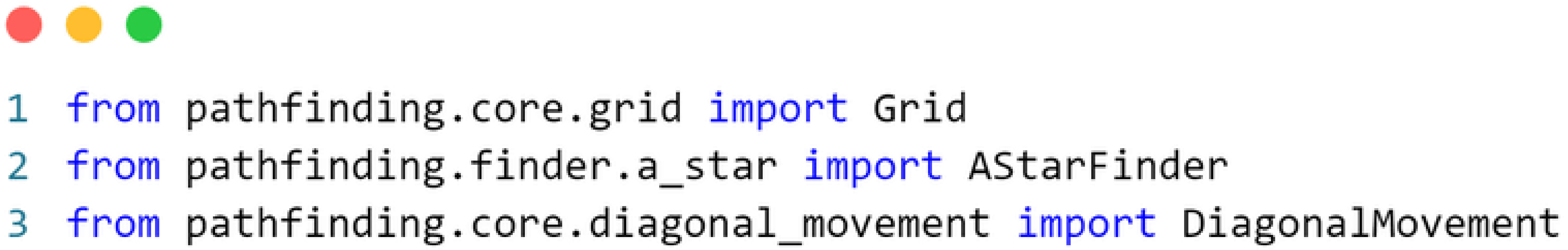
```python
import pygame, sys

pygame.init()

clock = pygame.time.Clock()

FPS = 60
screen_width = 1280
screen_height = 704

screen = pygame.display.set_mode((screen_width, screen_height))

while True:
    for event in pygame.event.get():
        if event.type == pygame.QUIT:
            pygame.quit()
            sys.exit()
    clock.tick(FPS)

```

This simple block of code is used to generate a GUI window in python.

# Methods:

***Library:***

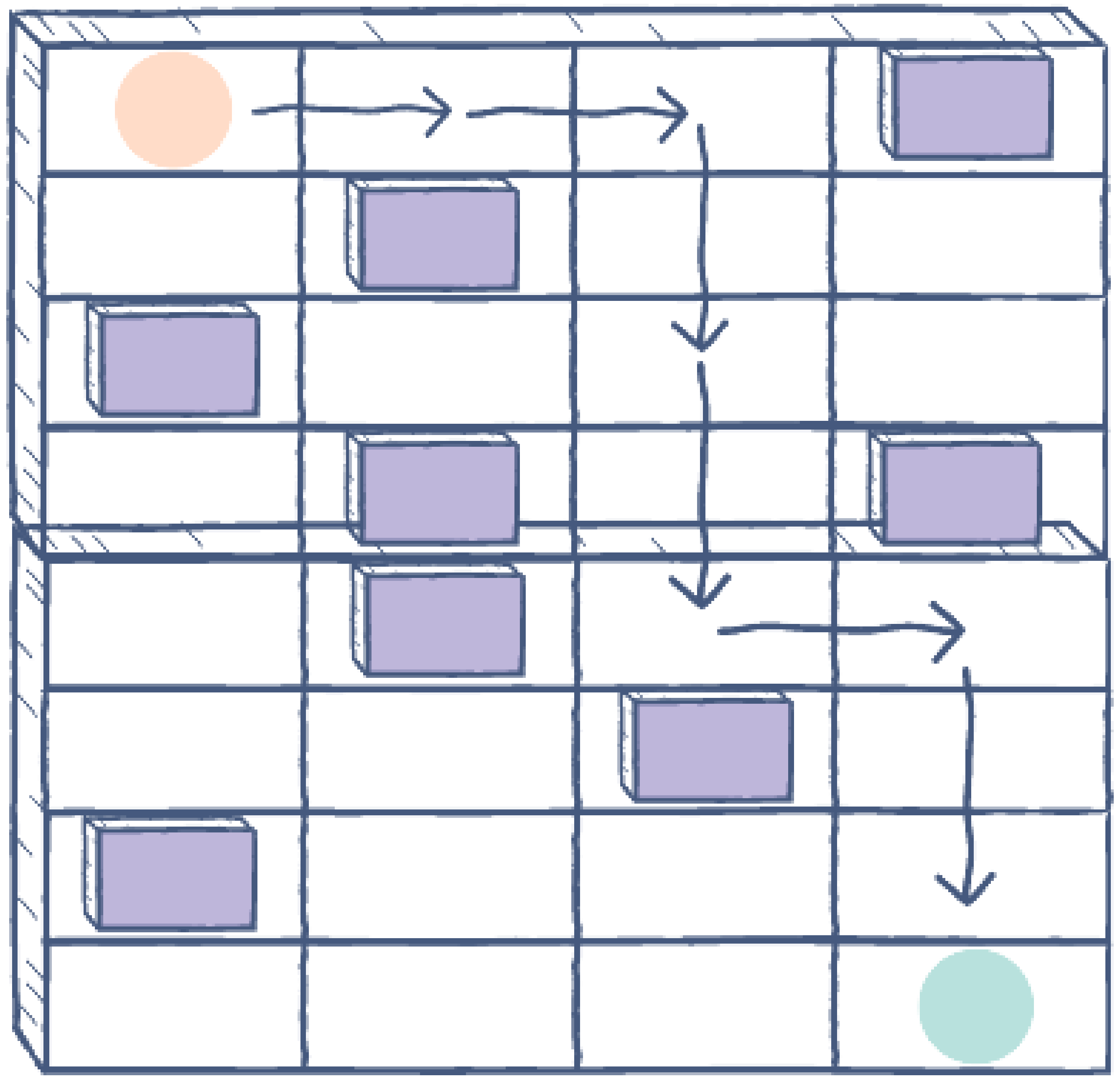
We imported these libraries from the pathfinding module to complete our logic



```python
from pathfinding.core.grid import Grid
from pathfinding.finder.a_star import AStarFinder
from pathfinding.core.diagonal_movement import DiagonalMovement
```

# Methods:

***Algorithm:***

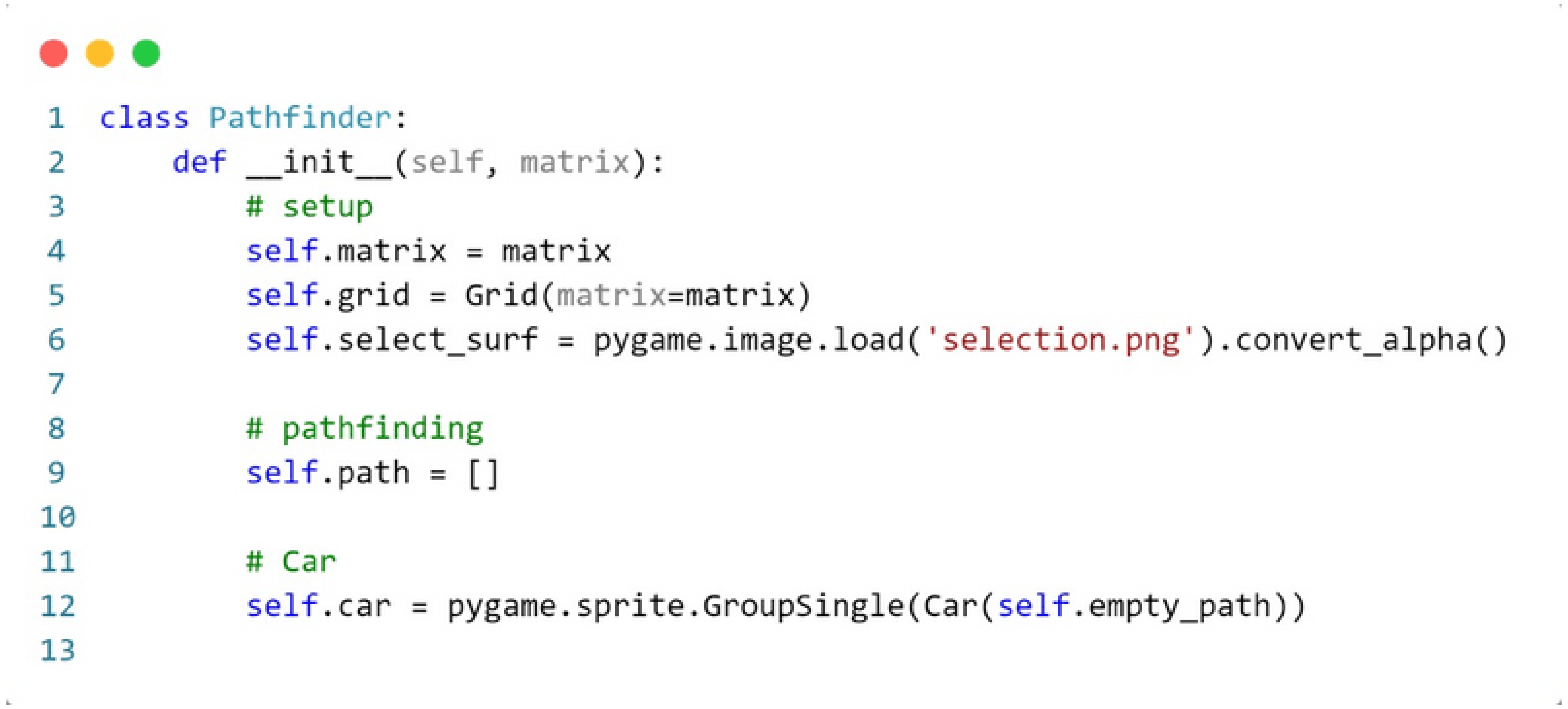


Our primary algorithm is A * algorithm is a type of search algorithm that finds the shortest path between two states. It is used in many different applications, including maps.

In maps, the A* algorithm is used to determine the shortest distance between the source (starting point) and the destination (final state).

# Methods:

*Classes:*

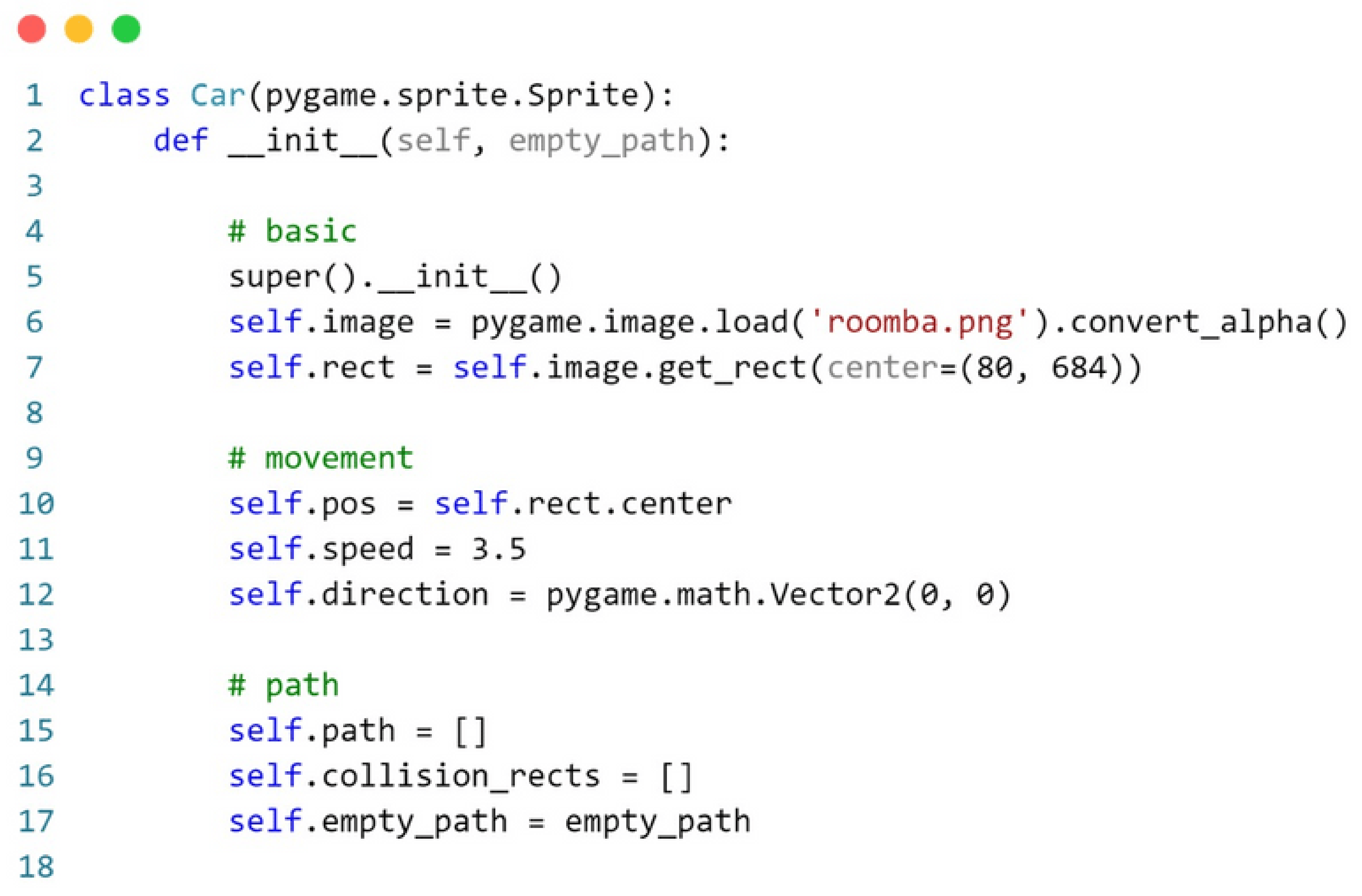


```python
class Pathfinder:
    def __init__(self, matrix):
        # setup
        self.matrix = matrix
        self.grid = Grid(matrix=matrix)
        self.select_surf = pygame.image.load('selection.png').convert_alpha()

        # pathfinding
        self.path = []

        # Car
        self.car = pygame.sprite.GroupSingle(Car(self.empty_path))

```

The (Pathfinder) class is used to find the closest path from points A to Z.

# Methods:

*Classes:*



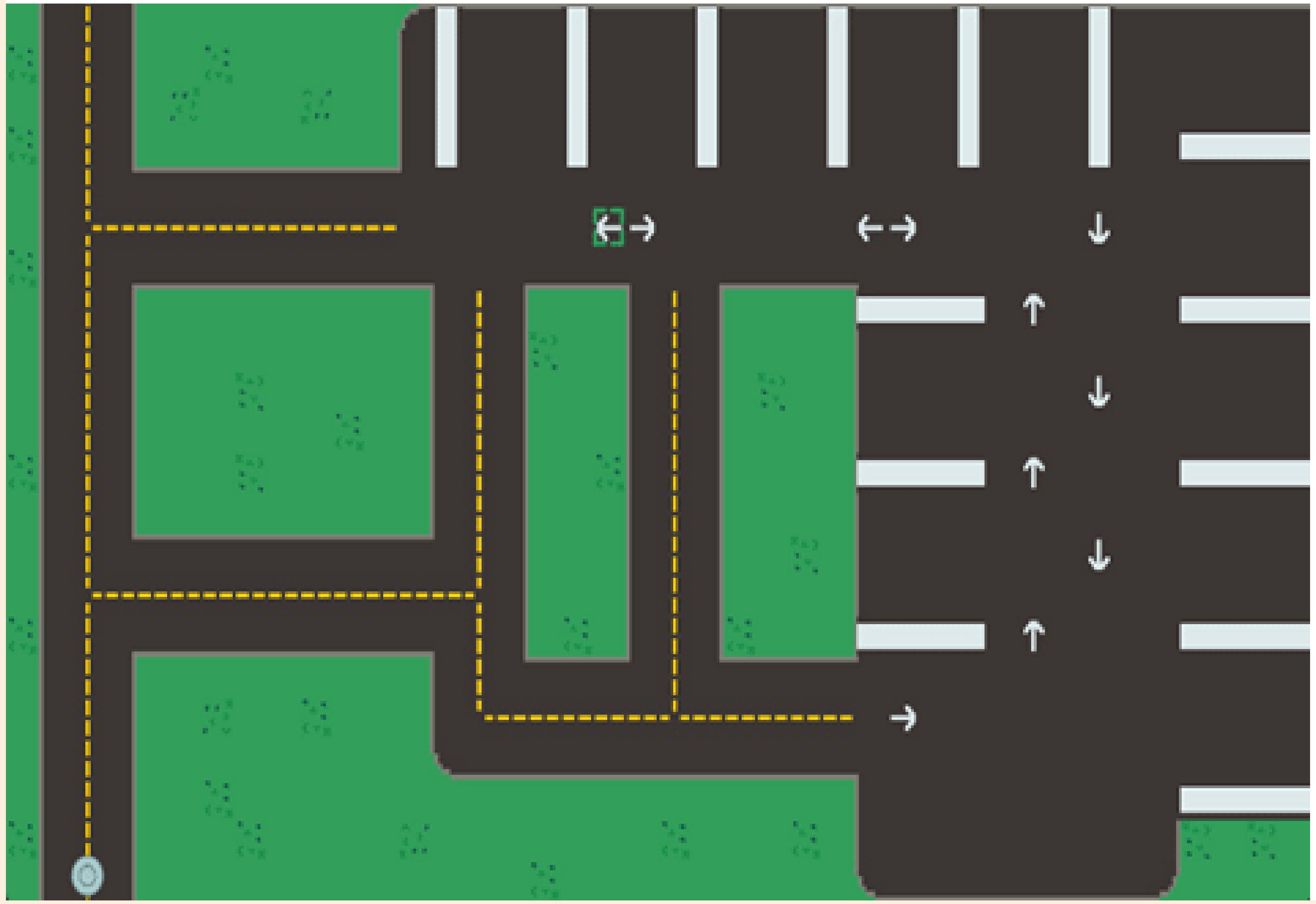
```
class Car(pygame.sprite.Sprite):
    def __init__(self, empty_path):

        # basic
        super().__init__()
        self.image = pygame.image.load('roomba.png').convert_alpha()
        self.rect = self.image.get_rect(center=(80, 684))

        # movement
        self.pos = self.rect.center
        self.speed = 3.5
        self.direction = pygame.math.Vector2(0, 0)

        # path
        self.path = []
        self.collision_rects = []
        self.empty_path = empty_path

```

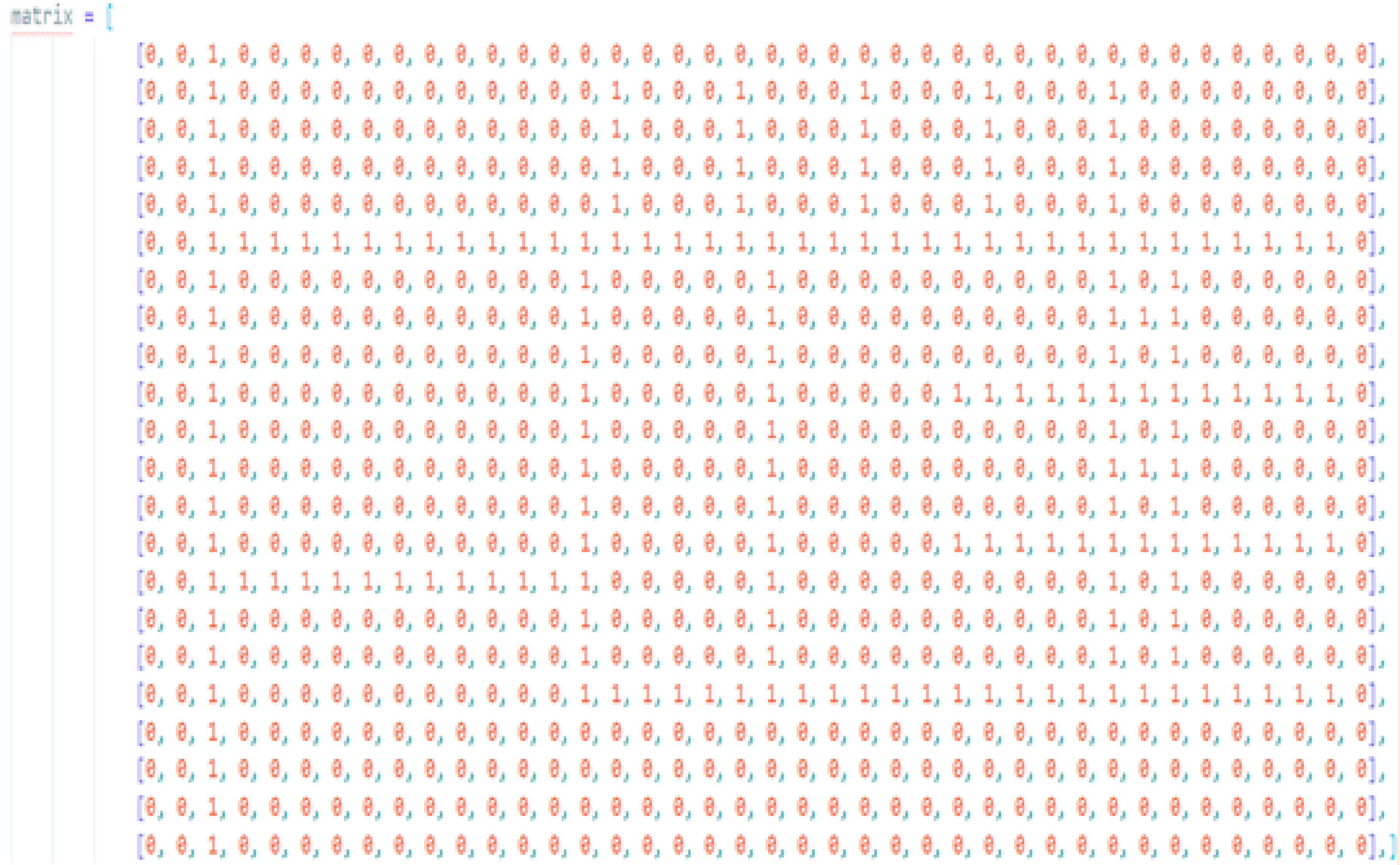
The (car) class is used to control the car movement..

# Methods:

***Map & Matrix:***

Our map is mirrored in the matrix. Every drivable location on the map is made up of 1s in the matrix, and the inverse is true for 0s.





```
matrix = [
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 1, 1, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 0],
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        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 1, 0, 1, 0, 0, 0, 0, 0, 0],
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        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0],
        [0, 0, 1, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0, 0],]
```

# Result:

Lastly, our program is very reliable and helps you find the closest parking slot in the shortest amount of time possible.

# Future Work:

Our program is unfinished yet. We still have a lot to work on and improve. Our next objective is to make the program calculate the closest distance from the gate to the nearest empty parking slot.

# THANK YOU!

Discrete Mathematics - Math211