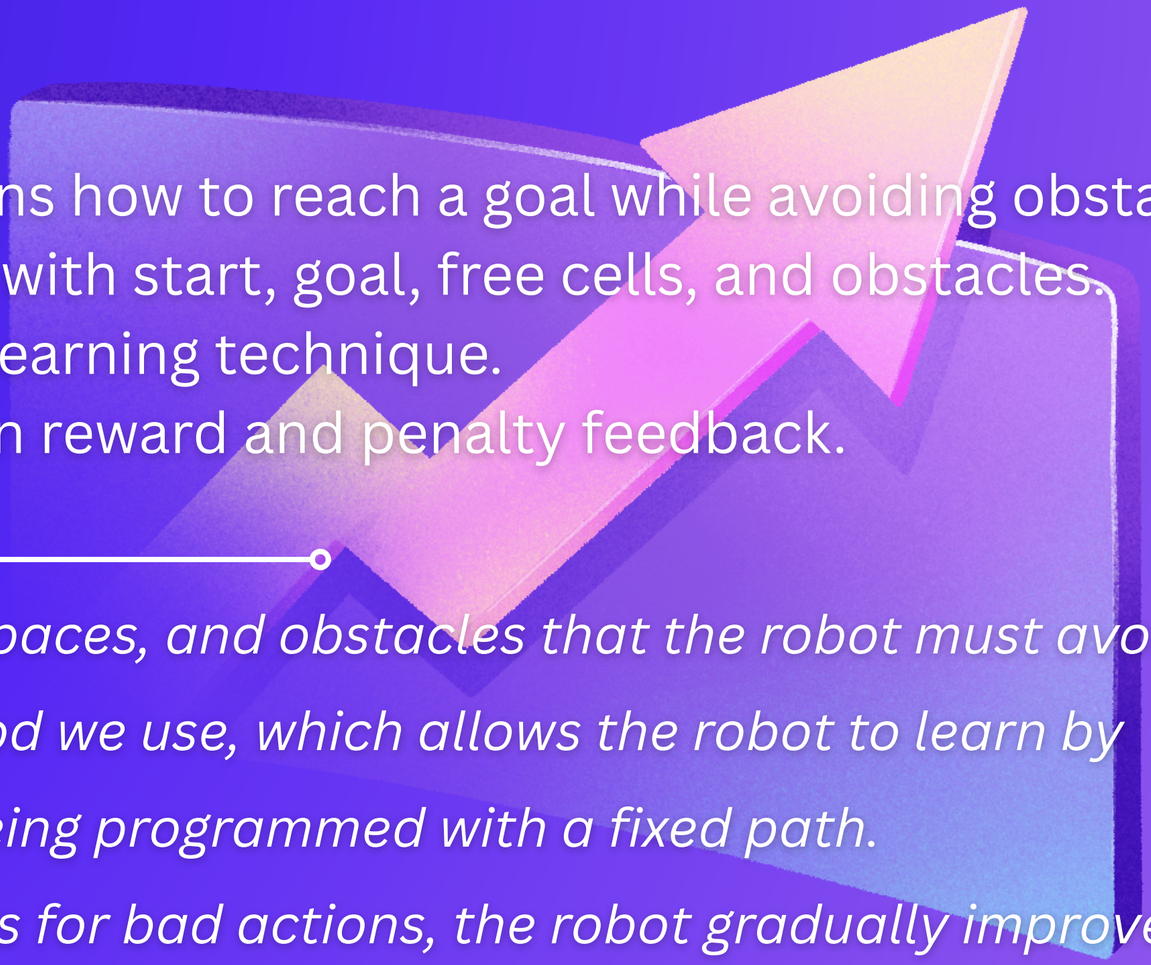
SMART ROBOT USING QLEARNING

Introduction

- This project implements a robot that learns how to reach a goal while avoiding obstacles.
- The environment is represented as a grid with start, goal, free cells, and obstacles.
- Q-Learning is used as the reinforcement learning technique.
- The robot improves its decisions based on reward and penalty feedback.



The grid contains a starting point, a goal, free spaces, and obstacles that the robot must avoid.

Q-Learning is the reinforcement learning method we use, which allows the robot to learn by interacting with the environment rather than being programmed with a fixed path.

Through rewards for good actions and penalties for bad actions, the robot gradually improves its choices and learns the best route to reach the goal efficiently

Problem & Objectives

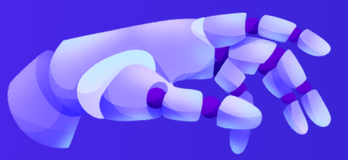
Problem Statement:

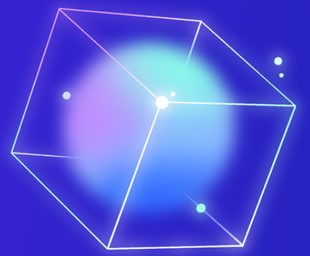
Robots must navigate autonomously in environments that contain obstacles or unknown layouts.

Objectives:

- Train a robot to find the optimal path to a target location.
- Enable learning without prior knowledge of the map.
- Avoid obstacles and detect situations where no valid path exists (“robot stuck”).
- Visualize the robot’s movement and the Q-table learning process.

Methodology & Results





Methodology

- The robot navigates a 2D grid using Q-Learning.
- States are grid cells; actions are up, down, left, and right.
- The Q-table learns the best actions through rewards and penalties.
- After training, the robot follows the optimal path to reach the goal.

Results

- The robot successfully finds efficient paths.
- The Q-table converges after training episodes.
- The system detects when no valid path exists (“robot stuck”)

Conclusion

- Q-Learning is effective for simple robot navigation tasks.
- The approach can be expanded to larger or more complex environments.

THANK YOU!