Autonomus Robot for the Detection of Landmines in a Simulated Environment

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I. ABSTRACT

II. INTRODUCTION

En este trabajo, se presenta un agente de aprendizaje por refuerzo profundo (DRL) diseñado para la detección de minas terrestres en un entorno simulado. La detección de minas es un desafío crítico en la ingeniería y la seguridad, ya que estas representan una amenaza significativa para la vida humana y la infraestructura. La combinación de tecnologías avanzadas, como el aprendizaje a utomático y los sensores LiDAR, ofrece una solución prometedora para abordar este problema.

To develop and test our deep reinforcement learning (DRL) agent, we use the Gymnasium library, specifically the CarRacing environment [**?**]. This library provides a simulated environment that is both flexible and widely used in the research community. The CarRacing environment allows us to create realistic scenarios for training and evaluating our agent. By using this tool, we can focus on improving the agent's performance without the need for a physical setup, saving time and resources.

Recent advancements in reinforcement learning have demonstrated the potential of feedback linearization techniques for controlling autonomous vehicles in complex environments. For instance, [**?**] explores the use of reinforcement learning to design a linearizing controller for car racing dynamics, enabling efficient path planning and trajectory tracking. Inspired by these methods, our work adapts similar principles to address the unique challenges of landmine detection in simulated environments.

III. METHODS AND MATERIALS

Our desing first of all we make a component diagram to show the components of our system, and how they are related to each other. The diagram is shown in Fig. **??**.

Our techincal decisions are based on use LiDAR sensors to detect the landmines, and the use of a deep reinforcement learning agent to control the robot. The LiDAR sensors are used to create a 3D map of the environment, and the deep reinforcement learning agent is used to control the robot's movements in the environment. The deep reinforcement learning agent is trained using a reward function that encourages it to move towards the landmines and avoid obstacles. Also we use the giroscope, acceleromenter. The giroscope is used to get the orientation of the robot, the accelerometer is used to get the speed of the robot. The deep reinforcement learning agent is trained using a reward function that encourages it to move towards the landmines and avoid obstacles. The reward function is based on the distance to the landmines and the distance to the obstacles. The deep reinforcement learning agent is trained using a Q-learning algorithm, which is a model-free reinforcement learning algorithm that learns a policy by estimating the value of each action in each state.

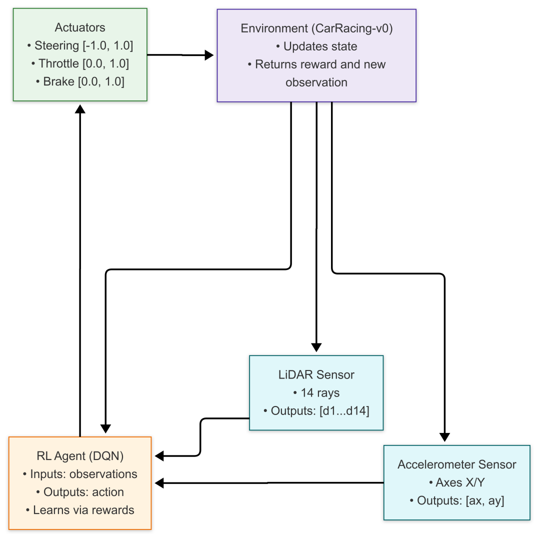

Fig. 1. Component diagram of the system.

IV. RESULTS

V. CONCLUSIONS

ACKNOWLEDGMENT

VI. BIBLIOGRAPHY

Funded by *Your Funding Source* under grant No. 12345.