



A.R.E.S. (AI Rover Exploration Scout)

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Opportunity: California Space Grant Consortium



HARTNELL COLLEGE



The A.R.E.S. (AI Rover Exploration Scout) project is a NASA-sponsored initiative developed through the California Space Grant Consortium (CaSGC) aimed at designing and constructing a semi-autonomous bogie rover capable of simulating planetary exploration missions. This rover is a six-wheeled, all-terrain ground vehicle that employs a Raspberry Pi 4 Model B along with one Arduino Mega board for control, data processing, and navigation. It features a night vision camera and ultrasonic sensors for obstacle detection, for better operational sustainability in uneven terrains, a temperature sensor, and GPS to know the location of the rover at all times. A.R.E.S. also incorporates computer vision and machine learning techniques to identify and classify rock types commonly found on Earth and Mars, such as basalt and granite. A custom-trained TensorFlow model, converted to TensorFlow Lite

for real-time operation, processes live video footage to detect and label rocks with bounding boxes. Additionally, the system can stream data wirelessly to a smartphone interface, facilitating remote observation. Currently, A.R.E.S. demonstrates moderate accuracy in real-time rock detection and autonomous navigation over uneven surfaces. Future enhancements are planned, including expanding the training dataset for improved classification accuracy, advancing autonomous pathfinding capabilities, and potentially adding a robotic arm. A.R.E.S. represents a scalable, AI-integrated robotic solution for future Mars exploration efforts and serves as an educational tool for outreach in space science and robotics.

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