Press release

NASA Space ROS Sim Summer Sprint Challenge Winners Announced

Hosted by Freelancer.com, the $30,000 challenge aimed to help NASA plan future space missions

SAN FRANCISCO, California - 4 December 2024 – Freelancer.com (ASX: FLN), the world's largest freelancing and crowdsourcing marketplace by number of users and jobs posted, today announced the winners of the NASA Space ROS Sim Summer Sprint Challenge.

Announced in July 2024, the US$30,000 global crowdsourcing challenge aimed to stimulate involvement in Space ROS, an open-source framework for developing mission-ready robotic systems for space.

The objective of this challenge was to enhance the robustness of Space ROS and support NASA's planning for future missions by developing new functionalities, creating demonstration environments, or refining existing ones. Participants came from diverse backgrounds—ranging from robotics professionals to software development enthusiasts—who explored potential improvements and contributed innovative solutions that NASA could leverage. The challenge received significant interest, with participants tackling a wide array of issues, including developing new demonstration environments, enhancing existing documentation, and improving the versatility and faithfulness of simulations.

"This challenge was able to grow the Space ROS community 70 times bigger. What's exciting is that beyond the space applications, the open-source robot operating system can be adapted for agtech, mining, and extreme environment workers right here on Earth," said **Trisha Epp**, **program manager for the NASA Open Innovation Services (NOIS2) contract at Freelancer.com**

Challenge Winners

The challenge received a total of 30 eligible entries which aimed to improve the Space ROS. The winners include:

First place *| Space ROS Gazebo Demos |*
Team Lead: Katie Hughes from Boston, MA, USA. Team members: David Dorf | $10,000 USD

Github Pull Request: https://github.com/space-ros/demos/pull/33
Summary: This submission offers a comprehensive simulation of accurately modeled robots—including an orbiter, submarine, robotic arm, helicopter, and rovers—set in realistic environments like

Mars, the Moon, Enceladus, and the ISS orbit, all with *adjusted* gravity and coordinate systems. Utilizing actual NASA-JPL data for models like Perseverance and Ingenuity ensuring high fidelity, it was implemented in Gazebo Harmonic with ROS 2 integration. The robots possess advanced capabilities aligning with future NASA missions, making them useful for mission testing.

Second place *| Parallel ProcGen Environments |*
Team lead: Andrej Orsula from Esch-Sur-Alzette, Luxembourg | $7,500 USD

Github Pull Request: https://github.com/space-ros/demos/pull/72
Summary: This submission introduces the spaceros_procgen_envs package, which enhances space robotics simulation by providing procedurally generated environments that reflect the unpredictability of space. Utilizing Blender for on-demand creation of unique 3D assets and integrating with NVIDIA Isaac Sim for highly parallel simulations, it enables extensive testing and training without relying on large static datasets. The package is compatible with Space ROS and the Gymnasium API, supporting multi-robot operations and aiding in the development of robust algorithms for autonomous space missions.

Third place *| Space-ROS-NVIDIA-Isaac-Sim Curiosity's Sulfur Stone Discovery |*
Team Lead: Po-Jen Wang from Daly City, CA, USA. Team members: Aleksandr Kalmykov | $5,000 USD

Github Pull Request: https://github.com/space-ros/demos/pull/74
Summary: This submission presents a simulation demo that integrates NVIDIA Isaac Sim with Space ROS. The team built a realistic digital twin of Mars using the HIRISE Mars Digital Terrain Model dataset. They created custom materials and assets specific to the Martian environment avoiding generic placeholders to authentically recreate a historic planetary exploration site. Users can operate the Curiosity rover in this environment, with controls fully compatible with the existing Space ROS interface. The simulator provides essential sensory feedback like camera, lidar, and odometry data.

Fourth place *| Mars Rover Demo on NVIDIA ISAAC with RVIZ based teleop and a Controller Loader |*
Team lead: Philip Saidely from Reston, VA, USA. Team members: Abhinesh Srivastava, Abhi Anuket | $ 3,000 USD

Github Pull Request: https://github.com/space-ros/simulation/pull/34 & https://github.com/space-ros/demos/pull/68
Summary: This submission enhances the Space ROS project by adding two key features: it ports the Mars Rover Demo to NVIDIA Isaac Sim, a simulation platform that provides highly realistic visuals and efficient performance, allowing simulations to run at high frame rates closer to real-world conditions. This improves the development and tuning of autonomy algorithms without heavy reliance on physical prototypes. Second, it introduces an RViz plugin with a user-friendly interface for controlling the rover through on-screen buttons, simplifying teleoperation. These contributions make simulations more realistic and accessible, enabling software developed in simulation to be more easily deployed on actual hardware.

Fifth place (Tied) *| Ingenuity Flight Simulation | Team lead: Baris Yazici from Munich, Germany | $1,250 USD*

Github Pull Request: https://github.com/space-ros/demos/pull/39
Summary: This submission introduces a custom cyclic and collective control simulation for coaxial rotor aircraft, implemented as parameterizable Gazebo plugins. These control algorithms are applicable not only to the Ingenuity helicopter but also to new-generation Martian helicopters, and they include an aircraft automatic altitude control with collective output—features that are new to Gazebo simulation. Additionally, the submission provides solutions for simulating sensor data and environmental effects like Martian dust storms, enabling developers to test perception algorithms under realistic noisy conditions.

Fifth place (Tied) *| Ingenuity coaxial helicopter model | Team lead: David Zamblera from Castelli Calepio, Italy | $1,250 USD*

Github Pull Request: https://github.com/space-ros/demos/pull/60
Summary: This submission advances open-source development of autonomous flying robots based on helicopter architectures by providing Gazebo physics plugins and assets that model complex helicopter flight dynamics. It introduces a modular physics model allowing users to adjust complexity, computational load, and fidelity of sub-components like rotor flapping dynamics, inflow modeling, and rotor-generated forces. It also includes a demonstration simulating the Ingenuity Mars Helicopter within the Space ROS ecosystem, enabling control over flight parameters such as collective pitch and rotor velocity, and publishing sensor data like camera feeds, IMU readings, and laser altimeter measurements.

Honorable mentions ($400 USD each)

This challenge also awarded 5 honorable mentions. They include:

IsaacSim Integration of Curiosity Rover Demo | Team lead: Adithya Selvakumar from Mount Laurel, NJ, USA.

Github Pull Request: https://github.com/space-ros/demos/pull/34
Summary: This submission integrates NVIDIA Isaac Sim—a photorealistic physics simulator—with the Curiosity Rover demo, standardizing the demo packages for both GazeboSim and Isaac Sim. This allows users to choose between simulation engines with minimal changes and easily adapt the Curiosity Rover into the Isaac Sim ecosystem using drag-and-drop functionality. This solution received an honorable mention for a critical eye at organization of assets and supporting multiple simulation environments from common assets and configuration.

Improving fidelity of SSRMS demo with Trick | Team lead: Blazej Fiderek from Krakow, Poland.

Github Pull Request: https://github.com/space-ros/demos/pull/41
Summary: This submission enhances Space ROS by providing an end-to-end demonstration of the Canadarm2 robotic arm interfacing with NASA's Trick simulation environment. It improves the physics fidelity of Canadarm2 in Space ROS by adding dynamic simulation and a more complex friction model, and enhances visualization of the Space Station Remote Manipulator System (SSRMS). This submission received an honorable mention for pioneering the integration of NASA's Trick simulation with Space ROS, enhancing simulation realism and providing an adaptable, open-source ROS 2-Trick bridge with extensive documentation for future robotic applications.

Lunar Pole Exploration Rover & Plugins | Team lead: Robin Baran from Stockholm, Sweden. Team members: Stevedan Ogochukwu Omodolor

Github Pull Request: https://github.com/space-ros/demos/pull/43
Summary: This submission presents a Gazebo simulation of a lunar south pole exploration mission inspired by NASA's VIPER mission. It features a realistic model of the Mons Mouton landing site and a fully controllable rover model. Key elements include custom Gazebo plugins that simulate the unique power generation challenges of the lunar south pole reflecting conditions like constant solar power outside shaded areas and its absence within them. This submission received an honorable mention for its innovative and adaptable simulation of lunar conditions, providing a valuable tool for realistic mission testing and exploration beyond the VIPER mission.

CADRE Demo: Cooperative Autonomous Distributed Robotic Exploration | Team lead: Sanjay Jayalakshmi Prabakar from Indiana, USA.

Github Pull Request: https://github.com/space-ros/demos/pull/66
Summary: This submission provides a comprehensive, open-source simulation of NASA's upcoming CADRE mission, featuring a realistic lunar environment created using actual NASA data and a custom-built CAD model of the CADRE rover integrated into ROS 2. It includes advanced features like point cloud-based lunar mapping and supports teleoperation of multiple rovers across various development platforms. This submission received an honorable mention for its impressive contribution to autonomous lunar exploration, offering a highly detailed, open-source simulation that advances real-world applications in multi-rover coordination and mapping.

Apollo 15 Lunar Roving Vehicle Simulation | Team lead: Jasper Grant from Halifax, Nova Scotia, Canada.

Github Pull Request: https://github.com/space-ros/demos/issues/61, https://github.com/space-ros/simulation/issues/31, https://github.com/space-ros/demos/pull/62 & https://github.com/space-ros/simulation/pull/32
Summary: This submission provides a simulation of the Lunar Roving Vehicle (LRV) used in the Apollo missions, addressing the lack of actual flight-tested rovers in lunar simulations that often focus on theoretical models. The team created a controllable LRV model with accurate dimensions

and dynamics, implemented as an SDF model with DAE meshes, and set it in a realistic Apollo 15 landing site environment. The simulation includes odometry, an IMU, two cameras, and pays special attention to realism in both the rover and the environment. The submission received an honorable mention for creating a highly realistic and adaptable lunar simulation that bridges the gap between theoretical models and practical, tested rover dynamics.

More details surrounding the challenge, including all the details and prize allocations, can be accessed here: https://www.freelancer.com/contest/2417552

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