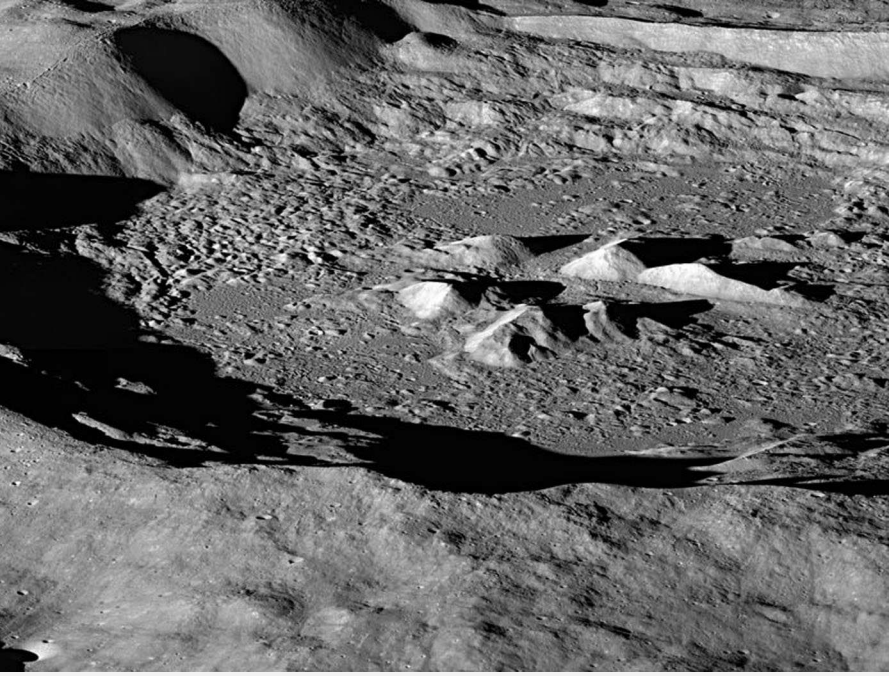


National Aeronautics and
Space Administration

Robotics, Automation and Control

Walk and Roll Robot

A robot using wheels associated with pivotal hip joint, knee joint and rolling motions

In smooth terrain, the most efficient motion to traverse the terrain is rolling; however, when a wheeled vehicle encounters obstacles, it must circumvent it if possible or choose an alternate path. Legged vehicles can traverse such obstacles by stepping over them, but are not energy efficient on smooth terrain. The Walk and Roll Robot combines walking and rolling capabilities for energy efficient motions. It utilizes a directed flux motor and epicyclical gear bearings to articulate the legs and wheels, which allows for a compact configuration and prevents gear backdrive. This compact design where all of the components are contained within the body allows the robot to be utilized for multiple applications including those with harsh environments where robots traditionally have difficulty with debris, moisture, or dust. Furthermore, more efficient gaits utilizing walking and rolling have been developed using the Walk and Roll Robot.

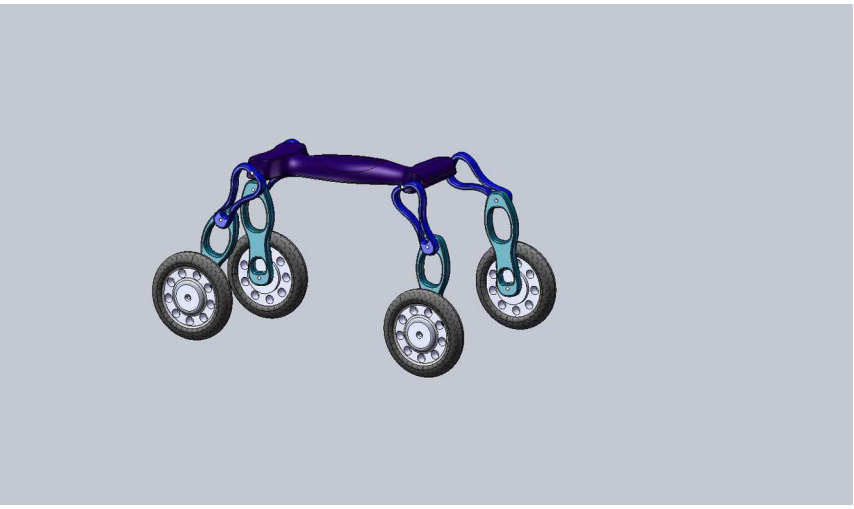
BENEFITS

- Combines walking and rolling capabilities for energy efficient motions;
- Shifts center of mass easily when needed for various movements;
- Increases stability while traversing obstacles; and
- Provides greater stability during turning at high speed.

technology solution

THE TECHNOLOGY

This technology is a mobile robotic unit. The unit has multiple legs supporting a main body i.e. vehicle body, and moving the main body in forward direction and reverse direction about a base surface. The leg includes wheels to roll along the base surface. A drive assembly comprises a motor operatively associated with hip and knee joints and the wheels for independently driving pivotal movement of the hip joint and the knee joint and rolling motion of the wheels. The assembly comprises drive shafts imparting driving pivotal movement to the hip and knee joint and rolling motion to the wheels. The Walk and Roll Robot includes various features which increase its robustness, lighten its weight, and increase its overall energy efficiency. The improvements include passive compliance in the leg gearing system and gear bearings, an actuated ball and socket joint to replace the hip joint, and a shaft drive to transfer power from the motor to the legs and wheels. As a result, the robot system would have the ability to deal with unexpected bumps in terrain without having to rely solely on an active suspension system. Furthermore, it allows for increased range of motion and a more compact housing. The shaft drive system is an improvement upon the previous mechanism which transferred power down to the legs and wheels. The new system allows for a spring damper to add passive compliance and shock absorption. It also allows for a significant decrease in weight and size over the previous method and allows for much greater scalability of the design.



A drawing of the Walk and Roll Robot

APPLICATIONS

The technology has several potential applications:

- Planetary exploration rovers;
- Urban search and rescue missions;
- Traversing harsh terrain for scientific exploration; and
- Military reconnaissance and exploration missions.

PUBLICATIONS

Patent No: 8,030,873; 6,640,949; 7,999,427

More Information

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NASA's Technology Transfer Program pursues the widest possible applications of agency technology to benefit US citizens. Through partnerships and licensing agreements with industry, the program ensures that NASA's investments in pioneering research find secondary uses that benefit the economy, create jobs, and improve quality of life.

GSC-15419-1, GSC-13905-1, GSC-15416-1
GSC-TOPS-43