IIT MADRAS
Indian Institute of Technology Madras

Technology Transfer Office
TTO – IPM Cell

Industrial Consultancy & Sponsored Research (IC&SR)

Novel Dune Rover Configuration for Improved Lateral Stability and Mobility in uneven Terrains.

IITM Technology Available for Licensing

Problem Statement

- Existing **wheeled robotic platforms lack** stability in **lateral and longitudinal directions** over **uneven terrain.**
- There is a demand for a solution that can enhance stability enabling wheeled robots to navigate challenging terrains reliably and efficiently.
- The primary goal of the design is to obtain **postural stability in all-terrain rovers** with the **least number of actuators possible**, which will reduce overall cost and result in a less sophisticated control strategy.

Technology Category/ Market

Category – Robotics and Automation
Applications – Agriculture, Exploration, Transportation, Hazard Monitoring
Industry - Robotics, Autonomous Vehicles, Agricultural Technology, Aerospace, Logistics, Space Rover platforms, Manufacturing
Market - The Robotics Market size is estimated at USD 45.85 billion in 2024, and is expected to reach USD 95.93 billion by 2029, growing at a **CAGR of 15.91%** during the forecast period (2024-2029).

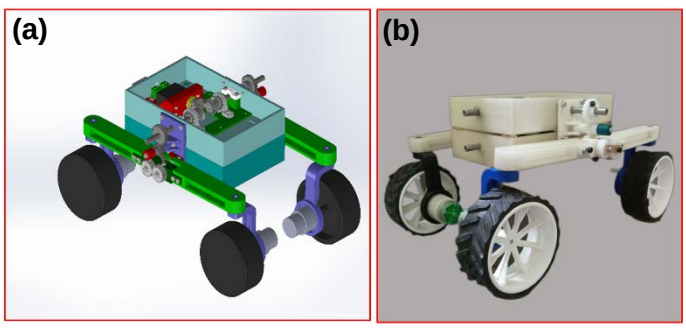


FIG. 1 depicts the schematic for the proposed rover architecture where (a) illustrates the novel design and (b) the experimental prototype

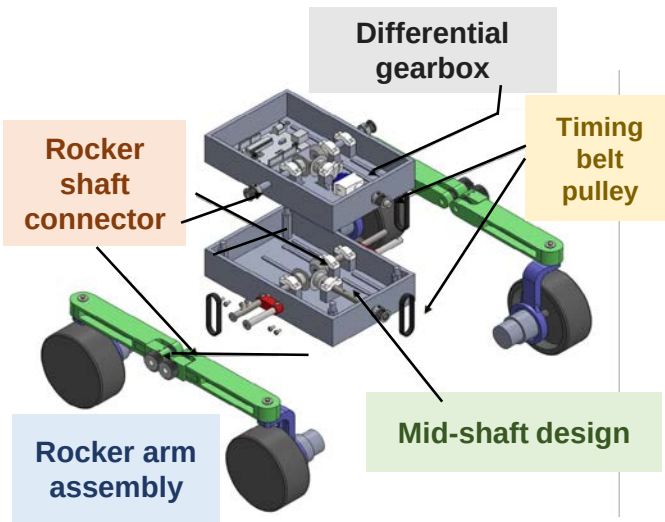
Intellectual Property

- **IITM IDF Ref. 2361**
- **IN 466271 (Patent Granted)**

Technological proposition

1 Rocker arm assembly :
Split rocker-arm assembly interconnected with dual differential allows for the synchronous as well as asynchronous actuation on uneven terrain.

2 Differential gearbox mechanism :
Dual differential layer can achieve pitch averaging and actively control chassis roll using only single actuator and the offset arm spur gear arrangement



3 Mid-shaft design :
Incorporates a mid-shaft arrangement with coaxial spur arrangement enabling passive movement for pitch stabilisation

4 Rocker shaft connector :
Features a connector with groove ball bearing and gear arrangement to synchronize the gearbox mechanisms on the top and bottom layers of the chassis, ensuring coordinated movement.

5 Rocker shaft connector :
Incorporates timing pulley-belt to prevent the rover from collapsing under its own weight

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Key Features / Value Proposition

User Perspective:

- **Improved Stability:** Users benefit from **enhanced stability,** enabling more reliable **navigation in challenging terrains.**
- **Versatile Applications:** The invention's **stability across various terrains** expands its utility in **agriculture, exploration, transportation, and hazard monitoring.**

Technical Perspective:

- **Unified Actuation:** Utilizes a **single actuator for roll and pitch control, simplifying system design and reducing control complexity .**
- **Synchronization Mechanism: Differential gearbox** and **timing pulley-belt system** ensure **coordinated movement, optimizing stability control.**

TRL (Technology Readiness Level)

TRL- 4, Technology validated in Lab scale.

Research Lab

Prof. Asokan T
Robotics Lab, Dept. of Engineering Design

Technological Validation

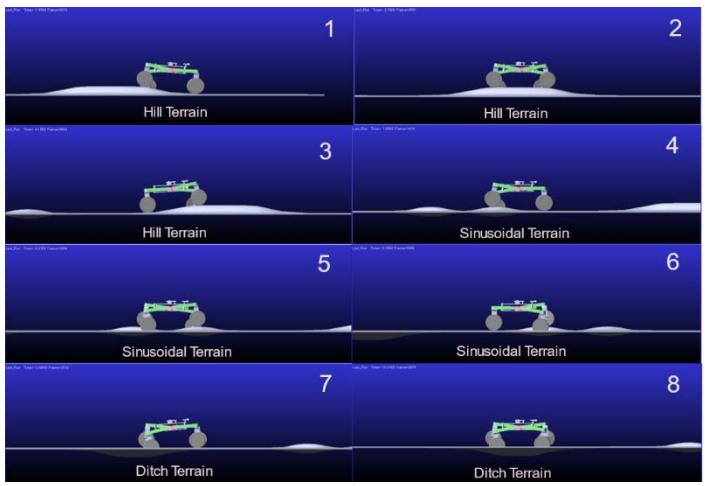

FIG. 2 illustrates simulation frame sequences of the proposed rover design moving across a hill, sinusoidal feature and a ditch terrain

Images

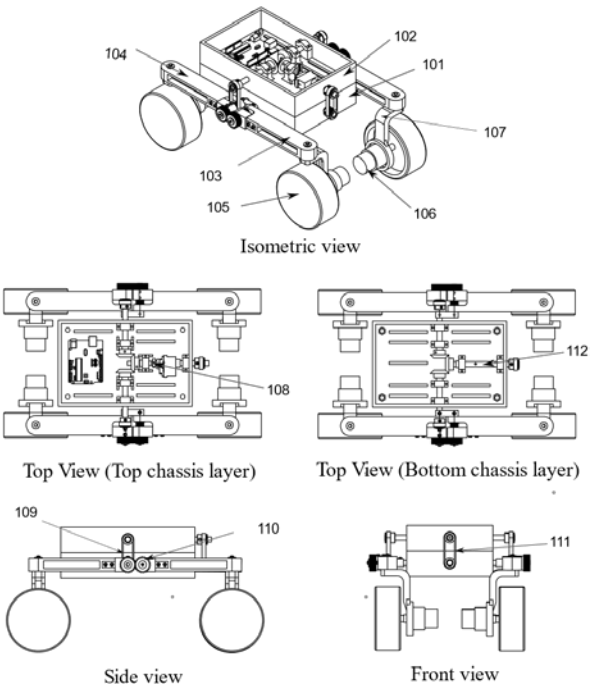

FIG. 3 depicts the detailed drawing of the novel rover architecture

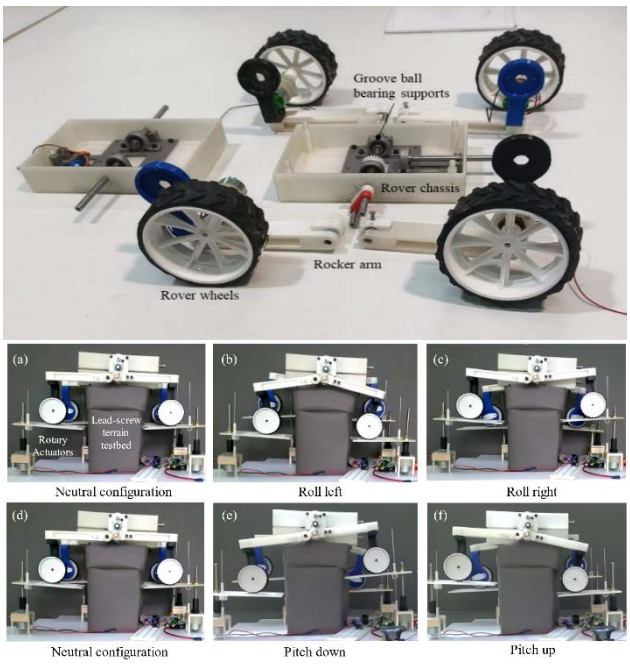

FIG. 4 shows fabricated prototype demonstrating different operational modes in unstructured terrains

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