

REVIEWER'S REPORT

Manuscript No.: IJAR-53849

Date: **16.09.2025**

Title: RBR-1: Design and Development of a Multi-Purpose Autonomous Rover with Modular Arm, SLAM-Based Navigation, and Integrated Sensor Systems for Smart Agriculture

Recommendation:

Accept after Minor revision

Rating	Excel.	Good	Fair	Poor
Originality	✓			
Techn. Quality		✓		
Clarity		✓		
Significance		✓		

Reviewer Name: Dr.K.Arumuganainar

Date: **16.09.2025**

Reviewer's Comment for Publication.

1. Clarity & Language

- Simplify lengthy technical descriptions for readability.
- Maintain consistent terminology (e.g., "RBR-1 rover" instead of variations).

2. Figures & Diagrams

- Improve figure captions with explanations of results.
- Provide clear schematics for hardware integration and software flow.

3. Experimental Validation

- Expand field trials across multiple agricultural scenarios.
- Compare results with at least one existing rover prototype.
- Include error bars/statistical measures for performance metrics.

4. Discussion

- Provide a cost-benefit analysis for small/medium farmers.
- Discuss energy optimization (battery replacement/charging strategies).
- Highlight limitations and future scope in more detail.

5. References

- Standardize citation style.
- Add more recent (2023–2025) robotics and agriculture automation studies.

Detailed Reviewer's Report

Title of the Paper: RBR-1: Design and Development of a Multi-Purpose Autonomous Rover with Modular Arm, SLAM-Based Navigation, and Integrated Sensor Systems for Smart Agriculture

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1. Originality

The work presents the design and development of an autonomous rover with a modular robotic arm, multi-sensor integration, and SLAM-based navigation for smart agriculture. The **integration of RTK-GPS, LiDAR, vision systems, and agricultural sensors in a modular, low-cost rover** is a noteworthy contribution. While similar studies exist in precision agriculture and robotics, this research demonstrates a **comprehensive, multi-purpose rover platform** with both software and hardware validation.

Strengths:

- Novel integration of multiple sensing technologies with modular robotics.
- Emphasis on cost-effectiveness and scalability for small/medium-scale farmers.
- Detailed description of both hardware and software frameworks.

Weaknesses:

- Some features (e.g., rocker-bogie suspension, robotic arms, SLAM) are adapted from existing robotics research, reducing novelty.
- Lacks strong benchmarking against other agricultural robots.

Score: 8/10

2. Significance

The research addresses **critical issues in precision agriculture** such as automation, labor shortage, and environmental adaptability. The rover has **cross-domain applicability** in

mining, industrial automation, and disaster management, making the work **highly relevant and impactful**.

Strengths:

- Addresses sustainability, efficiency, and labor challenges in agriculture.
- Offers practical solutions for diverse field tasks (planting, spraying, payload handling).
- Provides potential for low-cost adoption using open-source tools and off-the-shelf components.

Weaknesses:

- Economic feasibility analysis (cost per unit vs. benefits) is missing.
- No discussion on long-term durability under real agricultural conditions.

Score: 8.5/10

3. Quality of Work

The methodology is strong, with a clear system architecture, hardware integration, and software development using ROS frameworks. Experimental validation (controlled track vs. farmland trials) provides **practical insights** into performance.

Strengths:

- Well-structured engineering design (mechanical, electrical, software).
- Detailed testing metrics: navigation accuracy, runtime, power consumption, payload capacity, robotic arm precision.
- Identifies and addresses operational issues (traction loss, arm misalignment).

Weaknesses:

- Results are promising but lack **statistical validation** or **comparison with state-of-the-art robots**.

- Field tests were relatively limited (e.g., only runtime, navigation deviation, payload).
- Some critical parameters such as long-term reliability, safety, and weather resistance are not addressed.

Score: 7.5/10

4. Presentation

The manuscript is **technically rich and logically structured** but could benefit from refinement in clarity and formatting.

Strengths:

- Abstract and introduction provide clear motivation.
- Literature review is comprehensive and supports the study.
- Detailed figures and system diagrams aid understanding.

Weaknesses:

- Some sentences are repetitive and overly descriptive.
- Figures are referenced but lack detailed captions/labels.
- Minor typographical and formatting issues (e.g., inconsistent spacing, “rbr1” vs “RBR-1”).
- Reference list is a mix of books, articles, and datasheets, but citation formatting is inconsistent.

Score: 7/10

5. Recommendation

The paper is **innovative and significant**, but it requires **moderate revisions** to enhance clarity, strengthen experimental validation, and improve presentation.

Recommended Decision: Minor to Moderate Revision

Reviewer's Suggestions for Improvement

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3. Experimental Validation

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4. Discussion

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5. References

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□ Final Evaluation:

- **Originality:** 8/10
- **Significance:** 8.5/10
- **Quality:** 7.5/10
- **Presentation:** 7/10

Overall Recommendation: Minor to Moderate Revision