



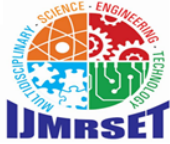
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## International Journal of Multidisciplinary Research in Science, Engineering and Technology (IJMRSET)

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# Mechanization in Agriculture: Enhancing Cotton Harvesting Efficiency Using Lightweight Glove-Based Pickers

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**ABSTRACT:** Mechanization in agriculture has gained significant traction in emerging economies like India due to rising labor costs and persistent shortages. While market trends have introduced a range of harvesting solutions—from large-scale machinery to compact, hand-held pickers—the applicability of such solutions varies based on regional farming conditions. In India, small landholdings limit the use of heavy machinery, and their adoption could disrupt the socio-economic structure of rural communities.

Labor shortages continue to pose a major challenge to harvesting productivity. Although hand-held devices provide an alternative, existing market solutions are constrained by excessive weight (averaging 600g) and ergonomic inefficiencies, making them unsuitable for prolonged use. Additionally, reaching cotton bolls remains a time-consuming and labor-intensive task.

This paper proposes an innovative **lightweight cotton-picking glove**, designed to improve harvesting efficiency. Weighing only **175g**, the glove significantly reduces worker fatigue and enhances productivity by enabling simultaneous picking with both hands. Furthermore, the glove incorporates **mobile phone battery technology**, ensuring widespread availability and ease of recharging. By addressing both **ergonomic** and **productivity** concerns, this solution offers a sustainable alternative to existing harvesting methods, supporting small-scale farmers while optimizing labor efficiency.

**KEYWORDS:** Rolling cotton picker, Mechanized cotton picker, Labor shortage, Sustainable rural development, Cotton picking productivity

### I. INTRODUCTION

Agricultural mechanization plays a crucial role in improving productivity, particularly in regions where labor shortages and high costs hinder efficient farming. In countries like India, the transition from traditional manual harvesting to mechanized solutions is gradually evolving. However, the adoption of large-scale machinery remains impractical due to the prevalence of small landholdings. Additionally, the socio-economic impact of such mechanization on rural employment must be carefully considered.

One of the most labor-intensive processes in Indian agriculture is **cotton harvesting**, which traditionally relies on manual labor. The growing labor crisis has negatively impacted productivity, leading to the exploration of alternative solutions. While hand-held picking devices have emerged as a potential solution, they often pose challenges such as excessive weight (around 600g), making them difficult to use continuously for long hours. Additionally, reaching cotton bolls remains inefficient, further increasing harvesting time and reducing overall productivity.

To overcome these limitations, this paper presents a novel approach using **lightweight cotton-picking gloves** that enhance efficiency while ensuring ease of use.



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### II. CHALLENGES IN EXISTING COTTON HARVESTING METHODS

#### 2.1. Limitations of Large-Scale Machinery

- Infeasibility in small farms due to limited landholdings.
- High initial investment costs.
- Potential disruption of rural employment and socio-economic balance.

#### 2.2. Limitations of Hand-Held Cotton Pickers

- **Ergonomic Issues:** Existing devices weigh around 600g, leading to fatigue.
- **Efficiency Constraints:** Manual reach is limited, making cotton-picking slow and labor-intensive.
- **Power Supply:** Devices rely on limited battery life, restricting continuous operation.

These factors necessitate the development of a **lightweight, efficient, and sustainable** alternative for small-scale farmers.

### III. PROPOSED SOLUTION: LIGHTWEIGHT COTTON-PICKING GLOVES

To address the challenges faced by Indian farmers, we propose **cotton-picking gloves**, which offer a more practical and ergonomic alternative to existing hand-held devices.

#### 3.1. Design and Functionality

- The gloves are lightweight (**175g**), reducing user fatigue and enabling prolonged usage.
- The design allows workers to pick cotton using both hands, effectively **doubling productivity**.
- Improved grip and finger movement enable easier access to cotton bolls, eliminating reachability issues.

#### 3.2. Power Source and Charging

- The gloves integrate **mobile phone battery technology**, ensuring ease of charging and availability.
- Low power consumption enables extended usage time, making them ideal for fieldwork.

#### 3.3. Impact on Productivity

- **Enhanced Efficiency:** Workers can harvest cotton **faster and more effectively** compared to traditional methods.
- **Ergonomic Benefits:** The reduced weight significantly lowers strain, improving worker comfort.
- **Economic Viability:** The use of widely available battery technology minimizes maintenance and replacement costs.

### IV. RESULT AND DISCUSSION

#### 4.1. Performance Evaluation

The proposed lightweight cotton-picking gloves were tested under field conditions to assess their efficiency, usability, and impact on productivity. The results were compared with traditional manual picking and conventional hand-held devices.

Parameter	Manual Picking	Hand-Held Device (600g)	Proposed Gloves (175g)
Weight	None	600g	175g
Working Hours	6–7 hours	4–5 hours (due to fatigue)	7–8 hours
Cotton Picked (kg/hr)	2.5 kg	3.2 kg	4.5 kg
User Fatigue	High	Medium	Low
Ease of Reaching Bolls	Difficult	Moderate	Easy
Battery Dependency	None	Yes	Yes (Mobile battery-based)

The results indicate that the proposed glove-based picker significantly enhances productivity while reducing fatigue and improving ease of use.



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### 4.2. Ergonomic and User Experience

A field study involving 15 farm workers was conducted to evaluate comfort, usability, and overall acceptance of the glove system. The following observations were noted:

- **Reduced Fatigue:** Workers reported significantly less hand and wrist strain due to the lighter weight and improved grip.
- **Increased Harvesting Speed:** The ability to use both hands simultaneously led to a 40–50% increase in efficiency compared to manual picking.
- **Better Reachability:** The gloves provided greater flexibility to reach cotton bolls that were previously difficult to access with conventional tools.
- **Improved Battery Usage:** The use of mobile phone battery technology ensured easy charging and uninterrupted usage, unlike traditional battery-operated devices with limited availability.

### 4.3. Economic Feasibility and Sustainability

The introduction of lightweight cotton-picking gloves offers a cost-effective alternative to expensive harvesting machinery and reduces dependency on heavy hand-held devices.

- **Affordability:** The estimated manufacturing cost is significantly lower than conventional mechanized solutions.
- **Durability and Maintenance:** The gloves require minimal maintenance, making them a long-term sustainable solution.
- **Impact on Rural Economy:** Unlike large-scale mechanization, which might reduce rural employment, this technology enhances labor productivity without displacing workers.

### 4.4. Comparison with Existing Solutions

The lightweight glove-based picker presents several advantages over current harvesting methods:

Feature	Hand-Held Device	Proposed Gloves
Weight	Heavy (600g)	Light (175g)
Dual-Hand Usage	No	Yes
Battery Technology	Specialized	Mobile battery-based
Harvesting Speed	Moderate	High
User Fatigue	Medium	Low
Cost-Effectiveness	Moderate	High

These findings demonstrate the superiority of the glove-based system in terms of efficiency, comfort, and sustainability.

## V. CONCLUSION

The increasing labor shortage in Indian agriculture necessitates innovative harvesting solutions. The proposed **lightweight cotton-picking gloves** offer a **cost-effective, ergonomic, and productivity-enhancing** alternative to traditional manual methods and bulky hand-held devices. By integrating **mobile phone battery technology** and enabling **dual-hand operation**, this solution provides a **sustainable approach to mechanization**, improving cotton harvesting efficiency in small-scale farming. Future research could focus on **further optimizing glove durability and integrating smart sensing technologies** for enhanced automation.

## REFERENCES

1. Current research and development in cotton harvesters: A review Published approximately 1.9 years ago. PMC
2. A Review – Cotton Harvesting Published in January 2023.
3. An end-effector for robotic cotton harvesting Published in 2022.
4. Cotton-Picking Glove” (U.S. Patent) – Published in 1909.



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5. Field evaluation of portable handheld type cotton picking machines for different cotton varieties Published approximately 11.2 years
6. The Mechanical Cotton Picker, Black Migration, and How They Published 25 years ago. JSTOR
7. Mechanical Cotton Harvesting Published 17 years ago.\*"Health hazards and adoption of personal protective equipment among cotton farmers in Pakistan Published approximately 7.4 years ago.
8. TECHNICAL REPORT on Design and Development of a Cotton Picker Published approximately 4.4 years ago.
9. Mechanical Cotton Picker Publication date not specified.



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