

SMART INDIA HACKATHON 2025

TITLE PAGE



- **Problem Statement ID** – ***SIH25267***
- **Problem Statement Title**:- *Developing more efficient jute Ribboner Machine to extract fibre for enhancing in-situ retting technology*
- **Theme**- *Agriculture & Rural Development*
- **PS Category**- *Hardware*
- **Team ID**- ***83032***
- **Team Name**- ***Kisan Sarthi***



Proposed Solution:

• Pre-treatment of the Jute Barks:

The bark of the jute plant is pre-treated with ICAR-recommended chemicals to ease ribboning. A detachable spraying unit applies an **ammonium oxalate and sodium sulphate** solution to soften the bark without causing any damage.

• Made more efficient and effective Ribbon cutter:

After the pre-treatment, the bark is allowed to rest briefly to ensure proper softening for ribboning. The **cutting gears** are designed with sharp edges to precisely separate about 15% of the bark containing the **outer fibre layers**. A dedicated chamber is provided at the bottom of the machine for efficient **waste bark collection**. The power distribution system is optimized to ensure effective **energy utilization** during ribbon cutting. Additionally, a separating chamber is integrated to guide the extracted ribbons directly to the **retting tank**.

• Adjustable Conveyer belts :

All the **conveyer belts** that we have used including the chemical sprayer can be removed and attached again as per the need , **minimizing** the space and making transportation easy.

• Hybrid power systems:

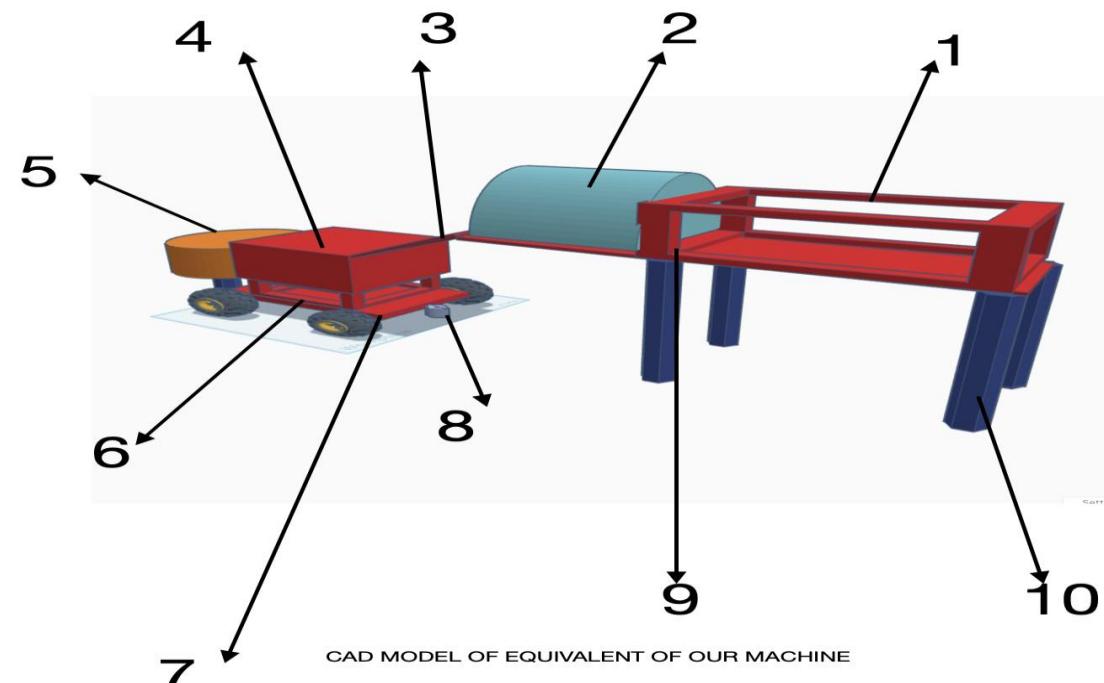
The system is equipped with an **MCU(Micro-Controller based unit)** capable of handling multiple operations. It includes signal detection chambers linked to power units, allowing the MCU to identify whether an electric or diesel source is connected. This ensures **optimized workflow** and provides warnings in case of incorrect or **multiple power connections**..

• Attachable Retting tank with suitable measures:

We made a small retting tank at the end of the machine so which is also removable, and new tanks of similar sizes can be placed which helps in **proper utilization of water** . These tanks are treated by the chemicals suggested by ICAR and other research teams like **Ammonium oxalate and Sodium sulphate** making retting easy.

• Easy Transportation:

This whole machine is fit on **wheels** which can be easily transported by the **hook** that can be attached to a **tractor** and can be easily navigated to different places.



- 1.Chemical Sprayer
- 2.Chemical settling camber
- 3.Inclined conveyor connected to ribbon machine
- 4.Ribbon machine
- 5.Detachable Retting tank
- 6.waste collector
- 7.Hook for attachment
- 8.Detachable conveyor belts
- 9.Extensions for conveyor

TECHNICAL APPROACH



Technologies Required:

1. Core Hardware Components

- Microcontroller Unit (MCU) — Raspberry Pi
- Motor Driver Modules — L298N, BTS7960, or DRV8833 (depending on motor size).
- Sensors (for feedback and monitoring):
 - Load sensors / strain gauges (to detect overloading)
 - Vibration or damping sensors
 - Temperature sensors (To check temperature and for arrangement of heatsinks)
 - RPM sensors / Hall effect sensors (for motor inspection)
- Input Buttons / Keypad — for manual operation and control.
- LCD Display / TFT Display — 16x2 LCD, 20x4 LCD, or 2.4" TFT touch display.
- Conveyor Belt Motor System — with motor and belt assembly.
- Chemical Sprayer Unit — solenoid-controlled or pump-driven system.

2. Embedded System Technologies

- C / C++ / MicroPython Programming
- Real-Time Operating System (RTOS)
- Sensor Calibration Algorithms — for precise overload/damping detection.
- Signal Conditioning Circuits — operational amplifiers, filters for sensor signals.
- PWM (Pulse Width Modulation) — for motor control and power regulation.

3. Power & Control Systems

- Power Signal Detection Circuits — to differentiate diesel and electric sources.
- Voltage Regulators (LM7805, LM317) — for stable MCU power.
- Battery Management System (BMS) — if battery operation is needed.
- Isolation Techniques — optocouplers or isolation amplifiers for signal safety.

4. Communication and Connectivity

- Serial Communication (UART / SPI / I²C) — between MCU and peripherals.

5. Software and Simulation Tools

- MPLAB X IDE — for coding and flashing MCU.
- MATLAB Simulink — for circuit simulation and validation.
- EAGLE / KiCad / Altium Designer — for PCB design (if making a custom board).

6. Mechanical & Auxiliary Systems

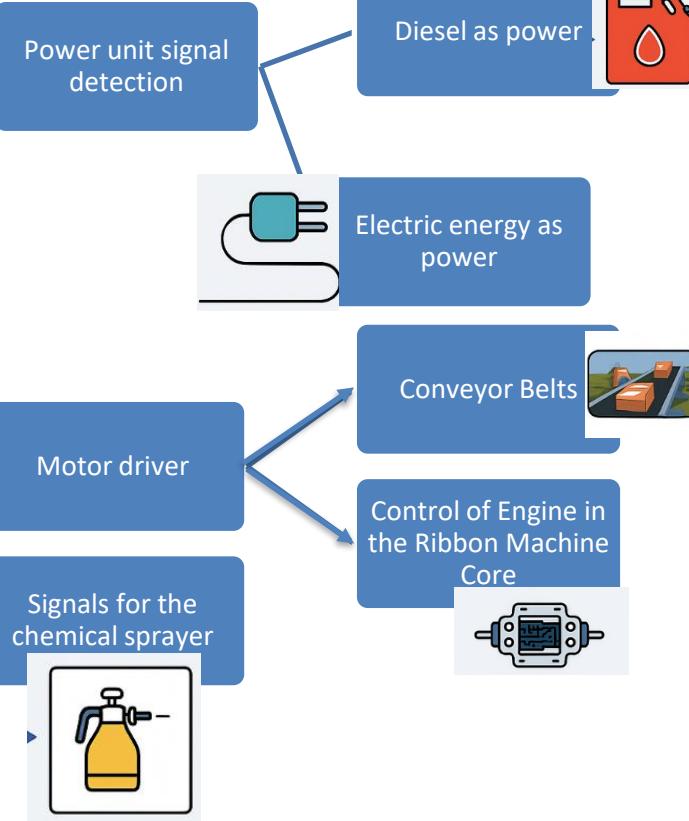
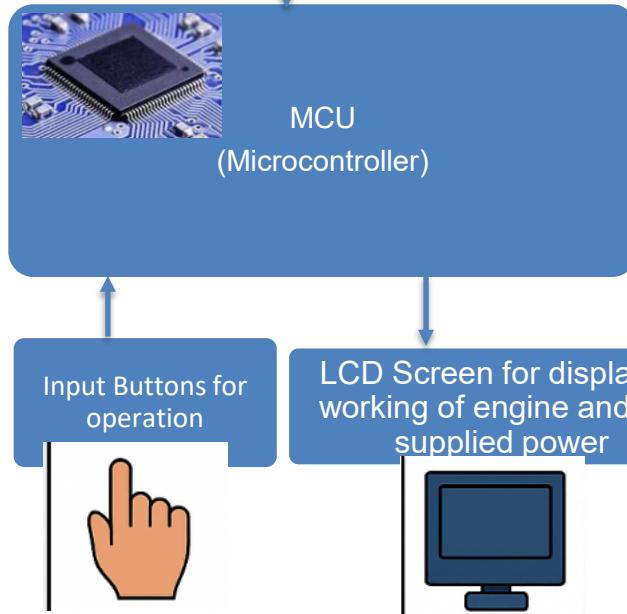
- Conveyor System Assembly — rollers, motor mount, frame.
- Engine Coupling Mechanism — to connect MCU control to engine systems.
- Sprayer Mechanism — with pump, nozzles, and pressure regulation.

7. Safety and Protection

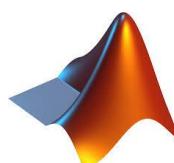
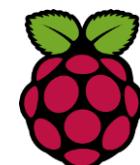
- Fuses and Circuit Breakers
- Overcurrent and Overload Protection Circuits
- Emergency Stop Switch

Flow of work:

Signals need to be taken from sensors to indicate operation for user at different stages to get rid of over loading and over damping.



Technologies used:



FEASIBILITY AND VIABILITY



Technical :

- **Feasibility:** Proven tech—Raspberry-Pi is efficient enough to handle the tasks along with good signal processing units.
- **Risks:** Errors caused in the signals from sensors and signal processing units and delays in DSP units.
- **Solutions:** Designing efficient filters.



Financial :

- **Feasibility:** Viable—ROI through yield gains + policy support.
- **Risks:** A bit high maintenance costs
- **Solutions:** Regular maintenance checks and inspection



Operational :

- **Feasibility:** Practical with phased deployment + personalized engagement.
- **Risks:** May be new for farmers to adapt.
- **Solutions:** Giving elementary training regarding the operation of machine to the farmers.



Legal / Regulatory :

- Legally sound—aligns with govt. digital agriculture goals.
- Supports **National Mission on Natural Fibre Technologies** and related agricultural policies.



Increased Fibre Yield & Farmer Income

Enhanced ribbon extraction efficiency (up to 90%) and reduced fibre breakage directly increase total fibre yield and farmer profitability.



Cost-Effective & Scalable Solution

Affordable modular design suited for small farmers. Scalable models for cooperatives and agro-based industries.

IMPACT AND BENEFITS



Water Conservation & Faster Retting

Ribbon retting saves up to 70% water and cuts retting time by 4–5 days, promoting sustainable jute farming in dry months.



Eco-Friendly & Sustainable Mechanization

Reduces stagnant water retting and methane emissions, promotes climate-resilient jute production aligned with green farming goals.



Portability & Power Flexibility

Compact, lightweight design attachable to tractors or power tillers; supports electric, diesel, or PTO operation for field mobility.



Reduced Labour & Manual Effort

Automated/semi-automated feeding minimizes manual work, improves safety, and allows faster continuous processing of jute bundles.



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Improved Fibre Quality

Uniform extraction with optimized roller control ensures better fibre strength, colour, and lustre — boosting export market value.



Empowering Rural Entrepreneurship

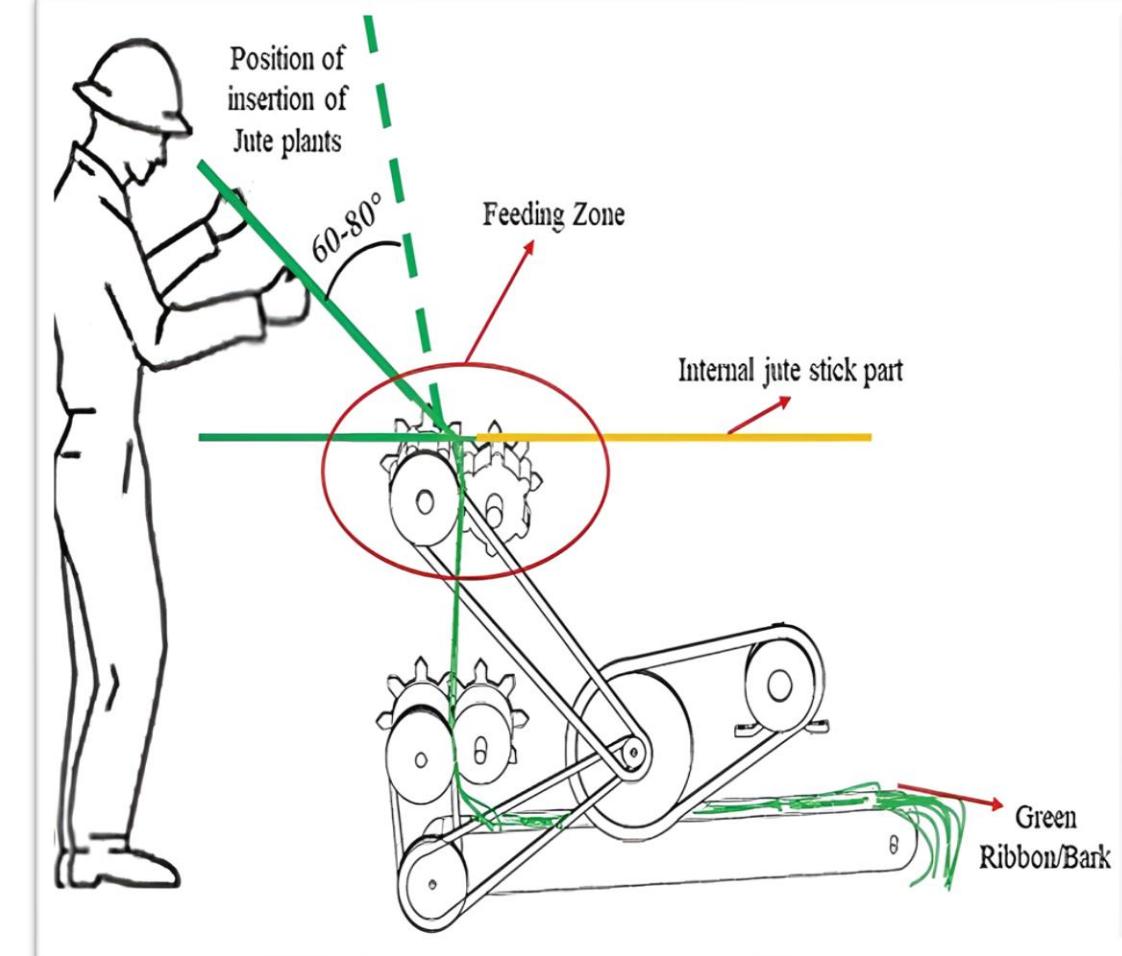
Supports creation of local ribboning units and SHGs, generating rural employment and sustainable income opportunities.

RESEARCH AND REFERENCES



References & Supporting Research

- [Mechanical and Biochemical Methods for Bast Fibre Extraction — ICRISAT](#)
- [Power-Operated Jute Ribboning Machine — QuickCompany](#)
- [ICAR Research on Mechanized Jute Fibre Extraction — JAEM Journal](#)



Core and Interior Structure of the Machine