कृषि एवं किसान कल्याण मंत्रालय
MINISTRY OF AGRICULTURE AND FARMERS WELFARE

NABARD
NATIONAL BANK FOR AGRICULTURE AND RURAL DEVELOPMENT

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AGRISURE GREENATHON

Team Details

- **Team Name:** PIRAC
- **Team Leader Name:** CHITTOSH TIWARI, MUSKAN YADAV
- **Problem Statement:** ***AGRICULTURAL WASTE MANAGEMENT*** - India produces over 35 million tonnes of corn annually, resulting in approximately 200 million tons of corn stover (agricultural waste). This waste is often burned, leading to environmental pollution, or left to decompose, which is an underutilization of potential resources. This project aims to convert corn stover into bioethanol, addressing waste management and providing a renewable energy source.

Brief about the idea

- **Ecofuel: Bioconversion of corn waste to bioethanol -** The project will utilize corn stover to produce bioethanol through a series of biochemical processes including pre-treatment, hydrolysis, fermentation, and distillation. This will help in reducing agricultural waste, providing a cleaner alternative to fossil fuels, and supporting India's energy needs sustainably.

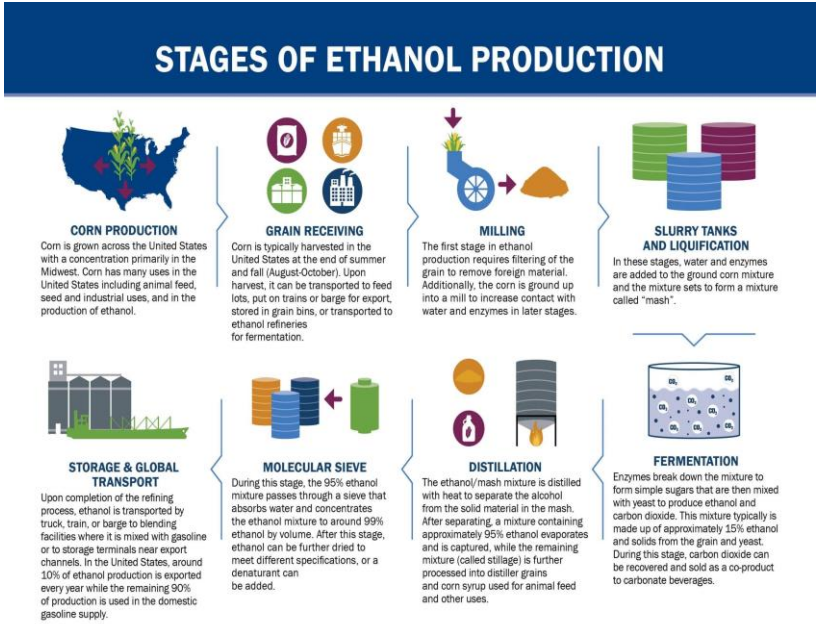
Prototype Components

1. Collection and Pre-Processing

- **Collection:** Corn stalks are collected from farms.
- **Cleaning:** Stalks are cleaned to remove dirt and impurities.
- **Shredding:** Clean stalks are shredded into smaller pieces.

2. Extraction and Fermentation

- **Milling:** Shredded corn stalks are milled to break down the fibers.
- **Hydrolysis:** Enzymes are added to break down cellulose into fermentable sugars.
- **Fermentation:** Sugars are fermented by microorganisms to produce ethanol.



3. Distillation and Purification

- **Distillation:** The fermented mixture is distilled to separate ethanol from water and other components.
- **Purification:** Ethanol is further purified to achieve the desired concentration.

4. Quality Control

- **Testing:** Ethanol undergoes tests for purity, energy content, and compliance with industry standards.
- **Certification:** Ensures ethanol meets environmental and industry standards.

5. Distribution

- **Packaging:** Finished ethanol is packaged for distribution.
- **Logistics:** Ethanol is distributed to fuel companies or industrial users.

Opportunities

- **Sustainability:** Bioethanol from corn stover is a renewable energy source.
- **Environmental Impact:** Reduces pollution from burning agricultural waste.
- **Economic Benefits:** Additional income for farmers and stimulation of rural economy.
- **Energy Security:** Contributes India's energy diversification and security.

1. How different is it from any of the other existing ideas?

- **Existing Ideas:** Traditional bioethanol production primarily uses food crops like corn kernels, which can compete with food supply.
- **Our Solution:** Uses non-food parts of the corn plant, such as stalks, leaves, and cobs, reducing competition with food resources and providing a sustainable waste management solution.

2. How Will it Solve the Problem?

- **Waste Management:** Converts corn stover into a valuable product, reducing waste.
- **Renewable Energy Production:** Provides an alternative to fossil fuels, contributing to cleaner energy.
- **Economic Development:** Offers an additional revenue stream for farmers, enhancing rural livelihoods.

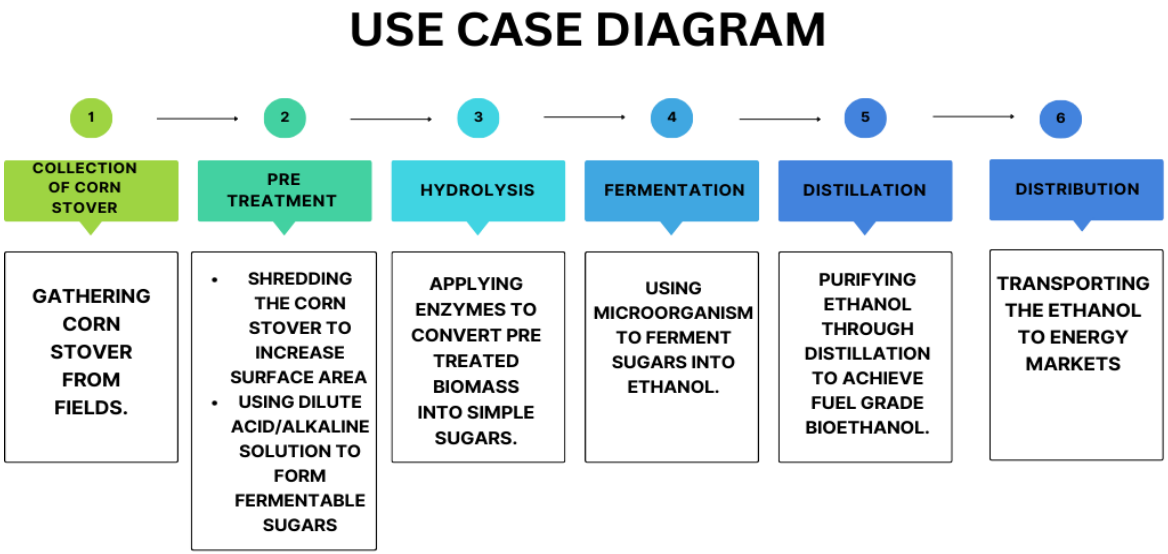
3. USP of the proposed solution

- **Sustainability:** Converts waste into a renewable energy source, contributing to a circular economy.
- **Economic Empowerment:** Creates economic benefits for farmers and rural communities.
- **Environmental Impact:** Reduces greenhouse gas emissions and pollution associated with agricultural waste.

List of features offered by the solution

- **Sustainable Fuel:** Production of bioethanol, a renewable and eco-friendly energy source.
- **Waste Utilization:** Effective use of corn agricultural waste, reducing environmental impact.
- **Economic Benefits:** Additional income for farmers and job creation in rural areas.
- **Scalable Technology:** The production process can be scaled to meet growing demand.
- **Environmental Certification:** Ethanol produced will meet environmental and industry standards.

Process flow diagram or Use-case diagram



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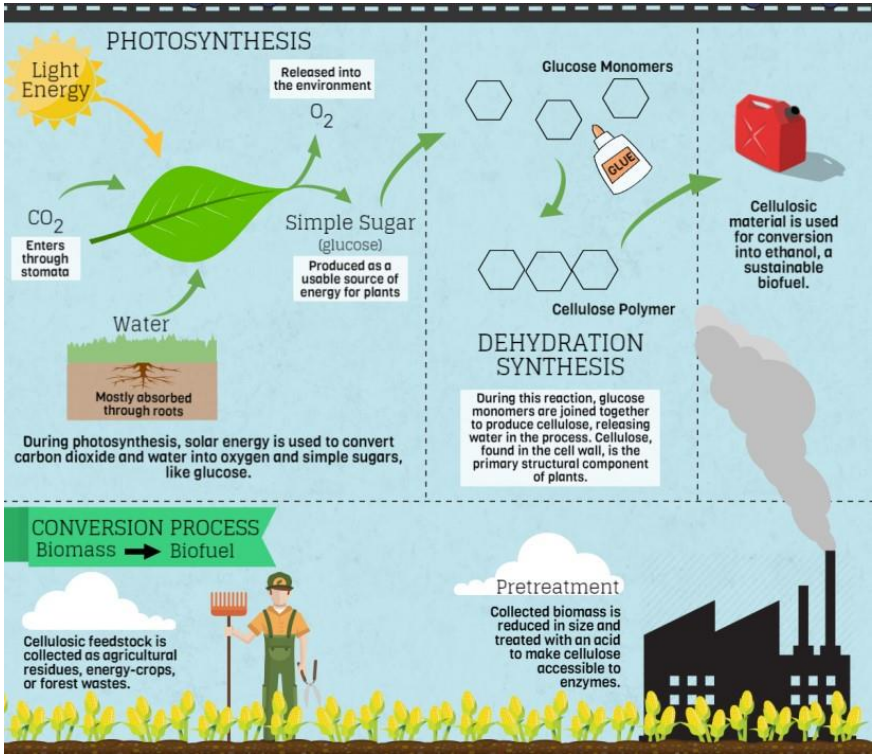
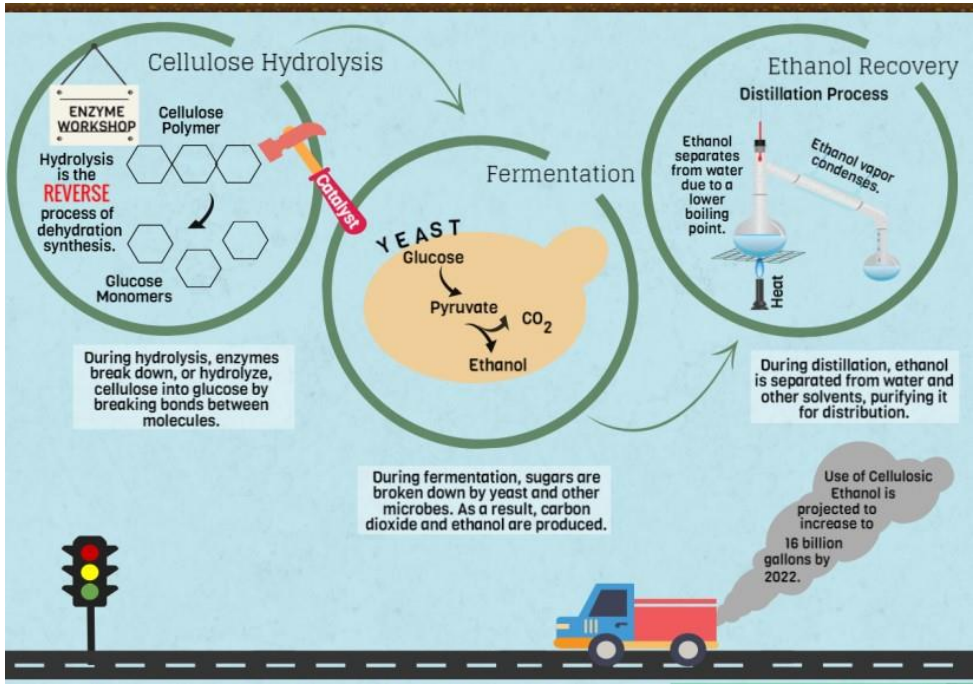
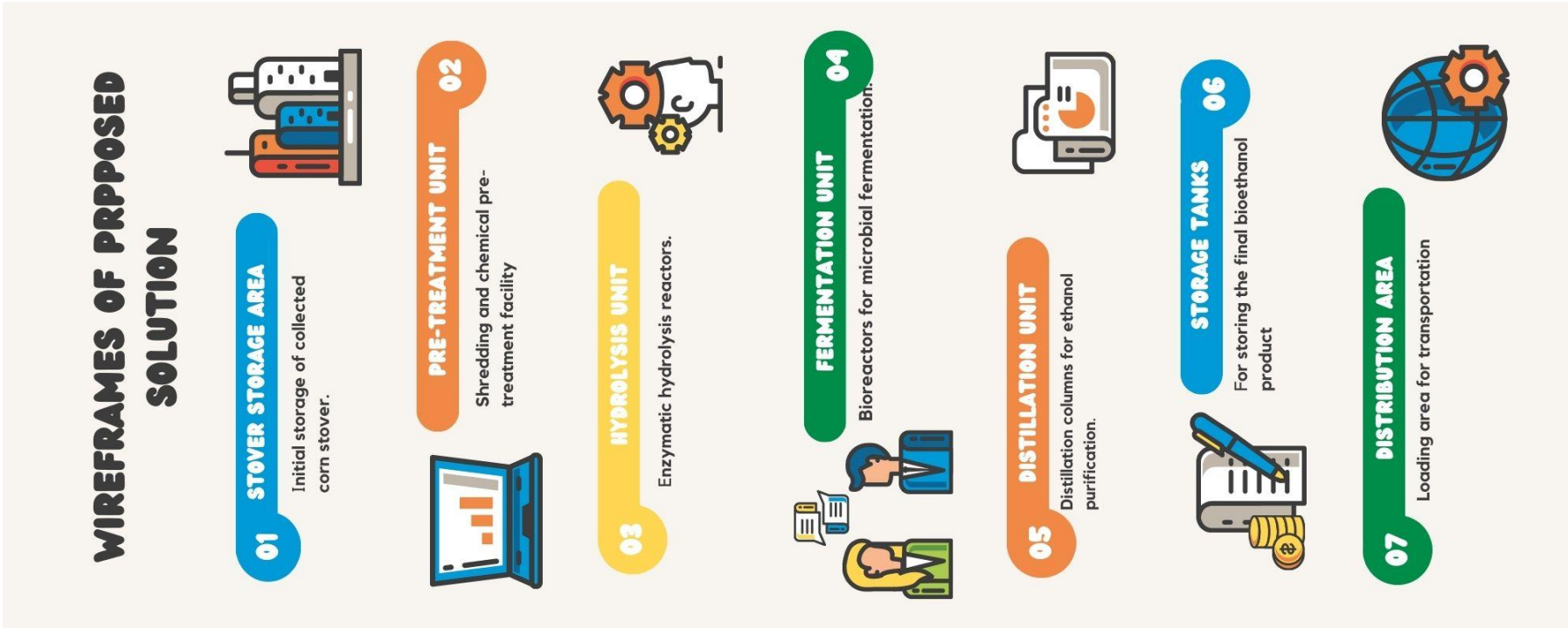
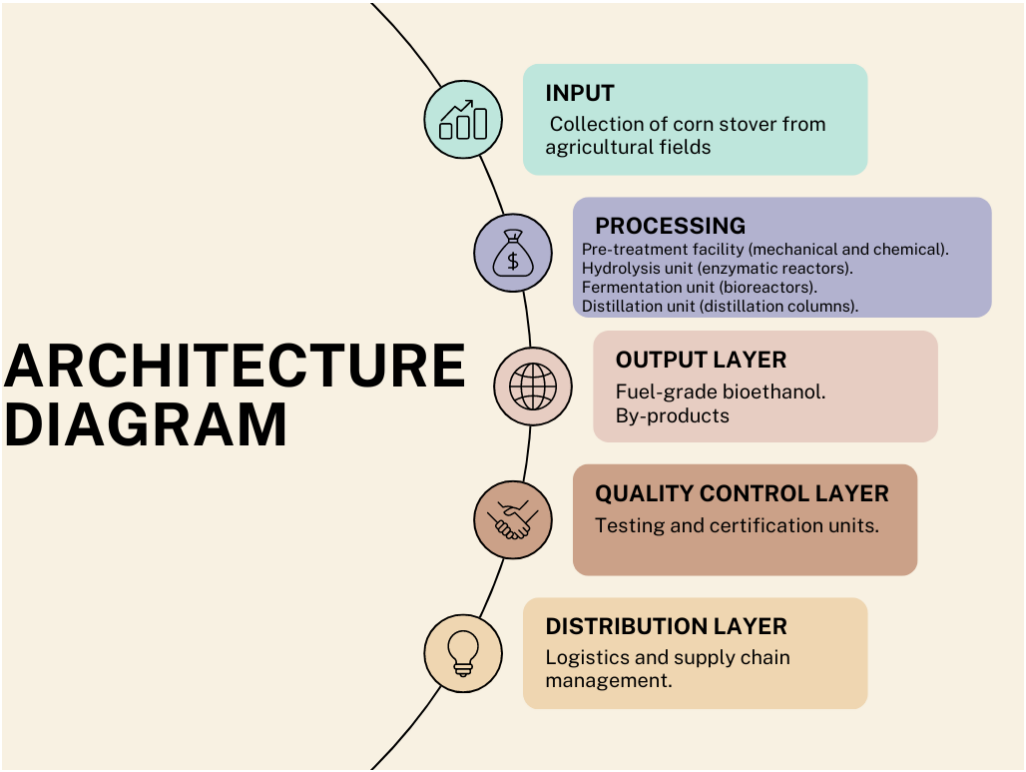




Wireframes/Mock diagrams of the proposed solution (optional)



Architecture diagram of the proposed solution



Technologies to be used in the solution

1. Pre-treatment Technology:

❖ Steam explosion, dilute acid hydrolysis.

2. Enzymatic Hydrolysis Technology:

❖ Using commercial enzymes like cellulase and hemicellulase.

3. Fermentation Technology:

❖ Employing yeast strains such as Saccharomyces cerevisiae.

4. Distillation Technology:

❖ Multi-stage distillation columns for ethanol purification.

5. Quality Control Systems:

❖ Ensures ethanol meets industry standards.

6. Supply Chain Management Software:

❖ Manages distribution and logistics.

Estimated implementation cost (optional)

1. Collection and Transportation:

- Approx. ₹15 lakhs annually (including labor and logistics).

2. Pre-treatment Equipment:

- ₹25-30 lakhs initial investment (for machinery and setup).

3. Enzymes and Chemicals:

- ₹10-15 lakhs annually (for chemical and enzyme procurement).

4. Fermentation and Distillation Setup:

- ₹40-50 lakhs initial investment (for bioreactors and distillation units).

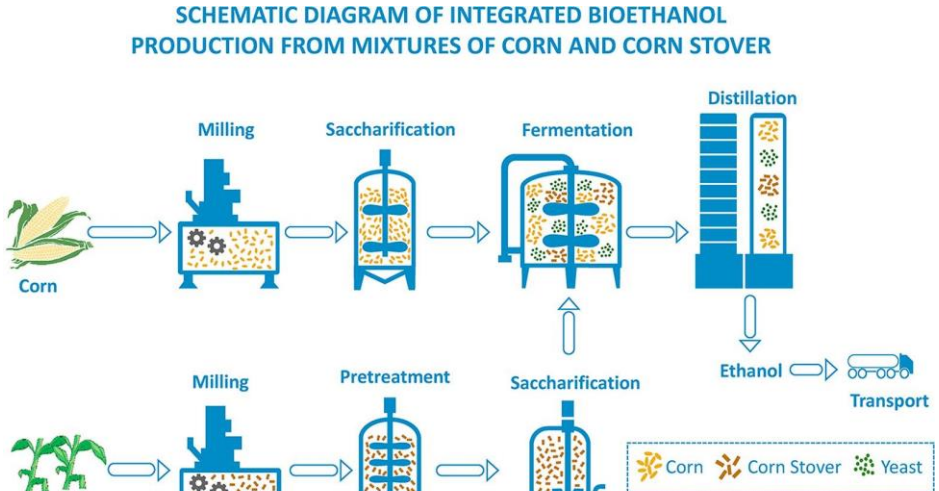
5. Operational Costs:

- ₹20-25 lakhs annually (including maintenance, labor, and utilities).

Grand Total Estimated Cost: ₹1,00,00,000 (approx.)

Snapshots of the prototype

- **Pre-treatment Unit:** A photograph or schematic of the pre-treatment machinery.
- **Hydrolysis Reactor:** Visuals of the enzymatic hydrolysis reactors in operation.
- **Fermentation Bioreactor:** Images showing the fermentation process.
- **Distillation Column:** A snapshot of the distillation columns purifying ethanol.



Prototype Performance report/benchmarking

- **Efficiency Metrics:** Conversion efficiency of corn stover to fermentable sugars.
- **Ethanol Yield:** Quantity of ethanol produced per ton of corn stover.
- **Environmental Impact:** Reduction in CO2 emissions compared to fossil fuels.
- **Economic Analysis:** Cost-benefit analysis highlighting the profitability for farmers and overall cost savings.

Additional Details/Future Developments

- **Scalability:** Potential to scale up the process to include other types of agricultural waste.
- **Innovation:** Ongoing research to improve conversion efficiency and reduce production costs.
- **Expansion:** Exploring partnerships with other regions and countries facing similar agricultural waste challenges.

GitHub Public Repository Link & Demo Video Link

- **GitHub Public Repository Link - https://github.com/tiwarichittosh/PIRAC**
- **Demo Video Link - https://drive.google.com/file/d/10Jw4JOH8b5I0C9g06KPyC7pxOHezbm4C/view?usp=drive_link**

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