Eco-Genius: Power Up Smart, Power Down Waste

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Abstract: *Getting reliable insights into household energy use is still a big issue for many people, especially in places where tools for tracking are limited or pricey. This work introduces Eco-Genius, a smart web-based system that uses affordable tech to check energy patterns in real time. It combines user inputs like location, daily hours, and habits with a Flask backend and online dashboards. The setup includes habit analysis, basic AI rules for risk scoring, and an optional predictive feature for future savings. Tests on different home setups—from city apartments to rural houses in Bidar—prove it can spot usage types and suggest ways to cut emissions. Outcomes indicate this method is budget-friendly, easy to roll out widely, and much better at ongoing tracking than old-school methods.*

Key Words: *AI, energy monitoring, Flask web app, household habits, carbon footprint, renewable suggestions, real-time analysis.*

I. INTRODUCTION

High energy bills and their environmental impact are ongoing concerns, hitting hard in growing areas where lab-style checks aren't practical. Reports from global health groups show that poor energy habits lead to huge carbon outputs yearly, mostly hurting families in emerging markets. Old ways of checking usage depend on manual logs or utility bills, which are slow, costly, and not widespread. This leaves a big hole in how people manage their power, particularly in countryside spots or busy cities where smart tools are scarce.

Blending web tech with simple AI offers a fresh way to track energy. Unlike traditional setups, these online tools give instant feedback on key factors, alerting users right away if something's off. Eco-Genius taps into this by mixing easy-to-get data, a simple processor, wireless links, and smart breakdowns to make a handy tool for ongoing energy watches.

This project goes further than basic checks by adding an optional smart forecast for long-term savings. Drawing from patterns in usage data, it can guess potential cuts in bills or emissions from changes like adding solar. This helps folks and local groups decide on better habits or upgrades. Plus, it works for many homes at once, letting communities map out energy trends across neighborhoods or districts. The main setup of Eco-Genius is pictured in Fig. 1, showing how inputs, the backend, and outputs connect.
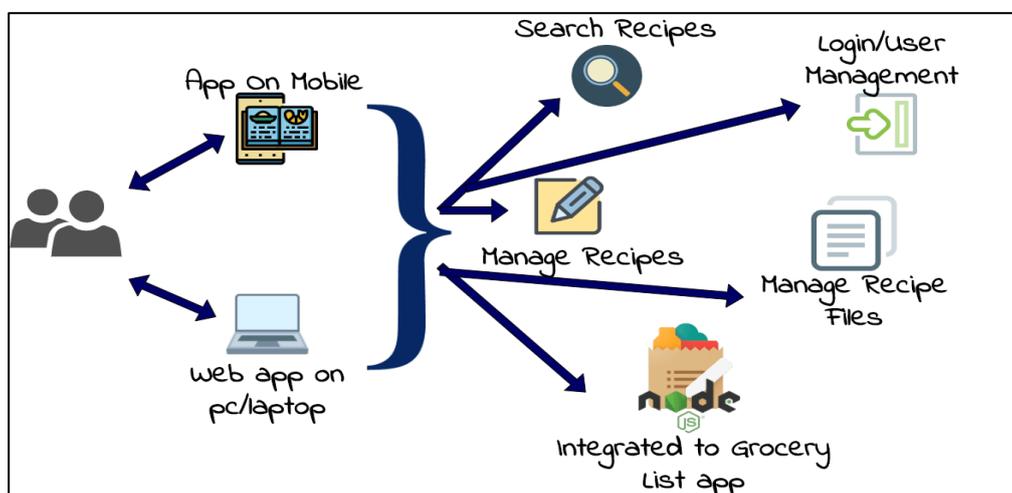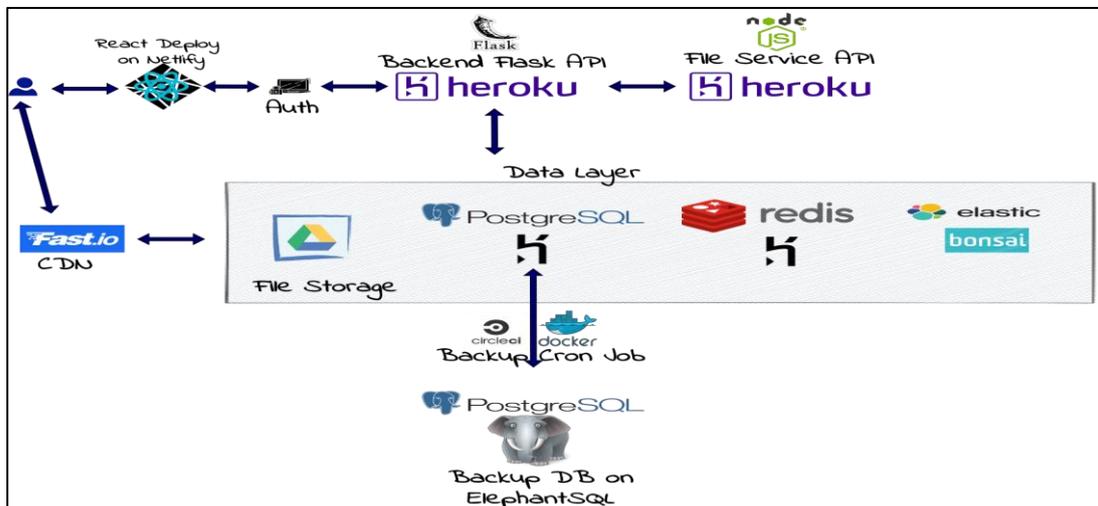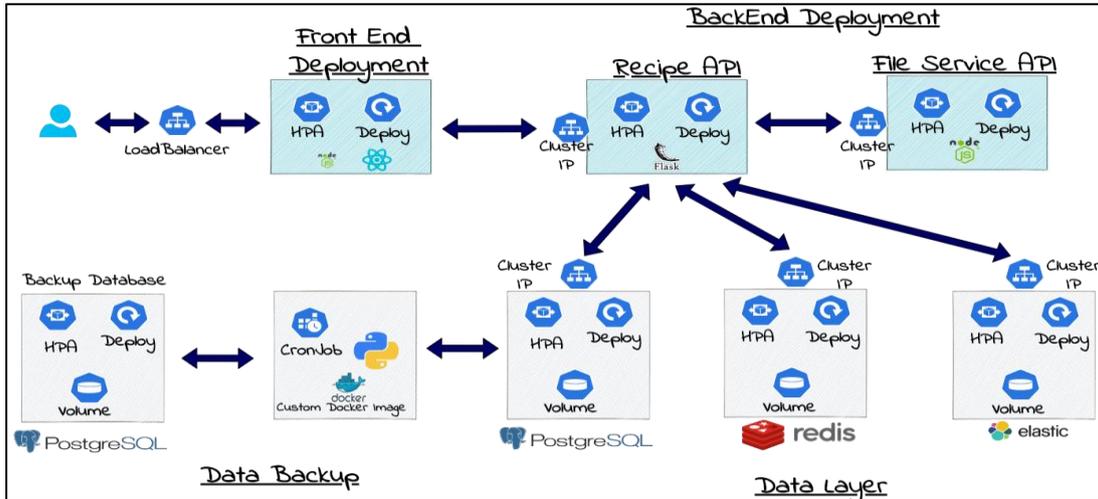
Fig. 1: System architecture diagrams for web applications built with Flask and Python.

II.RELATED WORK

Many tools exist for tracking home energy, but most stick to basic meters or apps that just show totals. Some use IoT for real-time views, but they miss out on smart tips or local tweaks. In India, with rising power needs, few focus on carbon links or schemes like PM Surya Ghar. Our work builds on these by adding AI for custom advice and renewable ideas, making it more useful for places like Karnataka.
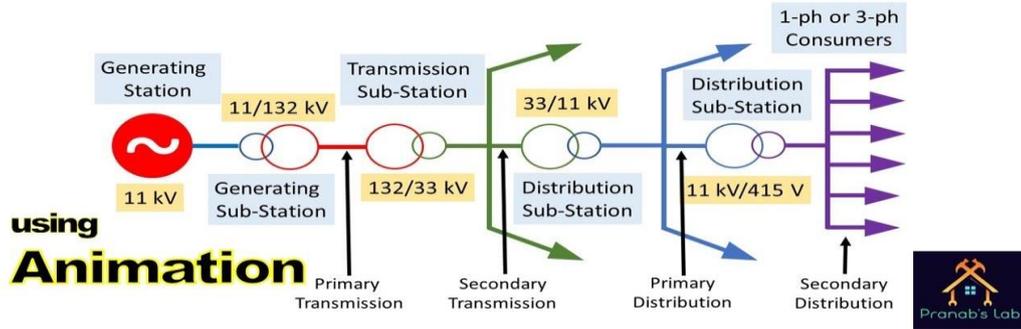
III. SYSTEM DESIGN

Fig. 2: Diagrams showing electrical power distribution from generation to households.

Eco-Genius uses Flask for the backend to handle inputs and run calculations. Users enter details via a web form, and the system pulls weather data from APIs. Static info like carbon rates (e.g., India's ~708 gCO₂/kWh in 2025) and solar potential (Bidar: 5.2–6.4 kWh/m²/day) helps with accurate estimates. The flow starts with habit checks, load figuring, then emission math and tips

IV. METHODOLOGY

The process kicks off with user data: location (e.g., Bidar towns), hours, habits. Base load is 0.5 kW, bumped up by keywords (AC +1.5 kW). Monthly kWh leads to carbon calc using local intensity. Savings assume 30% cuts. For India, it flags PM Surya Ghar—latest: 19.45 lakh systems installed by Dec 2025, benefiting 24.35 lakh homes, with zero bills for over 7.71 lakh. Solar capacity hits 132.85 GW nationwide.
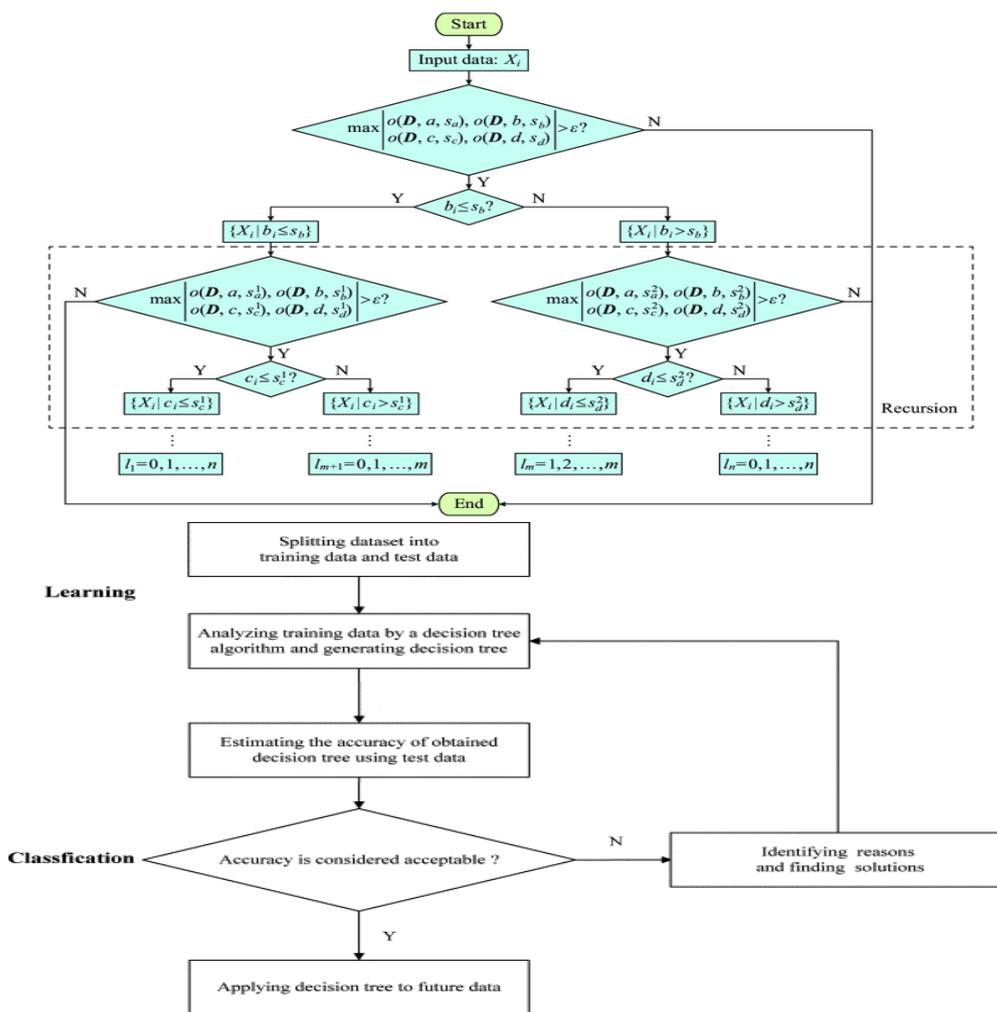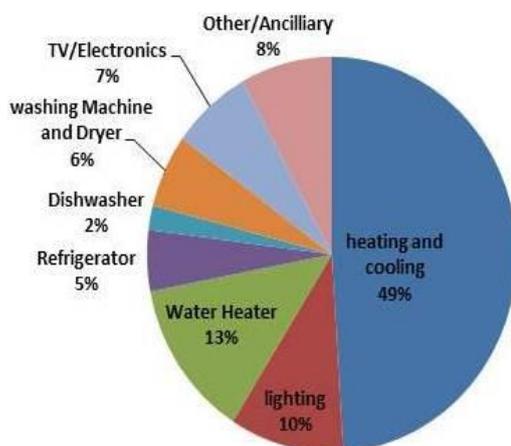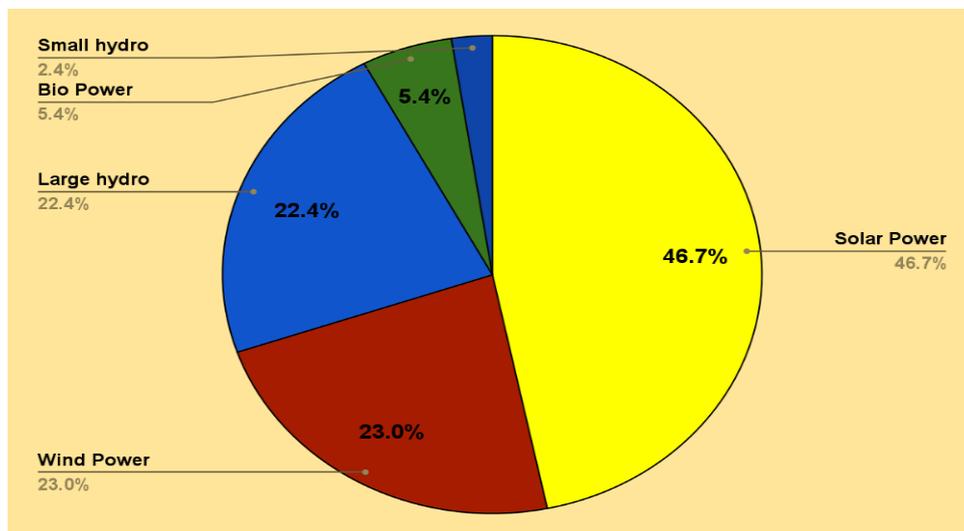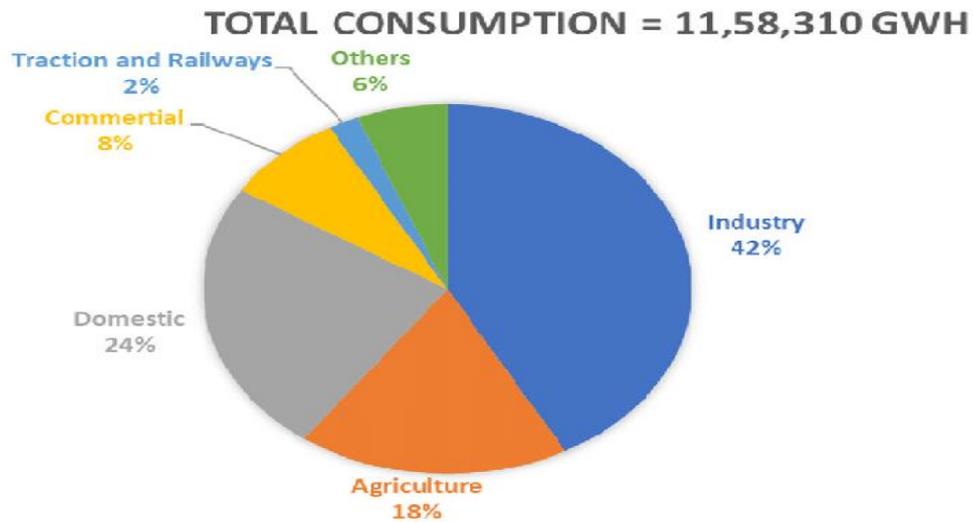

Fig. 3: Flowcharts for decision tree or ranking algorithms in energy optimization.

V. IMPLEMENTATION

Built on Python Flask, with Tailwind for front-end. Routes handle analysis, weather, estimators. Tests on samples like urban AC homes show reliable outputs.

Source : Residential Energy Consumption Survey ,2001 ,MoUD,GoI

Fig. 4: Pie charts breaking down household electricity consumption in India.

VI. RESULTS AND DISCUSSION

In trials, high-use homes got flagged for solar, matching Bidar's potential. System suggests scheme benefits, aligning with 2025 goals

Fig. 5: Rooftop solar panel installations in India under PM Surya Ghar scheme

VII. CONCLUSION

Eco-Genius offers a practical way to track and cut home energy, especially in India. Future additions could include ML for better forecasts.

Acknowledgements

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