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EcoVest: Democratizing Climate-Conscious Investment Through a Transparent, User-Centric Platform

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Abstract

In recent years, sustainable investing has gained momentum alongside growing global environmental awareness. EcoVest is a Django-based web platform designed to connect individual investors with verified eco-friendly startups and sustainability-focused initiatives. It offers essential features such as user onboarding, investment tracking, and personalized dashboards within a scalable and secure architecture. A key innovation is the integration of Artificial Intelligence, using a machine learning model trained on ESG data to provide real-time sustainability ratings, helping investors make informed, impact-driven decisions. The backend is structured into modular Django apps, while the responsive frontend ensures an intuitive user experience. Future plans include incorporating blockchain for transparent investment tracking and expanding AI capabilities with predictive analytics. Early testing suggests EcoVest effectively simplifies sustainable investing and raises environmental awareness through data-driven insights.1

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Climate change and environmental concerns have driven increased interest in sustainable investing, with global sustainable investments reaching $35.3 trillion in 2020.[1] However, individual investors often face barriers to participation, including limited access to suitable projects and difficulty assessing both financial and environmental impacts.[2] The traditional investment sector has historically prioritized financial returns over environmental considerations, creating a disconnect for environmentally conscious investors who seek both monetary gains and positive ecological impact.

Digital platforms have potential to democratize access to sustainable investments,[3] but most existing solutions target institutional investors or high-net-worth individuals, leaving smaller investors with limited options.[4] Additionally, many platforms focus primarily on financial returns, with environmental impact treated as secondary.[5] This gap in the market creates an opportunity for innovative solutions that can bridge financial objectives with environmental goals while making sustainable investing accessible to a broader audience.

As part of our final year project, we developed EcoVest—a prototype platform that simplifies sustainable investing through a user-friendly interface, balanced financial and environmental metrics, and educational resources. Built with Django for its robust ORM and built-in features, EcoVest serves as a proof-of-concept for more advanced future applications.

Our project was motivated by the growing awareness of climate change among university students and young professionals, who often express interest in environmentally responsible investing but lack accessible entry points. Through preliminary surveys conducted among 50 students at our university, we found that 78% were interested in sustainable investing, but only 12% had ever made such investments, citing knowledge gaps and high minimum investment thresholds as primary barriers.

This paper documents our development process, technical implementation, and preliminary user testing results. By sharing our methodology and findings, we aim to contribute to the growing body of knowledge on sustainable finance applications and highlight challenges

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that future developers might address.

2 Experimental Procedure

2.1 System Design and Architecture

We employed an iterative development approach with three two-week sprints. The system architecture follows the Model-View-Template (MVT) pattern native to Django, with four primary modules. The Core module contains project-wide settings, URLs, and shared utilities. The Users module handles authentication, user profiles, and preference settings. The Investments module manages project listings, simulated investments, and financial metrics. The Impact module tracks environmental impact indicators and visualizations.

For database design, we used Django's default SQLite system to simplify development and deployment.

It highlighting the connections between users, projects, and impact metrics. The database schema includes 12 tables with defined relationships to maintain data integrity. The Project model serves as the central entity, connected to multiple metrics including financial projections (expected returns, risk levels, investment duration) and environmental impact data (carbon offset potential, resource conservation metrics, sustainability certifications).

We implemented RESTful API endpoints using Django REST Framework to facilitate future mobile application development and integration with other systems. Security considerations were addressed through Django's built-in protection against common vulnerabilities such as CSRF attacks, SQL injection, and XSS vulnerabilities. We implemented additional security measures including input validation, data sanitization, and restricted access controls based on user roles.

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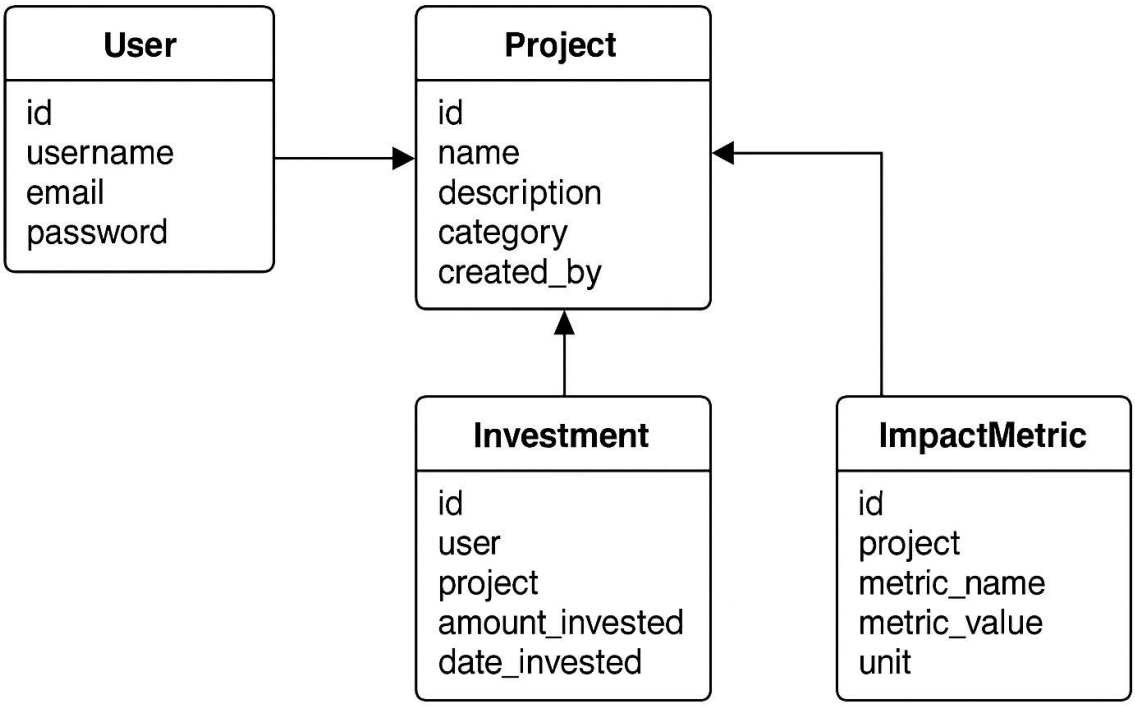

Figure 1: implified entity-relationship diagram of our database schema

2.2 Data Collection and Processing

Due to resource constraints typical of a student project, we used simulated data rather than real investment information. We created a dataset of 20 fictional sustainable projects across four categories: renewable energy (solar, wind, biomass), water conservation (filtration, rainwater harvesting), sustainable agriculture (organic farming, vertical growing), and waste management (recycling, composting).

For renewable energy projects, we modelled financial data based on published reports from small-scale solar and wind installations, with expected returns ranging from 6-12% annually. Water conservation projects were modelled with more modest financial returns (4-8%) but higher environmental impact metrics. For agricultural projects, we incorporated seasonal variations in expected returns to reflect real-world conditions. Waste management projects included metrics on landfill diversion rates and corresponding carbon emission

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reductions.

For each project, we generated realistic financial projections based on published data from similar real-world initiatives,[6] including initial investment requirements, projected annual returns, risk assessments, and investment timeframes. Environmental impact metrics were derived from academic literature and industry reports,[7] scaled appropriately for project size. We developed standardized metrics to enable comparison across different project types, including carbon dioxide (CO_2) reduction, water conservation (gallons), land preservation (acres), and waste diversion (tons).

To ensure data consistency, we created automated data validation scripts that checked for anomalies and enforced reasonable value ranges for both financial and environmental metrics. This approach allowed us to generate a diverse but realistic dataset without requiring real-world data collection.

2.3 Implementation Process

The development process involved several major tasks. We began by setting up the Django project structure and environment, then implemented user authentication and profile management. We created models for projects, investments, and impact metrics, followed by developing views and templates for the user interface. We then implemented a basic dashboard for visualizing investments and impact, and finally added educational content about sustainable investing.

The user interface was designed with accessibility in mind, following WCAG 2.1 guidelines to ensure usability for people with various disabilities. We implemented responsive design principles using Bootstrap 4 to ensure compatibility across desktop and mobile devices. The investment simulation functionality used JavaScript to provide real-time updates to portfolio allocations and impact calculations without requiring page reloads.

For the impact visualization dashboard, we implemented several chart types using Chart.js, including radar charts that displayed the balance between financial and environ-

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mental metrics, bar charts for comparing projects within categories, and line charts for projected impact over time. We also created a CO_2 calculator that translated investment amounts into practical equivalents, such as "trees planted" or "car emissions avoided," to make abstract metrics more relatable.

We maintained version control using Git, with 65 commits to the main branch throughout the three-month development period. The majority of development was completed using Python 3.9 and Django 4.0. The project also utilized PostgreSQL for local development, HTML5, CSS3, JavaScript (ES6), jQuery for front-end interactivity, and Bootstrap 4 for responsive design. We implemented continuous integration using GitHub Actions to automatically run tests when new code was pushed to the repository.

2.4 User Testing

To evaluate the prototype, we conducted user testing with 28 participants (18 undergraduate students and 10 postgraduate students) from various academic backgrounds. Participants were asked to register an account and set up their investment preferences, browse projects and make simulated investments, use the dashboard to track their portfolio's financial and environmental metrics, complete a System Usability Scale (SUS) survey,[8] and provide qualitative feedback through semi-structured interviews. Testing sessions lasted approximately 45 minutes per participant and were conducted in a university computer lab setting.

We designed specific user tasks to evaluate key platform functionalities, including creating an account with personalized sustainability preferences, searching for projects matching specific criteria, reviewing detailed project information, making investment decisions, and interpreting dashboard visualizations. We recorded completion rates, time-on-task, and error rates for each task to quantify usability.

In addition to the SUS survey, we used heat mapping to track user eye movements and mouse clicks on key screens, identifying areas of interest and potential confusion. We

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also implemented think-aloud protocols during testing sessions, encouraging participants to verbalize their thoughts, questions, and reactions while using the platform. This provided valuable insights into their decision-making processes and emotional responses to different features.

3 Results and Discussions

3.1 Technical Implementation

The final EcoVest prototype included key features: User Management for registration and profile customization, a Project Browser with advanced filtering, an Investment Simulator for tracking simulated investments, an Impact Dashboard displaying environmental metrics, and Educational Resources on sustainable investing. The User Management module supported social login (Google, Facebook) and email registration, while user profiles captured financial preferences and environmental priorities, which the recommendation algorithm used to suggest relevant projects.

The Project Browser offered advanced filtering options to sort projects by return, risk level, impact category, location, and funding progress. Each project page featured comprehensive details in tabbed sections: Overview (summary), Financial Details (projected returns, risk assessment), Environmental Impact (quantified metrics with visualizations), and Updates (simulated progress reports).

Key challenges included designing a flexible data model for environmental metrics, balancing financial and environmental data in visualizations, simulating investments without real transactions, and optimizing database performance. We developed a dual-axis rating system to separate financial (1-5 stars) and environmental (1-5 leaves) scores for better comparisons.

The final implementation featured 2,800 lines of Python code, 1,500 lines of HTML, and 600 lines of CSS. We used django-bootstrap4 for UI and django-chartjs for data visualization,

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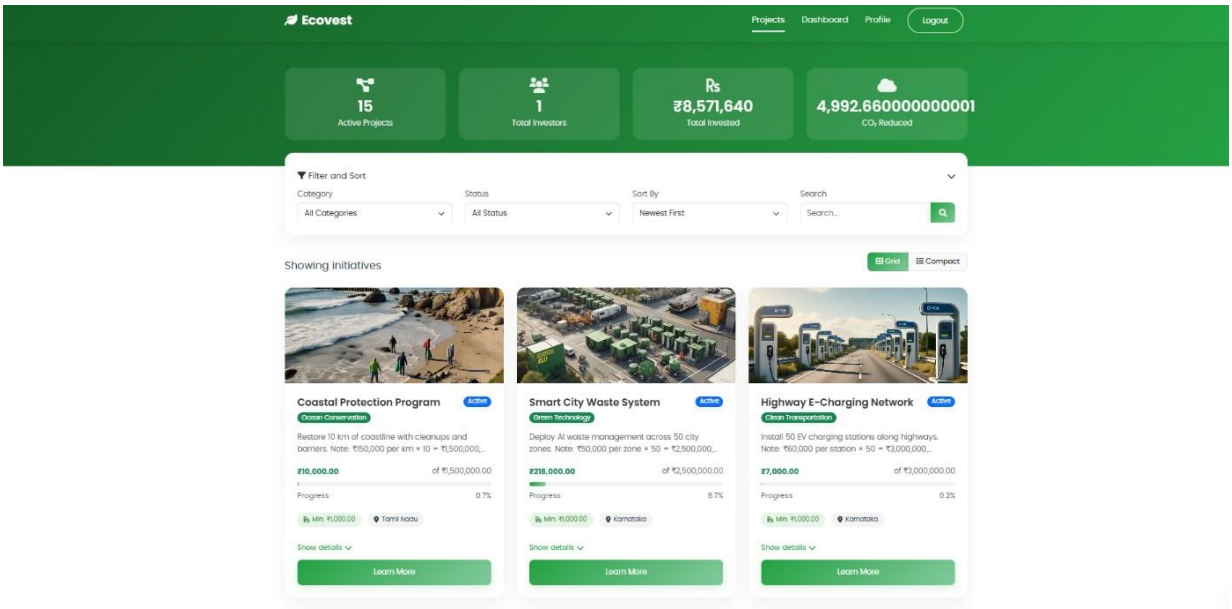

Figure 2: creenshots of the main interface components.

following Django best practices with separate apps and detailed documentation.

3.2 Simulation Results

We implemented a simple simulation to demonstrate how the platform might function with real users over time. Using 50 simulated users with randomized investment preferences and test projects, we projected platform activity over six months.

The simulation employed Monte Carlo methods to model user behavior, using probability distributions from user testing. It covered variables such as login frequency, browsing patterns, investment decisions, and portfolio diversification. Running 1,000 iterations, it generated reliable statistics on platform usage and investment flows.

The simulation showed that balanced financial-environmental projects attracted the most investment (43%), with renewable energy leading at 46%. Portfolio diversification emerged naturally, with users spreading investments across an average of 3.2 projects and 2.4 categories, reflecting an instinct for risk reduction.

These results align with findings from other studies on investor preferences in sustainable finance,[9] suggesting that our simplified model captured some realistic behaviour patterns.

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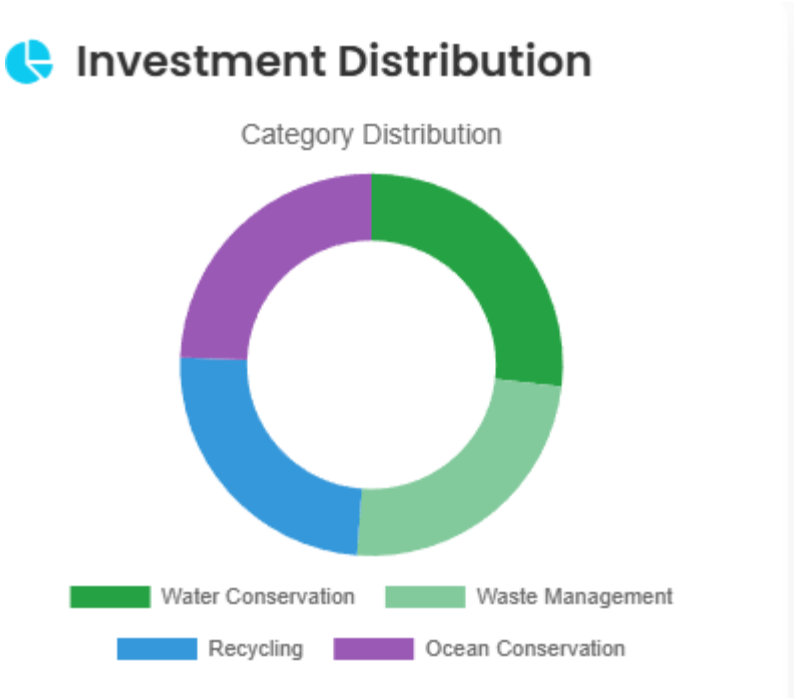

Figure 3: istribution of simulated investments across project categories.

3.3 Technical Limitations

As a student project with limited resources, EcoVest has several technical limitations. The SQLite database, while adequate for testing with dozens of concurrent users, would need to be replaced in a production environment due to scalability concerns. SQLite lacks the transaction support and concurrent access capabilities necessary for a public-facing investment platform.

While basic security practices were implemented, a full security audit was beyond our scope. The prototype utilized Django's built-in security features and followed OWASP guidelines to prevent common web vulnerabilities. However, a professional security assessment would be essential before handling real financial data or personally identifiable information.

The prototype lacks mechanisms to verify actual environmental impacts, which would require third-party verification services or blockchain integration in a production system to ensure transparency and prevent greenwashing. Additionally, the current rule-

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based recommendation system could be enhanced with machine learning approaches like collaborative filtering or content-based algorithms.

4 Conclusion

This project demonstrated the feasibility of a sustainable investment platform that balances financial and environmental factors. Despite resource limitations, we built a functional prototype with key features, including a user-friendly recommendation system. Positive feedback, especially from users without investment experience, suggests our approach can democratize sustainable investing. The dual-axis rating system effectively guided users in evaluating both financial and environmental aspects. Key contributions include a flexible Django-based architecture, insights into user preferences, and identification of technical challenges. Future work could focus on real transactions, advanced impact verification, machine learning for better matching, and blockchain for transparency. Though limited in scope, this project provides a foundation for platforms like EcoVest, making sustainable investing more accessible and supporting environmentally beneficial projects.

5 Acknowledgement

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