



Gamified Platform to Promote Sustainable Farming Practices

Dr. T. Ragini, K. Keerthi, B. Devi Priya, R. Akanksha, A. Maha Lakshmi

Department of Computer Science Engineering, Vijaya Institute of Technology for Women(Autonomous), Vijayawada, Andhra Pradesh, India.

To Cite this Article

Dr. T. Ragini, K. Keerthi, B. Devi Priya, R. Akanksha & A. Maha Lakshmi (2026). Gamified Platform to Promote Sustainable Farming Practices. International Journal for Modern Trends in Science and Technology, 12(06), 17-24. <https://doi.org/10.5281/zenodo.20572499>

Article Info

Received: 12 May 2026; Revised: 30 May 2026; Accepted: 02 June 2026.

Copyright © The Authors ; This is an open access article distributed under the [Creative Commons Attribution License](#), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

KEYWORDS

React, Node.js, Express.js, SQLite, JavaScript, Sustainable agriculture, gamification, web-based platform, farmer engagement, environmental sustainability, farmer engagement, resource conservation, agricultural productivity, digital agriculture,

ABSTRACT

Agriculture plays a significant role in the economic development of a country, yet many traditional farming practices continue to harm the environment. Issues such as soil degradation, excessive water usage, and overdependence on chemical fertilizers have reduced agricultural sustainability. Although sustainable farming methods are available, farmers often fail to adopt them due to a lack of awareness, motivation, and continuous guidance. To address this challenge, this project proposes a gamified web-based platform designed to promote sustainable farming practices. The system integrates game elements such as points, badges, levels, and leaderboards into agricultural activities to make them more engaging and motivating. Farmers can register on the platform, participate in farming-related tasks known as quests, and submit proof of completion through images or descriptions. The system verifies these submissions and rewards users accordingly. By combining technology and gamification, the platform encourages farmers to adopt eco-friendly practices, thereby contributing to environmental sustainability and improved agricultural productivity.

1. INTRODUCTION

Agriculture is considered the backbone of many economies, providing food, employment, and raw materials for industries. Despite its importance, modern agricultural practices have led to several environmental problems, including soil fertility loss, water scarcity, and increased pollution due to chemical usage. Sustainable farming practices offer effective solutions by promoting

resource conservation, organic farming, and efficient irrigation methods. However, the adoption of these practices remains limited because farmers often lack motivation and practical exposure. With the rapid advancement of digital technology, web-based platforms have emerged as effective tools for knowledge dissemination and user engagement. Gamification, which involves the use of game-like elements in

non-gaming contexts, has proven successful in improving participation and motivation across various domains. This project introduces a gamified platform that transforms traditional farming activities into interactive tasks, encouraging farmers to actively participate and implement sustainable methods in their daily practices.

2. RELATED WORK

Sustainable agriculture has been widely studied as a solution to environmental challenges such as soil degradation, water scarcity, and excessive use of chemical fertilizers. Researchers have proposed practices like organic farming, crop rotation, agroforestry, and efficient irrigation techniques to improve long-term agricultural productivity while maintaining ecological balance. Despite these advancements, the adoption rate among farmers remains low due to lack of awareness and practical exposure.

To address these challenges, several digital solutions such as web-based platforms and mobile applications have been developed to provide farmers with access to agricultural knowledge. These systems offer information related to weather forecasting, crop selection, pest control, and soil management. While they improve accessibility, their primary focus remains on knowledge delivery rather than ensuring actual implementation in real-world farming scenarios.

Gamification has gained attention as an effective method to enhance user engagement and motivation by incorporating game elements such as points, badges, leaderboards, and rewards. It has been successfully applied in domains like education, healthcare, and corporate training to influence user behavior. The use of gamification encourages active participation and sustained engagement by combining intrinsic and extrinsic motivation.

In the context of agriculture, a few studies have explored gamified systems to encourage farmers to adopt sustainable practices. These systems convert farming activities into structured tasks and reward users for participation. Although they show improved engagement, most existing solutions rely on self-reported data, which reduces reliability. Additionally, they often lack proper verification mechanisms and real-time progress tracking.

Furthermore, existing platforms face challenges related to scalability, user retention, and community interaction. Many systems do not provide continuous feedback or motivation, leading to reduced long-term usage. The absence of proof validation and structured engagement highlights the need for a more comprehensive system that integrates gamification with verification, real-time tracking, and collaborative features.

3. PROPOSED WORK

The proposed system introduces a gamified web-based platform designed to promote sustainable farming practices by improving farmer engagement and motivation. Unlike traditional systems that focus only on information delivery, this platform emphasizes practical implementation by encouraging users to actively participate in farming-related activities.

The system allows farmers to register and access a set of structured tasks known as quests, where each quest represents a specific sustainable farming practice such as water conservation, organic farming, or soil management. These tasks are designed to be practical and relevant, enabling farmers to apply eco-friendly techniques directly in their fields.

A key feature of the proposed system is the proof submission and verification mechanism. After completing a task, users are required to upload evidence in the form of images or descriptions. These submissions are verified by administrators to ensure authenticity, thereby maintaining system reliability and preventing false reporting.

To enhance user motivation, the system incorporates gamification elements such as points, badges, levels, and leaderboards. Users are rewarded based on their performance, and their progress is tracked in real time through a dashboard. The leaderboard promotes healthy competition, encouraging users to participate actively and improve their performance.

The system is developed using modern web technologies, including React for the frontend, Node.js with Express for the backend, and SQLite for database management, along with secure authentication using JSON Web Tokens. By integrating engagement, verification, and real-time feedback, the proposed system effectively bridges the gap between awareness and implementation of sustainable farming practices.

System Architecture

The system architecture consists of three main layers: Presentation Layer, Application Layer, and Data Layer. These layers work together to process farmer queries, analyze them using AI models, and provide appropriate advisory responses. The architecture ensures smooth communication between user interface, processing unit, and database.

Presentation Layer (Frontend):

The presentation layer is responsible for user interaction and acts as the interface between the user and the system. It is developed using React and provides a responsive and user-friendly environment for farmers to access system features such as registration, login, quest participation, dashboard viewing, and progress tracking. This layer handles input collection, displays real-time updates, and ensures smooth navigation across different modules like leaderboard, community, and profile management. It focuses on usability and accessibility so that even users with minimal technical knowledge can easily interact with the platform.

Application Layer (Backend):

The application layer acts as the core processing unit of the system, where all business logic and decision-making operations are executed. It is implemented using Node.js with Express.js and is responsible for handling user requests, processing data, and coordinating between the frontend and database. This layer manages functionalities such as quest allocation, progress tracking, reward calculation, leaderboard ranking, and proof verification workflows. It ensures that all operations follow predefined rules and maintains consistency across the system by validating inputs and controlling the flow of data.

Data Layer (Database):

The data layer is responsible for storing, managing, and retrieving all system-related data in a structured manner. SQLite is used as the database to store user information, quest details, progress records, rewards, and community interactions. This layer ensures data integrity, consistency, and efficient retrieval through optimized queries and relational table design. It supports real-time updates and maintains a reliable

record of all user activities, enabling accurate tracking and reporting of performance within the system.

API Layer (Communication)

The API layer facilitates communication between the presentation layer and the application layer using RESTful APIs. It handles all client-server interactions by processing HTTP requests such as GET, POST, PUT, and DELETE. This layer ensures seamless data exchange, enabling functionalities like user authentication, quest management, leaderboard updates, and proof submission. By maintaining a standardized communication structure, the API layer improves system scalability, flexibility, and integration with potential external services.

Additional Modules:

The system includes additional modules to enhance functionality and user engagement. The Notification Module provides real-time updates on quests, rewards, and verification status. The Recommendation Module suggests suitable tasks based on user activity and performance. The Analytics Module tracks user participation and system performance for better insights. These modules improve user experience, engagement, and effective adoption of sustainable practices.

System Workflow:

The system workflow begins with user registration and secure login using authentication mechanisms. After logging in, users can view and select available quests related to sustainable farming practices. They perform the tasks in real-world conditions and update their progress on the platform. Upon completion, users submit proof, which is verified by the administrator for authenticity. Once verified, rewards are assigned, progress is updated, and rankings are reflected on the leaderboard, encouraging continuous participation.

ARCHITECTURE DIAGRAM
GAMIFIED PLATFORM TO PROMOTE SUSTAINABLE FARMING PRACTICES

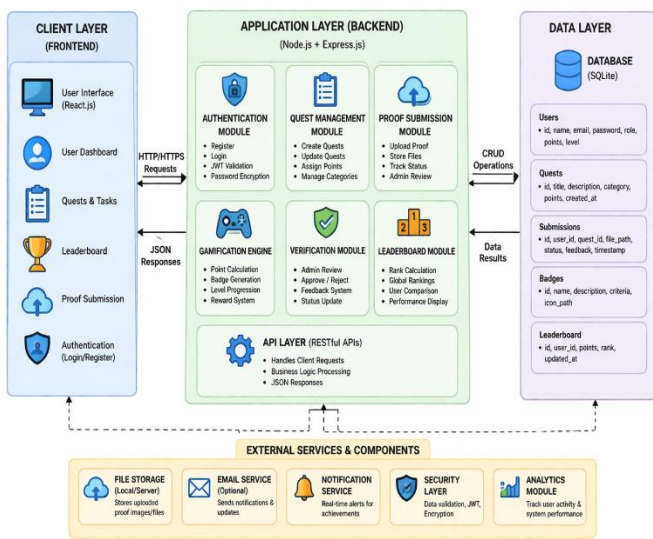


Fig.3.1 System Architecture

4. RESULTS

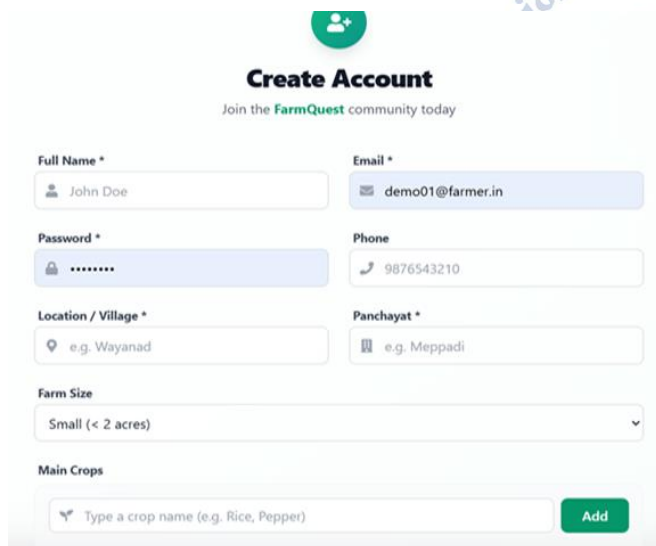


Fig.4.1 Gamified platform register page

The registration page allows new users to create an account by entering essential details such as name, email, password, and other required information. It serves as the entry point for farmers to access the platform and participate in sustainable farming activities. The system performs input validation to ensure that all fields are filled correctly and that the data provided is accurate and complete. This helps in maintaining data consistency and prevents invalid or duplicate entries in the system.

Once the user submits the registration form, the system securely stores the information in the database

after encrypting sensitive data such as passwords. This ensures the protection of user credentials and enhances system security. After successful registration, users can log in using their credentials and access the platform features such as quests, progress tracking, and rewards. The registration process is designed to be simple and user-friendly, enabling easy access even for users with limited technical knowledge.

The registration page is designed with a simple and intuitive interface to ensure ease of use for all users, especially farmers with limited technical experience. Clear labels, minimal input fields, and guided instructions help users complete the registration process without confusion. The system may also include basic validations such as password strength checks and email format verification to improve account security. Overall, the registration module ensures smooth onboarding of users and provides a strong foundation for secure and efficient interaction with the platform.

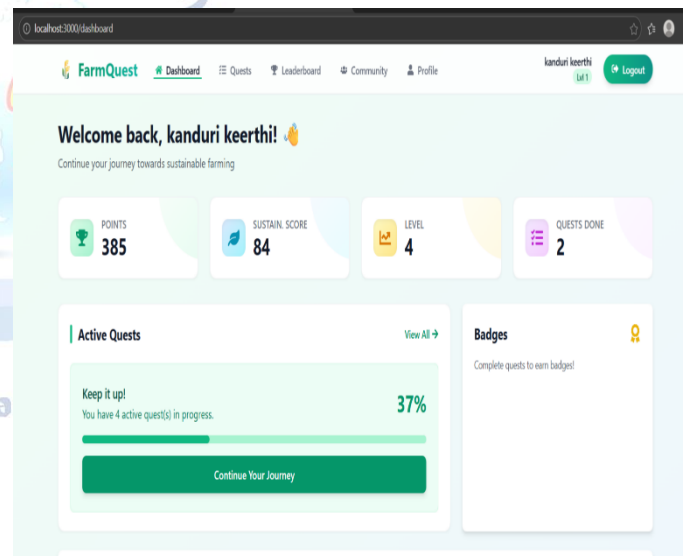


Fig.4.2 Gamified platform-Dashboard Page

The dashboard serves as the central interface of the system where users can view an overview of their activities and performance. After successful login, users are redirected to the dashboard, which displays key information such as available quests, completed tasks, earned points, and current level. It provides a quick summary of user progress, helping farmers understand their engagement with sustainable farming practices. The dashboard is designed to provide easy navigation to different modules of the system, including quests,

leaderboard, profile, and community sections. Users can access these features directly from the dashboard, making it convenient to explore various functionalities without confusion. The layout is kept simple and organized to ensure that users can easily locate and use different options.

Another important feature of the dashboard is real-time progress tracking. It continuously updates user activity, showing recently completed tasks, rewards earned, and current rankings. This helps users stay informed about their performance and motivates them to actively participate in more tasks. The visual representation of progress enhances user engagement and encourages consistency.

The dashboard also enhances user experience by providing personalized content based on user activity. It may display recommended quests, recent notifications, and performance insights tailored to the user's behavior. This personalized approach improves usability and ensures that users remain engaged with the platform while promoting the adoption of sustainable farming practices.

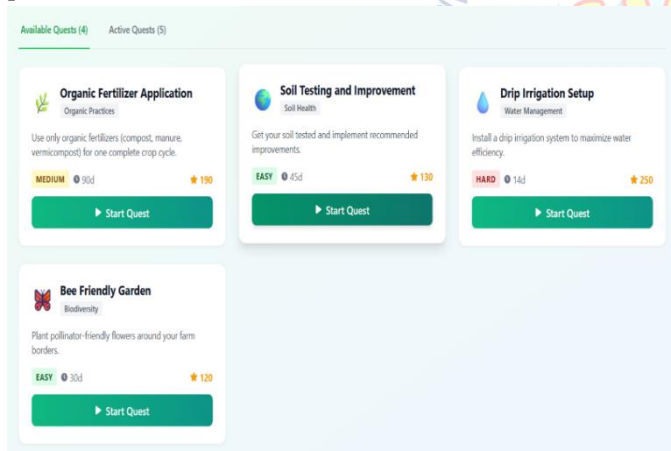


Fig.4.3 Available Quests

The available quests module displays a list of farming-related tasks designed to promote sustainable agricultural practices. Each quest represents a specific activity such as water conservation, organic farming, or soil management. The module provides clear details about each task, including its objectives, description, and expected outcomes, enabling users to understand what needs to be done before participating.

This module is designed to help users easily browse and select tasks based on their interests and capabilities. Quests may be categorized based on difficulty level, type of activity, or environmental impact, allowing users to

choose tasks that are suitable for their farming conditions. This structured presentation improves usability and encourages users to actively explore and participate in different activities.

Once a user selects a quest, it is marked as active, and the system begins tracking the user's progress. The module supports step-by-step task execution, allowing users to complete activities over time and update their progress accordingly. This flexibility is important for agricultural tasks, which often require multiple stages and time intervals.

The available quests module plays a key role in motivating users by integrating gamification elements. Each quest is associated with rewards such as points, badges, or levels, which are displayed alongside the task details. This encourages users to complete more quests and remain engaged with the platform, ultimately promoting the adoption of sustainable farming practices.

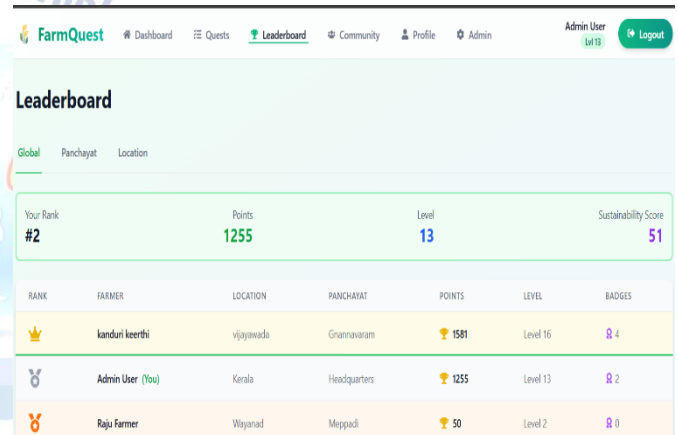


Fig.4.4 Leaderboard

The leaderboard module displays the ranking of users based on their performance and accumulated points within the system. It provides a clear comparison of user achievements and highlights top performers. This ranking system creates a sense of competition among users and encourages them to improve their performance.

The leaderboard is dynamically updated whenever users complete quests and earn rewards. This ensures that the rankings reflect real-time performance and user activity. Users can view their current position and track their progress relative to others on the platform.

This module may support multiple ranking categories such as global rankings or region-based rankings. Such categorization allows users to compete within their

community or on a larger scale. It enhances engagement by providing different levels of competition.

Overall, the leaderboard plays a crucial role in motivating users by combining recognition and competition. It encourages consistent participation and helps users stay actively involved in sustainable farming activities.

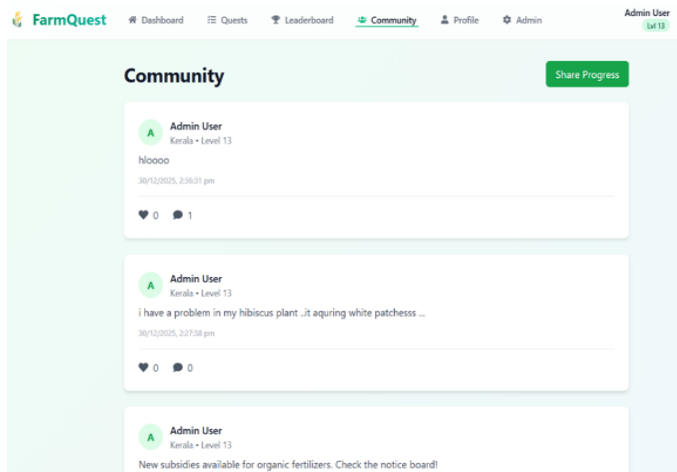


Fig.4.5 Community

The community module provides a platform for users to interact and share knowledge related to sustainable farming practices. It enables farmers to communicate with each other, exchange ideas, and discuss challenges they face in their agricultural activities.

Users can post queries, share experiences, and provide suggestions within the community. This interaction promotes collaborative learning and helps users gain practical insights from others who have implemented similar farming techniques.

The module also helps in building a sense of connection among users. By encouraging communication and participation, it creates a supportive environment where farmers can learn from each other and improve their practices.

Overall, the community feature enhances user engagement and strengthens the knowledge-sharing aspect of the platform. It contributes to the effective adoption of sustainable farming practices through collective learning.

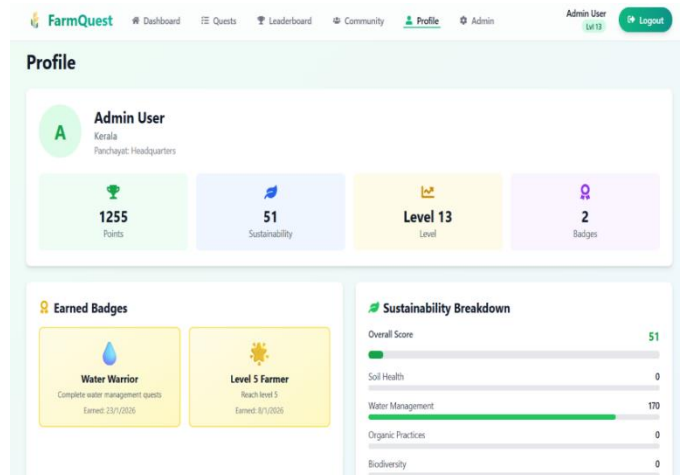


Fig.4.6 Profile of Farmer

The profile module provides detailed information about the user, including personal details, activity history, and achievements. It allows users to view their progress and track their involvement in various farming tasks.

Users can see the list of completed quests, earned rewards, and accumulated points. This helps them understand their performance and identify areas where they can improve their participation.

The profile also reflects the user's growth over time by displaying progress indicators such as levels and achievements. This motivates users to continue participating and reach higher milestones within the system.

Overall, the profile module acts as a personalized dashboard that helps users monitor their performance and stay engaged with the platform.

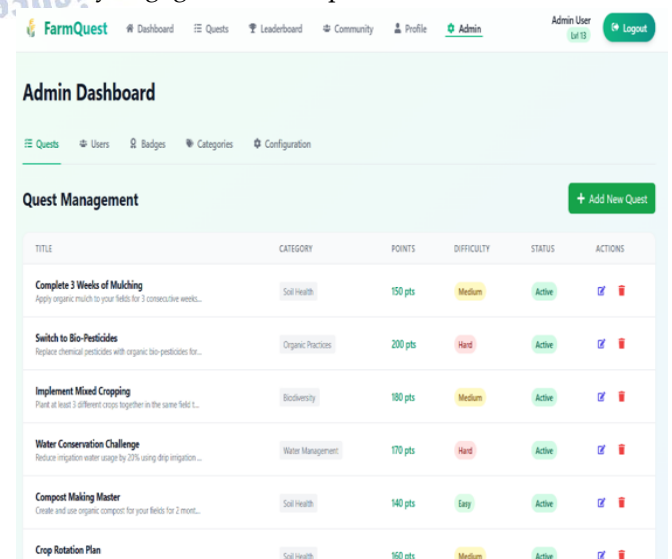


Fig.4.7 Admin Dashboard

The admin dashboard provides administrative control over the entire system. It allows administrators to manage users, monitor activities, and ensure that the platform operates smoothly.

Administrators can review user-submitted proofs and verify their authenticity. This verification process ensures that tasks are genuinely completed before rewards are assigned, maintaining system reliability.

The dashboard also provides insights into system performance, including user participation and activity levels. This helps administrators make informed decisions to improve system functionality.

Overall, the admin dashboard plays a vital role in maintaining system integrity, ensuring proper monitoring, and supporting efficient management of platform activities.

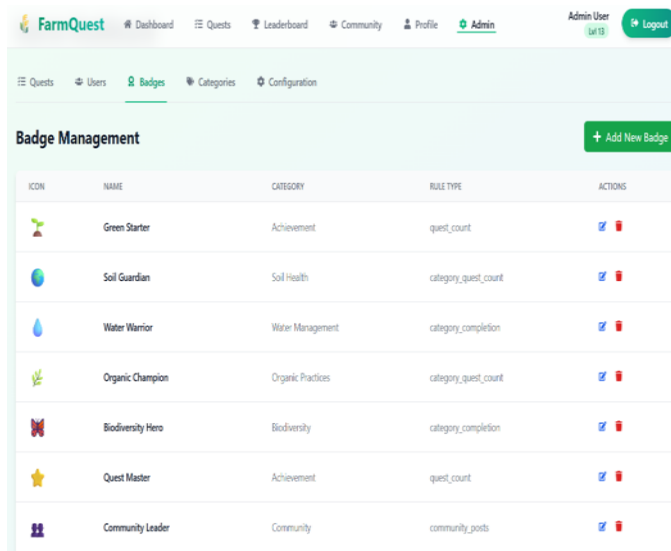


Fig.4.8 Badges

The badges module represents the reward system of the platform, where users earn badges for completing specific tasks or achieving milestones. These badges act as recognition for user efforts and accomplishments.

Each badge is associated with a particular achievement, such as completing a set number of quests or reaching a certain level. This encourages users to participate more actively and strive for higher achievements.

The visual representation of badges enhances user motivation by providing a sense of accomplishment. Users feel rewarded for their efforts, which increases their engagement with the platform.

Overall, the badges module supports gamification by rewarding user performance and encouraging

continuous participation in sustainable farming activities.

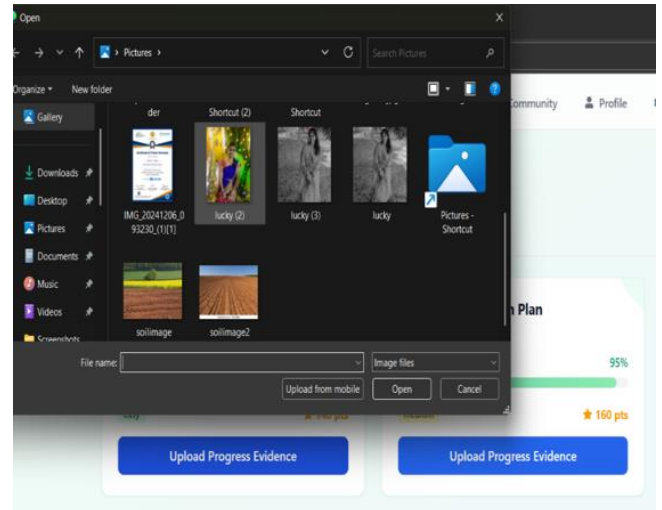


Fig.4.9 Proof Uploading

The proof uploading module allows users to submit evidence after completing a task. This evidence can be in the form of images or textual descriptions that demonstrate task completion.

The module ensures that users provide valid proof before receiving rewards. It acts as a bridge between task completion and verification, ensuring accountability within the system.

The uploading process is designed to be simple and user-friendly, allowing users to easily submit their proof without technical difficulty. This encourages users to actively participate and complete tasks.

Overall, the proof uploading module ensures transparency and supports the validation process, making the system reliable and trustworthy.

The proof uploading module also supports efficient data handling and storage by securely saving submitted evidence in the database for further verification and future reference. It maintains proper linkage between user activities and submitted proofs, enabling easy tracking and auditing of task completion. Additionally, the module can handle multiple submissions and ensures that each proof is associated with the correct quest and user.

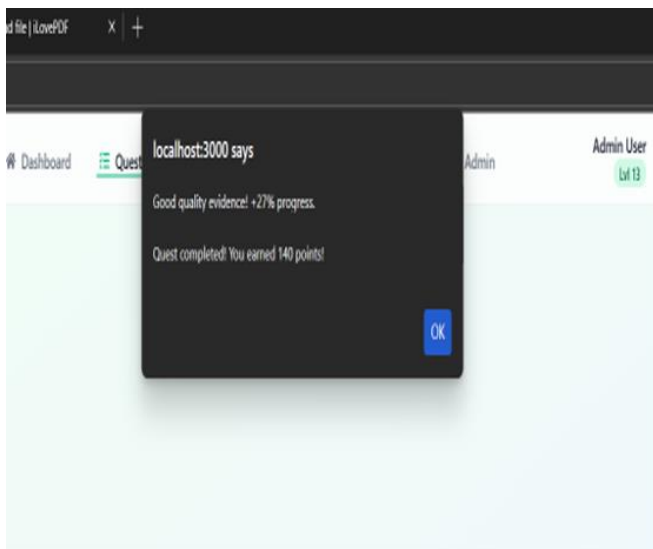


Fig.4.10 Quality Checking

The quality checking module is used by administrators to review and verify the proof submitted by users. It ensures that the tasks have been genuinely completed before rewards are assigned.

Administrators analyze the uploaded evidence and decide whether to approve or reject the submission. This process helps maintain the accuracy and credibility of the system.

If the proof is valid, the system updates the user's progress and assigns rewards. If not, the submission is rejected, and appropriate feedback may be provided to the user.

Overall, the quality checking module plays a critical role in maintaining system integrity by ensuring that only genuine efforts are rewarded.

5. QUANTATIVE SUMMARY

The proposed system was evaluated based on key performance aspects such as system efficiency, user engagement, and response time. The platform supports multiple users and processes requests through a structured workflow including task selection, execution, proof submission, and verification. The results indicate that the system effectively manages user activities and provides reliable outputs through accurate progress tracking and reward allocation. The system demonstrates fast response time, handling user interactions and updates in real time without noticeable delay. Overall, the platform shows consistent performance in delivering reliable functionality and

promoting active participation in sustainable farming practices.

6. CONCLUSION AND FUTURE SCOPE

The Gamified platform to promote sustainable farming practices is successfully presents a gamified web-based platform to promote sustainable farming practices by enhancing farmer engagement and motivation. By integrating features such as quests, rewards, leaderboards, and proof verification, the system ensures that users not only gain knowledge but also implement eco-friendly practices in real-world conditions. The use of modern technologies enables efficient performance, secure data handling, and real-time interaction. Overall, the platform bridges the gap between awareness and practical adoption of sustainable agriculture, providing a scalable and effective solution for improving environmental sustainability and agricultural productivity.

Conflict of interest statement

Authors declare that they do not have any conflict of interest.

REFERENCES

- [1] Deterding, S., Dixon, D., Khaled, R., and Nacke, L., "From Game Design Elements to Gamefulness: Defining Gamification," Proceedings of the 15th International Academic MindTrek Conference, 2011.
- [2] FAO, "Sustainable Agriculture and Rural Development," Food and Agriculture Organization of the United Nations, 2017.
- [3] Hamari, J., Koivisto, J., and Sarsa, H., "Does Gamification Work? – A Literature Review of Empirical Studies," 47th Hawaii International Conference on System Sciences, 2014.
- [4] Klerkx, L., Jakku, E., and Labarthe, P., "A Review of Social Science on Digital Agriculture," *Agricultural Systems*, vol. 155, pp. 1–12, 2017.
- [5] Zeng, D., Chen, H., and Lusch, R., "Social Media Analytics and Intelligence," *IEEE Intelligent Systems*, vol. 25, no. 6, pp. 13–16, 2010.