E-Gamuda Smart Community: A Web-based Donation and Resource-Sharing Platform for University Ecosystems

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ABSTRACT

Many valuable items such as clothing, food, and electronics within university communities often go unused and are eventually discarded, contributing to unnecessary waste. At Universiti Teknikal Malaysia Melaka (UTeM), the absence of a structured platform for donations has limited the ability of students, staff, and affiliated organizations to efficiently redistribute resources to those in need. To address this issue, the E-Gamuda Smart Community system was developed as a web-based platform that facilitates item donations, requests, urgent help, and charity event participation within the campus ecosystem. The system incorporates role-based access control for donors, recipients, and administrators, supported by intuitive dashboards and features such as a real-time map for donation centres. A modular development approach was applied, supported by data flow diagrams (DFD), entity-relationship diagrams (ERD), and structured design models. The system was evaluated through functional, usability, validation, and performance testing, all of which confirmed its effectiveness, reliability, and user-friendliness. The results highlight that the platform not only streamlines donation activities but also reduces resource wastage, enhances trust through verified interactions, and fosters a culture of social responsibility. By aligning with Sustainable Development Goal (SDG) 11 on Sustainable Cities and Communities, the E-Gamuda Smart Community contributes towards building a more sustainable and compassionate university environment.

Keywords: Smart Community, Donation Management, Web-based System, Sustainable Development Goals, UteM

INTRODUCTION

University campuses generate substantial waste, including food scraps, paper, plastics, textiles, and electronics, contributing both to environmental degradation and social challenges. Waste management is especially pressing in higher education institutions, which, due to their dense populations and daily activities, often produce significant volumes of refuse. Studies report that campuses can generate as much as two tons of waste per day, comprising both organic and inorganic materials, potentially disrupting cleanliness, health, and productivity if not properly managed [1].

To address these issues, universities around the world have implemented sustainable waste strategies such as recycling programs, waste segregation, and reuse initiatives to foster circular campus environments [2]. These strategies promote a shift from traditional linear consumption models to more sustainable, closed-loop systems.

Beyond mere waste reduction, there lies an opportunity to tap into surplus yet usable resources like clothing, electronics, and non-perishable food that are often discarded due to the absence of structured donation processes. Donation management platforms bridge this gap by facilitating connections between donors and recipients, thereby enhancing sustainability and community engagement. A prime example is the Clothes Recycle Management System (CRMS), a web-based platform designed to streamline clothing donations by incorporating features such as event management, item tracking, automated reporting, and a points-based incentive scheme [3].

In response to these developments, the E-Gamuda Smart Community system was conceived. It leverages a role-based, web-driven approach to support intra-campus resource sharing among students, staff, and affiliated organizations. By enabling users to offer or request items across a range of categories including clothing, electronics, food, and urgent supplies, the system addresses not only resource wastage, but also logistical inefficiencies and trust issues often present in informal donation efforts. This approach aligns with the global agenda for sustainable resource consumption and resilience in community, particularly as embodied in Sustainable Development Goal 11: Sustainable Cities and Communities.

BACKGROUND

The rapid integration of digital technologies, such as IoT, AI, and big data has significantly transformed how communities interact, collaborate, and manage shared resources. In higher education, these smart technologies bolster sustainable initiatives, such as waste reduction, resource optimization, and community engagement [4].

Universities are increasingly adopting smart campus solutions to drive digital transformation and sustainability. Platforms built with role-based access, user verification, and responsive dashboards enhance trust and efficiency in community systems [5]. As institutions modernize their operations, such systems are pivotal for fostering sustainable behaviour and social innovation.

Donation management platforms face typical challenges, including trust deficits, verification issues, and logistical gaps. Emerging technologies like blockchain and transparent design features have been shown to improve accountability and participation in charitable platforms [6]. For instance, blockchain mechanisms enable traceability and transparency in donation systems, thereby strengthening donor confidence and platform integrity [7].

Positioned within this evolving landscape, the E-Gamuda Smart Community system was conceptualized to serve the unique dynamics of the Universiti Teknikal Malaysia Melaka (UTeM) environment. The proposed web-based solution emphasizes user verification, role-based access, and intuitive dashboards to support donations, urgent help, and event management. All with the aim of closing logistical gaps and enhancing trust across campus interactions.

Related Work

Donation management within university and community contexts has increasingly leveraged cloud-based and centralized platforms to streamline connections between donors and beneficiaries. Radaideh et al. (2022) proposed a cloud-based platform designed to support financially needy students through discreet, privacy-preserving donation and verification workflows, demonstrating system modularity and usability within academic environments [8].

Modern applications have also introduced communication-enhancing features. Singh et al. (2024) developed DONAPP, a centralized mobile platform that facilitates donor-recipient interaction through location-based discovery, push notifications for urgent needs, user profile histories, and impact insights which resulting in increased donation responses and user satisfaction [9].

Gamification continues to emerge as a potent motivator in donation platforms. A gamified crowdfunding interface using the MDA (Mechanic–Dynamic–Aesthetic) framework significantly boosted user engagement in donation-based campaigns, showcasing tangible increases in participation [10]. Complementing this, Behl et al. (2023) found that reward-based gamification mechanisms significantly encourage repeat donations, particularly during crises like the COVID-19 pandemic [11].

Beyond engagement, technological transparency remains central. Almaghrabi et al. (2022) introduced a blockchain-based donation traceability framework, enabling donors and organizers to track contributions securely and transparently, thereby elevating trust and accountability in donation processes [12].

These insights inform the design of the E-Gamuda Smart Community system, which integrates discreet donation handling, real-time notifications, user-centric dashboards, gamified incentives, and transparent tracking which tailored to meet the unique needs of the UTeM campus community.:

Table I. Comparison Between Existing and Proposed System

Work / System	**Focus**	**Key Strength**	**Limitation**
Radaideh et al. (2022) [8]	Cloud platform for students	Privacy-preserving, modular	Limited to student aid
Singh et al. (2024) DONAPP [9]	Mobile donation app	Location-based, notifications	General community focus
Golrang & Safari (2021) [10]	Gamified crowdfunding	Boosts engagement	Not for item donations
Behl et al. (2023) [11]	Crisis donation	Encourages repeat giving	Crisis-specific use
Almaghrabi et al. (2022) [12]	Blockchain tracking	Transparency, trust	Complex to implement
E-Gamuda Smart Community	University donation system	Combines privacy, communication, gamification, and trust	Prototype, needs enhancements

METHODOLOGY

The project followed four phases: planning, system design, development, and evaluation. Planning focused on identifying problems and requirements, system design outlined the architecture and user interfaces, development implemented the modules with secure role-based access, and evaluation tested functionality, usability, and performance to ensure reliability and user satisfaction.

A. Planning

The planning phase focused on identifying the problems, defining the project objectives, and outlining the scope of the E-Gamuda Smart Community system. Key issues included the absence of a centralized donation platform at UTeM, difficulties in connecting donors and recipients, and concerns about trust and transparency. From this, objectives were established to create a secure, role-based web system that supports item donations, urgent requests, and charity events while promoting sustainable community practices. The scope was defined to include user roles such as donors, recipients, administrators, and charity organizations, each with distinct functions. This phase ensured that the system requirements were aligned with both user needs and the project's sustainability goals.

TABLE II. PROJECT OBJECTIVES AND EXPECTED OUTCOMES

Objective	**Expected Outcome**
Develop a centralized platform for donations at UTeM	Easy access for students, staff, and organizations to donate or request items
Enhance trust and transparency in donations	Verified user roles and secure transactions
Support urgent requests and charity events	Faster response to needs and improved community engagement
Promote sustainable practices within the campus	Reduced waste and stronger culture of sharing

B. System Design

The system design phase translated the project requirements into a structured architecture and user interface. The E-Gamuda Smart Community was designed as a three-tier web-based system consisting of the frontend, backend, and database layers. The frontend emphasized usability and accessibility, adopting a responsive interface to ensure compatibility across devices. Role-based dashboards were developed for donors, recipients, administrators, and charity organizations, allowing each user type to access only relevant functions.

To guide development, modelling tools such as Data Flow Diagrams (DFD) were created to define data flows, interactions, and relationships between system components. User interface prototypes were designed using Figma, providing a visual blueprint of navigation flows, forms, and dashboards. This approach ensured clarity in requirements and consistency between the design and the final implementation.

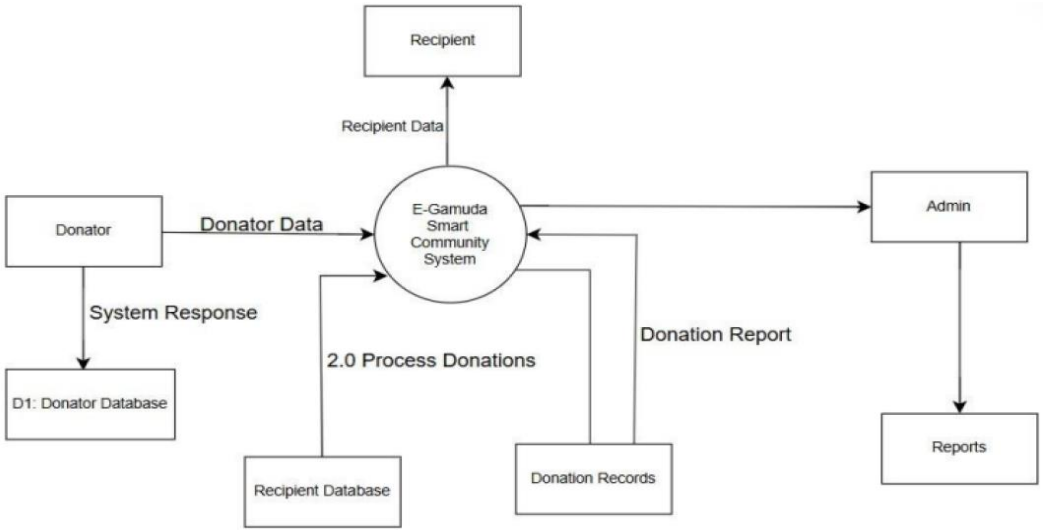

Fig. 1. DFD Level 0 Proposed System

The Data Flow Diagram (DFD) Level 0 of the E-Gamuda Smart Community System provides a high-level overview of how data moves between the system and its external entities. Donors interact with the system by submitting donation details, which are processed and stored in the Donor Database, with the system providing confirmation responses. Recipients send their requests and related information to the system, which then processes the data and returns suitable responses while maintaining recipient details in the Recipient Database. Administrators oversee the system by receiving donation reports and generating summary reports that reflect the overall performance of the platform. At the core, the system's main process which is Process Donations ensures that donor inputs, recipient needs, and administrative oversight are integrated, with all transactions recorded in the Donation Records for accountability. This diagram highlights the central role of the system in managing donations efficiently while ensuring data integrity and transparency.

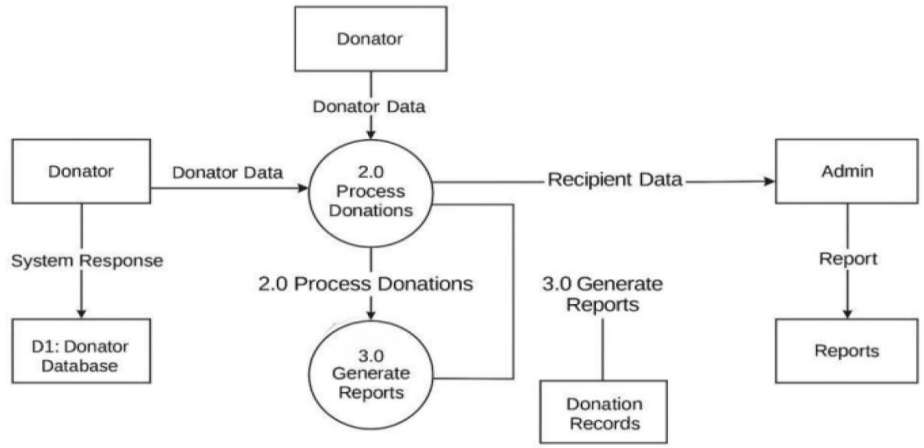

Fig. 2. DFD Level 1 Proposed System

This Level 1 DFD decomposes the central process from a higher-level context diagram, breaking down the main functions of a Donation Management System. The system interacts with three key external entities: the Donator (who provides data and donations), the Admin (who manages the system and requests reports), and a Database (which acts as the central repository for all data).

The core functionality is handled by three main processes. Process 2.0, "Process Donations," is the primary operation where the system receives "Donator Data" and "Donations" from the Donator. This process is responsible for validating, recording, and storing this information. It outputs "Donation Records" to the "Database" for permanent storage, ensuring all transactions are logged.

Process 3.0, "Generate Reports," serves the Admin's needs. This process is triggered when the Admin requests information. It retrieves the necessary "Donation Records" and other relevant data from the "Database," processes it, and outputs the formatted "Reports" back to the Admin. This allows the Admin to analyse donation trends, generate financial summaries, and review donor history.

C. Development

The development of the E-Gamuda Smart Community system was carried out using a modular and iterative approach to ensure flexibility and maintainability. The backend was implemented with PHP as the server-side language and MySQL as the database management system, while HTML, CSS, and JavaScript were used to design an intuitive and responsive frontend interface. Each module, such as user registration, login, item donation, item request, urgent help, event management, and report generation was developed independently and later integrated into the complete system.

Role-based access control was introduced to differentiate the permissions of donors, recipients, administrators, and charity organizations, ensuring that each user could only access features relevant to their role. Security was emphasized through session management, data validation, and secure file handling for uploading donation images. Agile practices were adopted during development, enabling continuous feedback and iterative refinements. This approach facilitated the delivery of a reliable system that aligns with user requirements and supports the overall goal of fostering sustainable community engagement at UTeM.

TABLE III. SYSTEM MODULES AND THEIR FUNCTIONS

Module	**Function**
User Registration & Login	Allows users to create accounts, authenticate, and access role-based dashboards
Item Donation	Enables donors to post items with descriptions, categories, and images
Item Request	Allows recipients to request specific items and track status
Urgent Help	Provides a dedicated space for fast-response requests
Event Management	Facilitates creation and promotion of charity events by admins
Reports	Generates summaries of donations, requests, and user activities
Admin Management	Allows administrators to oversee users, approve or reject actions, and maintain system integrity

D. Evaluation

The evaluation phase was conducted to ensure that the E-Gamuda Smart Community system met its functional and non-functional requirements. Several testing strategies were employed. Functional testing verified that core modules such as registration, login, item posting, and request handling operated as intended. Usability testing was carried out with selected students and staff, who evaluated the system’s navigation, layout, and clarity; their feedback guided improvements in interface design. Validation testing ensured that input fields, such as email addresses, item descriptions, and form submissions, were processed accurately, reducing the risk of errors.

Performance testing assessed the responsiveness of the system during data submissions, logins, and navigation, confirming that it could handle multiple operations smoothly without significant delays.

The testing results confirmed that the system functioned reliably and was user-friendly. Minor issues, such as image upload errors and incomplete form validation, were identified and resolved during this phase. Overall, the evaluation demonstrated that the platform is secure, efficient, and well-suited to support donation and request activities within the UTeM community, while also highlighting areas for future enhancement such as real-time tracking and automated notifications.

TABLE IV. TEST RESULTS SUMMARY

Test Case	Expected Output	Actual Result	Status
User Registration	Account created and redirected to dashboard	Works as expected	Pass
User Login	Redirect to role-specific dashboard	Redirected correctly	Pass
Post Donation Item	Item displayed with image and details	Item appears in donation list	Pass
Submit Item Request	Request saved and listed	Request shown in request section	Pass
Admin Manage Users	View, update, or delete user accounts	Admin actions executed successfully	Pass

RESULT

The results of the E-Gamuda Smart Community project are demonstrated through the implementation of its web-based modules and interfaces. The system successfully integrates features for user registration, login, item donation, item requests, urgent help, event management, and reporting, each accessible through role-based dashboards. Donors, recipients, administrators, and charity organizations can interact with the system according to their designated permissions, ensuring both efficiency and security.

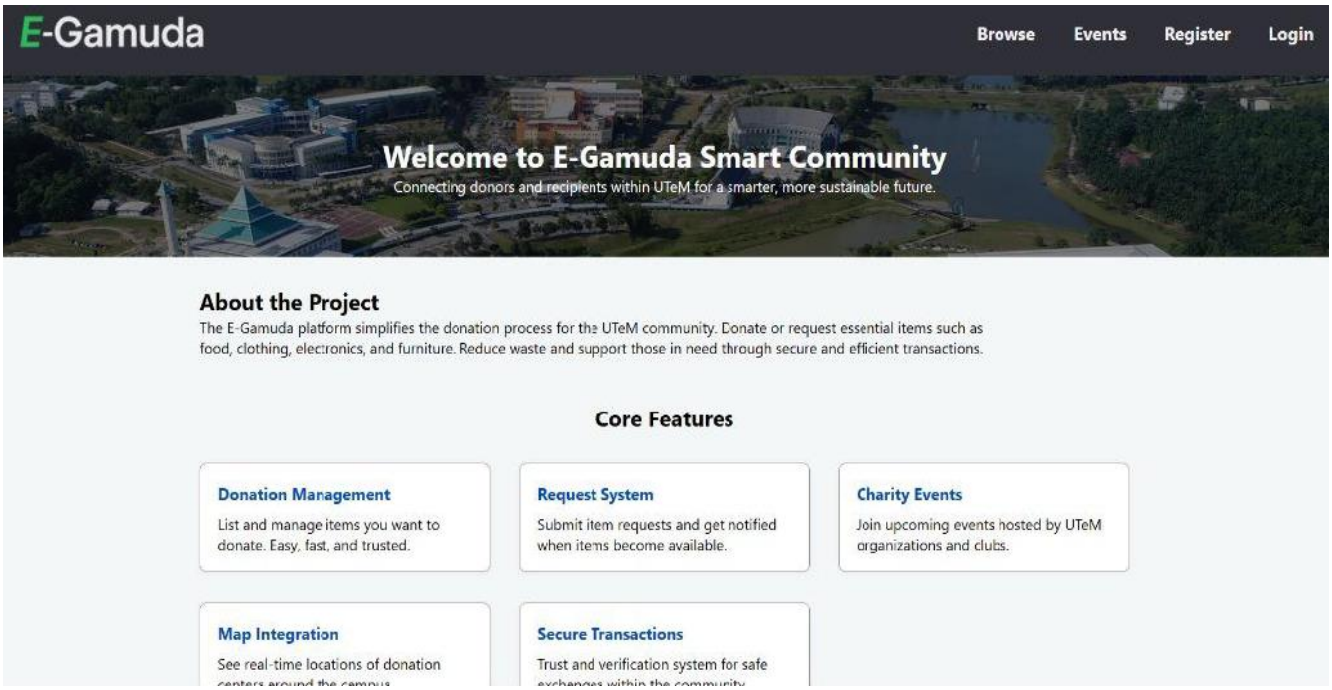

Fig. 3 Home Page

Figure 3 shows the home page that provides an overview of the platform, featuring recent donations, urgent requests, and upcoming charity events. It acts as the main entry point for users, offering quick navigation to key system modules.

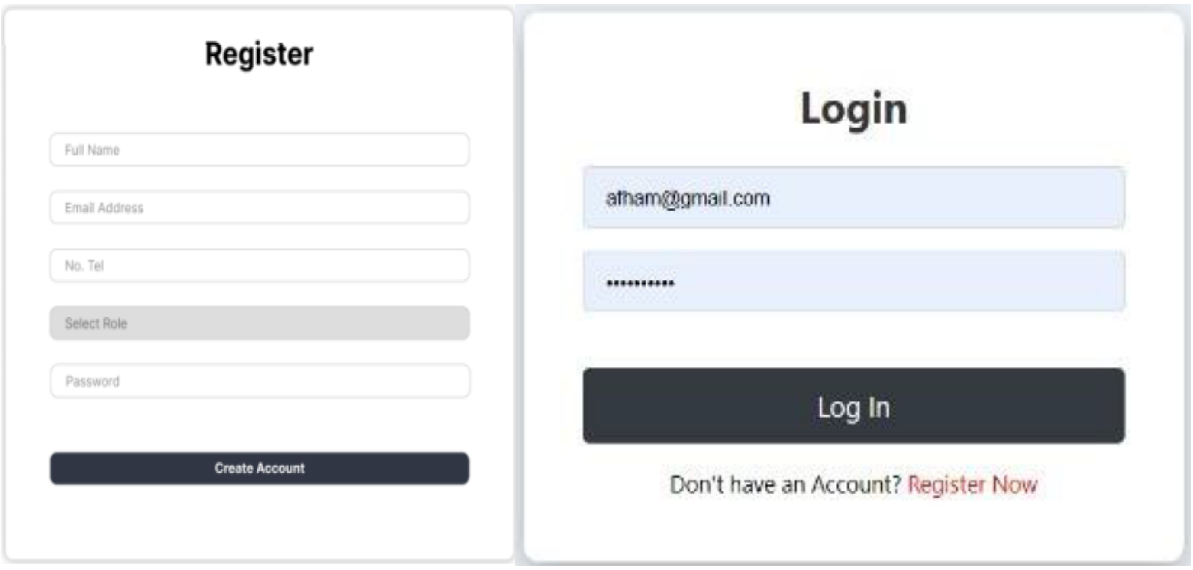

Fig. 4. Login and Register Page

Figure 4 shows the registration page which allows new users to create an account by providing personal details and selecting their role (donor, recipient, admin). Role-based access begins from the registration stage to ensure proper system use. After that, login page authenticates users and redirects them to their respective dashboards.

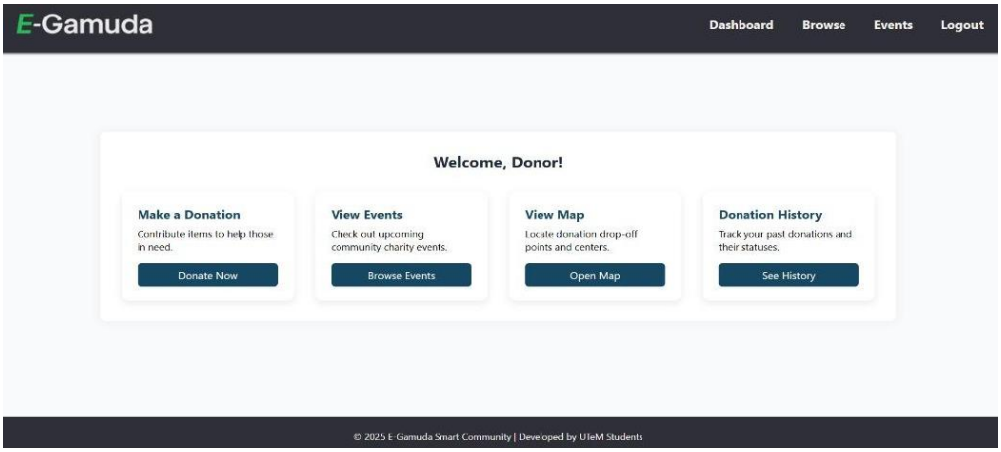

Fig. 5. Donor Dashboard

Figure 5 shows the donor dashboard where donors are provided with a dedicated dashboard to manage their activities. From here, they can post new donation items, monitor donation history, and respond to recipient requests.

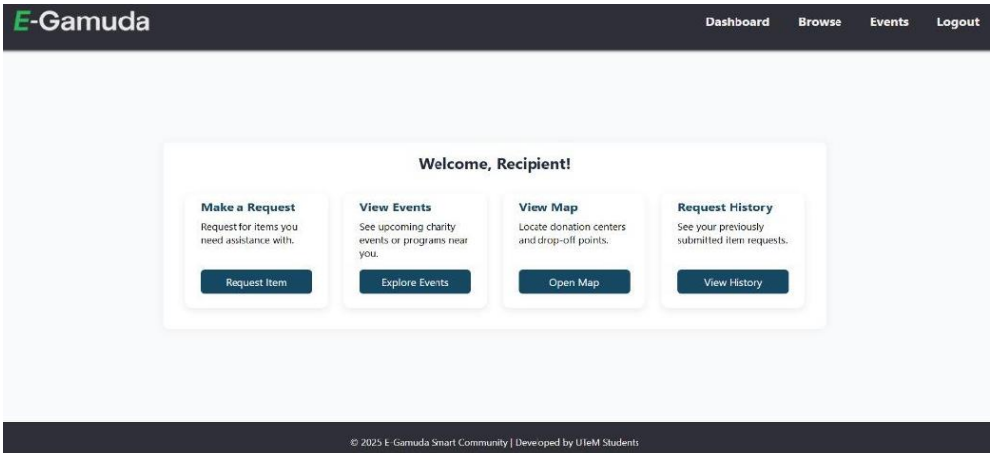

Fig. 6. Recipient Dashboard

Figure 6 shows the recipient dashboard where they can browse available items, submit requests, and track their request status. The dashboard provides a personalized view of recipient-specific functions for efficiency.

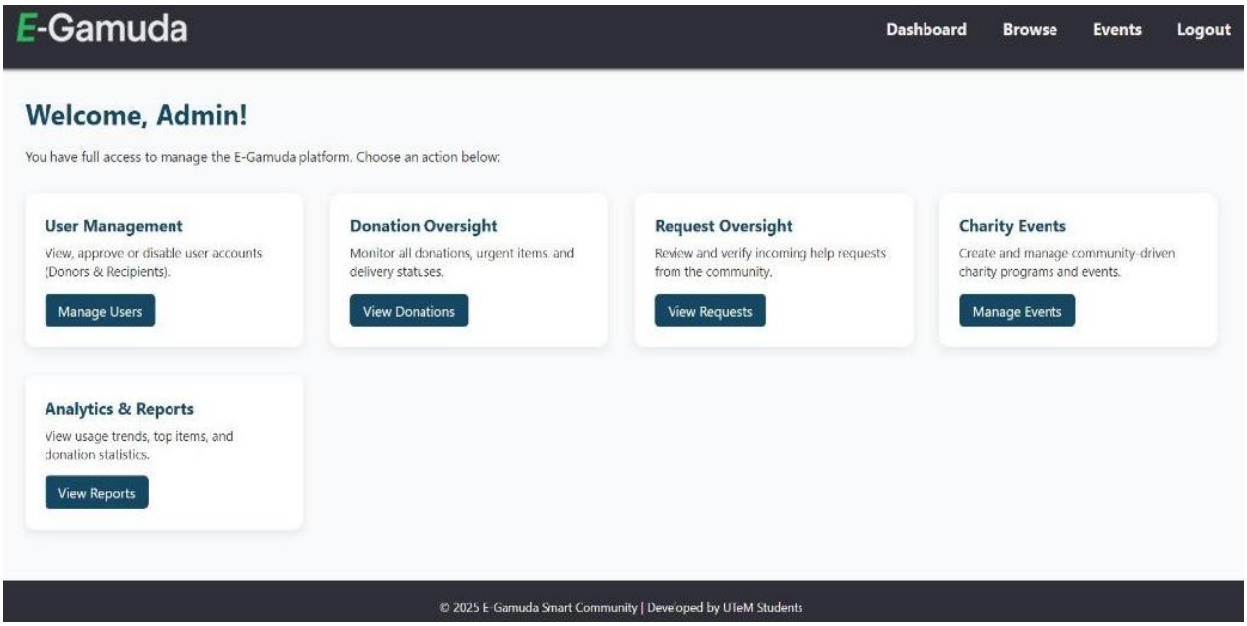

Fig. 7. Admin Dashboard

Figure 7 shows the admin dashboard where administrators are given full control to manage users, monitor donation activities, approve or reject posts, and generate system reports. This ensures overall governance and transparency.

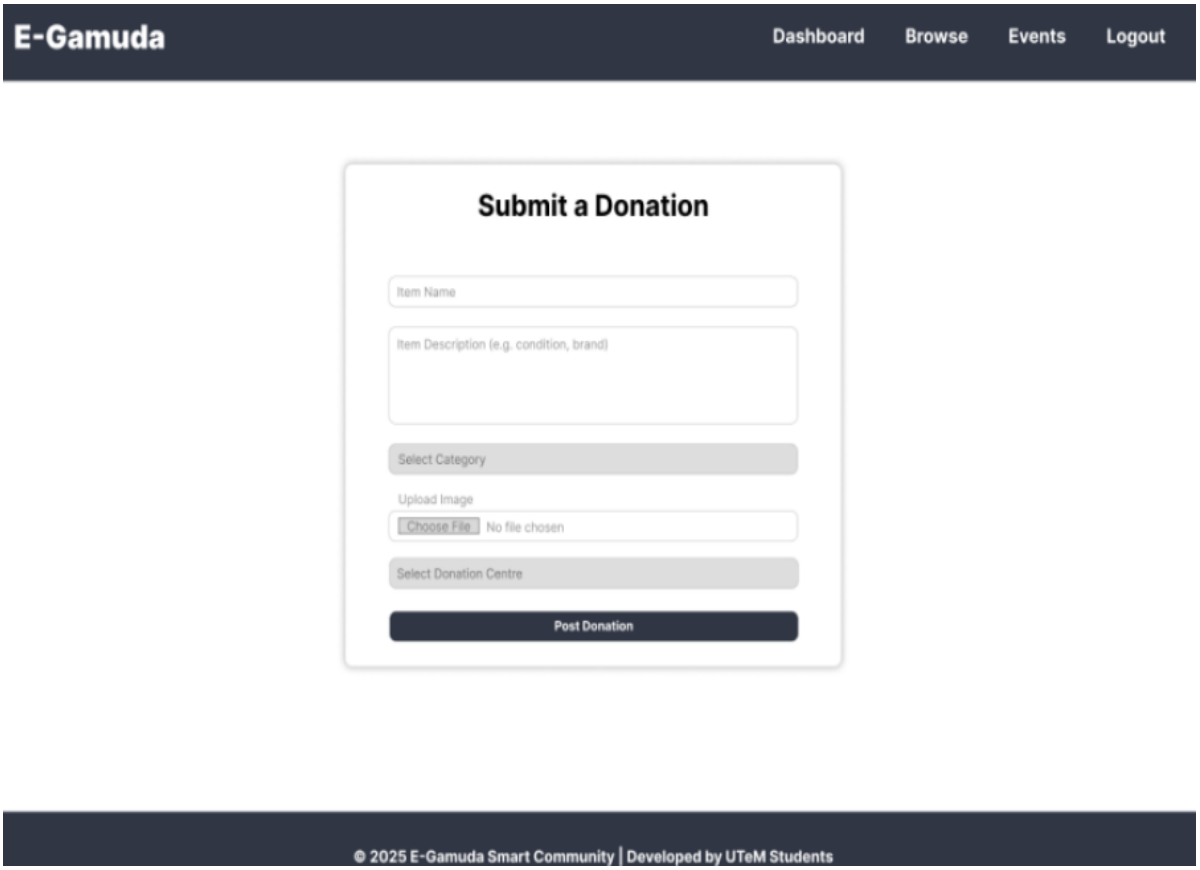

Fig. 8. Donation Page

Figure 8 shows the donation page which donors can upload item details, including descriptions, categories, and images. This page ensures that donations are properly catalogued for browsing by recipients.

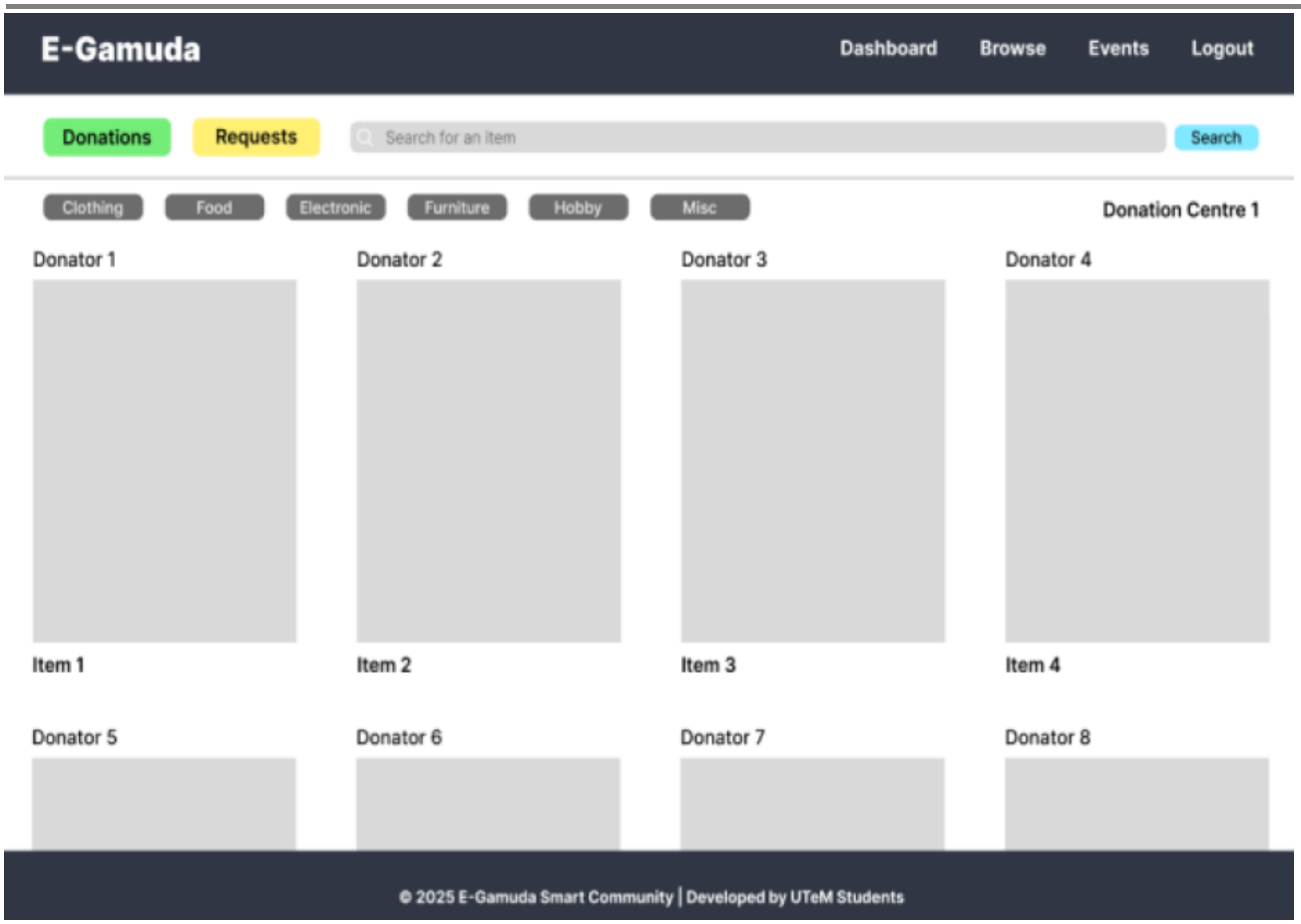

Fig. 9. Browse (Donation) Page

Figure 9 shows page when donation page is browsed and it will list all items available for donation, complete with categories and images, making it easy for recipients to search for suitable items.

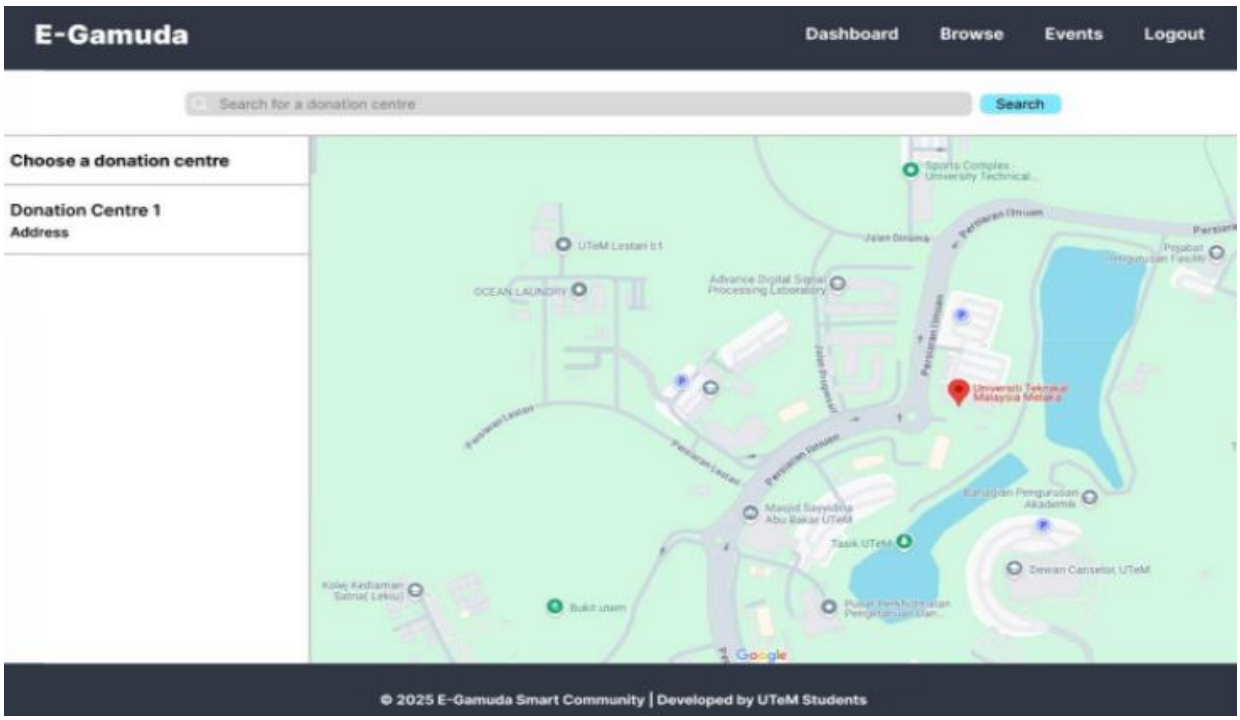

Fig. 10. Maps Page

Figure 10 shows the map feature which providing a visual display of nearby donation centres, allowing users to locate drop-off points conveniently.

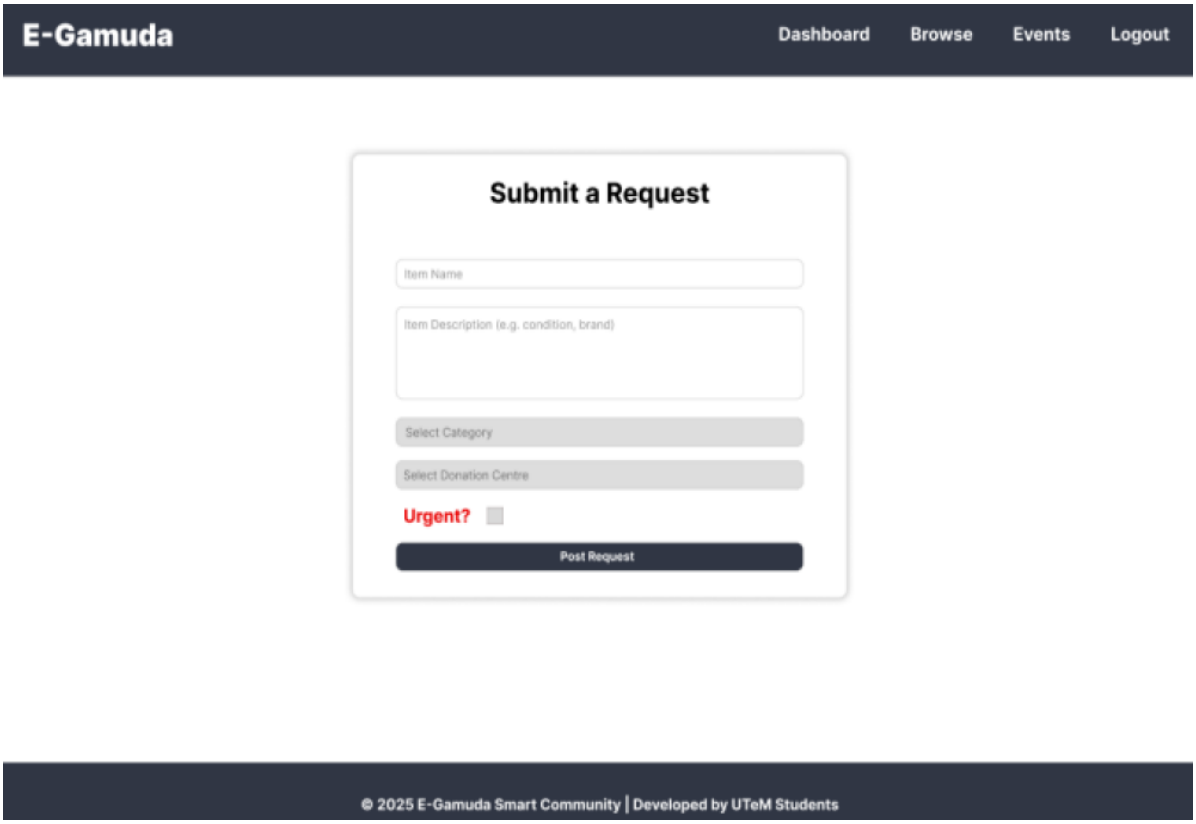

Fig. 11. Request Page

Figure 11 shows the request page where recipients can request specific items by submitting details such as item type and description. This module links directly with the donor side for efficient matching.

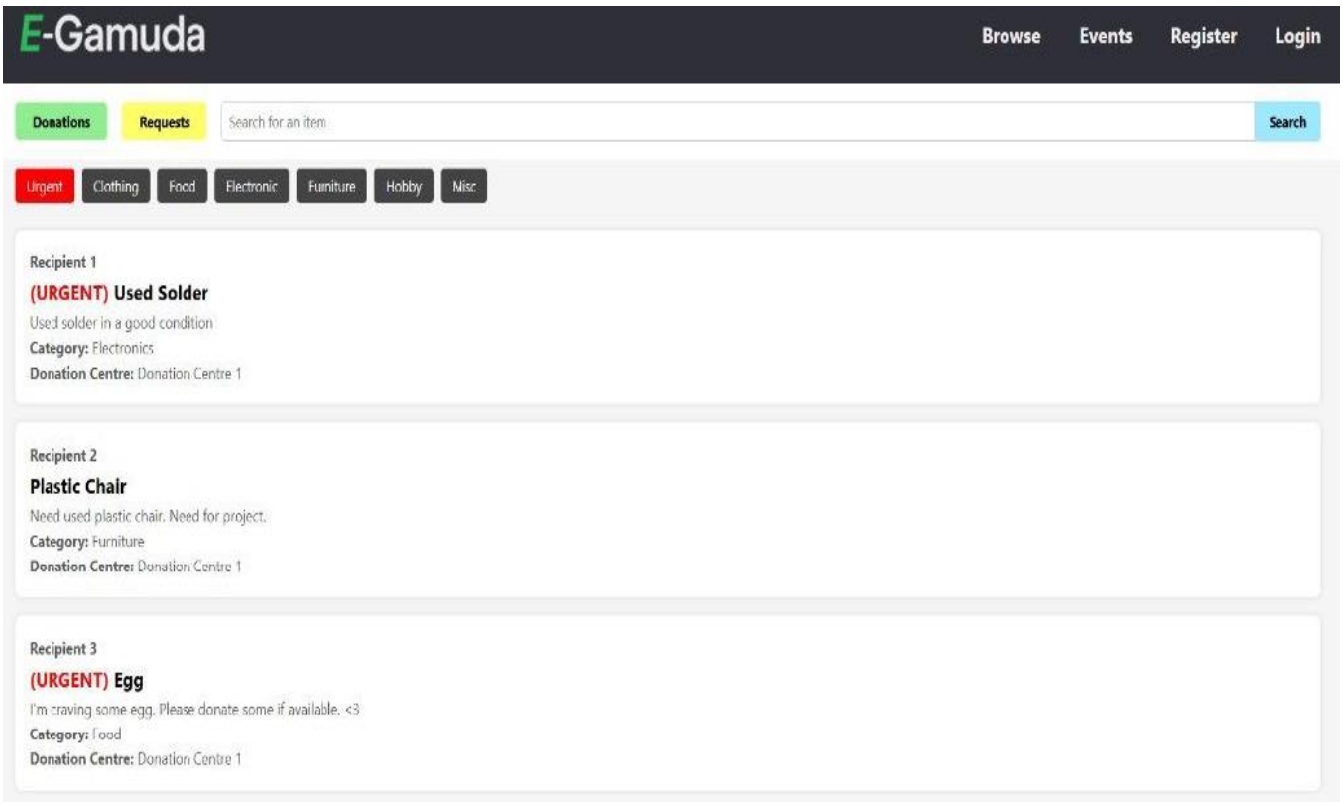

Fig. 12. Browse (Request) Page

Figure 12 shows browse request page where donors and admins can view all recipient requests, enabling them to identify urgent needs or recurring demands within the community.

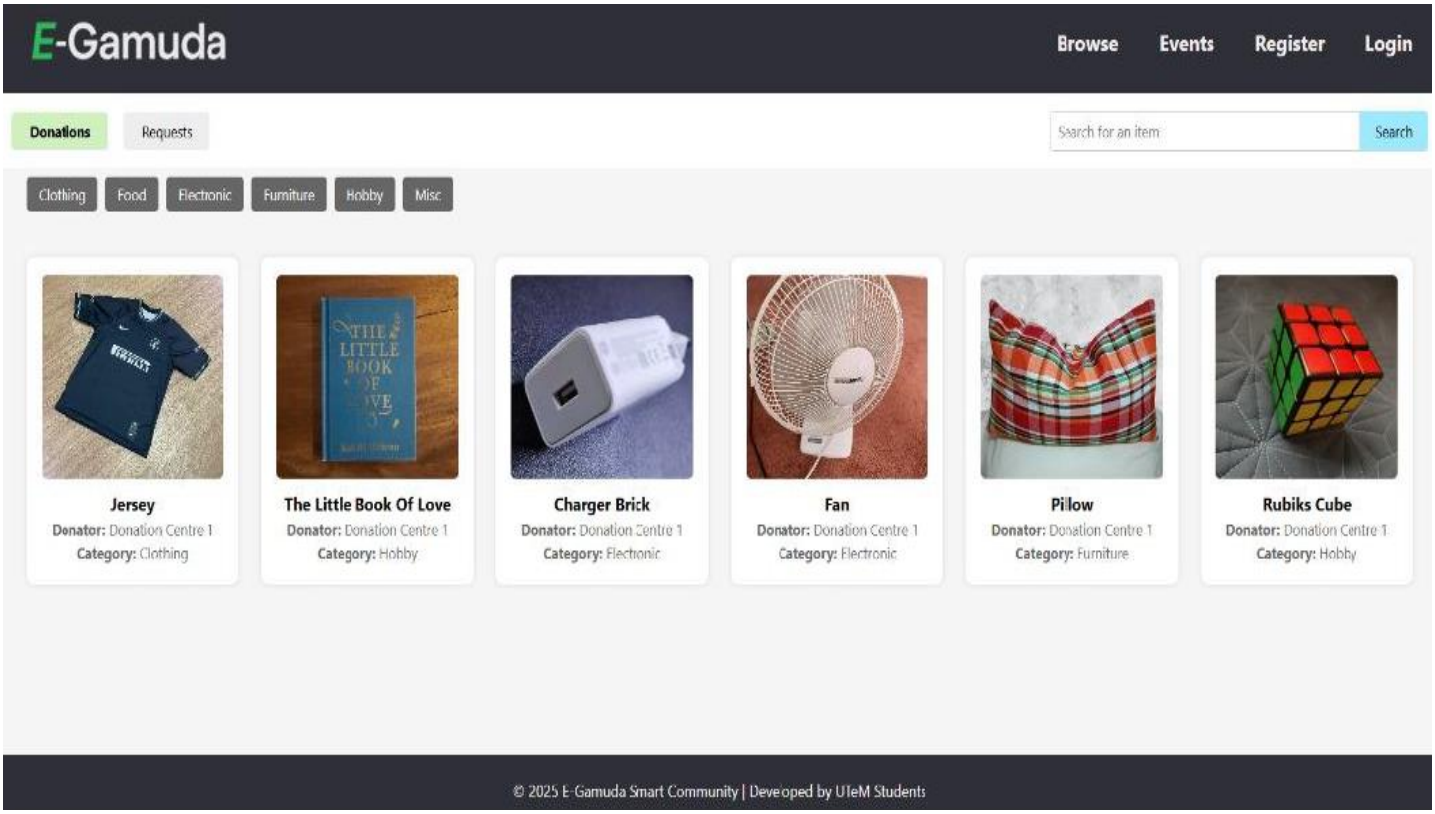

Fig. 13. Item Page (Donation)

Figure 13 shows item donation page which each donation item has its own detailed page displaying images, descriptions, donor information, and status, allowing for greater transparency.

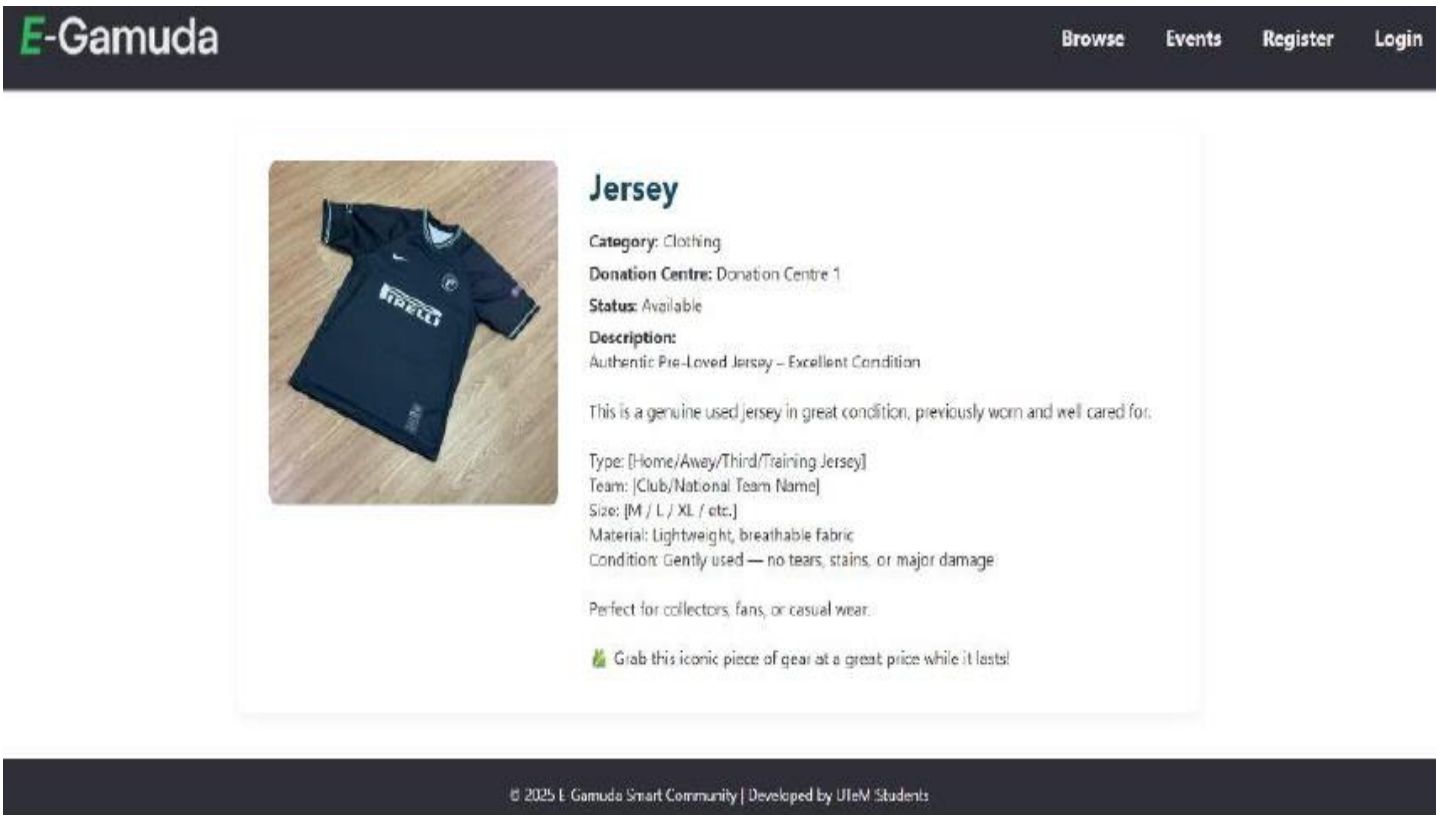

Fig. 14. Item Page (Request)

Figure 14 shows the item request page which similar to the donation item page, this page shows full details of a recipient's request, helping donors decide how to respond.

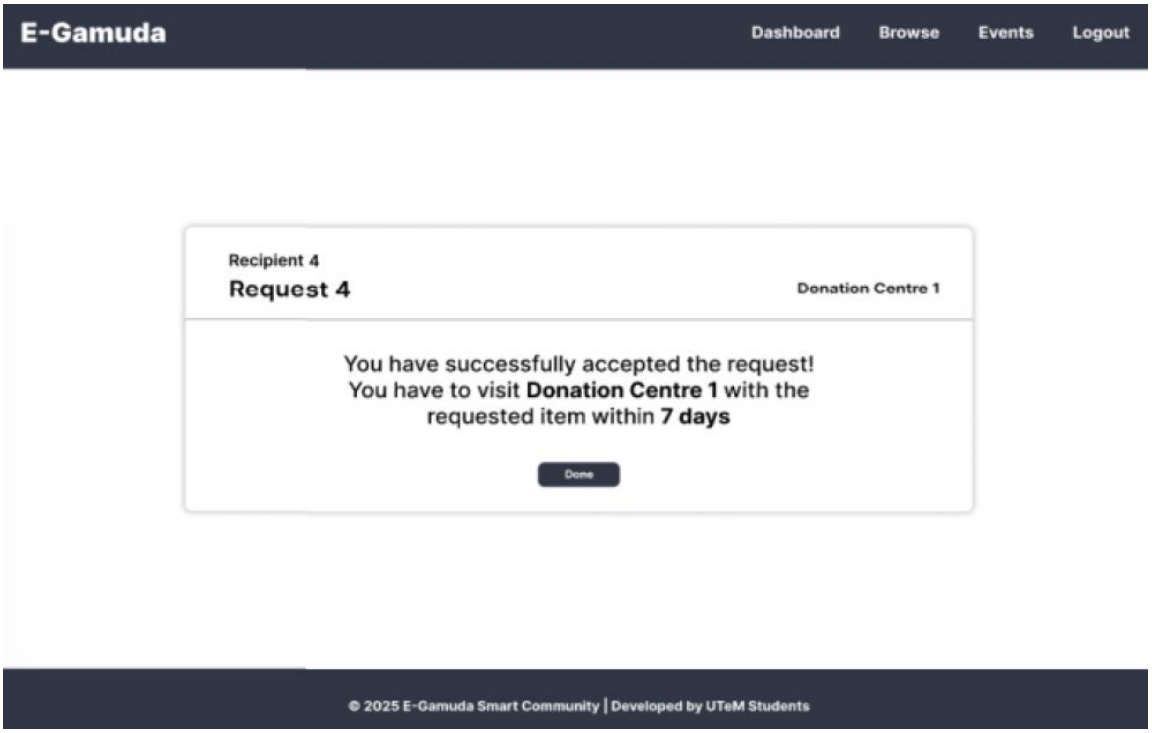

Fig. 15. Accept Page (Donation)

Figure 15 shows the donation accept page which confirms when a donation has been accepted by a recipient, updating the item's status in the system and preventing duplication.

Fig. 16. Event Page

Figure 16 shows the event module that lists charity events organized by admins or affiliated groups. Users can view details, dates, and locations, encouraging participation in community activities.

CONCLUSION

The E-Gamuda Smart Community system was developed to address the lack of a structured and transparent donation platform within the UTeM community. By integrating role-based access, modular functions, and user-friendly interfaces, the system facilitates item donations, urgent requests, event management, and reporting. The platform not only strengthens connections between donors, recipients, and administrators but also promotes trust, transparency, and accountability in community-based sharing activities.

Evaluation results confirmed that the system performs reliably across its modules, with usability and performance tests showing positive user feedback. Minor issues identified during testing were resolved, and the system now provides a secure and efficient way to manage donations within the university context. Beyond

functionality, the project contributes to sustainable community practices by reducing waste and fostering a culture of sharing, aligning with the principles of Sustainable Development Goal 11.

Future enhancements could include integrating real-time notifications, expanding location-based services, and deploying mobile applications to increase accessibility. With these improvements, the system has the potential to serve as a model for other higher education institutions seeking to adopt digital solutions for sustainable community engagement.

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