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Research and Application of Service Design-Based Models for Stray Animal Management in Universities

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Abstract: The issue of stray animals on university campuses has become increasingly problematic, with traditional management models facing significant challenges. This paper applies service design theory to propose a hybrid online-offline system aimed at enhancing the campus ecosystem, managing stray animals, and promoting students' mental health. Using co-creation methods, stakeholder analysis, and tools such as in-depth interviews and user experience mapping, the study identifies needs, pain points, and design opportunities. A hybrid service system, combining a service blueprint and system map, is developed to offer a comprehensive pet care experience for students, alleviate psychological stress, improve stray animal welfare, and foster campus culture. This research provides both a solution to campus stray animal issues and transferable service design insights for similar settings.

Keywords: Stray animal management; Service design; Campus ecological environment; User experience

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1. Introduction

University campuses play a vital role in shaping students' academic and personal development, where safety and harmony significantly influence growth and campus culture. However, the rapid rise in stray animal populations has turned campuses into critical habitats, leading to public health risks, safety concerns, and challenges for campus ecosystems and management systems [1]. Stray animal disturbances and injuries disrupt students' daily lives and learning, underscoring the urgent need for effective management. Annually, approximately 7.6 million stray animals in China are sent to shelters, with only a small fraction rehomed [2]. Uncontrolled breeding and abandonment, particularly by university students, exacerbate the problem, with research showing that a pair of cats can produce up to 420,000 offspring in seven years, and a pair of dogs up to 670,000 in six years. Current management efforts, primarily led by charitable organizations and animal protection groups, include sterilization,

adoption, and socialization initiatives at universities such as Peking University, Shenzhen University, and East China Normal University. However, these approaches are hindered by fragmented operations, unstable funding, and inefficient resource allocation, limiting their ability to address the systemic demands of stray animal management. With the problem's scale expanding and stakeholder demands increasing, traditional methods are insufficient.

In this context, service design—a user-centered and interdisciplinary approach—offers innovative perspectives and practical strategies for stray animal governance on campuses. By systematically integrating resources, addressing user needs and pain points, and creating comprehensive solutions, service design has demonstrated its effectiveness in fields such as social welfare and healthcare [3]. Grounded in service design theory, this study explores the symbiotic relationship between university students and stray animals, aiming to develop a systematic framework for fostering harmonious campus ecosystems. Employing tools such as stakeholder analysis, user personas, service blueprints, and service system maps, the study proposes a hybrid online-offline service model. This approach provides actionable insights and theoretical guidance for improving stray animal management and enriching campus culture, with broader implications for similar service design contexts.

2. Multidimensional value of stray animal management in universities

University students often face academic, employment, and personal pressures that can lead to psychological issues. Without timely intervention, these issues may result in unsafe behaviors and campus safety incidents [4]. Service design provides stress-relief pathways, particularly through interaction with stray animals, which alleviates anxiety, depression, and loneliness while promoting well-being and psychological health. This approach also mitigates health and safety risks posed by stray animals, such as bacterial transmission and attacks, creating a safer campus environment. Additionally, it improves the living conditions of stray animals, offering clean shelters and adequate food to meet their physical and psychological needs. By enhancing public perceptions and empathy toward stray animals, this method fosters social harmony, reduces safety incidents, and enriches campus culture with humanistic care, creating a more inclusive and supportive environment.

3. User need and service design analysis

3.1. Key stakeholder analysis

The core of service design lies in enhancing service value and fostering positive interactions through the collaborative involvement of diverse stakeholders [5]. Therefore, a comprehensive analysis of stakeholders is essential during the design process to identify their needs and priorities. This study positions the campus as the design focus, identifying key stakeholders through brainstorming, including students, security personnel, cleaning staff, teachers, and volunteers (**Figure 1A**). Specifically, three potential stakeholders were identified:

(1) "Invisible Abandoners," the primary source of stray animals;
(2) The "Missing Management Department," as the campus lacks an institution dedicated to overseeing stray animals, leading to unclear accountability;
(3) "Emerging Animal Rights Advocates," a growing number of professionals using new media platforms to voice concerns and offer assistance for stray animals. In-depth analysis of these stakeholders ensures the comprehensiveness and feasibility of the service design system and offers new pathways for

collaboration among stakeholders.

3.2. User persona model and experience map

This study considers university students as typical users and classifies them into three categories— "concerned," "playful," and "rejecting" based on their attitudes toward stray animals. In-depth interviews with these three user groups were conducted to create user personas and an experience map, revealing their needs, pain points, and experiences, as shown in **Figure 1B**. The analysis identified key pain points, including the unpredictability of stray animals' presence, difficulties in feeding, dietary habits, health conditions, safety risks, and lack of interaction spaces with animals. Additionally, the lack of student behavior norms emerged as a significant issue. These analyses provide a clear understanding of user needs and offer actionable insights for subsequent service design improvements.

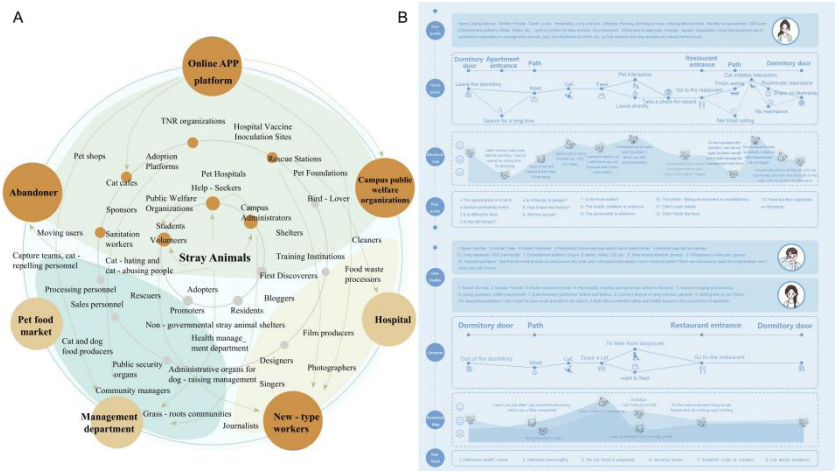

Figure 1. (A) Stakeholder map, (B) User experience map

3.3. Service blueprint analysis and system construction

3.3.1. Service blueprint analysis

The service blueprint is a key analytical tool in service design, visualizing user-service interactions and helping designers identify critical touchpoints for optimization [6]. It simplifies complex processes by depicting behaviors at both user and service levels, enhancing clarity and supporting improvements in user experience [7].

This study applies a service blueprint to map the entire service process, based on research findings, covering user behavior, physical elements, front-end and back-end tasks, and supporting processes. The service is divided into online and offline components:

(1) Online: Users engage through the "Caught You" application (app), capturing and adopting stray animals, with backend support ensuring smooth operation.

(2) Offline: Users interact at the "Love You MORE Community" and the Animal Socialization Center, using facilities like smart collars and feeders. Front-end services support activities, while the back-end manages data and operations. Support services include database maintenance, venue setup, and media assistance. The blueprint clearly defines responsibilities and processes, ensuring efficient system operation. **Figure 2A** shows the complete service blueprint.

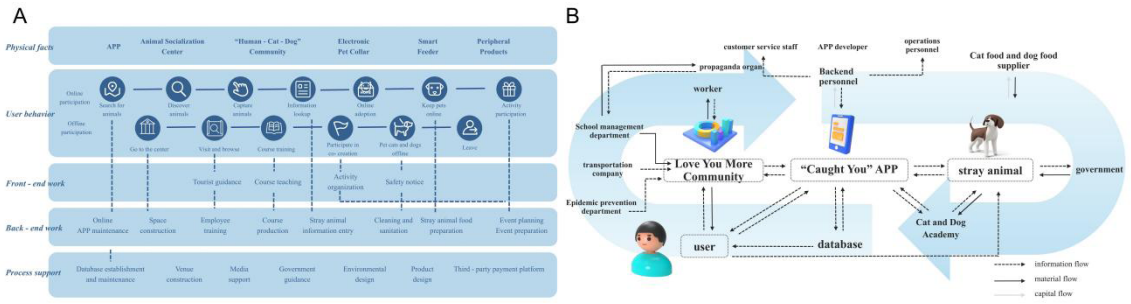

Figure 2. (A) Service blueprint, (B) Service system diagram

3.3.2. Service system construction

The service system map connects stakeholders using arrows to depict the dynamic relationships between information, financial, and material flows. It aids designers in clarifying interactions and helps users intuitively understand the service process. Based on actual needs, a campus pet-sharing service system map (**Figure 2B**) was developed, illustrating key stakeholders and their roles: university management, transportation companies, epidemic control departments, publicity agencies, community staff, app developers, the Cat and Dog Academy, stray animals, pet food suppliers, and government entities. University management oversees operations, while the "Love You MORE" community facilitates human-animal interactions. The Cat and Dog Academy handles animal training and rehabilitation, ensuring their health and adaptation. The app system manages information flow and user access, while government policies support animal protection and management. This comprehensive map clarifies the entire service process, enhancing transparency and facilitating implementation and optimization.

4. Service design practices and applications

This section demonstrates the practical application of service design, including the development of an online community app, offline interactive facilities, and a smart feeding system. By integrating online and offline services, the system meets users' needs for interacting with, caring for, and protecting stray animals, enhancing their management and interaction experiences on campus, and fostering a more interactive, sustainable, and community-oriented environment.

4.1. Online community app design: "Caught You"

The "Caught You" app is a comprehensive platform designed for campus pet enthusiasts, seamlessly integrating cloud-based pet care, offline interactions, and community engagement through innovative design and modular functionality. Key features include a "Home Page" with banners, trending topics, event recommendations, and a dual-feed community interaction format, enhancing user immersion and participation. The "Cloud-based Pet Care" module enables users to interact with virtual pets through cameras, offline booking, and interactive games, converting online traffic into resources for pet welfare and ensuring online-offline integration. The "Search Function" utilizes real-time news, animal tracking, and nasal print recognition to locate stray animals, simplifying the process with user-friendly design. The "Messages" module delivers notifications, updates, and friend interactions, fostering community cohesion. Finally, the "Personal Center" allows users to manage profiles, pet care records, and community interactions efficiently, making the app a holistic tool for campus pet care and engagement.

4.2. Offline interaction community and smart device design

This study not only enhances the online platform but also designs offline interactive spaces and facilities to promote ecological coexistence and social management. Additionally, an innovative automatic feeder is designed to enhance feeding efficiency and management convenience for stray animals. The device features environmental sustainability and smart functionality, enabling resource recycling. The specific design includes:

(1) The Cat and Dog Academy, serving as a socialization center for stray animals, providing trap-neuter-return (TNR), behavioral training, vaccinations, and health checks, reintegrating animals into the campus as "shared pets" and offering an interactive space for students and staff to relax and relieve stress.

(2) The Love You MORE Community (**Figure 3A**), as the core venue for offline interaction, offers a space for students to engage with trained pets, ensuring health and behavioral standards, and promoting the socialization and integration of stray animals on campus.

(3) The Green Feeding smart feeder (**Figure 3B**), allowing users to exchange recycled plastic bottles for pet food, offers real-time feedback, remote monitoring, and sanitization features, enhancing feeding convenience and health.

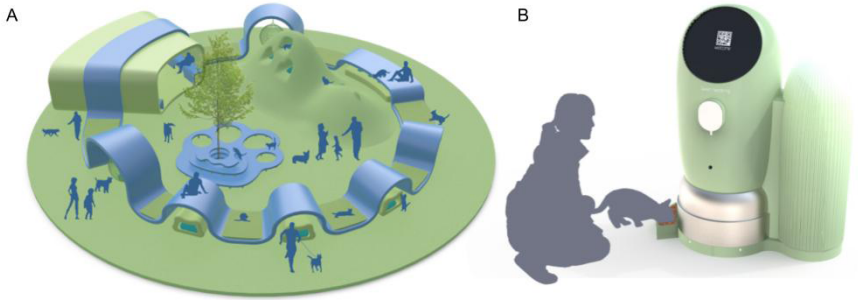

Figure 3. (A) Love MORE community, (B) Green feeding feeder

5. Conclusion

This study, grounded in service design theory, proposes a systematic solution for managing stray animals in universities, integrating online platforms and offline interactive facilities to foster ecological harmony on campus. Through stakeholder analysis and user research, this study identifies key pain points and needs, and develops user personas and experience maps to ensure design relevance and effectiveness. Service design integrates campus resources, optimizes stray animal management, enhances student interaction experiences, alleviates psychological stress, and improves animal welfare. Innovative designs such as the "Catch You" app, Love You MORE community, and smart feeding devices enable seamless integration of online and offline services, offering a new governance model. This study not only provides new insights for managing stray animals in universities, but also offers practical experience in applying service design to the public welfare sector. In the future, intelligent and data-driven technologies are expected to further enhance governance efficiency and service quality.

Disclosure statement

The authors declare no conflict of interest.

Author contributions

Conceptualization: Xianru Shang, Yanfang Ma
Writing: Xianru Shang, Yanfang Ma
Investigation: Yanfang Ma, Siyan Chen, Le Li, Mingchong Lu
Formal analysis: Yanfang Ma, Siyan Chen, Le Li, Mingchong Lu

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