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Stray Rescue Management System (SRMS)

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***Abstract*—This thesis paper the development and deployment of the Stray Rescue Management System (SRMS), a robust web-based platform aimed at enhancing the management and rescue operations for stray animals. The SRMS integrates essential functionalities, including reporting stray animals, facilitating donations, managing adoptions, coordinating volunteer activities, and providing educational resources on animal welfare. By fostering collaboration between shelters, rescue teams, and the public, the SRMS optimizes rescue efforts and promotes responsible pet ownership. The system employs a secure architecture utilizing PHP for backend logic and HTML, CSS, and JavaScript for frontend interface, ensuring both functionality and user accessibility. Through systematic testing and user feedback, the SRMS demonstrates its efficacy in streamlining operations and improving community engagement towards stray animal welfare. Future enhancements focus on expanding user capabilities and incorporating advanced AI-driven features to further support global animal rescue initiatives.**

***Keywords*—Web-Based Application, Adoption and Fostering System, Volunteer and Donation Management**

I. INTRODUCTION

The rising population of stray animals, particularly cats and dogs, in Malaysia poses significant challenges. Mismanagement and mistreatment by pet owners are primary contributors to this increase, further exacerbated by the Covid-19 pandemic (New Straits Times, 2022). According to Serpell (1996), the human-animal relationship is often strained due to a lack of understanding of animal behaviour, leading to abandonment and mistreatment. The presence of stray animals impacts community safety and cleanliness, exemplified by the ongoing rabies outbreak in Sarawak, which reported over 2,000 animal bite cases in early 2023 (Sarawak Deputy Premier, Public Health, Housing and Local Government Minister, Datuk Seri Dr Sim Kui Hian). Cleaveland and Hampson (2017) emphasize the importance of effective stray animal management in controlling zoonotic diseases like rabies.

Additionally, inhumane practices such as the "drive-by" shooting of stray dogs highlight the need for humane treatment education (Free Malaysia Today, 2022). Many animal lovers are willing to help but lack proper guidance.

To address these issues, the Stray Rescue Management System (SRMS) has been developed. This web-based application enables users to report stray animals, make donations, adopt pets, and apply for volunteer opportunities. Users can report strays, locate nearby shelters and rescue teams, and receive updates once the animal is rescued. The SRMS also facilitates monetary donations and fosters parent sign-ups while ensuring secure access through user registration. The ultimate goal of the SRMS is to contribute to making Malaysia a stray-free country, taking inspiration from the Netherlands, which successfully eliminated stray dogs (Sawbridge, 2022).

II. PROBLEM BACKGROUND

A comprehensive analysis of the challenges faced in managing the stray animal population in Malaysia reveals several key issues that need to be addressed.

A. Pet Mismanagement and Mistreatment

Pet abandonment has been a long-standing issue, exacerbated during the Covid-19 pandemic. This highlights the need for comprehensive education on responsible pet ownership. Relinquishment of pets to shelters often results from a lack of understanding of the responsibilities involved in pet ownership. Morgan et. al. (2022) found that pets acquired less than six months before the pandemic were three times more likely to be considered for or be relinquished. Financial constraints, health concerns related to COVID-19, and

behavioural problems were the most cited reasons for considering or actually giving up a pet. Additionally, owners who returned their dogs within three months had significantly higher expectations for their dog's health, behaviour, and the human–dog bond compared to those who did not return their dogs (Powell et.al.). The SRMS addresses this by providing resources and information on animal welfare to improve public awareness and prevent pet abandonment.

B. Community Safety and Hygiene

Stray animals pose significant risks to community safety and cleanliness. The rabies outbreak in Sarawak, resulting in four deaths, underscores the urgency for effective stray management. The SRMS helps mitigate this by offering a platform for users to report and manage stray animals, connecting them with animal shelters and rescue teams (Sarawak Deputy Premier, Public Health, Housing and Local Government Minister, Datuk Seri Dr Sim Kui Hian). Cleaveland and Hampson (2017) also highlight the importance of community-based approaches in controlling zoonotic diseases like rabies.

C. Lack of Guidance for Animal Lovers

Many animal lovers are willing to help strays but lack proper guidance. The SRMS bridges this gap by connecting users with nearby shelters and rescue teams, and by providing opportunities to become foster parents or volunteers. This structured support enables effective and organized rescue efforts.

In summary, the SRMS tackles issues of pet mismanagement, community safety, and the need for guidance in animal rescue, fostering a more humane and organized approach to stray animal management in Malaysia.

III. PROJECT AIM

The aim of the SRMS is to reduce the number of stray animals and to provide a comprehensive platform for reporting and managing stray animals, while also promoting responsible pet ownership and facilitating the rescue and fostering of stray animals in Malaysia.

IV. LITERATURE REVIEW

This project employs the Society for the Prevention of Cruelty to Animals (SPCA) Penang as a case study to develop and implement the Stray Rescue Management System (SRMS). SPCA Penang serves as a pivotal organization in managing and rescuing stray animals, offering insights into current practices and technological needs within animal welfare. The literature review explores existing systems and technologies pertinent to stray animal management, highlighting key considerations for the development of effective web-based solutions.

Manual Operation of SPCA Penang:

A. Manual Handling Methods

SPCA Penang uses physical methods like metal with nylon rope to manage difficult animals, reflecting their reliance on manual handling techniques.

B. Public Opposition Concerns

Significant public opposition arises due to fears of animal euthanasia, impacting SPCA Penang's operational effectiveness and community trust.

C. Collaboration with Stakeholders

The organization engages with various authorities such as State Veterinary Department, Wildlife Department, Civil Defence for specific rescue needs, ensuring appropriate handling of different animal types.

D. Lack of Technological Integration

SPCA Penang has not yet integrated technological solutions into their operations, potentially hindering efficiency and data management capabilities.

V. ANALYSIS OF SIMILAR EXISTING SYSTEM

Several existing systems have been selected to analyse their functionality and features to serve as a reference for developing a better Stray Rescue Management System (SRMS). These systems were chosen based on their similarity to the functionalities and features of SRMS.

A. PetFinder.my

PetFinder.my is a web application in Malaysia aimed at helping pets find their forever homes. The platform is free to use for both pet owners and adopters, and it also offers a mobile app for easy browsing and adoption on the go.

- Extensive list of pets available for adoption.
- Easy navigation with clear categories and filters.
- Hosts events to raise awareness about pet adoption.
- Actively promotes pets on platforms like Facebook, Instagram, Twitter, and YouTube.
- Provides opportunities for users to adopt pets and make donations.

B. World Animal Protection

World Animal Protection is a global animal welfare organization with a web application aimed at promoting animal welfare and protection.

- Presence in over 50 countries.
- Provides extensive resources on animal welfare, including news, research, and campaigns.
- Focuses on improving animal welfare policies and practices.

C. 600Million.org

600Million.org is a web application aimed at raising awareness about the global animal welfare crisis.

- Uses videos, images, and infographics effectively.
- Available in multiple languages, covering global issues.
- Provides information on how individuals can take action to support animal welfare.

D. Pet Animal Welfare Society (PAWS)

PAWS is a non-profit animal shelter in Malaysia providing adoption, sterilization, and medical treatment services.

- Easy to navigate and find information.
- Provides options for donations, volunteering, and adoption.

VI. COMPARISON BETWEEN EXISTING SYSTEM

Table I shows the comparison between the proposed system, SRMS and four other web-based applications which are PetFinder.my, World Animal Protection, 600Million.org and PAWS. SRMS and PetFinder.my are based in Malaysia while World Animal Protection, 600Million.org and PAWS are global organization with branches in more than one country.

TABLE I. COMPARISON OF EXISTING WEB-BASED APPLICATION RELATED TO ANIMAL PROTECTION

Web based Applications	PetFinder.my	World Animal Protection	600Million.org	Paws Animal Welfare Society	SRMS
Country	Based in Malaysia	Global organization	Global organization	Global organization	Based in Malaysia
Donations	✓	✓	✓	✓	✓
Sign up for volunteers	×	×	×	✓	✓
Sign up for fostering	×	×	×	×	✓
Sign up for adoption	✓	×	×	✓	✓
Report an animal	✓	×	×	×	✓
User's authentication is prioritized (Sign up or Register in to the system)	✓	×	×	×	✓

While existing systems like PetFinder.my and World Animal Protection offer valuable services, they have notable limitations. PetFinder.my, for instance, focuses primarily on pet adoption but lacks comprehensive features for managing stray animal reports, volunteer coordination, and fostering. World Animal Protection, although global in scope, does not provide localized solutions for stray animal management in Malaysia. Additionally, 600Million.org and PAWS, while effective in raising awareness and providing adoption services, do not integrate advanced features like real-time reporting, AI-driven analytics, or centralized donation management.

The SRMS addresses these gaps by offering a comprehensive platform that integrates reporting, adoption, fostering, volunteer management, and donation tracking. Unlike existing systems, SRMS provides real-time updates on stray animal rescues, facilitates collaboration between shelters and rescue teams, and offers educational resources on animal welfare. These unique features make SRMS a more holistic solution for managing stray animals in Malaysia.

VII. METHODOLOGY

The methodology chosen for developing the Stray Animal Management System (SRMS) is the Waterfall methodology. Waterfall methodology was selected because of its structured and sequential approach, aligning with the project's goals of efficiently managing operations related to stray animal care. Unlike Agile, which emphasizes flexibility and iterative cycles, Waterfall follows a step-by-step process from planning to testing. Fig. 1 illustrates the stages of the Waterfall model adapted for SRMS development.

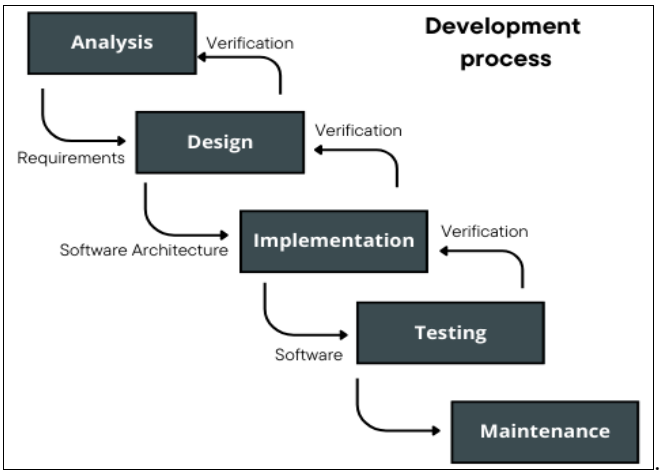

Fig. 1. The five-stage waterfall model (Winston W. Royce, 2019)

D. Requirement Gathering and Analysis phase

Through discussions with Ms. Lily Leng, administrator of SPCA Penang, it was revealed that the organization relies on manual processes, facing challenges such as public opposition and limited resources. While they have not considered technology solutions previously, the Stray Rescue Management System (SRMS) could address these challenges effectively. To effectively address the issue of stray and companion animal management in Malaysia, it is crucial to foster collaborative efforts among government bodies, private sectors, and the public (Munir, Mokhtar, & Arham, 2023). SRMS provides a centralized platform for reporting strays, maintaining

transparent records, facilitating collaboration with external stakeholders, and offering tailored functionalities. SRMS aligns well with SPCA Penang's goals and also the different SPCAs throughout Malaysia. Adoption of the SRMS could significantly enhance the organization efficiency in stray management, as well as bringing the community to be part of the solution.

E. System Design Phase

During the System Design Phase, following the requirement analysis, the Waterfall methodology proceeded systematically. For the Stray Rescue Management System (SRMS), this involved designing the database structure to store animal information, creating user interfaces for reporting and tracking strays, and developing modules for volunteer sign-ups, fostering, adoption, and donation management.

1) Software Structure Design

The Software Structure Design phase involved creating Unified Modelling Language (UML) schemas, including use case diagrams, activity diagrams, and sequence diagrams, to illustrate the system's construction. Class diagrams and Entity-Relationship Diagrams (ERD) were also designed to outline database structure and entity relationships.

Fig. 2 shows the System Architecture Design of SRMS. The system architecture of the SRMS is designed using a typical three-tier architecture, consisting of the Presentation Layer, Application Layer and Data Layer.

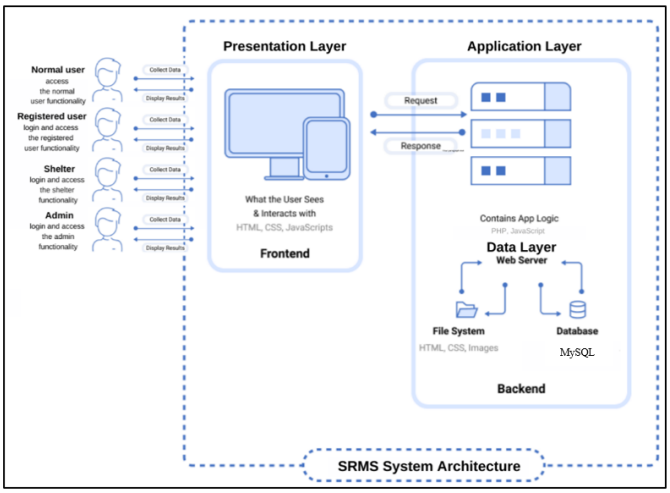

Fig. 2. System Architecture Design of SRMS

The communication between these layers follows a request-response model. The user interacts with the UI, which sends requests to the application layer. The application layer processes the requests, performs necessary operations using the business logic, and retrieves or updates data from the database layer. The results are then sent back to the presentation layer to display to the user.

2) User Interface Design

User Interface Design involves creating a visually appealing and user-friendly layout, enhancing the overall user experience of the system. It plays a crucial role in making the system intuitive for end users. Fig. 3 shows the interface design, showcasing the dashboard of SRMS tailored towards specific operations catered.

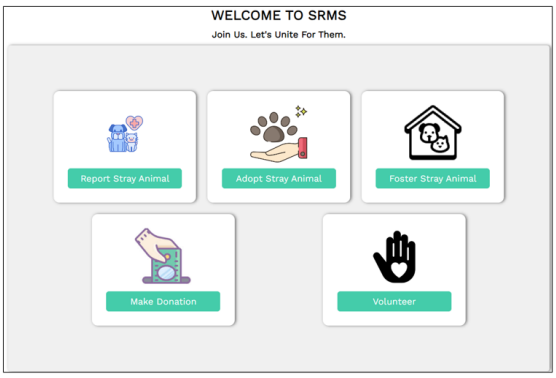

Fig. 3. SRMS Dashboard of Registered User

F. Development and Implementation Phase

The Implementation Phase, also referred to as the development phase, involves the actual construction and coding of the system. During this stage, code written using programming languages and technologies identified in the requirement analysis and planning phases. For the front-end, HTML, CSS, and JavaScript are employed to create an interactive and user-friendly interface. The back-end logic is implemented using plain PHP, while MySQL is used as the database management system to store and manage system data. Apache is chosen as the web server, and the completed system is deployed online via cPanel for public access.

There are 5 main modules in SRMS for each user type. Table II shows the actors and their respective functions in the system based on the five modules. Non-registered users, can only get to browse the main website of the SRMS. They can explore the website and can get an idea on what is the purpose of SRMS.

TABLE II. LIST OF ACTORS OF SRMS AND THEIR RESPECTIVE FUNCTIONS

Main modules of SRMS	**Registered User**	**Registered Shelter**
Reporting Module	Report stray animals, upload photos, provide location details.	Review and respond to stray reports, manage rescue operations.
Adoption Module	View adoptable animals, submit adoption requests, receive updates on adoption status.	Manage adoptable animal profiles, review adoption requests, update adoption status.
Fostering Module	View foster opportunities, apply to foster animals, receive updates on fostering status.	Manage foster animal profiles, review fostering applications, update fostering status.
Volunteering Module	View volunteer events, register for events, receive event details and updates.	Organize volunteer events, review volunteer registrations, manage volunteer details and communications.
Donation Module	Make donations, submit donation details, receive acknowledgment and status updates.	Track and manage donations, verify and acknowledge received donations, communicate with donors.

G. Testing Phase

After the coding phase, the software undergoes several testing processes to ensure its functionality and compliance with requirements. This includes black box testing to evaluate the system's external behaviour and white box testing to assess its internal structure and logic. Additionally, usability testing is carried out to assess how effectively real users can interact with the system and identify areas for improvement.

The usability test was done online on the hosted system and feedback was collected through a Google Form to gather input from stakeholders for any system improvement. The test involved two main user types, which are the shelter representative and registered users. The shelter user type representative is Ms. Yvonne from SPCA Penang, while the registered user type representatives are Ms. Sharvini and Ms. Ming Hui. The SPCA Penang is a small branch and also similarly operated like other SPCAs throughout Malaysia. To that end, and for the limited timeline of the project, a representative from each type of actor/user is deemed enough to carry on the usability test. Table III displays the general functionalities feedback from the users.

TABLE. III GENERAL FUNCTIONALITIES FEEDBACK

Questions	User Type		
	Registered Shelter	Registered Users	
	Ms Yvonee	Ms Ming Hui	Ms Sharvini
Were you able to successfully register for the SRMS?	Yes	Yes	Yes
Did you receive the email verification code after registration?	Yes	Yes	Yes
Was the email verification process straightforward?	Yes	Yes	Yes
I can login and logout of the system smoothly.	Agree	Strongly Agree	Strongly Agree
I can reset my password of my profile easily.	Unsure	Strongly Agree	Strongly Agree
Is the interface design user-friendly?	8-Oct	10-Oct	10-Oct
Do you consider the system to be secure?	Agree	Strongly Agree	Strongly Agree
Is the system flow easy to understand and navigate?	8-Oct	10-Oct	10-Oct
Do you think all the functionalities you tested are working fine?	4-May	5-May	5-May
Did you encounter any issues or difficulties while using the system?	No	No	No
Would you be willing to use this system in the future?	Yes	Yes	Yes

The feedback on the Stray Rescue Management System (SRMS) has been highly positive, with users expressing satisfaction with the website's design and functionality. Comments such as "The website looks great and functions really good" and "all good" reflect a smooth user experience, while a third participant, Ms. Yvonne, provided more detailed suggestions from her perspective as the shelter representative. Her feedback included valuable recommendations such as the distinction between "adopted" and "rehomed," improving the process for resending verification codes, and allowing estimated birthdates for animals. She also suggested adding an "on hold" status for animals undergoing medical treatment, making the maximum age for volunteers optional, allowing optional event poster uploads, and refining breed categories to include terms like "Mongrel," "Mixed Breed," and "Other." Overall, the feedback highlights both strong user approval and useful insights for future system enhancements.

VII. DISCUSSION

The development and implementation of the Stray Rescue Management System (SRMS) highlight the potential of technology to address the long-standing challenges in stray animal management across Malaysia. Traditional methods; such as manual handling, fragmented communication, and limited outreach; are insufficient in managing the growing stray population and improving public engagement. SRMS introduces a centralized, user-oriented platform that facilitates reporting, adoption, fostering, volunteering, and donations. Feedback from initial users, including shelter staff and registered users, has been overwhelmingly positive. Participants praised the system's functionality, intuitive interface, and seamless flow, demonstrating the community's readiness to embrace digital solutions in the realm of animal welfare.

At the same time, the feedback has revealed meaningful areas for refinement to further enhance the system. Moreover, adjustments to registration processes and volunteer requirements indicate that customization based on user context is essential. These insights validate the importance of iterative development and continuous stakeholder involvement to ensure the system remains practical and inclusive for its target users.

Looking forward, SRMS is well-positioned for future scalability and technological advancement. Transitioning to a cloud-based infrastructure would allow the system to scale efficiently, handle increasing user traffic, and support broader regional or national adoption. The development of a mobile application could enhance accessibility and promote real-time engagement, especially in field reporting scenarios. Additionally, the integration of AI features, such as image recognition for breed identification and chatbots for user support, could streamline operations and improve user responsiveness. Other potential enhancements include API integration with local authorities for coordinated rescue efforts, multilingual support, and blockchain-based donation tracking to ensure transparency. By incorporating these innovations, SRMS can evolve into a robust, sustainable solution that not

only supports local animal welfare efforts but also serves as a model for similar initiatives in other countries.

VIII. CONCLUSION

In summary, the Stray Rescue Management System (SRMS) is a comprehensive web-based platform developed to enhance and streamline the operations of animal rescue organizations. It empowers users; including shelters, volunteers, and the public; to efficiently manage stray animal data, monitor their condition and location, and coordinate timely rescue efforts. SRMS centralizes key functionalities such as stray reporting, volunteer registration, fostering, adoption, and donation management, effectively reducing reliance on manual processes. This integration promotes greater efficiency, transparency, and community involvement in stray animal welfare. Looking ahead, future enhancements will further strengthen SRMS's role as a pivotal tool in advancing humane, technology-driven solutions for stray animal management across Malaysia and potentially beyond.

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CONFLICTS OF INTEREST

The author(s) declare(s) that there is no conflict of interest regarding the publication of this paper.

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