

iCarePets: Pet Crossing Animal Clinic System with Breed Recognition App

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Abstract- *Pet Crossing Animal Clinic in Malasiqui, Pangasinan relied on paper-based records for customer, pet, service, and appointment information, which created difficulties in record tracking, duplicate entries, retrieval, and data organization. This study designed and developed iCarePets, consisting of a web-based clinic management system and a mobile application with dog and cat breed recognition. The study used descriptive and developmental research methods, while Rapid Application Development (RAD) guided requirements planning, user design, construction, and cutover. Structured interviews were used to document the clinic's manual process and problems, prototypes supported feature design, and a Technology Acceptance Model (TAM)-based questionnaire evaluated usefulness, ease of use, and behavioral intention to use. Ten clinic-side testers composed of the owner and staff evaluated the management system, while 60 customers evaluated the mobile application. The management system obtained mean scores of 4.07 for usefulness, 4.17 for ease of use, and 4.05 for behavioral intention, with an overall mean of 4.09, interpreted as acceptable. The mobile application obtained 4.45 for usefulness, 4.40 for ease of use, and 4.38 for behavioral intention, with an overall mean of 4.39, also interpreted as acceptable. The developed system centralized clinic records, supported appointments, service, product, employee, customer, and pet record management, and enabled pet owners to access records and use breed recognition. The results indicate that iCarePets addressed major limitations of the previous manual process and was positively accepted by its intended users.*

Keywords- *veterinary clinic management, breed recognition, image recognition, mobile application, Rapid Application Development, Technology Acceptance Model*

INTRODUCTION

Veterinary clinics handle growing volumes of customers, pets, appointments, services, and product information. When these records are maintained manually, retrieval and updating can become slow and error prone. The source project documented that Pet Crossing Animal Clinic used handwritten records and had trouble tracking customer information, duplicate customer entries, and time-consuming searches through record books. Previous work cited in the capstone similarly described manual record keeping as disorganized,

inefficient, and vulnerable to loss or inaccuracy (Caranto et al., 2018; Betlloch-Mas et al., 2019).

The project also responded to a second need: pet breed identification. Image recognition and machine learning can classify visual features and have been applied to animal identification. Kriangwanich et al. (2020) described the difficulty of distinguishing some dog breeds, while Shah et al. (2020) and Zhang et al. (2019) demonstrated the use of convolutional and deep learning approaches for dog and cat breed classification. These studies

provided a basis for incorporating breed recognition into a pet-oriented mobile application.

The iCarePets project therefore combined a clinic management system with a mobile breed recognition application. The web-based management component was designed to organize clinic branches, employees, customers, pets, services, products, and appointments. The mobile component was designed for pet owners to view pet records, products, and services and to identify dog or cat breeds using an uploaded or camera-captured image.

Because a technically functioning system must also be accepted by intended users, the project evaluated user responses using dimensions adapted from the Technology Acceptance Model. The evaluation focused on usefulness, ease of use or usability, behavioral intention to use, and overall acceptability. This approach is consistent with technology acceptance literature emphasizing perceived usefulness, effort, satisfaction, and intention as important indicators of adoption (Chao, 2019; Marikyan & Papagiannidis, 2023; Nadal et al., 2019).

OBJECTIVE OF THE STUDY

The objective of the project was to design and develop a system that offered quality information on the services of Pet Crossing Animal Clinic and a breed recognition application that could be utilized by its customers.

1. Describe the existing manual process of Pet Crossing Animal Clinic.
2. Identify the current problems encountered in the manual process.
3. Describe the features and processes of the proposed iCarePets: Pet Crossing Animal Clinic System with Breed Recognition App.
4. Test the acceptability of the developed system in terms of usefulness, ease of use/usability, behavioral intention to use, and overall acceptability.

MATERIALS AND METHODS

Research Design

The study used descriptive and developmental research methods. The descriptive component examined the existing clinic process and the challenges encountered in daily operations, while the developmental component covered the design, construction, and evaluation of the proposed management system and mobile application.

System Development Method

Rapid Application Development (RAD) was used as the development methodology. The project followed four phases: Requirements Planning, User Design, Construction, and Cutover. Requirements Planning gathered client, staff, and customer needs; User Design converted these requirements into prototypes and interface designs; Construction involved coding and iterative refinement; and Cutover covered final testing, transition, and implementation.

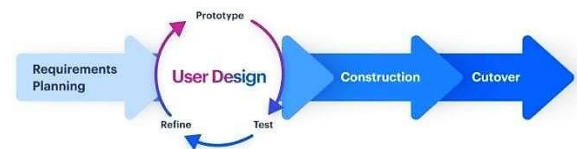


Figure 1. Rapid Application Development model used in the project

Study Locale and Participants

The project was conducted for Pet Crossing Animal Clinic in Malasiqui, Pangasinan. Structured interviews with the clinic owner and staff were used to determine how clinic work was performed and to identify problems in the manual process. The source manuscript states that the customer sample was determined using Slovin's formula. For acceptability testing, 10 clinic-side testers composed of one owner and nine staff evaluated the management system, while 60 Pet Crossing customers evaluated the iCarePets mobile application.

Data-Gathering Instruments

For Objectives 1 and 2, structured interview questionnaires were used to document the existing

process and identify problems in manual data management. For Objective 3, prototypes were used to demonstrate and refine system functionality. For Objective 4, an acceptability questionnaire based on the Technology Acceptance Model was administered to intended users. The questionnaire focused on usefulness, ease of use/usability, behavioral intention to use, and overall acceptability.

Table 1. Likert Scale for Acceptability Testing

Numerical Equivalent	Weighted	Descriptive Equivalent	Descriptive Interpretation
5	4.21-5.00	Strongly Agree	Acceptable
4	3.41-4.20	Agree	Acceptable
3	2.61-3.40	Neutral	Acceptable
2	1.81-2.60	Disagree	Not Acceptable
1	1.00-1.80	Strongly Disagree	Not Acceptable

Data Analysis

Interview responses were reviewed to establish functional requirements. Data Flow Diagrams (DFDs) were used to represent system flow, an Ishikawa diagram was used to organize causes of the manual-process problems, and a use-case diagram was used to represent interactions among administrators, sub-administrators, and users. Acceptability responses were summarized using arithmetic means and interpreted using the five-point scale shown in Table 1.

Development Environment and Requirements

The system was developed using Dart and JavaScript, together with HTML, CSS, and Bootstrap. Firebase Cloud Firestore was used as the database management system. The development environment used Windows 11 and Google Chrome. The source manuscript also documented hardware and software requirements for both development and system deployment.

Table 2. Hardware Requirements for System Development

Hardware	Specification
Processor	11th Gen Intel(R) Core(TM) i5-11260H @

	2.60GHz
Memory	16.0 GB
Solid-State Drive	512 GB
Display Resolution	1920 x 1080

Table 3. Software Requirements for System Development

Software	Specification
Programming Language	Dart, Javascript
Scripting Language	HTML, CSS, Bootstrap Framework
Database Management System	Firebase Cloud Firestore 4.9.3
Operating System	Windows 11
Web Browser	Google Chrome

Table 4. Minimum Hardware Requirements for the Management System

Hardware	Specification
Processor	Intel(R) Pentium(R) Gold G6400 @ 4.00GHZ
Memory	8.0 GB
Hard Disk Drive	256 GB
Display Resolution	1366 x 768

Table 5. Minimum Software Requirements for the Management System

Software	Specification
Database Management System	Firebase Cloud Firestore 4.9.3
Operating System	Windows 11
Web Browser	Google Chrome

RESULTS AND DISCUSSION

Existing Manual Process and Identified Problems

Pet Crossing Animal Clinic previously relied on handwritten records for customers and pet information and on manual procedures for appointment and record tracking. As the customer base increased, the clinic encountered duplicate customer entries, difficulty locating files, time-consuming retrieval, and greater risk of data loss or incomplete information. The Ishikawa analysis grouped the problems into people, process,

equipment, materials, environment, and management factors.

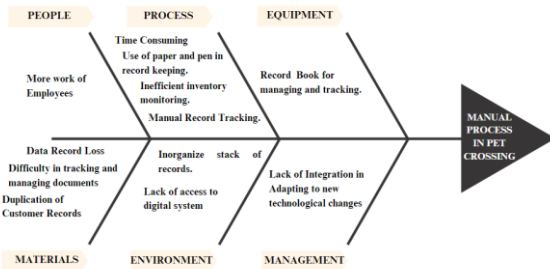


Figure 2. Ishikawa diagram of the problems encountered in the manual process.

Developed System Process and Features

The developed iCarePets solution consisted of a web-based management system and a mobile application. The management system supported branch, employees, customer, pet, service, product, appointment, and breed-related records. Admin and sub-admin roles were assigned different management functions. The mobile application allowed users to log in, view pet records, products and services, schedule or review appointment-related information, and use the breed recognition feature.

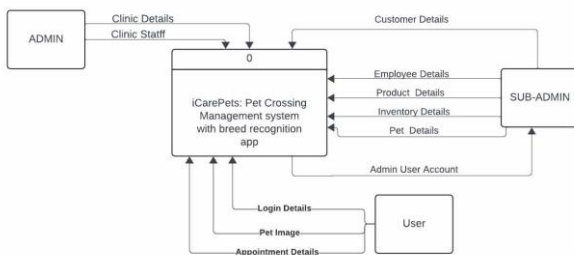


Figure 3. Context-level Data Flow Diagram of iCarePets.

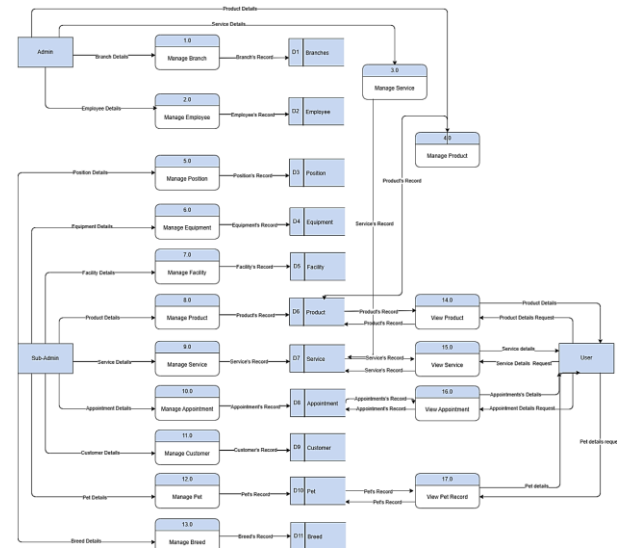


Figure 4. Detailed Data Flow Diagram of the iCarePets management system.

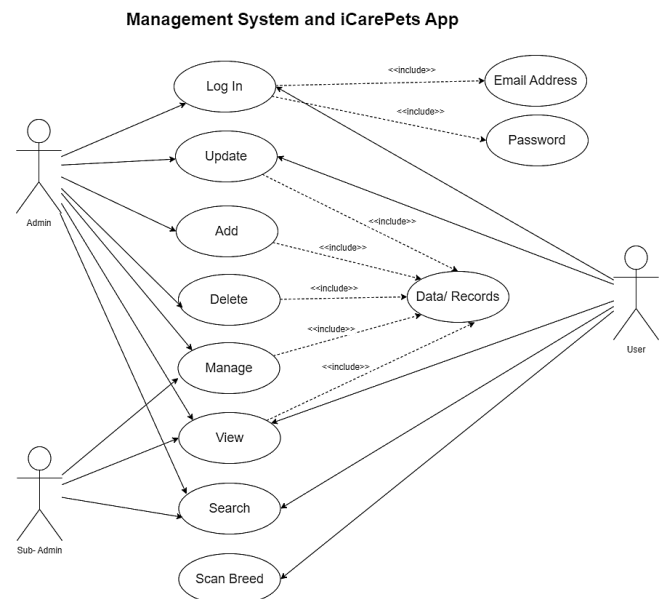


Figure 5. Use-case diagram of the management system and iCarePets app.

The administration dashboard summarized operational information such as customers, employees, app users, appointments, and branch-level customer counts. This interface supported the project's goal of replacing fragmented manual records with a more organized and accessible digital workspace.

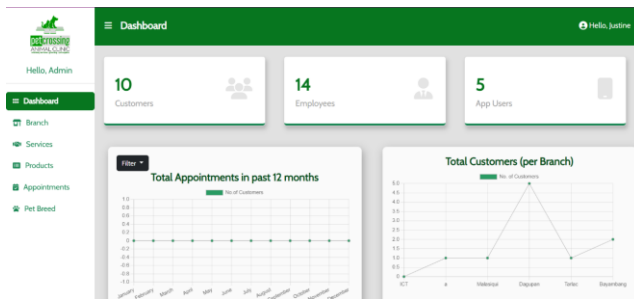


Figure 6. Administrator dashboard of the Pet Crossing management system.

For breed recognition, users could use a live camera image or an image selected from the device gallery. The source project required the pet to be clearly framed and visible, and the application returned a breed label together with breed-related information. The manuscript did not report a separate experimental accuracy metric for the trained breed-recognition model; therefore, the results below focus on user acceptability rather than classifier accuracy.

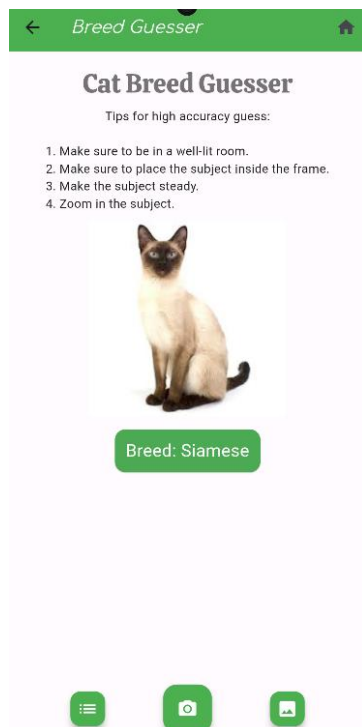


Figure 7. Breed Guesser interface showing a recognized cat breed.

Profile of the Testers

Table 6. Profile of the Admin System Testers

Profile	Items	Frequency	Percentage
Gender	Male	6	60.00%
Gender	Female	4	40.00%
Respondent's Types	Owner	1	10.00%
Respondent's Types	Staff	9	90.00%

Ten clinic-side respondents evaluated the management system: six males and four females. The respondent group consisted of one owner and nine staff members, allowing the system to be assessed from the operational perspective of people directly involved in clinic management.

Table 7. Profile of the Pet Crossing Customers

Measure	Item	Frequency	Percentage
Gender	Male	23	38.00%
Gender	Female	37	62.00%
Age	15 -18 years old	14	20.00%
Age	19 - 25 years olds	28	47.00%
Age	26 - 35 years old	6	10.00%
Age	36 years old and above	12	20.00%

Sixty customers evaluated the mobile application. The sample included 23 males and 37 females, with the largest age group reported in the source manuscript as 19-25 years old.

Acceptability of the Management System

Table 8. Acceptability Assessment of the Management System in Terms of Usefulness

Questions	Mean	Descriptive Equivalent
1. I find that using the admin site positively impacts the overall efficiency of managing clinic branches.	3.9	Agree
2. I think that the admin	4.10	Agree

site is beneficial to clinic branches when it comes to managing and organizing customer and personnel records.		
3. I find the admin site to be relevant in efficiently maintaining and updating records of clinic services and products.	4.10	Agree
4. I think the appointment option on the admin site as useful for the whole clinic management process.	4.20	Strongly Agree
Average Weighted Mean	4.07	Agree

The management system obtained an average weighted mean of 4.07 for usefulness, interpreted as acceptable. Respondents generally agreed that the system improved clinic management efficiency, supported records organization, maintained service and product information, and provided a useful appointment function.

Table 9. Acceptability Assessment of the Management System in Terms of Ease of Use

Questions	Mean	Descriptive Equivalent
1. I find the admin site easy to navigate through various features and functionalities.	4.10	Agree
2. I think the admin site simplifies the task of managing records of services and products compared to traditional methods.	4.20	Strongly Agree
3. I think scheduling and organizing appointments through the admin	4.20	Strongly Agree

Questions	Mean	Descriptive Equivalent
site to be convenient.		
4. I found it simple to understand how to work with the admin site.	4.20	Strongly Agree
Average Weighted Mean	4.17	Strongly Agree

Ease of use received an average weighted mean of 4.17. Respondents indicated that the system was easy to navigate and made records, products, services, and appointment management easier to perform.

Table 10. Acceptability Assessment of the Management System in Terms of Behavioral Intention to Use

Questions	Mean	Descriptive Equivalent
1. I am willing to refer to the admin site to other clinics or coworkers for their management needs.	3.90	Agree
2. I think that the admin site will provide long-term value by simplifying clinic management activities.	4.20	Strongly Agree
Average Weighted Mean	4.05	Agree

Behavioral intention to use received a mean of 4.05. This suggests that the clinic-side respondents were willing to recommend or continue using the system for clinic management activities.

Table 11. Overall Acceptability Assessment of the Management System

Category	Average Weighted Mean	Descriptive Equivalent	Descriptive Interpretation
Usefulness	4.07	Agree	Acceptable
Ease to Use	4.17	Strongly Agree	Acceptable
Behavioral Intention to	4.05	Agree	Acceptable

Category	Average Weighted Mean	Descriptive Equivalent	Descriptive Interpretation
Use Overall Mean	4.09	Agree	Acceptable

The management system obtained an overall mean of 4.09, interpreted as acceptable. Among the three dimensions, ease of use received the highest mean, followed by usefulness and behavioral intention to use.

Acceptability of the iCarePets Mobile Application

Table 12. Acceptability Assessment of the iCarePets Application in Terms of Usefulness

Questions	Mean	Descriptive Equivalent
1. The use of the iCarePets application could help me to identify the breed of my pet or a stray pet	4.43	Strongly Agree
2. It would be easy to track my pet record.	4.57	Strongly Agree
3. It would be easy to track available products using the app (iCarePets application).	4.42	Strongly Agree
4. The use of the iCarePets app could promote efficient pet records.	4.40	Strongly Agree
5. The use of the iCarePets app could improve my knowledge about certain breeds of dogs and cats.	4.50	Strongly Agree
6. The use of the iCarePets app could facilitate viewing of products.	4.40	Strongly Agree
Average Weighted Mean	4.45	Strongly Agree

The iCarePets application obtained a usefulness mean of 4.45. Users strongly agreed that the application could help identify pet breeds, track pet records and products, improve knowledge of dog

and cat breeds, and facilitate access to clinic product information.

Table 13. Acceptability Assessment of the iCarePets Application in Terms of Ease of Use

Questions	Mean	Descriptive Equivalent
1. The iCarePets application would be easy to use.	4.43	Strongly Agree
2. The iCarePets application is a flexible technology to interact with.	4.35	Strongly Agree
3. I could easily learn how to use the iCarePets application.	4.37	Strongly Agree
4. Using the iCarePets app, it could help me get the most time researching the breed of my pets.	4.48	Strongly Agree
Average Weighted Mean	4.40	Strongly Agree

Ease of use obtained a mean of 4.40. Respondents strongly agreed that the application was easy to use, flexible to interact with, and easy to learn.

Table 14. Acceptability Assessment of the iCarePets Application in Terms of Behavioral Intention to Use

Questions	Mean	Descriptive Equivalent
1. I intend to use the iCarePets application for my pet.	4.42	Strongly Agree
2. I intend to use the iCarePets app when it becomes available in the Play Store.	4.35	Strongly Agree
Average Weighted Mean	4.38	Strongly Agree

Behavioral intention to use obtained a mean of 4.38. Respondents expressed a strong intention to use the application for their pets and to use it if made

available through the Play Store. This pattern is consistent with technology acceptance research in which satisfaction, performance expectancy, effort expectancy, and trust influence intention to adopt mobile technology (Chao, 2019).

Table 15. Overall Acceptability Assessment of the iCarePets Application

Category	Average Weighted Mean	Descriptive Equivalent	Descriptive Interpretation
Usefulness	4.45	Strongly Agree	Acceptable
Ease to Use	4.40	Strongly Agree	Acceptable
Behavioral Intention to Use	4.38	Strongly Agree	Acceptable
Overall Mean	4.39	Strongly Agree	Acceptable

The mobile application achieved an overall mean of 4.39, interpreted as acceptable. All evaluated dimensions were rated positively, with usefulness obtaining the highest means. The app therefore received stronger overall acceptability than the clinic-side management system, although both were within the manuscript's acceptable range.

CONCLUSION AND RECOMMENDATIONS

CONCLUSION

The study successfully designed and developed iCarePets as an integrated clinic management system and mobile application with breed recognition for Pet Crossing Animal Clinic. The system addressed the clinic's documented manual-process problems by organizing customer, pet, employee, service, product, and appointment information in a digital environment.

The management system was evaluated by 10 clinic-side users and obtained an overall acceptability mean of 4.09. The mobile application was evaluated by 60 customers and obtained an overall mean of 4.39. Both results were interpreted as acceptable under the scale adopted by the study.

The findings indicate that the developed system met the operational and user-facing requirements documented in the capstone. The management component supported clinic records and transactions, while the mobile application provided access to pet-related information and a breed recognition function for dogs and cats.

RECOMMENDATIONS

1. Develop an application programming interface (API) for image processing so that breed recognition is not dependent solely on a fixed model trained in Teachable Machine and can support a more flexible number of breeds.
2. Enhance the system so that it can support multiple veterinary clinics and consider adding a map-based feature that helps users locate participating clinics.
3. Expand the breed-recognition component to include animal species beyond cats and dogs.
4. Conduct future validation of breed-recognition performance using a documented test dataset and report classification metrics such as accuracy, precision, recall, and confusion matrices.
5. Continue post-deployment usability and acceptability testing whenever major system functions, interfaces, or recognition models are revised.

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