I. Background of the Problem

It is a common sight in the Philippines seeing strayed and abandoned dogs wandering on the streets. Not only that this is quite an unpleasant site for some because of the trash or the organic wastes they scatter, but it also may cause risk for the community where the dogs roam. In an interview with the Dr. Manalastas, head Veterinarian of Makati Veterinary Office, instances of dog bites are sometimes associated with stray dogs wandering on the streets. [1] Each city/municipality has its own rules or ordinances against the proliferation of these dogs. With this, the city/municipality enforces unit/s to impound these dogs to prevent further growth of their population. A city pound is established to ensure the effective implementation of prohibiting straying and roaming animals in any public street [2].

Everyday the City Pound of Makati schedules its "Daily Stray Dog Operation" in the different *barangays* of the city. The exclusive villages which are also *barangays* themselves like Dasmarinas Village, Urdaneta Village, Bel Air Village and Salcedo Village are not included in the visits since there are none or only a few strayed dogs in these area attributed to the villages high level of security. Thus, only a part of Makati is visited by the city pound officials during their operations. The pound officials record each of the dog impounded on a log book where the following information is documented: *barangay* and street where the animal is found, sex and color of the dog and the time and date of the capture. (see Appendix A) In order to disseminate information about stray dog operation in a *barangay*, the City Pound informs the *barangay* details about their operation. These details are documented using a document submitted to the barangay called *pound notice* (see Appendix B) [1].

The City Pound and Makati Veterinary Office works hand in hand in the control of strayed dogs in Makati [1]. They are concerned on areas where there is high prevalence of strayed dogs. For the City Pound, it gives them insight on what areas in Makati require dog impounding operations. The Makati Veterinary Office on the other hand, uses the information to determine which area would the informative lecture on proper animal care including vaccination scheduling [1].

Under the Resolutions and Orders of Makati, one hundered thousand (P100,000.00) is appropriated for the maintenance of these pounds every year [3]. Keeping the animals in the pound too long will cost the city more money. A particular period of seven (7) days is appropriated for their stay in the pound. When the owner of the dog claims his pet, he will fill up a logbook where information about them and their dog will be recorded. (see Appendix C). Impounding fees are paid by the owner of the dog once it is redeemed within the said period. In case the dog is not yet tagged or registered by its owner, additional fees are to be collected for the registration of the said dog. On the 8th day, the unclaimed dog is due for adoption while on the 9th day, the unadopted dog is then subjected to euthanasia or mercy killing [2].

A person who wishes to adopt a dog impounded by the pound can visit the pound to inform their intent to adopt a dog. The city pound officials together with Compassion and Responsibility for Animals (CARA) shall determine if the said individual is viable to be the new owner of the said dog. The dog is exempted from euthanasia if it exceeds the period allotted for adoption while the adoption case is still being reviewed. If the request for adoption is approved, an adoption paper is filled up to document the adoption of the pet. (see Appendix D) Certain fees are also charged to the new owner of the pet.

B. Statement of the Problem

At the present, management of records of dogs impounded by the city pound has been manually implemented around city pounds in the Philippines. Information about the dogs is recorded only through logbooks. When the city pound officials document their daily operations, they transfer their data from the logbook and encoded through office applications. The City Pound of Makati currently does not have any computerized information system which would allow them to store their data on a database. It is hard to keep track of their work with only logbooks and piles of paper as their source of information. Also, reports on statistics like the number of dogs found on a particular area are manually tabulated and later encoded in tabular form using spreadsheets. The city pound officials aim to efficiently manage the information and data from their daily operations. Since one of the primary information provided for in the records are locations in Makati where impounded dogs are found, it would be a good help if officials could *visualize* these information [1].

Lack of more descriptive information supplied in the records causes problems when the owner inquires if the dog was included in the operation. Since most of the time, owners of the captured dogs go only to the *barangay* to inquire if there had been any stray dog operation; they are presented only with the list of dogs described with the location they were caught, the dog's sex. Thus, it is difficult to know if the dog the owner is looking for is included during the stray dog operation.

Another problem at present is information dissemination. The pound notice is only available if the owner inquires to the *barangay*. Most of the time the owners are informed only by their neighbors if ever one saw that the owner's dog has been captured. Since only seven (7) days are allotted for the claiming of the impounded dog, with the lack of information about the dog's whereabouts, the dogs are not usually claimed by the owners. Also, information about dogs that are available for adoption is not available unless the person who wishes to adopt will visit the pound. With the little time allotted for the adoption, it is vital to know the dog's status and the number of days it has stayed in the pound. In this case, the person who wishes to adopt will visit the pound or call the pound everyday for seven days to inquire if the dog is still available for adoption.

C. Objectives

To create an "AniMap: A Web-Based City Pound Manager and Geographical Information System" for Makati with the following capabilities:

1. allows the city pound officer to:
    a. Update dog record
        i. Add dog record via GIS
        ii. Edit dog record
    b. Query for impounded dog information on the Makati Map
        i. By month
        ii. By year
    c. View reports

        i.   Number of claimed impounded dogs in a particular area over a specified period of time

        ii.   Number of adopted dogs in a particular area over a specified period of time

        iii.   Number of euthanized dogs in a particular area over a specified period of time

  d. Approve adoption/retrieval requests

  e. Edit account information

2. allows users to:

  a. Search for impounded dog

        i.   Still in custody for adoption or retrieval

        ii.   Euthanized dog in the current month

  b. Apply for retrieval of a dog online

  c. Apply for adoption of an impounded dog online

  d. View Reports and FAQ's

        i.   Number of claimed impounded dogs in a particular area over a specified period of time

        ii.   Number of adopted dogs in a particular area over a specified period of time

        iii.   Number of euthanized dogs in a particular area over a specified period of time

        iv.   Frequently Asked Questions (FAQ's) in the proper care of dogs

3. allows the Pound General Manager acting as the System Administrator to:

  a. View Reports and FAQ's

        i.   Number of claimed impounded dogs in a particular area over a specified period of time

        ii.   Number of adopted dogs in a particular area over a specified period of time

iii. Number of dogs euthanized dogs in a particular area over a specified period of time

iv. View amount collected for the adoption/retrieval applications

b. Update user accounts

i. Add user account

ii. Edit user account

iii. Activate/deactivate user account/s

c. Update FAQ's on the proper care of dogs

d. Update billing amount

e. Edit account information

D. Significance of the Study

City Pound officials can benefit from AniMap since it allows them to visualize frequency of impounded animals on an area through a graphical representation using GIS. Managing of information is done more efficiently using AniMap. It not only records information about strayed animals on a web-based database but also map what street they are spotted in the created vector map. Other considerations like the scheduling of their operations on a particular area can be determined using the images generated by the map. Makati Veterinary Office can also use the information delivered by the map to determine which area they should visit to conduct lectures and other information awareness on proper animal care.

AniMap can also help inform the dogs' owners through records presented on the system. Since AniMap is delivered via the internet, the owners can easily determine if their dogs are caught by the pound just by accessing the system online. The problem of lack of descriptive information is lessened as details together with a picture of the dog are made available online.

Adoption of these dogs is also facilitated using AniMap. The possible new owners do not need to go to the pound everyday and can just apply online for adoption. The possible new owners can also pick

their desired pet online because pictures and description of animals are already made available. Adoption can help not only in reducing the number of dogs housed by the pound but also give the animals a new home and more importantly save them from possible euthanasia.

General viewers of the system particularly residents of Makati can access the city's effort to reduce the number of strayed dogs in the streets through the dynamic vector map. Barangay officials using the picture presented by the map can make the necessary move to further lessen the number of strayed dogs in their area.

E. Scope and Limitations

1) The project's scope is limited only to the City of Makati. Exclusive villages in Makati such as Forbes Park, Dasmarinas Villlage etc. and Makati Central Business District are not included in the system as they have their own dog impounding system.

2) AniMap can show the location of dogs down to the street level.

3) Information about animals is limited only to their state once they were impounded since most of the animals have not even been tagged and registered.

4) Records of dogs impounded shall be available for public viewing for the purposes of retrieval of dogs by their owners as well as possible adoption. Map containing information where strayed dogs are found are also viewable by general users.

5) Application for adoption can be made within the allotted 8 day period. But the applicant has to be physically present on the 8th day to finalize adoption process. Failure to physically present himself at the City Pound Office invalidates his application. The veracity of his suitability of dog adoption is outside the system.

6) Retrieval process can only be made within the allotted 7 day period. The owner needs to physically go to the City Pound Office to finalize retrieval application. Failure to do so invalidates his application for retrieval.

7) The system will not handle registration of dogs not impounded or not in custody of the city pound.

8) Payments of corresponding fees are outside the system.

9) The Pound General Manager acts as the system administrator.

F. Assumptions

- The users of the system must have internet connection and at least a desktop computer.

- Updating of the system is done real-time.

II. Review of Related Literature

Emergency Prevention System for Transboundary Animals and Plant Pest Diseases (EMPRES) developed Transboundary Animal Disease Information System (TADinfo), an open-source software package for animal disease quantification and management for national veterinary epidemiology units. It is a combined relational database system and Geographical Information System which used MS Access and ArcView. TADinfo guides the user in entry and analysis of data with outputs like interactive maps and graphs [4].

Pet911, a US based organization has a system which enables people to report lost and found animals through their website. PetFinder.org is an online animal adoption website based also in the US which displays information about animals housed by private and government animal shelters available for adoption [5].

Pirante in 2004 designed and developed a Special Problem entitled Pedigree and Canine Management System [6]. The web based information system records registration information about pure breed dogs and their respective owners.

In the Philippines, Compassion and Responsibility for Animals (CARA), a Non-Government Organization (NGO) has a static website that displays information such as pictures, breed and age of cats available for adoption [7]. The website also provides information about animal care and other issues about animal welfare.

Abanilla in The Makati Route Finder System: A Java Based Interactive Map and Route Finder Application Utilizing Dijkstras Algorithm created an interactive map of Makati Central Business District [8]. The standalone Java program created allowed the user to find the shortest path from a point to another using Dijkstras algorithm.

Traumap, a BS Computer Science Special Problem dated April 2003 designed and developed by Co, is a web-based Geographical Information System implemented using Scalar Vector Graphics (SVG). Traumap allows users to report information of trauma incidents in Manila through a point-and-click interface and represented through visual data and tables [9].

Larue in "Using GIS to establish a public library consumer health collection" used the software ArcView GIS to create maps in order to visualize the demographics of the people in the served by the library in a particular neighborhood [10]. She stated that using GIS helped them with the data presented and analyzed to justify their purchases for a dedicated consumer health collection or resources to cater the needs of people in the said area.

Andrew Edmonds in his study "A GIS based suitability model for emergency animal shelter" proposed a way to determine the possibility of locating a suitable area in Horry County for animal shelter using analyzing data derived from a GIS. Using color coded graphical representation through GIS; suitability of an area is shown. Several factors were considered in the model (i.e. veterinary locations, earthquake zones, etc.) to come up with a decision depicted by differently colored region which expresses the suitability of the area for animal shelter [11].

EMI Online, a web-based database of establishments and roads, used Geographical Information System to assist tourists traveling to Ermita, Malate and Intramuros. EMI Online, dated March 2001, is also a Special Problem (SP) in BS Computer Science. Access to information such as road classification and history of an area can be obtained using queries made on a particular establishment or roads [12].

III. Theoretical Framework

A. City Pound of Makati

Legal Basis of Creation

Makati City Pound was created on 1996 when Makati was declared as a city. Appropriation of certain amounts for the maintenance of a dog pound of the municipality was done under Ordinance no. 49 series of 1988 [13]. This is to ensure the effective implementation of Ordinance no. 30 series of 1988 which prohibits the straying and roaming of animals in any public street.

Mandate (Functional Statement) [13]

a.   The Makati City Pound shall impose strict implementation of the City's Ordinances with regards to animal stray control

b.   Makati City Pound shall only assist euthanasia or mercy killing of dogs. Execution of dogs shall be done only by a veterinarian of Makati Veterinary Services Office

c.   Makati City Pound personnel shall assist in the Education Campaign (program which promotes responsible pet ownership) conducted by MVSO

d.   Makati City Pound personnel shall assist in the Continuous Anti-rabies Vaccination Campaign (program aimed to control rabies in the city) conducted by MVSO

A city pound or a public pound is an establishment maintained under the supervision of a licensed Veterinarian where stray dogs or dogs running at large shall be confined or restrained. The location of the said establishment shall be designated by the city mayor. The office aims to remove stray dogs from community streets [14].

The following are the regulations followed by Makati City Pound on their operations: [14]

Upon receipt of dogs into the pound, the city pound officer shall advertise the *barangay* hall a pound notice for seven (7) consecutive says stating the following:

    a.   color, breed and other description of the impounded dog

    b.   date and time when the respective impounded dogs were caught

    c.   place and location where the respective impounded dogs were caught

    d.   a notice that unless redeemed, the dogs will be sold at a public auction at the said pound on the 8th day between 9:00 am to 4:00 pm

There shall be charges for each animal impounded. The following fees are as follows:

Impounding fee --- P 100.00

Adoption fee --- P 150.00

Rabies Vaccination fee (for all impounded dogs three months old and up) -- P 100.00

License Tag --P 10.00

Additional daily charge for each animal not redeemed ---------------------- P 10.00

All dogs impounded unless redeemed shall be sold at a public auction and those not sold after two consecutive days shall be donated to research institutions or shall be killed humanely.

Any person violating the City Ordinance shall be fined P500 for the first offense, and the same amount for the second offense, and P1000.00 for the third offense or imprisonment for one month or both at the discretion of the court [2].

The following additional information is gathered from Section 4 of the Pound/ City Pound Regulations: [14]

1. Stray dogs shall be removed from community streets.

2. The City Pound Officer shall direct and supervise daily rounds for picking-up strays.

3. Strays shall be impounded for 7 days to give owners enough time to reclaim their animals and to determine if human exposure has occurred.

4. Apprehended vicious strays may be destroyed at the discretion of the City Pound Officer.

5. Dogs found to be suffering from either two types of rabies shall be destroyed immediately.

B. Database Management System

A database management system (DBMS) is a software application that is used to create, maintain and provide controlled access to user databases [15]. This system furnishes its users with the ability to store, retrieve, and update data in a database. In providing this functionality, the DBMS should hide the internal physical implementation details (such as file organization and storage structures) from the user. It is also equipped with a catalog in which descriptions of data items are stored and which is accessible to users. Through this, information about data can be collected and stored centrally, meaning of data can be defined thus helping other users understand the purpose of the data, communication is simplified since exact meanings are stored and redundancy and inconsistencies can be identified more easily since the data is centralized.

 A DBMS also provides a mechanism which ensures that either all the updates corresponding to a given transaction are made or that none of them are made. Also, it ensures that the database is updated correctly when multiple users are updating the database concurrently. If a transaction fails, which may result from a crash, media failure, a hardware or software error or transaction abortion by a user, DBMS has a means for recovering the database and returning it to a consistent state. Data security prevents unauthorized users from viewing or updating the database. With the use of

passwords, user access to the database is limited accordingly. Depending on the type of user, the database may be accessed in its entirety or just subsets of it. The DBMS maintains the integrity of the database by not allowing more than one user to update the same record at the same time [15].

C. Information System

Information System is defined as a system, whether automated, or manual, which involves people, machines, and/or methods structured to collect, process, transmit, and disseminate data which represent user information [16]. Any telecommunications and/or computer related equipment or interconnected system or subsystems of equipment that is used in the acquisition, storage, manipulation, management, movement, control, display, switching, interchange, transmission, or reception of voice and/or data, and includes software, firmware, and hardware is also an information system. It is also the entire infrastructure, organization, personnel, and components for the collection, processing, storage, transmission, display, dissemination, and disposition of information.

D. Geographic Information System

Geographic Information System (GIS) is a technology that is used to view and analyze data from a geographic perspective. The technology is a piece of an organization's overall information system framework [17]. It is a computer system capable of capturing, storing, analyzing, and displaying geographically referenced information; that is, data identified according to location. It is also defined by practitioners as including the procedures, operating personnel, and spatial data that go into the system [18]. GIS links location to information (such as people to addresses, buildings to parcels, or streets within a network) and layers that information to give users a better understanding of how it all interrelates. Layers are chosen to combine based on the purpose [17].

Three Views of a GIS

A GIS is most often associated with maps. A map, however, is only one of three ways a GIS can be used to work with geographic information. These three ways are: [17]

1. The Database View: A GIS is a unique kind of database of the world—a geographic database (*geodatabase*). It is an "Information System for Geography." Fundamentally, a GIS is based on a structured database that describes the world in geographic terms

2. The Map View: A GIS is a set of intelligent maps and other views that show features and feature relationships on the earth's surface. Maps of the underlying geographic information can be constructed and used as "windows into the database" to support queries, analysis, and editing of the information. This is called *geovisualization*.

3. The Model View: A GIS is a set of information transformation tools that derive new geographic datasets from existing datasets. These *geoprocessing* functions take information from existing datasets, apply analytic functions, and write results into new derived datasets.

Data Types in GIS

Data comes in three basic forms: [17]

ii. Map data. Map data contains the location and shape of geographic features. Maps use three basic shapes to present real-world features: points, lines, and areas (called polygons).

iii. Attribute data. Attribute (tabular) data is the descriptive data that GIS links to map features. Attribute data is collected and compiled for specific areas like states, census tracts, cities, and so on and often comes packaged with map data. When implementing a GIS, the most common sources of attribute data are your own organization's databases combined with data sets you buy or acquire from other sources to fill in gaps

iv. Image data. Image data ranges from satellite images and aerial photographs to scanned maps (maps that have been converted from printed to digital format).

Data Models

14

Data models are the rules the GIS follows, such as "county lines do not overlap," and are essential for defining what is in the GIS as well as supporting the use of GIS software. All spatial data models fall into two basic categories: [17]

1. Vector data model. Discrete features, such as customer locations and data summarized by area, are usually represented using the vector model.

2. Raster data model. Continuous numeric values, such as elevation, and continuous categories, such as vegetation types, are represented using the raster model.

E. Scalable Vector Graphics (SVG) [19]

SVG is a platform for two-dimensional graphics. It has two parts: an XML-based file format and a programming API for graphical applications. Key features include shapes, text and embedded raster graphics, with many different painting styles. SVG allows for three types of graphic objects: vector graphic shapes (e.g., paths consisting of straight lines and curves), images and text. Graphical objects can be grouped, styled, transformed and composited into previously rendered objects. Text can be in any XML namespace suitable to the application, which enhances searchability and accessibility of the SVG graphics. The feature set includes nested transformations, clipping paths, alpha masks, filter effects, template objects and extensibility.

SVG drawings can be dynamic and interactive. The Document Object Model (DOM) for SVG, which includes the full XML DOM, allows for straightforward and efficient vector graphics animation via scripting. A rich set of event handlers such as onmouseover and onclick can be assigned to any SVG graphical object. Because of its compatibility and leveraging of other Web standards, features like scripting can be done on SVG elements and other XML elements from different namespaces simultaneously within the same Web page. Geographic Information Systems have very specific requirements: rich graphics features, support for vector and raster content and the ability to handle a very large amount of data. SVG is well-suited to this market and many GIS systems provide SVG export. Like the design case mentioned above, the ability to extend SVG and embed metadata is

useful to the mapping community. For example, graphical elements can be identified as their native

objects (such as a lake), allowing applications to interact with the objects in a graphical manner.

F. Definition of terms

Stray dogs or dogs running at large

- animal which is loose, unrestrained, unconfined or not under control of its owner or

the one in possession thereof [14]

Pound Officer / Animal Catcher

– appointed to catch stray dogs; appointed at the ratio of two (2) persons per pound

with a vehicle for 8 hour services. [14]

IV. Design and Implementation

A. Entity Relationship Diagram

AniMap offers a database which provides information regarding the dogs captured by the pound. It also covers the adoption and claiming of these dogs. The system uses five tables as indicated in the Entity-Relationship Diagram in Figure 1. The table DOG contains the dog information together with the coordinates in the map where it was spotted. The table OWNER contains information about the new adopting owner and the possibly the claiming owner of the dog. The associative entity, RECEIVE contains information about the owner of the dog, the dog and the corresponding bill. The BILL entity contains the amount per corresponding fees. ACCESS entity contains information about the users of the system. Attributes of the different entities are shown in Figures 2 to 8.
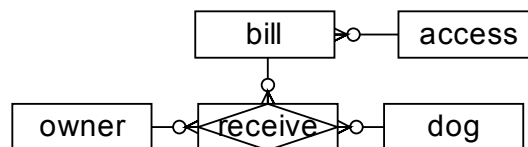
Figure 1 Entity Relationship Diagram, AniMap

17
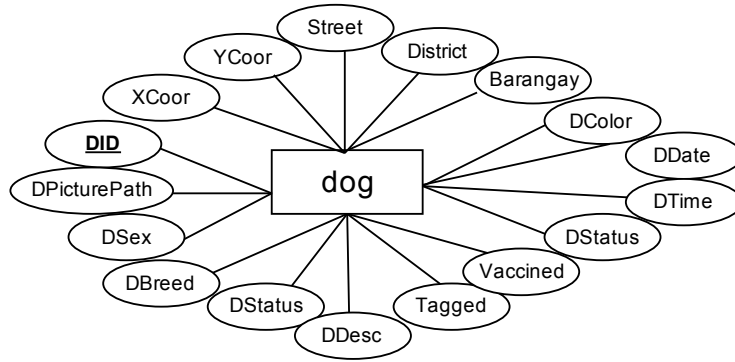
Figure 2. Attributes of Dog Entity, AniMap
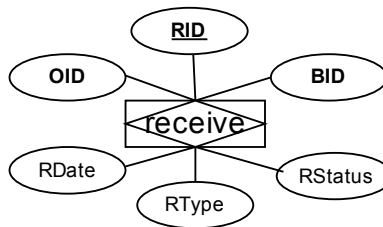
Figure 3. Attributes of Receive Entity, AniMap
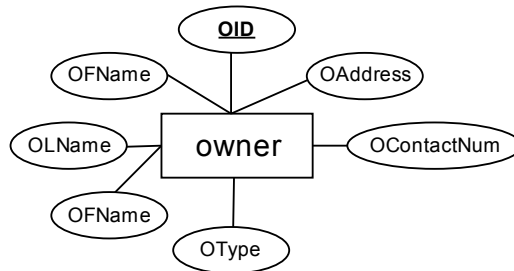
Figure 4. Attributes of Owner Entity, AniMap
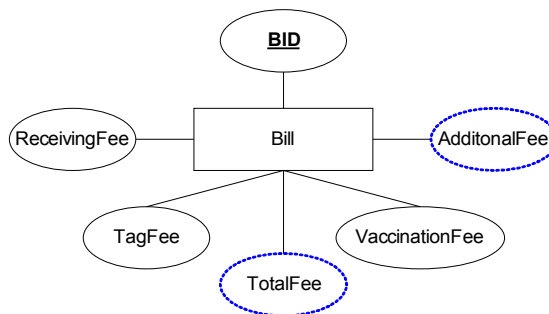
Figure 5. Attributes of Bill Entity, AniMap
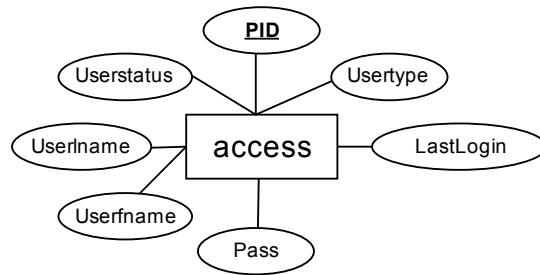
Figure 6. Attributes of Access Entity, AniMap
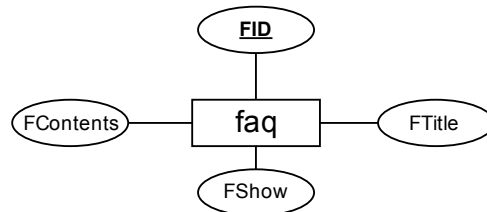
Figure 7. Attributes of FAQ Entity, AniMap
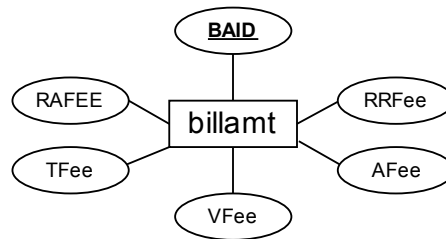
Figure 8. Attributes of Billamt Entity, AniMap

B. Context Diagram

Figure 9 shows the context diagram of AniMap. The following are the users accessing the system:

Pound Officer, General User and Pound General Manager. All of the users of the system are allowed to

view the statistical reports of impounded dogs and FAQs. The Pound General Officer will deal with the

clerical work in the City pound (updating dog records, approving request etc.). The General User can

access the records of impounded dogs still in custody of the City Pound and euthanized dogs in the

current month. He can also apply for adoption and retrieval online. The Pound General Manager also

acting as the System Administrator handles the management of user accounts, billing amount and

FAQs. In addition to the impounded dogs' statistical reports, he can also view the collection from the

retrieval and adoption applications.
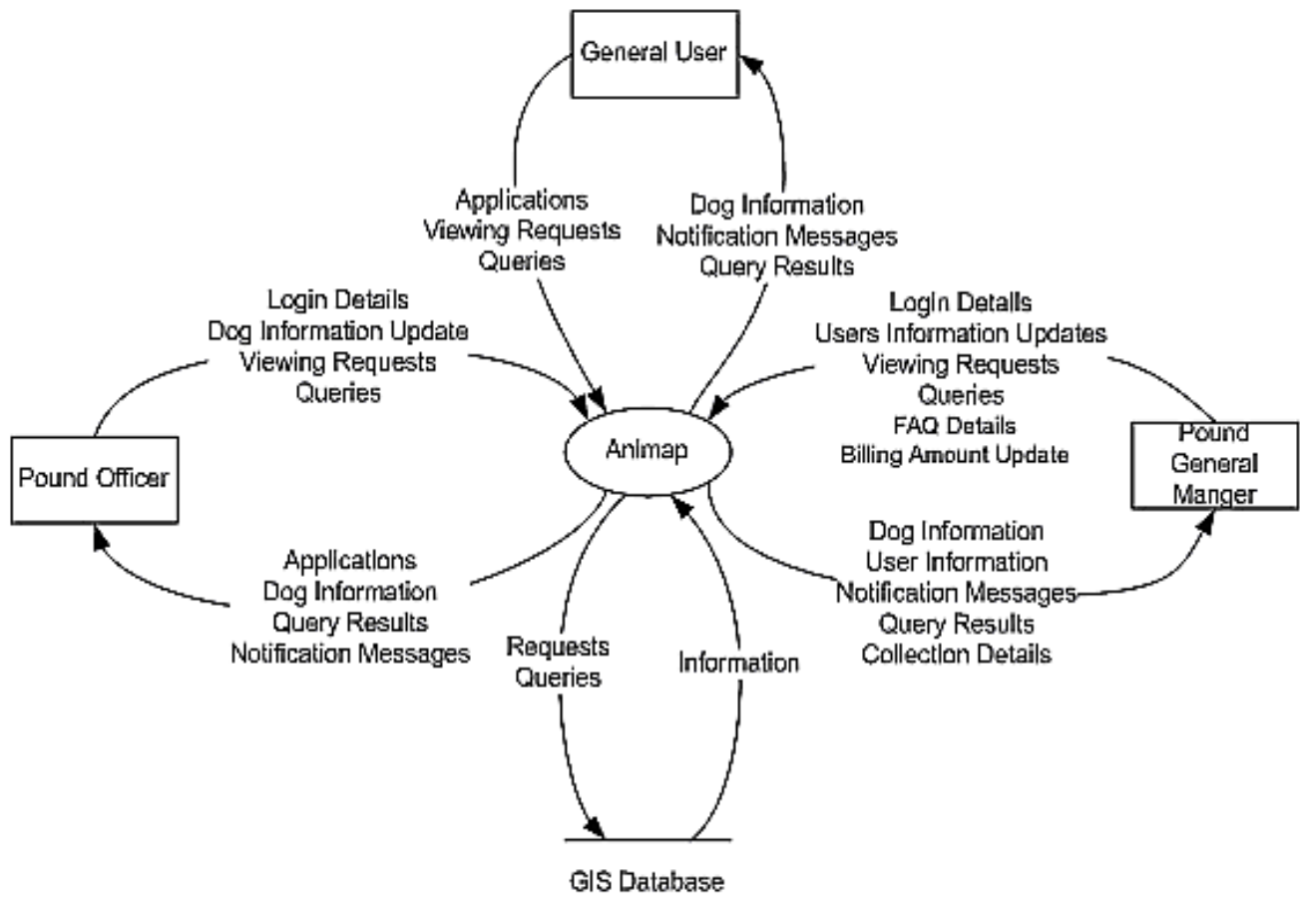
Figure 9. Context Diagram, AniMap

C. Data Flow Diagram

The Top Level Data flow diagram is seen in Figure 10. AniMap has six main processes: (1) update dog

records, (2) query impounded dogs, (3) apply for retrieval or adoption, (5) manage reports/faq/billing

and (6) update user accounts. The sub explosions for each process are shown in the succeeding

diagrams. (see Figures 11-19)
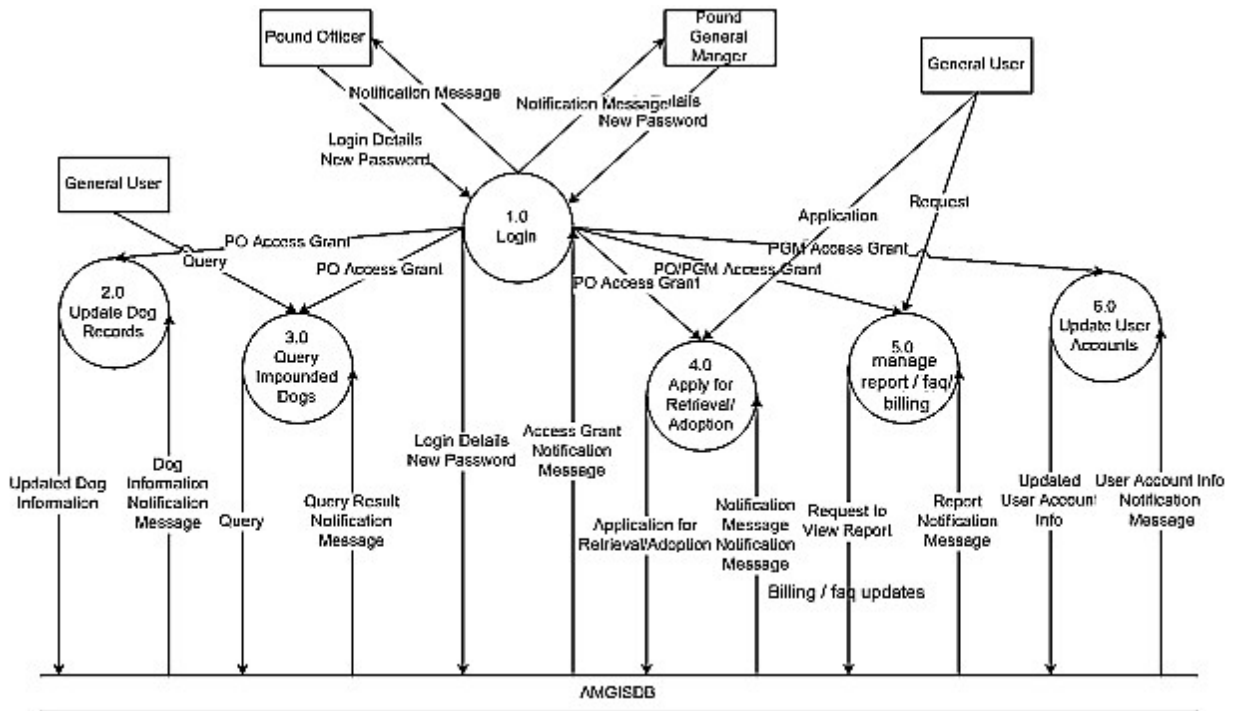
Figure 10 Top Level Data Flow Diagram, AniMap

The subexplosion of Process 1. Login is seen in Figure 11. There are two processes in the subexplosion namely: validate user account and edit account information. The subexplosion of Process 2. Update Dog Records is seen in Figure 12. The two processes in the subexplosion are: add dog record via GIS and edit dog record.
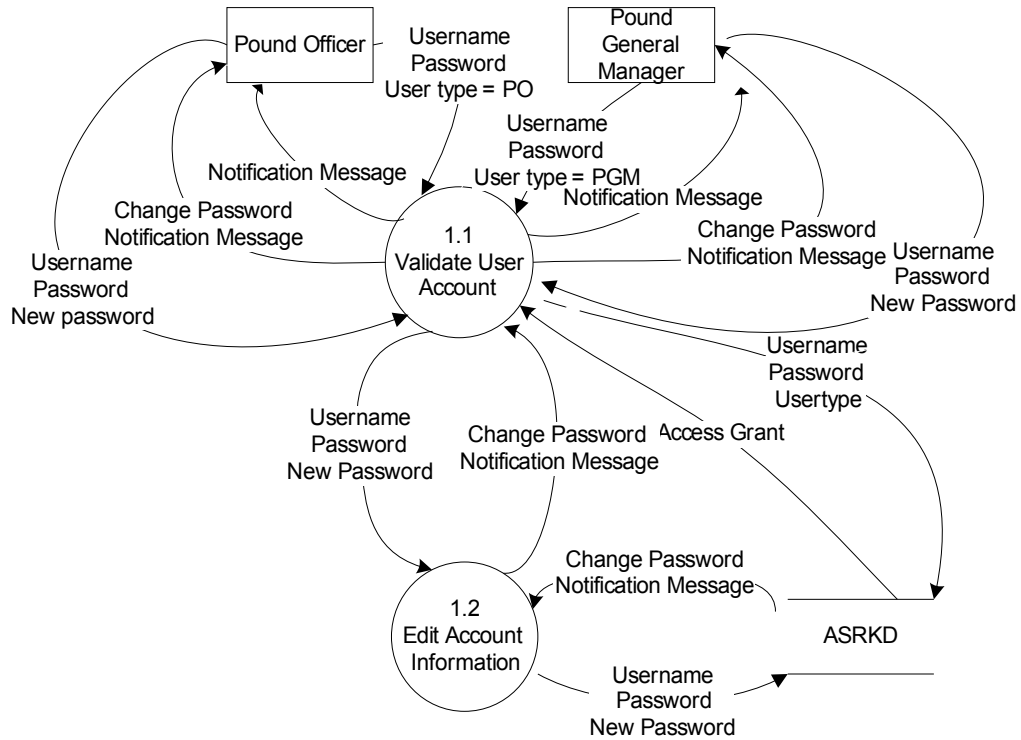
Figure 11 Process 1 Subexplosion, Login, AniMap
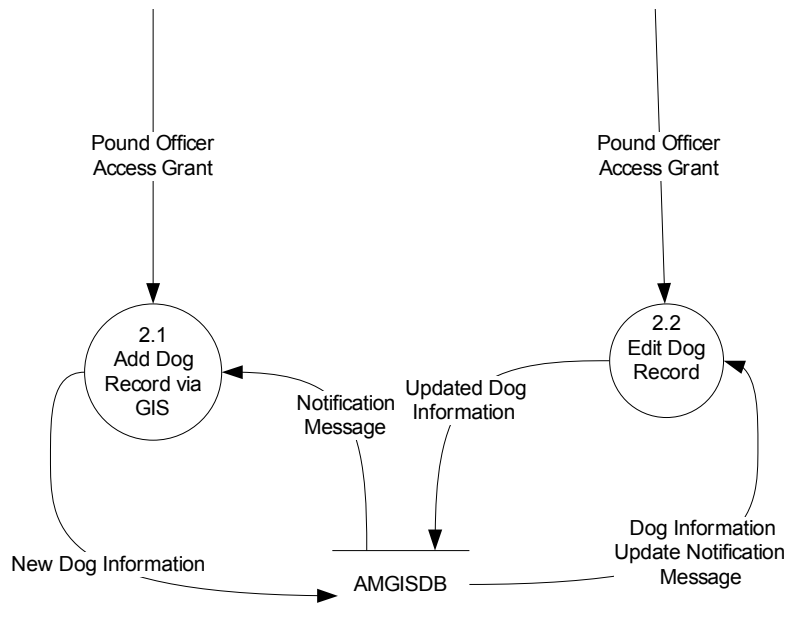
Figure 12 Process 2 Subexplosion, Update Dog Records, AniMap

Figure 13 shows the subexplosion of Process 3. Query Impounded Dogs. The processes within this subexplosion are as follows: query by month and year, search for impounded dogs, search for dogs for adoption and search for euthanized dogs. The diagram in Figure 14 shows the subexplosion of Process 4. Apply for Adoption Retrieval. Three processes are within the subexplosion namely: apply for retrieval, apply for adoption and approve applications.
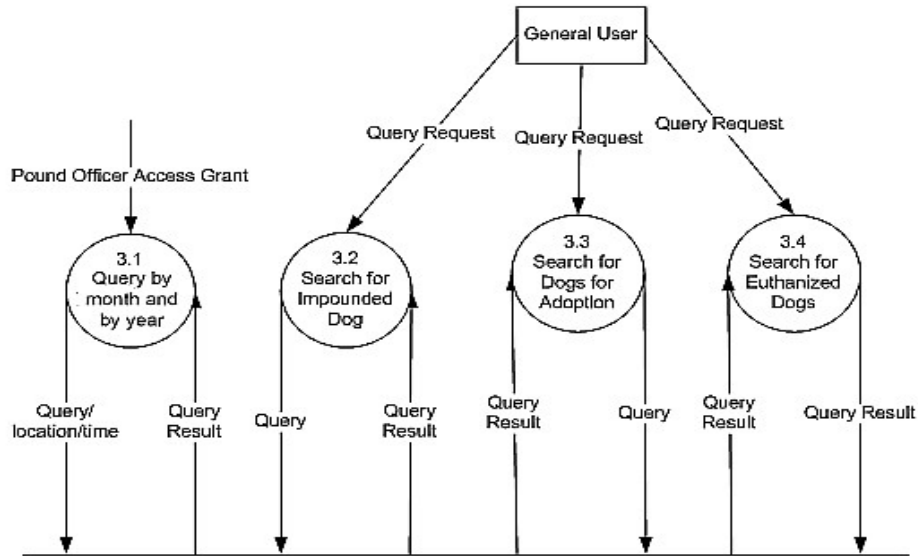
Figure 13 Process 3 Subexplosion, Query Impounded Dogs, AniMap
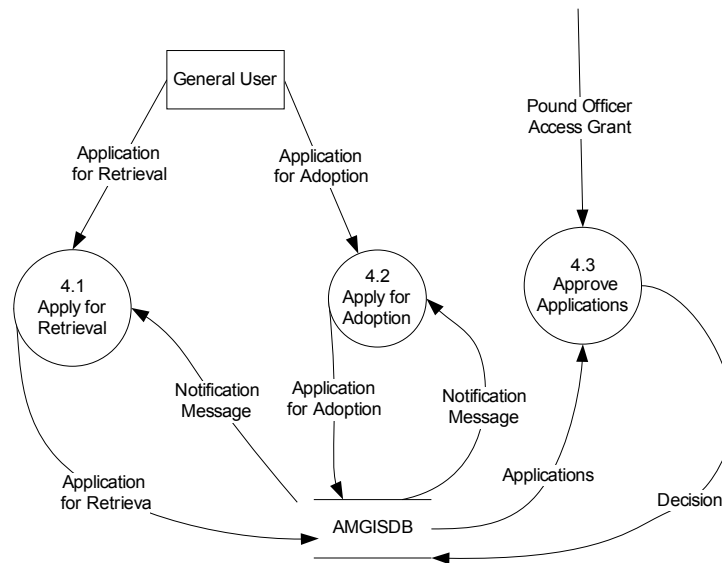
Figure 14 Process 4 Subexplosion, Apply for Adoption Retrieval, AniMap

Figure 15 shows the subexplosion of Process 5. Manage Report/ FAQ/ Billing. Three subexplosions are under this process namely: view reports of impounded dog statistic, manage FAQ's and manage billing.
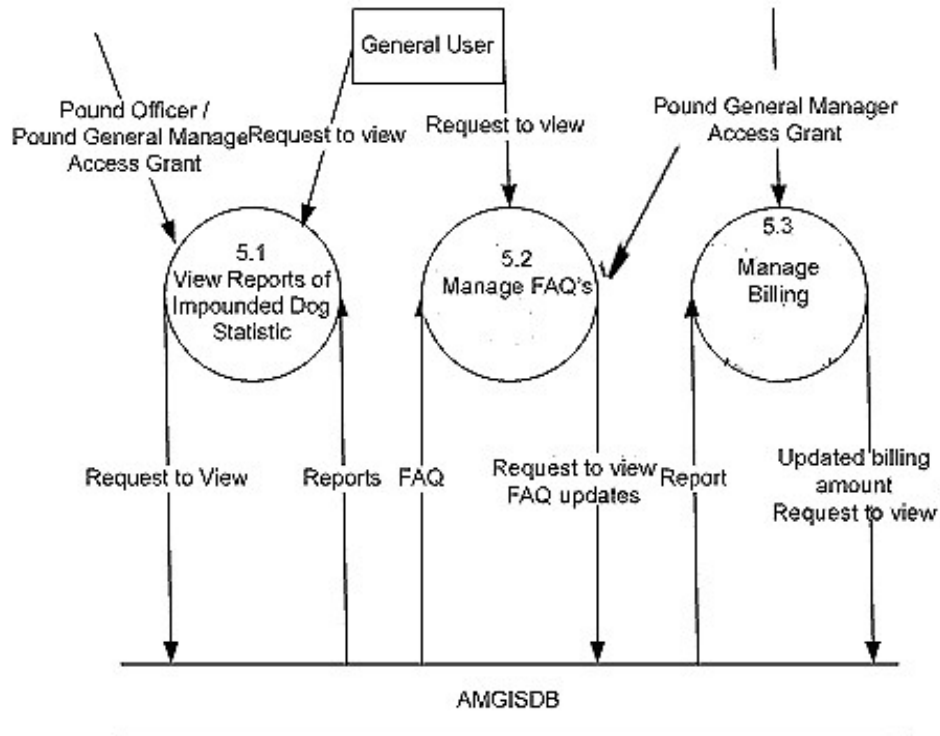
Figure 15 Process 5 Subexplosion, Manage Report/ FAQ/ Billing, AniMap

The subexplosion of Process 5.1. View Reports of Impounded Dog Statistic is seen in Figure 16. There are three processes in the subexplosion that allows the user to view reports of impounded dogs in a particular area over a specific period of time. Figure 17 shows the subexplosion of Process 5. 2. Manage FAQ. Three subexplosions are under this process namely: add, edit and view FAQs.
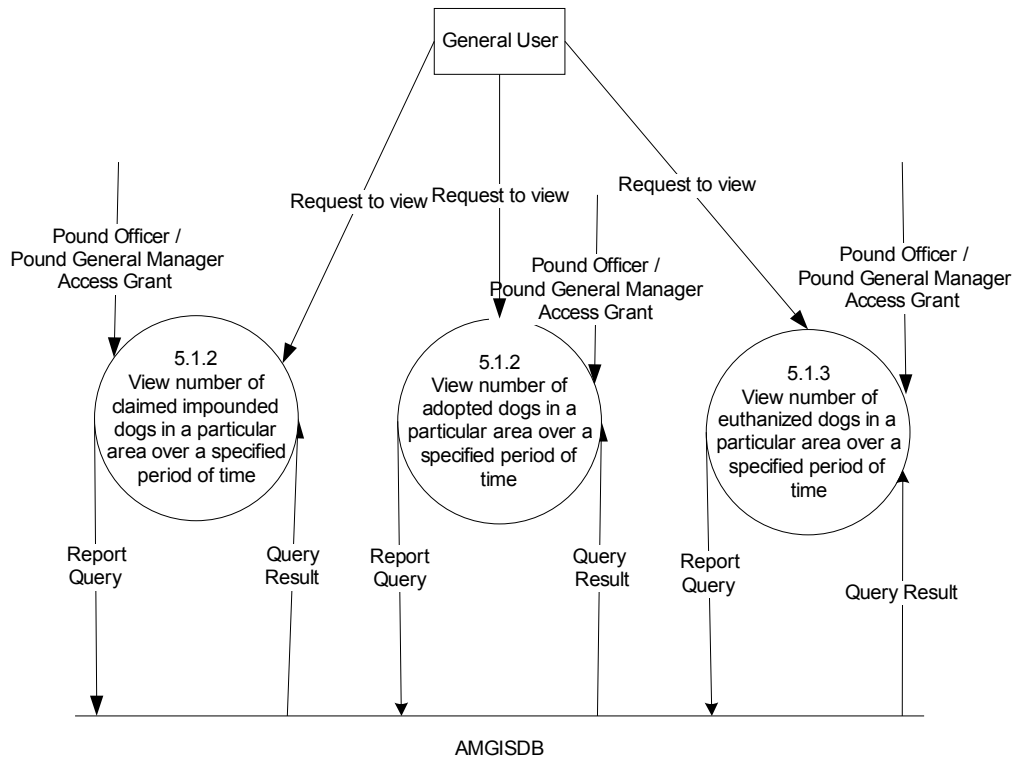
Figure 16 Process 5.1 Subexplosion, View Reports of Impounded Dog Statistic, AniMap
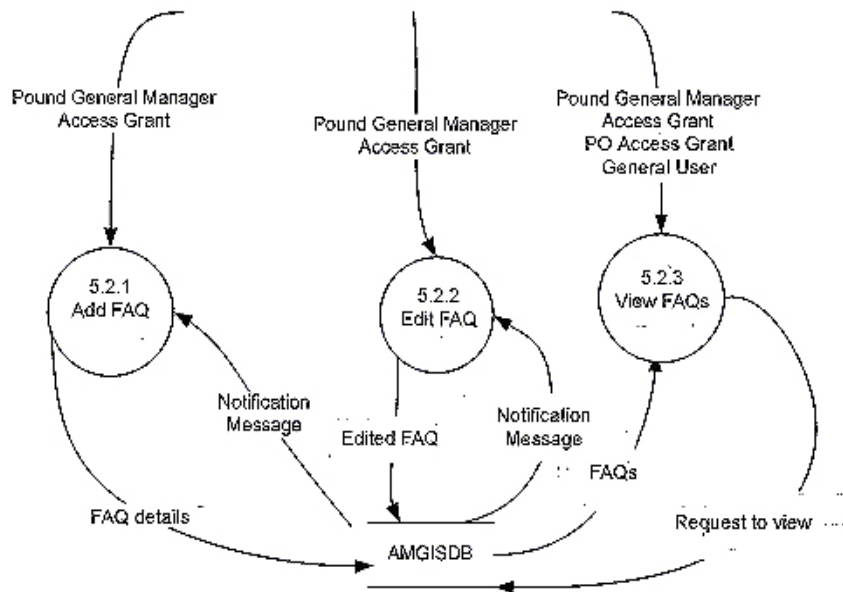
Figure 17 Process 5.2 Subexplosion, Manage FAQ, AniMap

The diagram in Figure 18 shows the subexplosion of Process 5.3. Manage Billing. Two processes are within the subexplosion namely: edit billing amount and view collections. The subexplosion of Process 6. Update User Account is seen in Figure 19. There are three processes in the subexplosion namely: add, edit, view user account.
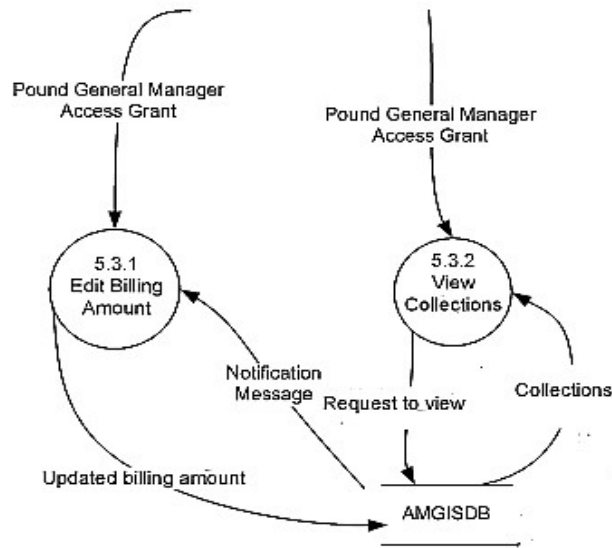
Figure 18 Process 5.3 Subexplosion, Manage Billing, AniMap
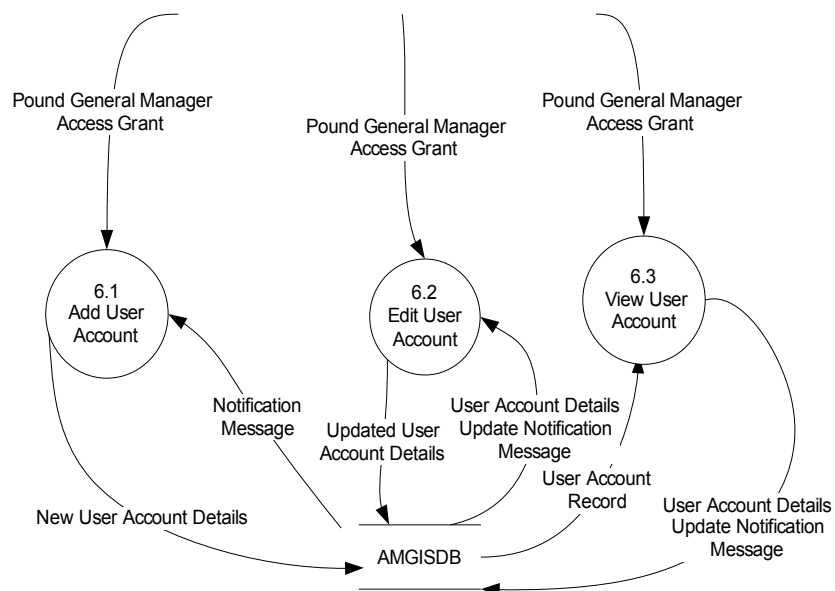
Figure 19 Process 6 Subexplosion, Update User Account, AniMap

D. Data Dictionary

The Data Dictionary shows the database table names and their corresponding attributes.

Field	Type	Description
DID	int(6) autoincrement	DID = *integer; range:6 digits* Primary Key of dog
DName	varchar(20)	DName=*range: 1..20* Name of dog (optional)
XCoor	varchar(10)	x-coordinate where dog was found in the map
YCoor	varchar(10)	x-coordinate where dog was found in the map
DName	varchar(20)	DName = *range: 1..20* Name of dog
DSex	varchar(6)	DSex= [Male|Female] Sex of the dog
Street	varchar(50	Street = *range: 1..20* Obtained for the map
Barangay	varchar(50)	Barangay= *range: 1..20* Obtained for the map
District	varchar(15)	District = *range: 1..20* Obtained for the map
DBreed	varchar(60)	DBreed = *range: 1..60* Breed of dog
DColor	varchar(10)	DColor = *range: 1..10* Color of dog
DPicturePath	text	Path where the picture was uploaded Md5 hashed
DDesc	text	Other description of dog
DStatus	varchar(10)	DStatus = [Available	Claimed	Adopted	Euthanized]
Vaccined	char(3)	Vaccined = [Yes| No]
Tagged	char(3)	Tagged = [Yes| No]
DDate	date	DDate='YYYY-MM-DD' Date when dog was impounded
DTime	time	DTime=HH:MM Time when date was impounded

Table 1 Dog (data table that stores information about the stray dog)

Field	Type	Description
RID	int(6) autoincrement	RID = *integer; range:6 digits* Primary Key of receive
DID	int(6)	DID = *integer; range:6 digits* Dog ID from Dog (Foreign Key)
OID	int(6)	OID = *integer; range:6 digits* Catch Operation ID from CatchOperation (Foreign Key)
BID	varchar(10)	BID = *range 1-10* Bill ID from Bill (Foreign Key)
RDate	datetime	RDate = YYYY-MM-DD HH:MM Date and time the application was made
RType	varchar(15)	RType=[Adoption|Retrieval]
RStatus	text	RStatus= [Pending|Approved|Disapproved]

Table 2 Receive (data table that stores information about the adoption/retrieval)

Field	Type	Description
OID	int(6) autoincrement	OID = *integer; range:6 digits* Primary Key of owner
OLName	varchar(20)	OLName = *range: 1..20* LastName of owner
OFName	varchar(20)	OFName = *range: 1..20* LastName of owner
OMName	varchar(20)	OMName = *range: 1..20* LastName of owner
OAddress	varchar(50)	OAddress = *range: 1..50* Address of owner
OContactNum	varchar(20)	OContactNum = *range: 1..20* Address of owner
OType	varchar(15)	OType = [New|True]

Table 3 Owner (data table that stores information about the owner)

Field	Type	Description
BID	int(10)	BID = *integer; range:10 digits* Primary Key of Bill
PID	varchar(10)	PID = *range:1..10 * ID of PO receiving the payment
ReceivingFee	char(10)	Receiving Fee Amount
VaccinationFee	char(10)	Amount of Vaccination
TagFee	char(10)	Amount of Tag
AdditionalFee	char(10)	Amount of Additional Fees
TotalFee	char(10)	Total Fee = (Derived from) ReceivingFee + VaccinationFee + TagFee+ AdditionalFee
BDate	datetime	BDate = YYYY-MM-DD HH:MM Date and time the payment was made

Table 4 Bill (data table that stores information about the bill)

Field	Type	Description
PID	varchar(10)	PID = *range:1..10 * Primary Key of Access
Userlname	varchar(20)	Userlname = *range:1..20 * Lastname of user
Userfname	varchar(20)	Userfname = *range:1..20 * Firstname of user
Userstatus	varchar(10)	Usertype=[active|inactive]
Password	varchar(20)	Encrypted password
Usertype	char(2)	Usertype=[PO|PGM]
LastLogin	datetime	Date and time of last login

Table 5 Access (data table that stores information about the users)

Field	Type	Description
FID	int(10)	FID = *integer; range:10 digits* Primary Key of faq
FTitle	text	Title of the FAQ

FContents	longtext	FAQ Contents
Fshow	char(3)	Fshow=[Yes|No] Show the FAQ on the FAQ page?

Table 6 faq (data table that stores information about the faqs)

Field	Type	Description
BAID	int(1)	FID = *integer; range:1 digit* Primary Key of billamt default value:1
RAFee	varchar(10)	Amount for the receiving fee (Adoption)
RRFee	varchar(10)	Amount for the receiving fee (Retrieval)
TFee	varchar(10)	Amount for the tag fee
VFee	varchar(10)	Amount for the vaccination fee
AFee	varchar(10)	Amount for the additional fee per day impounded

Table 7 billamt (data table that stores information about the billing amount)

E. How to Build Map

In order to build a vector map of Makati, Adobe Illustrator was used to hand-trace a scanned map of Makati. The scanned map will serve as the guide when redrawing each object in the Map. The pen tool of Adobe Illustrator was primarily used when drawing the map. As soon as the map is drawn, it was saved in SVG format with the background (scanned map) layer discarded.

F. Technical Architecture

The following specification is the minimum configuration of the computer:

- Pentium III processor or its equivalent

- 32 Mb Video Card

- 64 Mb of system memory

- Microsoft Windows 9x / NT / ME/ 2000 / XP

- 56KB Internet Connection on the client side

- Internet Explorer and SVG Viewer installed on the client and server side

- PHP, Apache Server and MySQL should be installed on the server side

- Adobe Illustrator installed to make the SVG Map

IV.   Results

The main page of AniMap is seen in Figure 20. It contains the login page, a navigation menu at the center and links at the upper right. The navigation menu at the center has links to view the distribution of impounded dogs on the map (**map**), search for profiles of impounded dogs (**search**), reports containing statistics (**reports**) and frequently asked questions (**faq**).

Figure 20 Main Page, AniMap

Figure 21 shows the About Page. It displays information about the developer of the system and other relevant information like the name of the adviser, the year the system was created and links to PAWS and CARA Philippines.

Figure 21 About Page, AniMap

Figure 22 shows the contents when the "map" button is clicked. The following module displays information about the dog when an instance (dot) is clicked. To distinguish it form the others, a paw-like figure envelops the dot. Its information is then displayed at left form. All the users of the system can access this module.
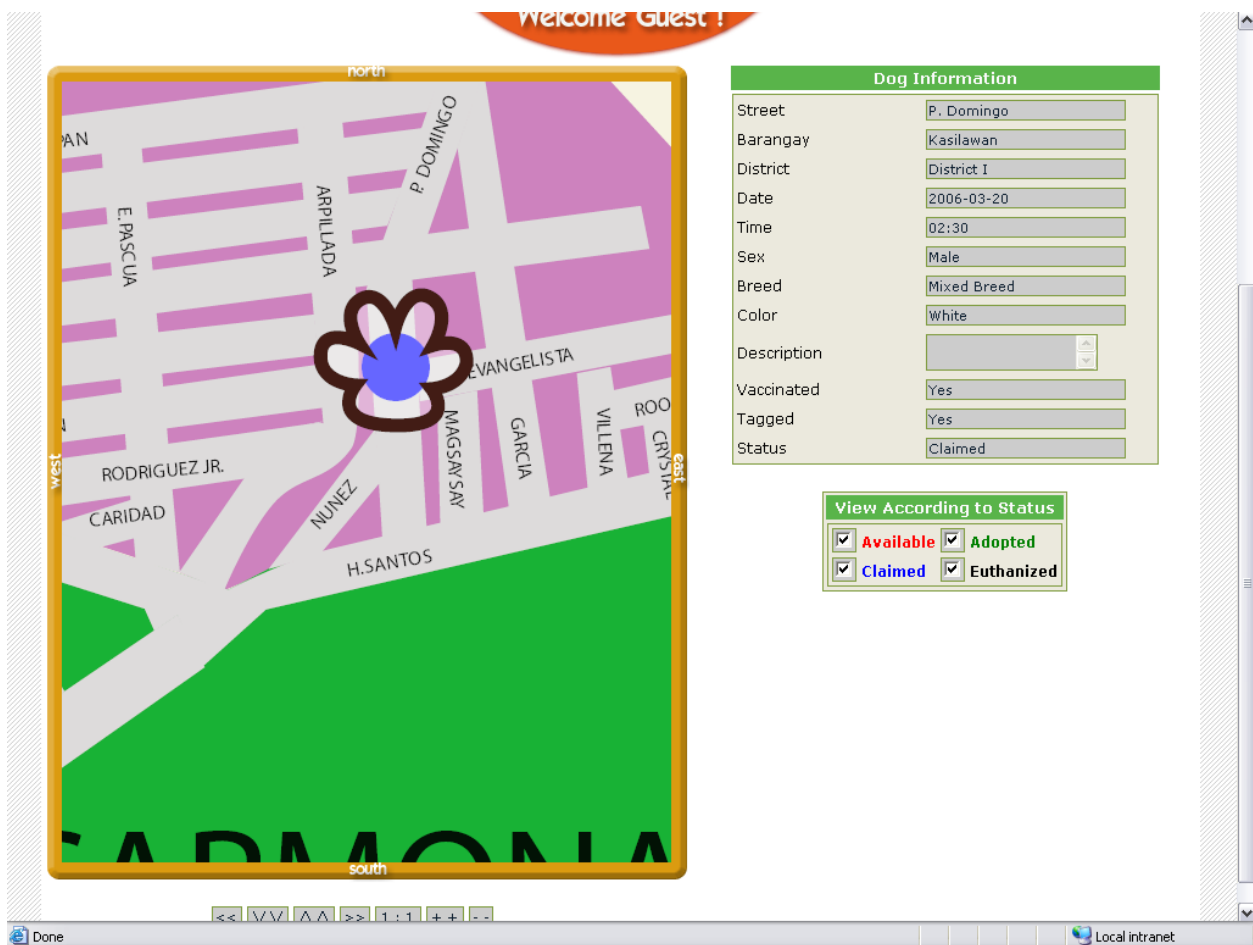
Figure 22 View Dog Information, AniMap

The search page of the system is shown in Figure 23. It allows general users to search for impounded

dogs using filters. If the user chooses to view records of euthanized dogs, he will not be able to edit

the date interval. The date interval is set to the current month's start and current date.

Figure 23 Search for Impounded Dog, AniMap

The profile of the dog once it is chosen to be viewed through the search page is illustrated in Figure 24. It displays data about the dog's profile and availability.

Figure 24 Dog Profile, AniMap

Application form for adoption and retrieval is shown in Figure 25. All values are required so as to properly address the person's request.
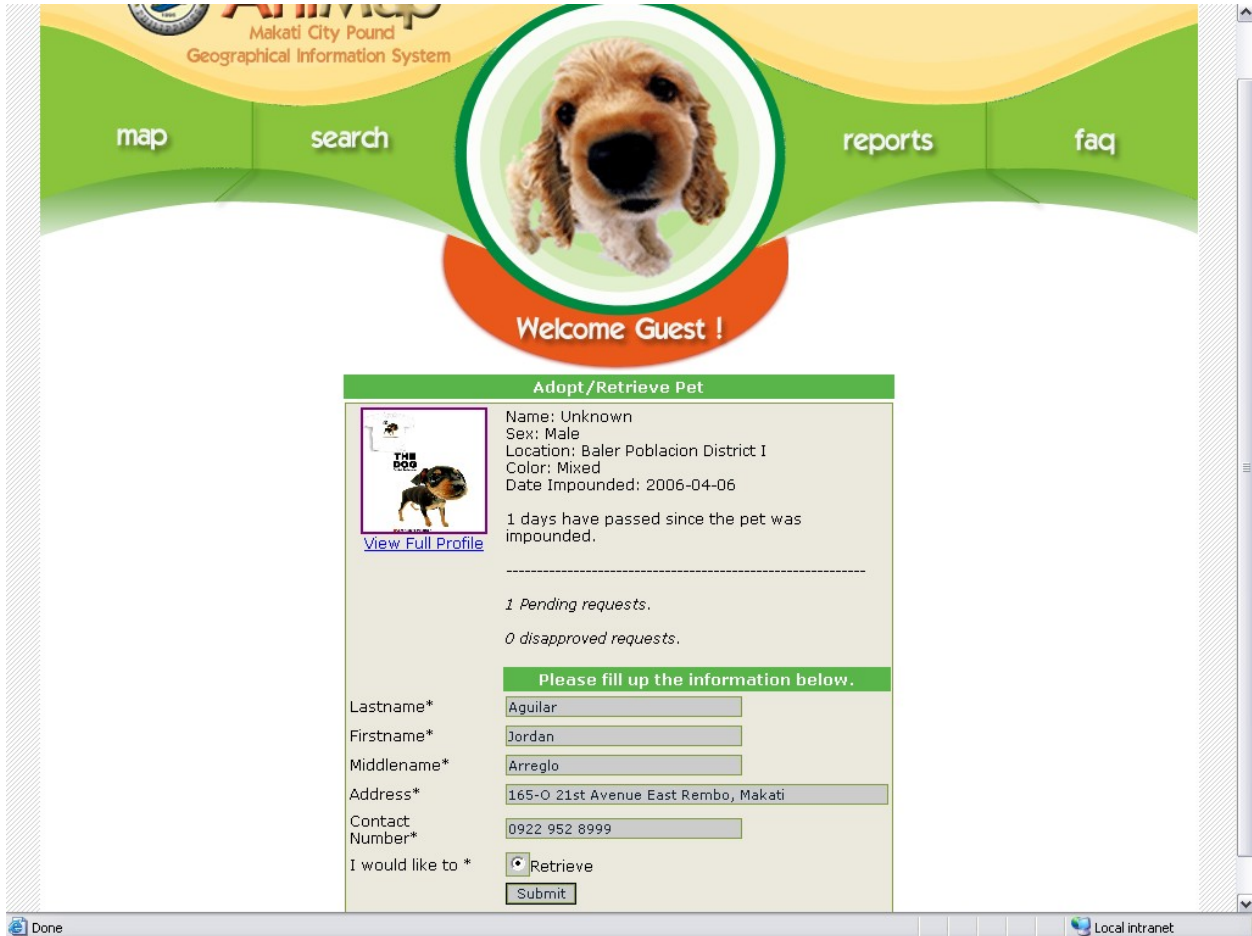
Figure 25 Adopt/ Retrieve Pet Page, AniMap

The input part of the report module is seen in Figure 26. Values of from and to dates are required to process the page and generate the report. The resulting report following the date interval inputted at Figure 26 is shown in Figure 27. This image displays statistics on the impounded dogs for a specific time interval and for the different *barangay* chosen.

Figure 26 Choose Report Values Page, AniMap

36

Figure 27 Report Page, AniMap

Add Impounded Dog page of AniMap shows where records of impounded dogs are added in the system's database using the integrated SVG map and processed using forms and PHP scripts. This functionality together with the edit impounded dog and query by month and by year can only be accessed by a Pound Officer. (see Figure 28)
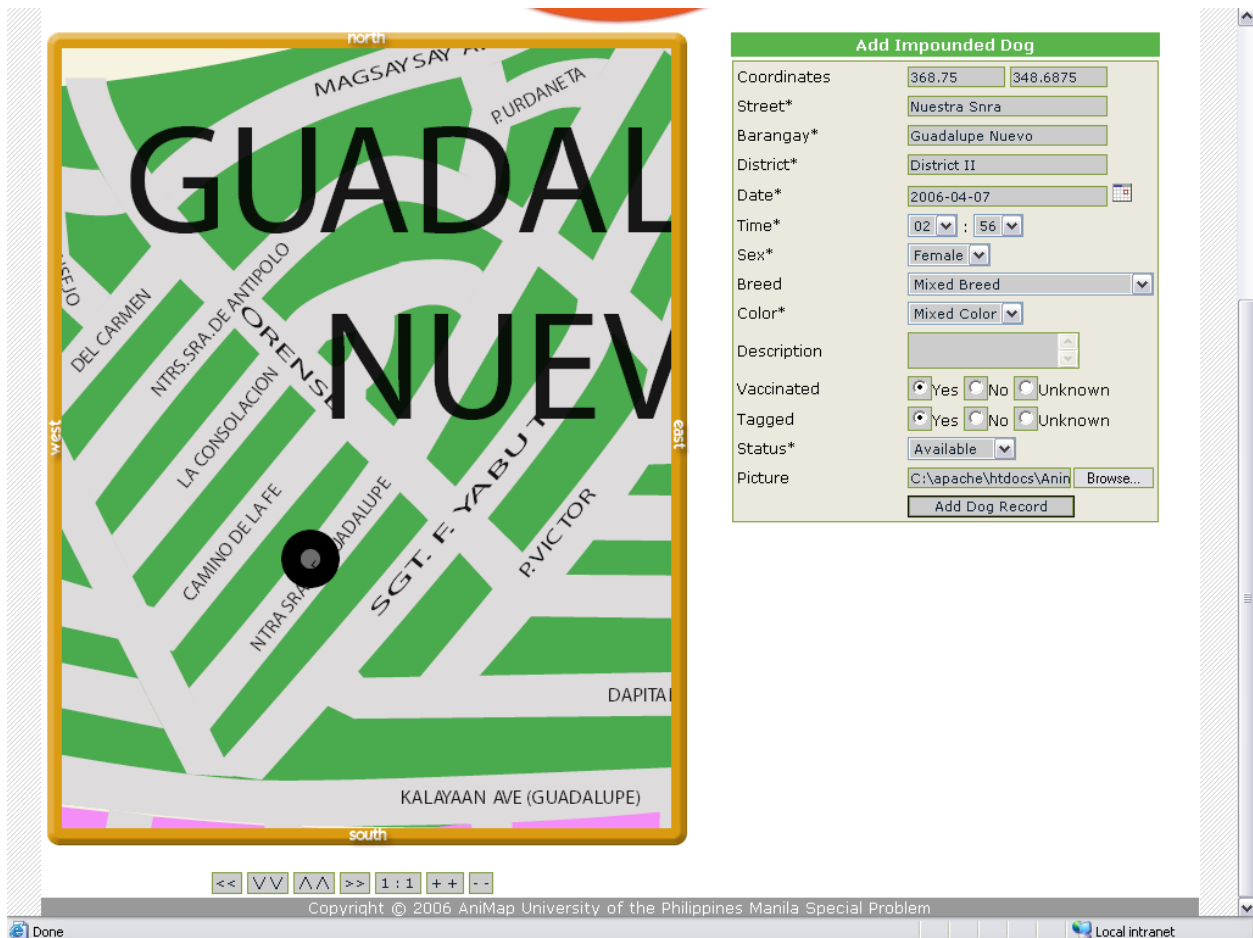
Figure 28 Add Impounded Dog, AniMap

Figure 29 shows the Edit Impounded Dog page wherein information about the dog can be edited except the date and time the dog was impounded. It allows the user to move the location where the impounded dog was found using the SVG map.
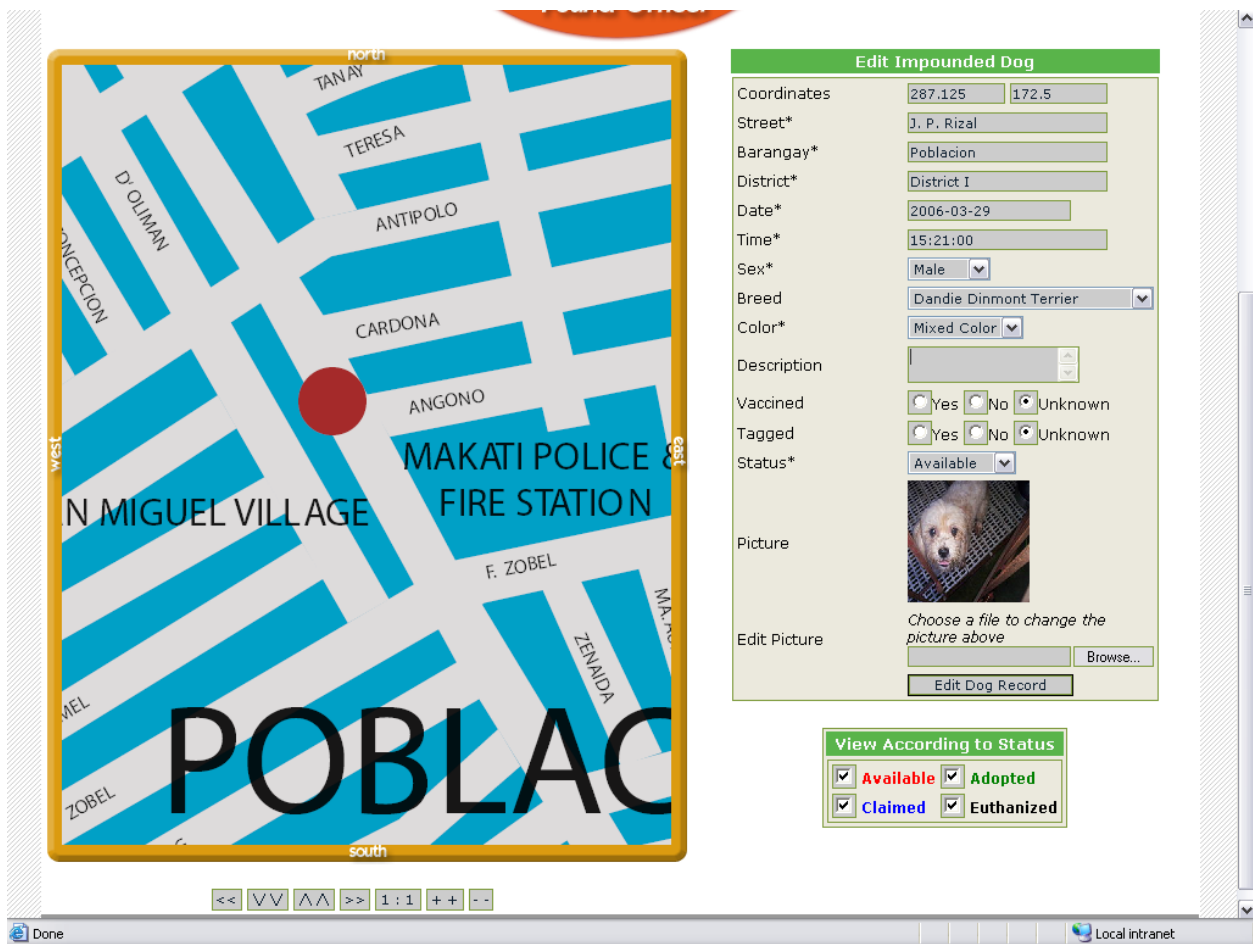
Figure 29 Edit Impounded Dog Record, AniMap

The adoption and retrieval requests confirmation page is seen in Figure 30. The user can also view the other requests as they are classified at the left part of the said page. Application for adoption and retrieval are confirmed using this form as depicted in Figure 31. The Pound Officer has the discretion to approve or disapprove applications.

Figure 30 Adoption/ Retrieval Confirmation Page, AniMap
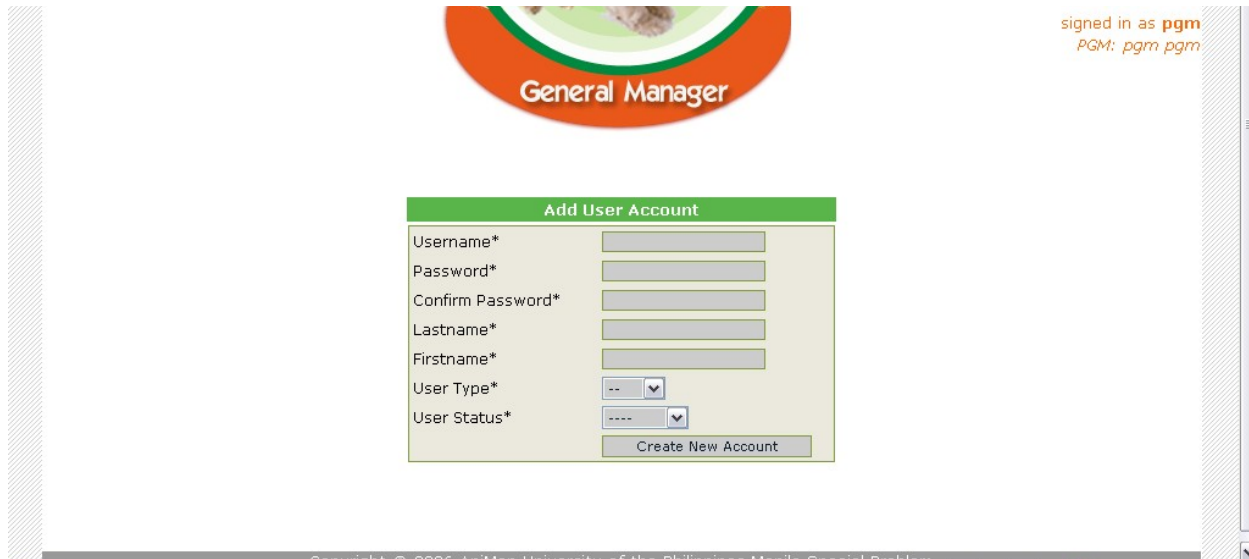
The add user account module shown in Figure 32 is a functionality of the system granted to the Pound

General Manager which also acts as the System Administrator. He will be able to add a new user of

the system using this page. Figure 33 shows the edit account functionality. The system administrator

can edit and view details about a user as well as activate and deactivate a user's account.
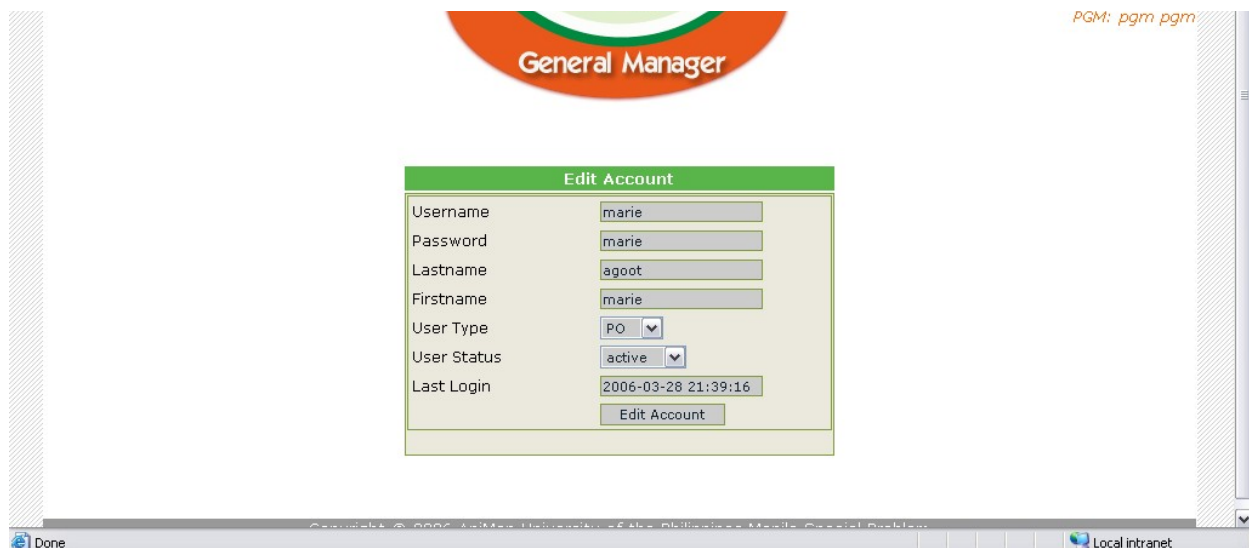

Figure 32 Add User Account, AniMmap

Figure 33 Edit User Account, AniMap

The Pound General Manager can add and edit an FAQ using the interface shown in Figure 34. He can

update the contents of the FAQ page as illustrated in Figure 35.

Figure 34 Manage FAQs Page, AniMap

Figure 35 FAQs Page, AniMap

Figure 36 shows the View Collections Page. It shows the collections for the current month. Collections

for the previous years can be accessed using the links at the left side. Update Billing Amount interface

is shown in Figure 37. It allows the Pound General Manager to edit values of the fees for

adoption/retrieval.

Figure 36 Collections Page, AniMap

Figure 37 Update Billing Amount, AniMap

42

Every registered user is allowed to edit his password given that he will provide his old passwords as depicted in Figure 38

Figure 38 Change Password, AniMap

Discussion

AniMap: A Web-Based City Pound Manager and Geographical Information System is a web-based

system that uses client-server standard for the management of data. It uses an SVG map wherein

location of the instances of dog impounded can be mapped. The system uses the PHP "session"

feature which keeps track of the user's login data. These session variables are used in the system for

determining the user's viability to access a particular page. Security is ensured using this feature but it

sometimes leave session expire messages for some pages when the back button is clicked.

AniMap's main SVG map is made using Adobe Illustrator. Its code is generated through its built-in

"Save as for Web" feature. JavaScript is used in the mouse events on the map. For instance, it

allows the user to know the name of street, barangay and district when mousing over a location.

The instances of impounded dogs shown as dots in the map also convey some data when moused

over. JavaScript is also used to dynamically add and edit an instance of impounded dog in the

map. The map is also designed to mark the map with the instances of impounded dogs only on

surfaces where a street is drawn. In order to display the instances of impounded dogs on the

map, PHP code is added at the bottom of the page of some of the maps. These are needed to be

able to query the database for records of impounded dogs. The resulting map with the SVG codes

and the embedded PHP scripts are renamed from ".svg" to ".psvg". Some Apache server

configuration files are also configured for it to read the scripts inside the PSVG files and properly

display the map on the user's screen.

JavaScript is used to populate the input boxes when an instance of an impounded dog is clicked. A dog

paw is surrounded around the chosen dot in order to distinguish it from the others. Ordinary

users and the Pound General Manager are not allowed to add and edit information about the

dogs. All registered Pound Officers are allowed to edit any dog record.

The dots are colored differently on the map according to the dog's current status. All users are allowed

to view the map containing details about the impounded dogs. They are also allowed to click on

each of the dots to view the more detailed dog information. On the other hand, the query module allows the pound officer to view the impounded dogs according to year and month.

AniMap also allows the ordinary users to search the database for dogs available for adoption and retrieval. With this feature, they can view the dog's full profile. Application for adoption or retrieval is easier with AniMap since user's intent to adopt or retrieve a dog is easily passed through the online adoption and retrieval. The number of pending requests and disapproved requests are also displayed. The person who wishes to adopt or retrieve a dog must be physically present in order to fully finalize the request. The requests are approved and finalized by the Pound Officer. After the request has been approved using the "request" module on the map, the user is given a bill indicating the expenses and other miscellaneous charges that is yet to be paid by the person.

All users are allowed to view the reports regarding the impounded dogs. The "report" module allows the user to pick up a date interval of the summary report and the location/s. After submitting the form, the users are given a report containing statistics on the impounded dogs over that specified interval. The report is shown in a tabular form. The Pound General Manager on the other hand can view the report on the collections from the adoption and retrieval. He is provided with the name of the person who gave the payment and the details regarding the payment given. All users can also view the frequently asked questions concerning the care of dogs, the mandate of the City Pound and the adoption/ retrieval rules and regulations.

All registered users are allowed to edit their passwords. The Pound General Manager is the only user allowed to add and edit other account's information. He can activate and deactivate a user account by setting its status to active/inactive respectively.

AniMap is a system manages data effectively and easily. Generation of reports is easier with the system. The creation of AniMap through its online application for retrieval and adoption will greatly help the owners of the dogs to claim their pet immediately as well as give chance for other people to adopt an unclaimed pet.

There is a need to regulate the proliferation of strayed dogs in the streets to maintain cleanliness and to prevent the continuous growth of these dogs. To address to this problem, dog adoption and retrieval is done in different municipalities and *barangay*. Different areas have different regulation in the retrieval and adoption of impounded dogs. Dog retrieval verification process is not 100% reliable since at the present, there are insufficient records that may link the owner to the dog. The officers of the pound only rely on the interaction of the claimant with the dog. The viability of a person to adopt a dog is also at the discretion of the pound officers and the background investigation sometimes done by NGO's.

Conclusion

 "AniMap: A Web-Based City Pound Manager and Geographical Information System" for Makati has been created with the following capabilities:

1. allows the city pound officer to:

    a. Update dog record

        i.   Add dog record via GIS

        ii.   Edit dog record

    b. Query for impounded dog information on the Makati Map

        i.   By month

        ii.   By year

    c. View reports

        i.   Number of claimed impounded dogs in a particular area over a specified period of time

        ii.   Number of adopted dogs in a particular area over a specified period of time

        iii. Number of euthanized dogs in a particular area over a specified period of time

    d. Approve adoption/retrieval requests

    e. Edit account information

2. allows users to:

    a. Search for impounded dog

        i.   Still in custody for adoption or retrieval

        ii.   Euthanized dog in the current month

b. Apply for retrieval of a dog online

c. Apply for adoption of an impounded dog online

d. View Reports and FAQ's

    i. Number of claimed impounded dogs in a particular area over a specified period of time

    ii. Number of adopted dogs in a particular area over a specified period of time

    iii. Number of euthanized dogs in a particular area over a specified period of time

    iv. Frequently Asked Questions (FAQ's) in the proper care of dogs

3. allows the Pound General Manager acting as the System Administrator to:

a. View Reports and FAQ's

    i. Number of claimed impounded dogs in a particular area over a specified period of time

    ii. Number of adopted dogs in a particular area over a specified period of time

    iii. Number of dogs euthanized dogs in a particular area over a specified period of time

    iv. View amount collected for the adoption/retrieval applications

b. Update user accounts

    i. Add user account

    ii. Edit user account

    iii. Activate/deactivate user account/s

c. Update FAQ's on the proper care of dogs

d. Update billing amount

e. Edit account information

VI.   **Recommendations**

By addressing the following concerns, the system could further be improved:

- Updatable color scheme for the map and the dot instances - The system at this moment uses predefined colors for each of the *barangay* and for each of the classified dot instances. A database is needed in order to reconstruct the system with customizable colors.

- Uploaded images of dog impounded should be seen as the user mouse over a dot instance in the map.

- Customized retrieval/adoption grace period- This could be implemented by making a new interface that could change these values.

- For faster loading of the map, it's size should be minimized using a compression technique, possibly using gzip.

- Add more visual enhancements in the SVG map.

- Add a pie chart when reports are displayed.

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APPENDIX

A. Makati City Pound Impounded Dogs Record Sample

B. Pound Notice

C. Makati City Pound Retrieval/Adoption Record Sample

D. Makati City Pound Adoption Form

E. Makati City Pound Order of Payment Form

F. Makati City Pound Monthly Report Sample

G. Source Code