Bilkent University

Department of Computer Engineering

Senior Design Project

HelPet

Final Report

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1. Introduction

For the maintenance of a balanced ecosystem, we cannot consider a world without animals. However, as the cities becomes bigger and wider, some of the animal species such as dogs, cats, birds, etc. start to live in the cities with us 'humans'. Some of us prefer to live with the animals and own them as pets but some of us do not prefer that. For the pet owners, having pet requires too much responsibility and attention. In other respects, without any human support, a lot of animals try to live in the crowded and dangerous cities. To help both pet owners about their pets and the stray city animals, we will develop an android application HelPet.

According to American Veterinary Medical Association, only in U.S.A. there are almost 44 millions of household dog owning, 36 millions of household cat owning and 3 millions of household bird owning [1]. For each household, veterinary visits per year is almost 3[1] .Thus, there is a huge need and market for pets and their care. By the help of HelPet, pet owners can easily manage their pets care. An android application HelPet can be reached by anybody who have the Internet access and smart phones to get help for their pets. Also HelPet users can have a profile for their pets if they want to breed their pets with others which they want to pair according to their profile. In addition, according to statistics of American Society for the Prevention of Cruelty to Animals, the %15 of the pets gets lost [2]. Thus, as a solution for that issue, HelPet users also can find their lost pets by sending their photo and location where pet is lost and by the help of the deep-learning pet owners receive the notification if the system notices their animal among the dataset of the animal photos which the other users share. Pet owners also can find a temporary caretaker for their pets if they have to leave their pets for a while and report the caretakers performance by rating them. Lastly, HelPet users can ask question about animals, get answers about users and get tips about the animal care as notification.

On the other hand, there are numerous city animals which have not got any house or owner who support them to live a healthy and happy life. According to presentation of Prof. Dr. Tamer Dodurka, there is no information about the number of pet dogs and stray dogs in Turkey [3]. However, according to Dodurka, in the world %75 of the dog population consists of the stray dogs and only in Italy, %25 of the pet dogs is abandoned by their owners into the

city streets [3]. To help the stray animals, animal lovers can report an animal which needs any help by taking the photo of it, specify the location and send it to the HelPet. This reporting will be sent to the nearby animal care volunteers as a notification and make them to be aware of the animals that need help. Also users can report the dangerous animals to protect people and also the other animals.

In the following parts of this report, the low-level properties and the design of HelPet will be described. Firstly, the design trade-offs of the system and the engineering standards will be discussed. Secondly, packages of the system will be described briefly with diagrams according to the model-view-controller architecture pattern. Thirdly, the class interfaces in all packages will be shown according to model-view-controller architecture.

2. Product Scope

2.1 Project Objectives

As a team, we aim to come up a with a marketable product given a time and budget restriction. The target customers of project Helpet is volunteers and pet owners.

2.2 Sub-phases

Our development period consists of 3 three main phases: Analysis, Design and Implementation. For the analysis part we tried to define the requirements of our project. For the design phase we tried to model a solution by referring to the low-level and high-level design guidelines. For the implementation phase we tried to implement the modeled solution with available tools and technologies.

2.3 Tasks

Tasks that are sub-parts of the implementation phase is listed below.

2.3.1 Front-end development

Visual design of the is made with the programs called Adobe XD CC, which is a graphical user interface design program and Android Studio, which is the program to add functionality to the GUI elements.

2.3.2 Back-end development

Logic behind the application is developed with Java and Python languages. Java will be used to develop user interface back-end, and Python will be used to implement the deep learning application which is used to detect lost animals.

2.3.3 Database Integration

Data management will be handled with a web service called Firebase. It's interface will be used via Java language to query,add, and delete data.

2.4 Resources

For this application the resources required is a development environment, and a computer which is capable of running the development environment

2.5 Budget

There is no necessary budget constraint.

2.6 Schedule

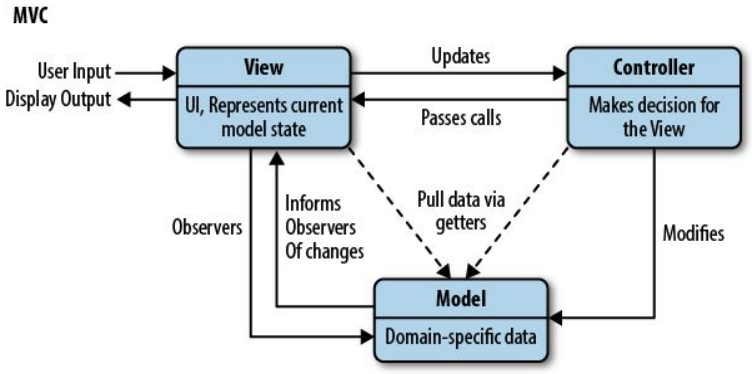
The project source code and reports must be delivered by the December 31, 2018.

3. Final Architecture & Design

3.1 Subsystem Decomposition

For Helpet, the chosen architectural pattern is Model-View-Controller(MVC). This pattern separates and classifies the software to three main components that are UI elements to be visualized, data to be hold and requested, and control elements that will pull/push requests to the other components in order to ensure the data flow. MVC pattern provides sufficient and genuine features and it's in a harmony with the design decisions made by us, developers.

Each package is visualized separately. Model package allows queries run by the controller package to access the related animal or user data. Another package View manages the user interface elements. It allows user to navigate through the application by providing the related page views for each panel requested by the user. The third package controller provides the system's main functionality with a collection of the subsystems. Controller acts as a bridge between model and view packages, getting the data from model, processing it, and demonstrating the results with the view package functionalities.



3.2 Hardware/Software Mapping

User interacts with the android application but to do that, an internet connection is needed. Firebase requires an internet connection for many features like uploading pictures, viewing dog in need, looking for a mate for your pet etc. Therefore, anytime users should be able to connect to internet.

3.3 Persistent Data management

Based on the classifier of Helpet, trained model requires relatively huge space which is kept in local. Another solution to this problem could be creating a API server for the classifier which would take new pet photos as input and returns the breed of the pet as output. But this process could slow down the application. Therefore we implemented the classifier inside the application in Android Studio even it requires extra space.

4. Solution Developed in Project

4.1. Global Context

Deep learning and artificial intelligence concepts are integrated to the current software systems rapidly, yet currently there is no solid instance of finding the lost animals with such technologies used. Helpet may gain popularity due to its way of using the deep learning technology which is quite unique in its field. Deep learning and image recognition may be an interesting approach to take in terms of solving the lost pet problem.

4.2. Economic Context

The application will be free to download from Google Play Store. Everyone can easily access it, and use its functionalities without any burden. In this case, people, especially pet owners and volunteers will be more encouraged to download and use the app. In the future iterations the application may also be available for the iOS users, however currently, only Android users can access it.

4.3. Social Context

Helpet may increase voluntary action for animals in need. The app's main goal is to make volunteers easily engage with the voluntary action. It also makes life for the pet owners easier with the

functionalities it provides. Both pet owners and volunteers will be more eager to create awareness and feel more responsible for the animals in need.

5. Tools & Technologies Used

Github:

Git is a version control system for tracking changes in computer files and coordinating work on those files among multiple people. It is primarily used for source code management in software development. GitHub is a web-based hosting service for version control using git. It is mostly used for computer code. It offers all of the distributed version control and source code management functionality of Git.

Firebase:

Firebase is a mobile and web application development platform developed by Google. It is a Backend-as-a-Service. With the help of Firebase there is no need of any SQL server or code. It is primarily used for this purpose.

Android Studio:

Android Studio is the official integrated development environment for Google's Android operating system and designed specifically for Android development. Android Studio is used to generate the main mobile android application since Helpet is designed for android mobile phones.

Python:

Python is an interpreted, high-level, general-purpose programming language. Python is used to train the breeds of animals and create a pretrained model for the Android Studio.

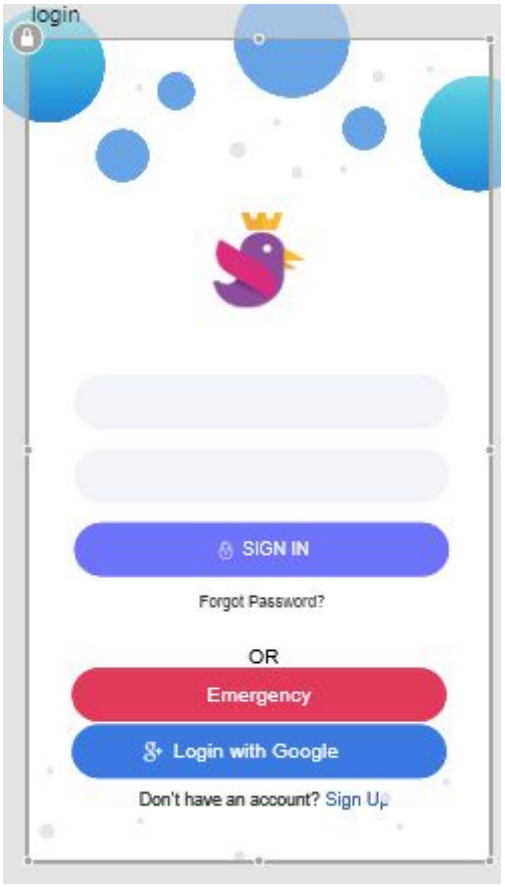
Tensorflow:

TensorFlow is an open-source software library for dataflow programming across a range of tasks. It is a symbolic math library and is used for machine learning applications

such as neural networks. In Helpet, Tensorflow is used in Android Studio to classify the breeds of pets by using the model created in python.

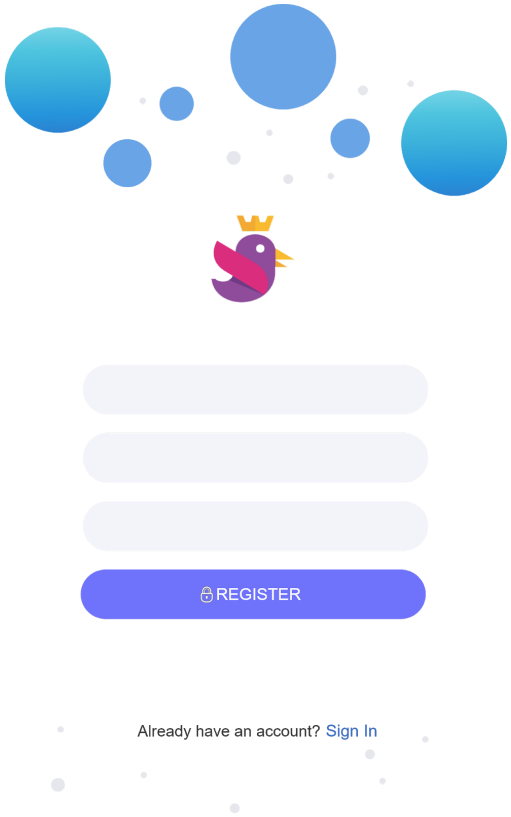
6. Software User Manual

6.1. Login Page



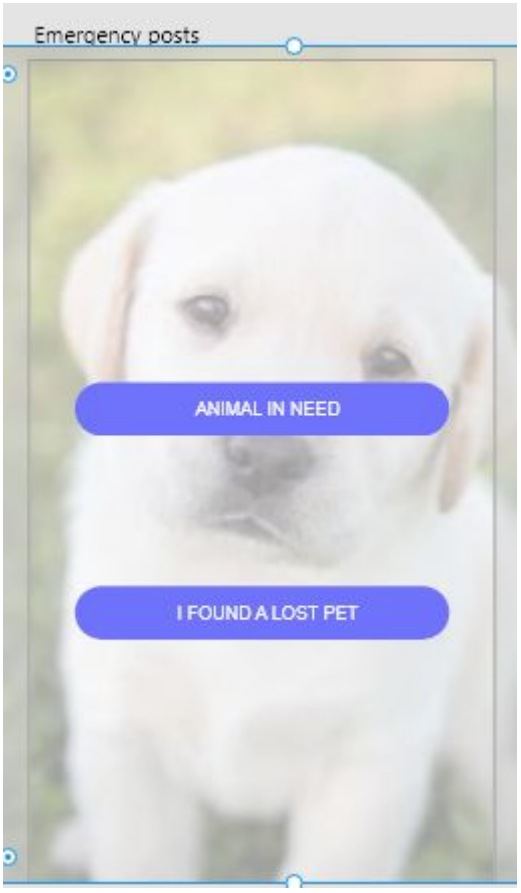
With login page, registered users can enter the system and can use all the functionalities provided via application. Each user is signs in to the system with email and password. If user has no account, registration to the system is available with sign up button. Or user can use the emergency button for urgent situations. Registration period can be easily done if user has a google account,since login with with Google functionality is also available.

6.2. Register



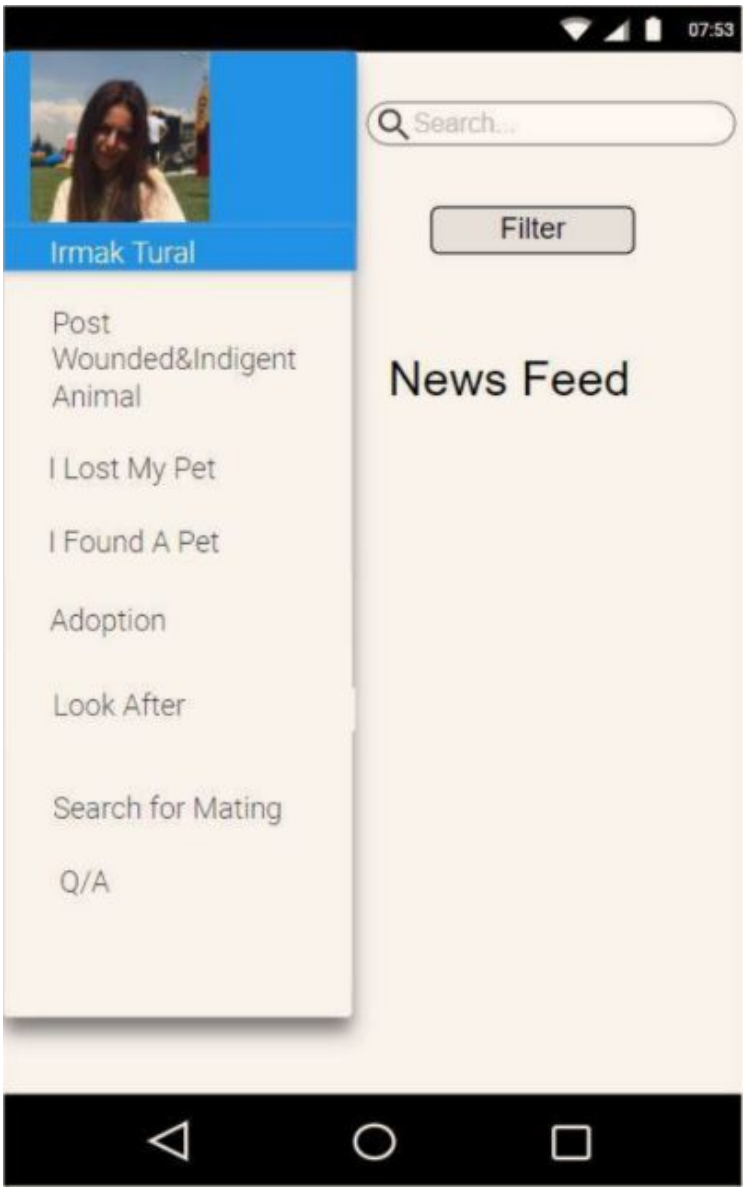
Through register screen users can sign up with their e-mail addresses.

6.3. Emergency



Emergency window is activated by pushing the button on the login screen. It enables the user to report the animal in need or lost animal directly to the system. If animal in need button is pressed, user is navigated to the post lost animal screen. Otherwise if I found a lost animal is pressed, user is navigated to the I found a pet functionality.

6.4. Homepage

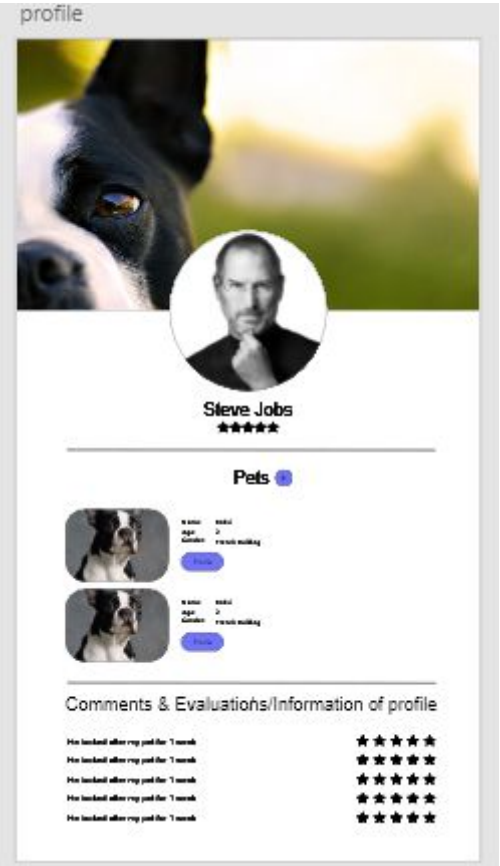


All of the entries are visualized in the homepage. Through this area, users can see the posts that are uploaded by the other users. In homepage, user can also filter the posts according to the post's type.

6.4.1. Filter Homepage

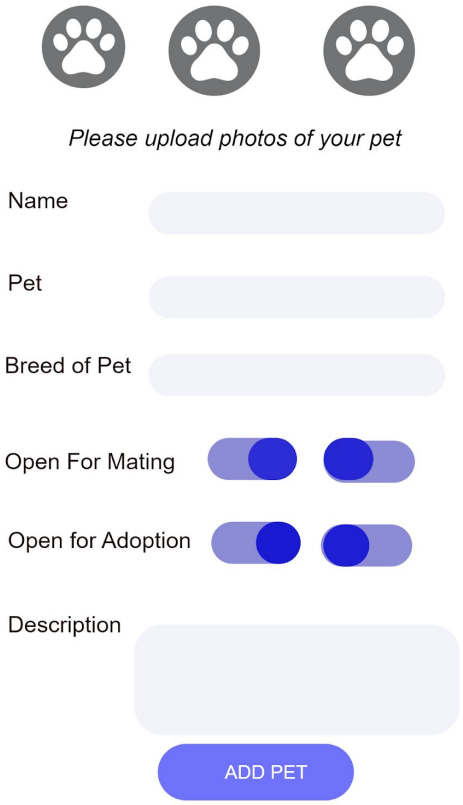
Once a post type is entered to the search bar in the main page, only the posts relevant to the entered type are visualized in the homepage.

6.5. User Profile



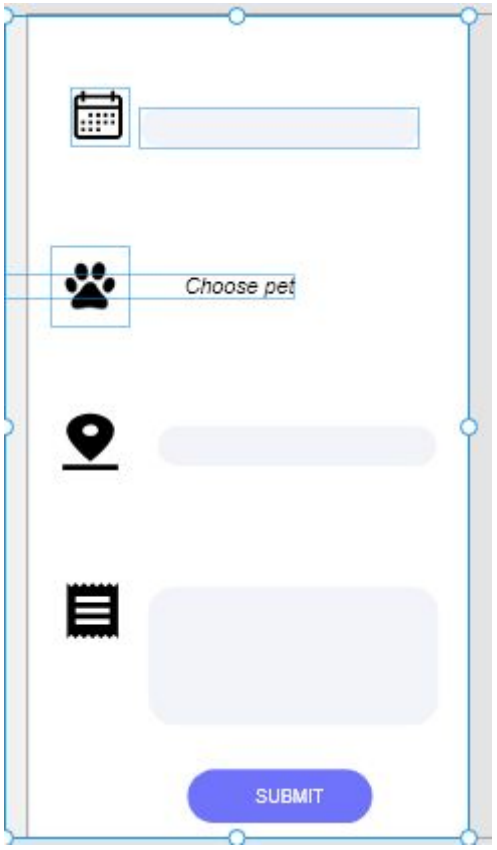
User will be able to see his/her own profile page by clicking the tab on top of the side menu choices. If the user wants to visit another profile page, it can be done by pressing the user he/she wants to visualize. Information such as pets owned by user and comments made about the user is shown here.

6.5.1. Adding a Pet to the Personal Profile



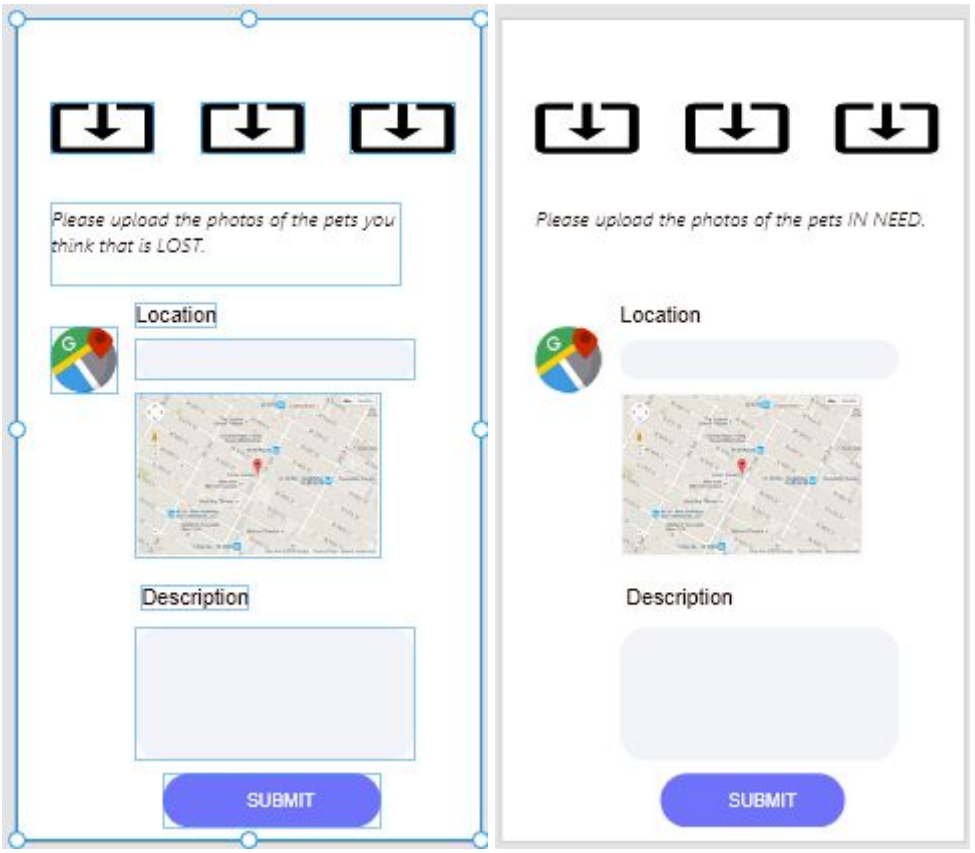
If the user wants to add a pet to his/her profile, it can be done by choosing the add pet button which is denoted with a plus sign available in the user's own profile. Pet's name, which animal it is, it's breed, vaccine period, pet's availability for mating are the information that user needs to give for the pet to be added in his/her profile. Once every field is filled, user can press the add pet button so that operation can be completed.

6.6. Posting



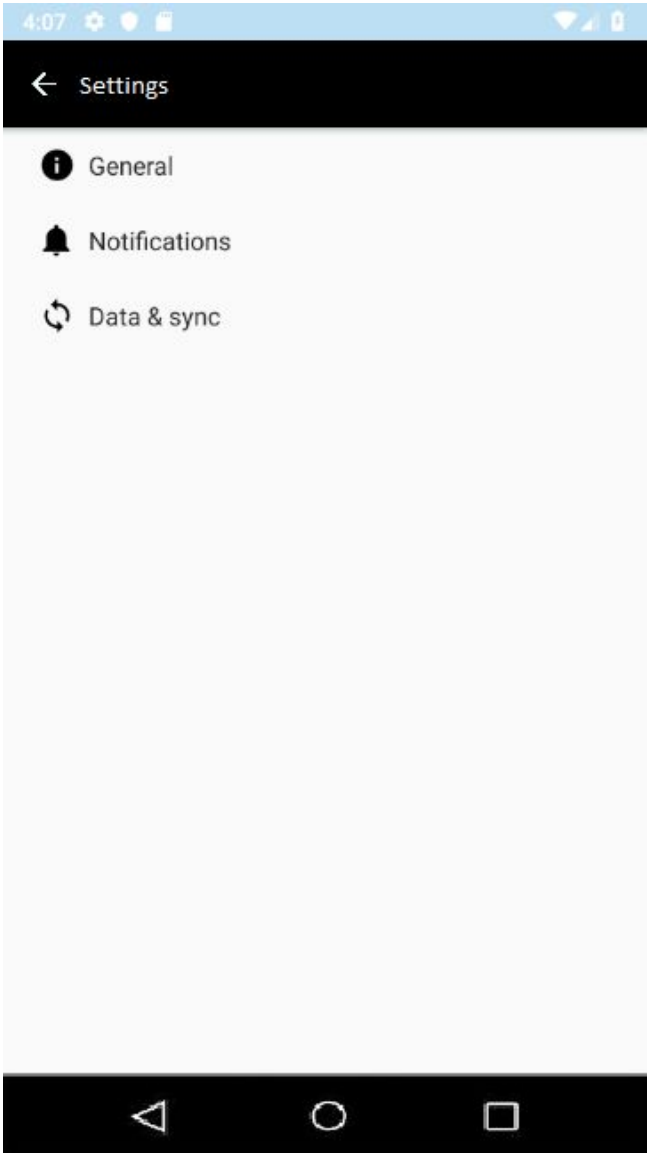
Posting interface is same for each type of adoption, look after cases. Name, which animal it is,breed, description,location fields must be filled and once they are all filled, pressing the submit button will generate the post with given credentials of the pet. User must be sure that the correct option from side menu is chosen. If wrong choice is made, user can reverse to the old page with the left arrıw button on top left, or user can access the side menu again to make the correct choice.

6.6.1. Posting Lost Pet or Indigent Pet



Both posting lost pet and indigent animals has the same interface. The information is provided for lost or indigent animals is location, description, and photographs of these animals.

6.7. Settings



Users can access settings page via side menu or by accessing the three dot notation which also allows user to logout from the system. In settings, user can find general information about application, change the notification sounds, or set the data and synchronization options as desired.

7. References

[1] "U.S Pet Ownership Statistics", Avma.org,(2012).[Online]. Available: https://www.avma.org/KB/Resources/Statistics/Pages/Market-research-statistics-US-pet-ownership.aspx. [Accessed: Feb. 17, 2018].

[2] "Lost Pet Statistics: Survey Looks At Likelihood Of Finding A Missing Dog Or Cat" , *The Huffington Post*, November 7, 2012.[Online]. Available: https://www.huffingtonpost.com/2012/07/11/lost-pet-statistics-survey-dog-cat_n_1662860.html. [Accessed: Feb. 17, 2018].

[3] Tamer Dodurka, "Köpek Popülasyonunun Yönetimi", turkvet.biz, May. 2012.[Online]. Available: www.turkvet.biz/yazi/hr_kopek_pop_yonet_dodurka.pps. [Accessed: Feb. 17, 2018].