Tecnológico de Monterrey

Programming Languages

Final Project

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Index:

Context of the problem:

Abandoned animals are a big problem in Mexico, there are many animals living in the streets or in refuges waiting for people to adopt them. Because of this there are many associations which promote adopting pets. They create campaigns to fertilize pets for a low cost and promote the adoption of pets they take care of.

According to the Mexican Senate there are 28 million pets of which 70% are abandoned. Associations like “Segunda Oportunidad Queretaro A.C” make campaigns and share information regarding pets that are in adoption.

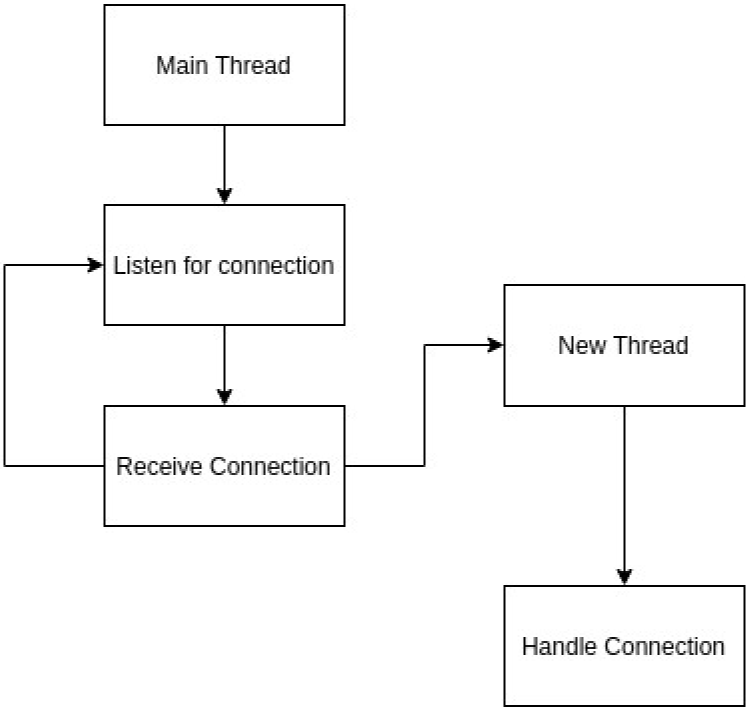
The development of an application to improve the awareness of the adoptable animals and adoptions campaigns might improve the probability of those animals to find a new home.

There are many applications in social media like Facebook or Instagram where applications using image processing match the users face with other people or fantasy characters. This applications like Google Arts & Culture which matches people's faces to paintings have gone viral and created a lot of attention. An app with the same idea, matching people's faces to adaptable pets might create a similar reaction.

Solution:

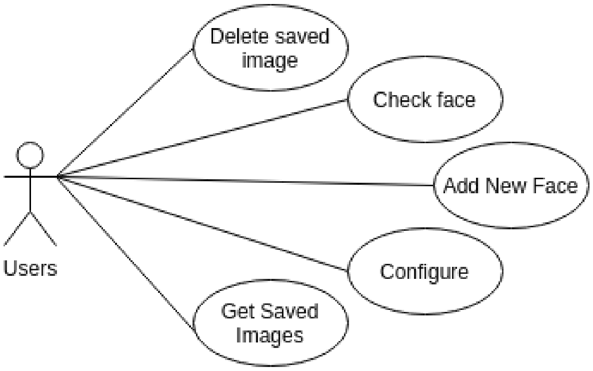
The possible solution is a web app designed to help animal adoption campaigns and events. It has one main purpose: Match an adoptable dog with a possible adopter using image processing. This app has an HTML5 interface and a backend running in Java. The users will be able to upload a picture of a possible adopter and get a match for an adoptable dog in the campaign.

The Java app will work as a server, communicating with hosts trough GET messages. Since it will have to communicate with multiple hosts at the same time it will need to create a new thread for every request. A thread pool was implemented so the host can handle up to 100 requests at the same time, any extra threads will be added to a queue.



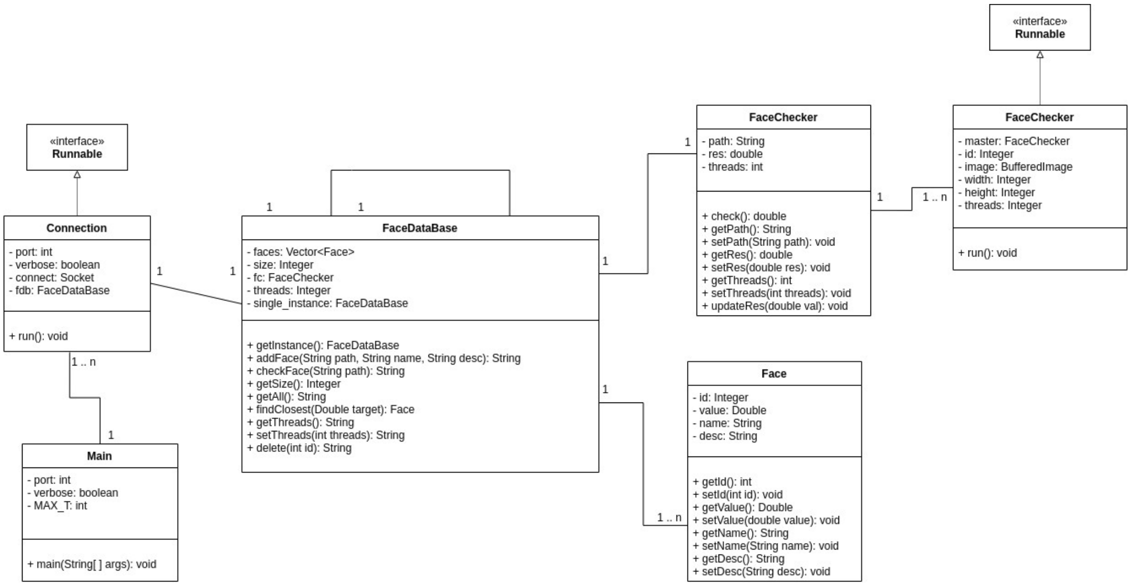
The server will create a thread for each connection.

The user of the web app will be able to add adoptable animals to the animal database in the server, delete adoptable animals in the server, configure the number of threads used on the processing of images, get a list of saved animals in the server and upload the image of a possible adopter to the server to get a match from the server.



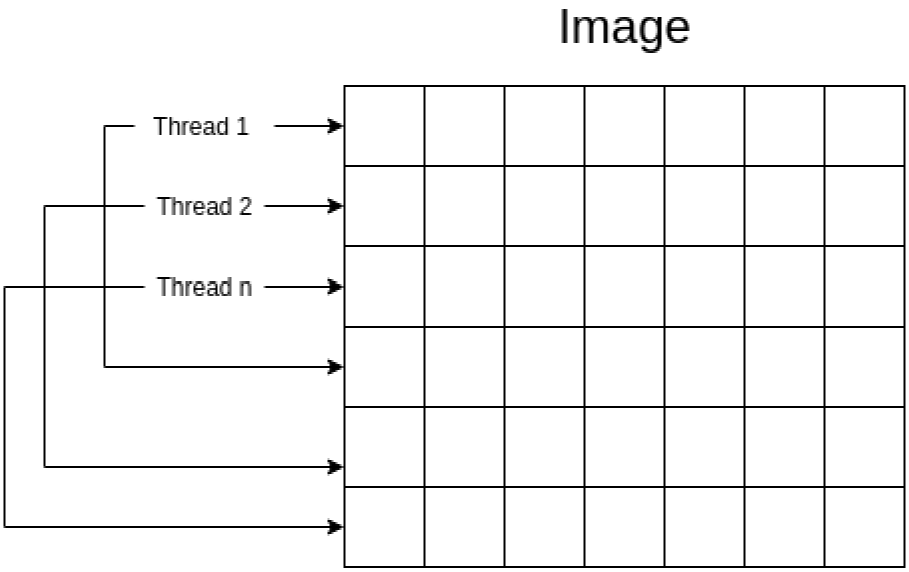
Server Use Cases

The Java server has an Animal database, which saves the path to the picture of the animal, the name, the description and the value given to the image by the Image Processing. This database is implemented using the Singleton pattern so every new thread connection access the same *FaceDataBase* object. The methods implemented in the database are synchronized, because many threads may access the objects at the same time.



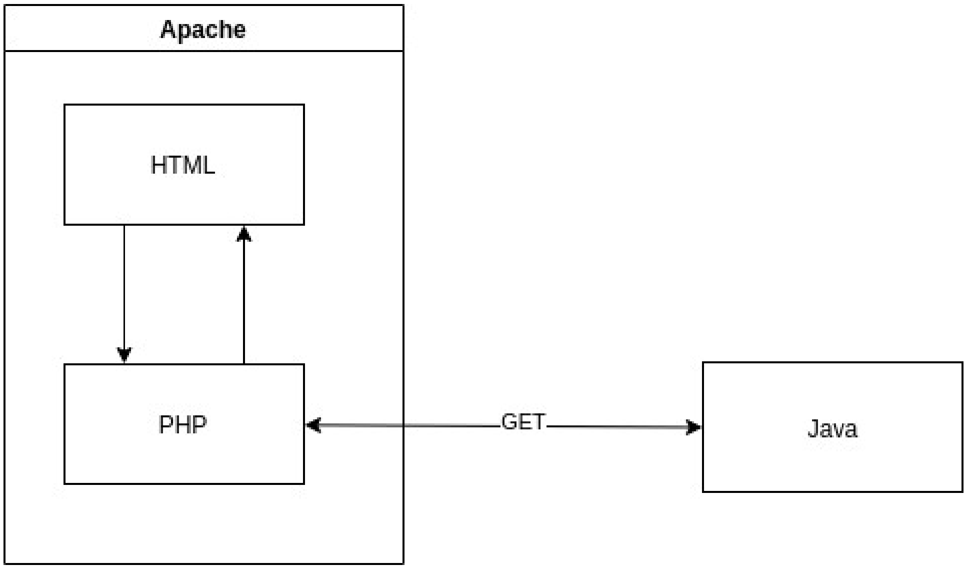
Class Diagram

The server processes the images using threads. It saves the pixels in a matrix and assigns the configurable number of threads (default 4) to process the matrix. Every thread is assigned to a row in the matrix and for every pixel it gets the Red, Green and Blue value and divides it by 3. The server then adds up the value of every pixel and divides it by the number of pixels in the image. The value is divided by the number of pixels so any image, regardless of the size has a consistent value.



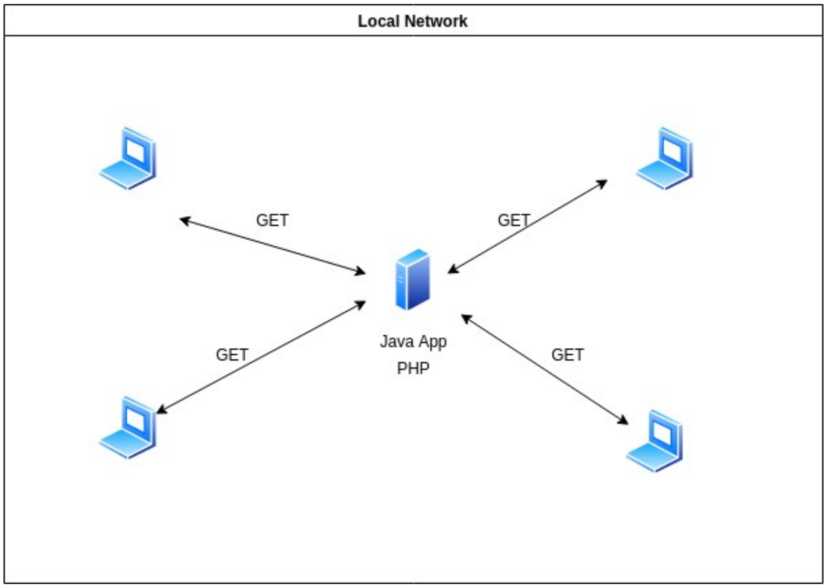
Representation of the threads working on an image

The interface will be running on HTML5 and it will need apache for php to run properly. This web app will handle the requests for the server. It will upload the images to the server and give the paths of the images to the Java app using GET messages. This interface can be further developed by the associations using the application, so it can be customized for each event.



Current Configuration

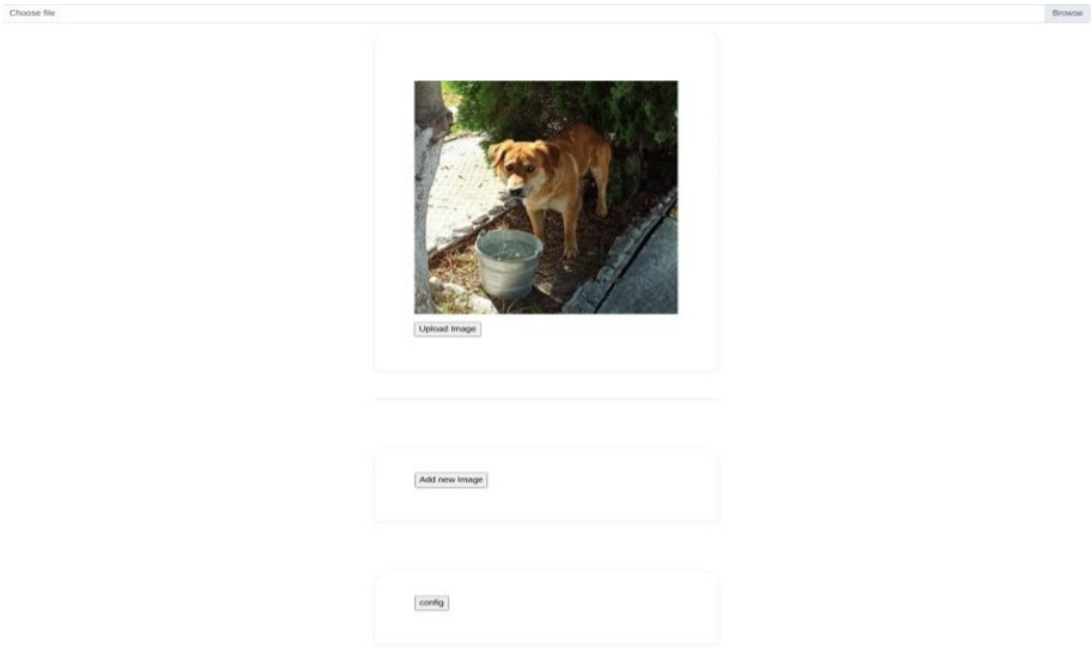
A deployment option with further development is to run the PHP configuration and the java app on a server, and have multiple computers in a local network on the event running the app. This way many of the possible adopters will be able to use the application and see which animals they match with. Currently the app is only made to run on one computer which can be carried to an event and used to match the eventgoers with animals on the database.



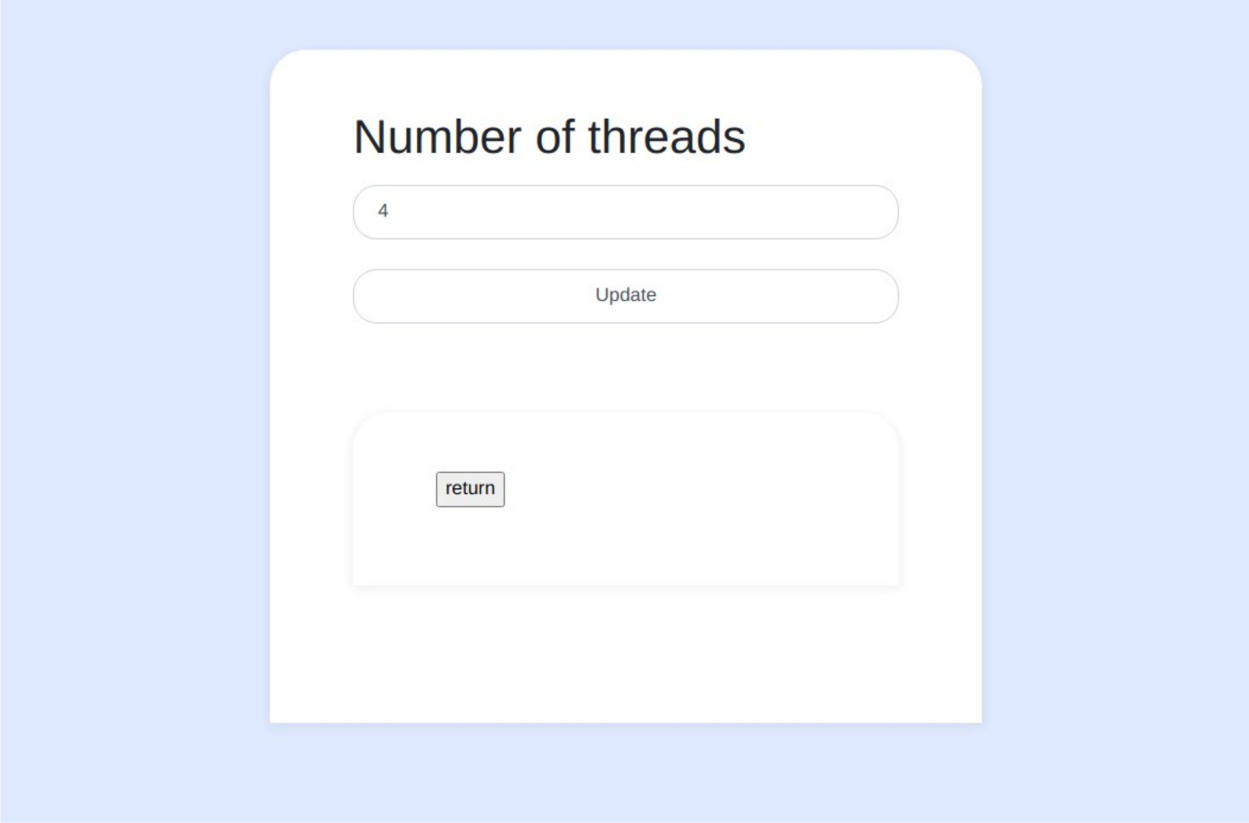
Possible implementation

Results:

The result of the project is a running web application working with the java server. It is deployed in apache and can run all the use cases. The use cases were tested using the interface and the server was tested using a Linux script.



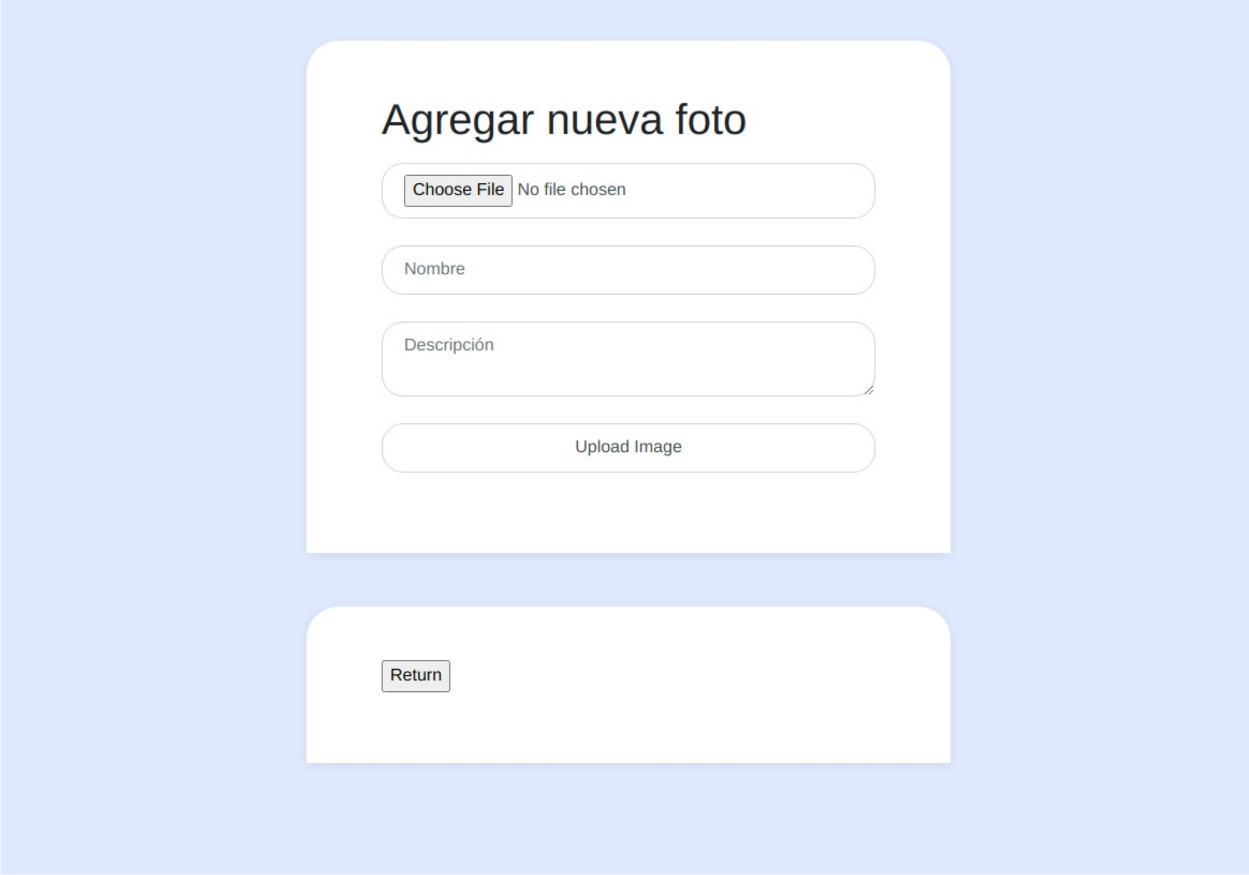
Main interface



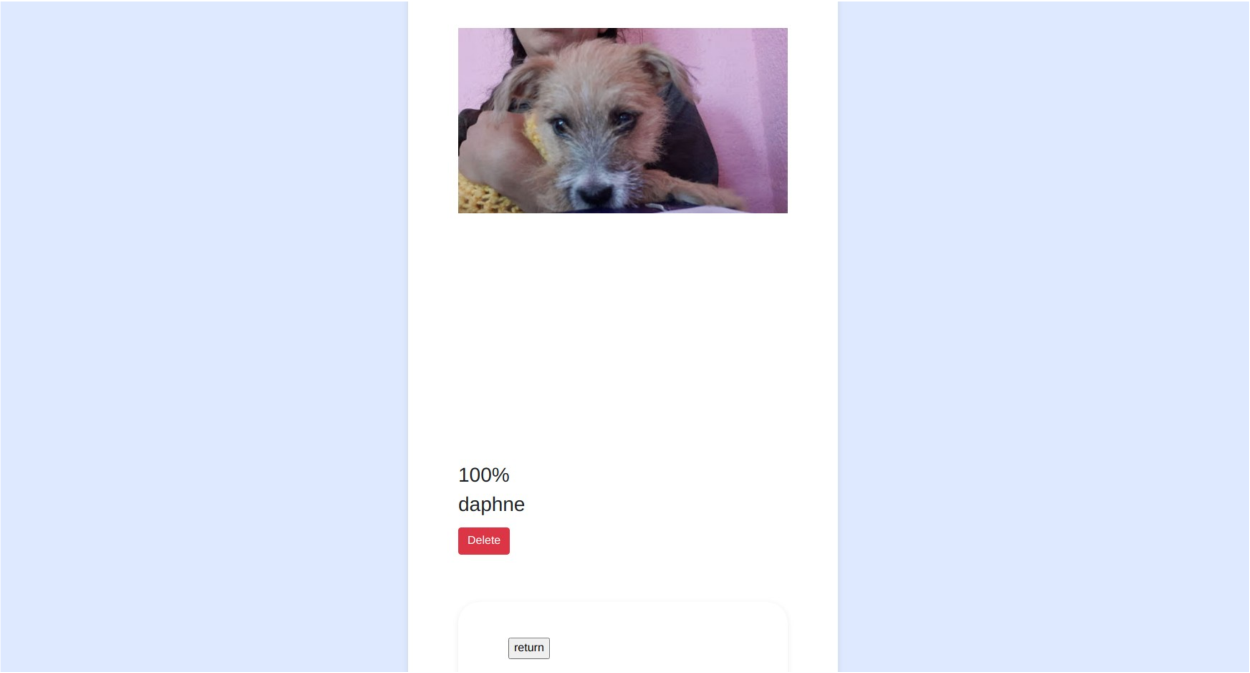
Number of threads

4

Configure Interface



Add new image interface



Result Interface

The project is allocated in GitHub and has a GNU license, it was also given to an association which works on dog adoptions. The program will be used when there is an in-person campaign after Covid-19 restrictions stop. The GitHub releases can be found on the evidence section.

Tests:

Thread speed up test (in nanoseconds):

Number of Threads

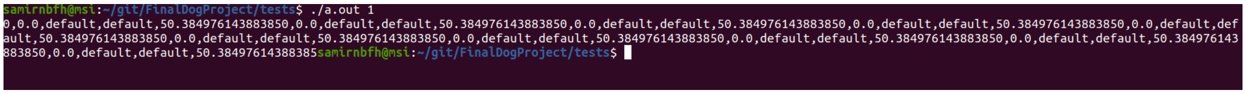
4	8
19600418	17626266
14873168	16332464
19495569	14439821
19779526	15981321
20607042	15352608
19405369	16613543
19001923	16971155
20719462	15534436
16116686	18166853
17203371	14928536

Image used for this test

	Average
4 Threads	18680253.4
8 Threads	16194700.3
Speed Up	15.35%

Java server request test:

In order to test the capability of the server to handle multiple requests a script was written which sends N number of requests to the server:



```
samirnbfh@msi:~/git/FinalDogProject/tests$ ./a.out 1
0,0.0,default,default,50.384976143883850,0.0,default,default,50.384976143883850,0.0,default,default,50.384976143883850,0.0,default,default,50.384976143883850,0.0,default,default,50.384976143883850,0.0,default,def
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883850,0.0,default,default,50.38497614388385samirnbfh@msi:~/git/FinalDogProject/tests$ 
```
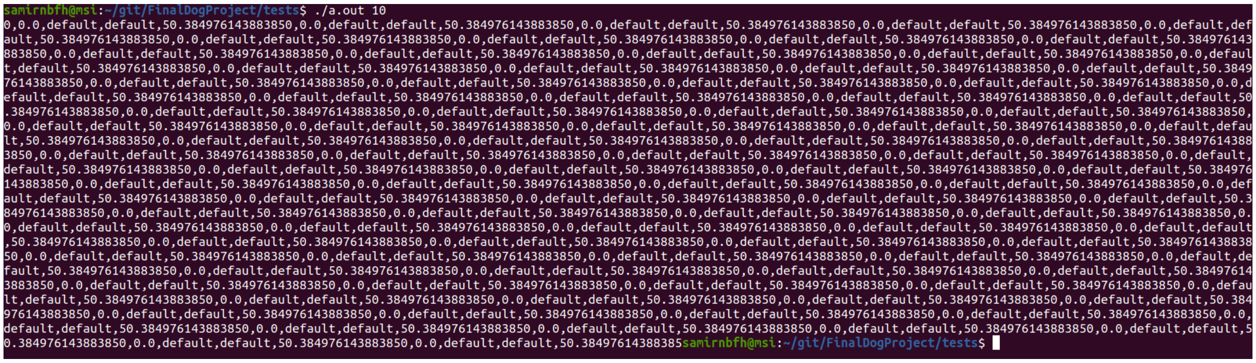

The server handles 10 requests correctly (10 simulated concurrent users)



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samirnbfh@msi:~/git/FinalDogProject/tests$ ./a.out 10
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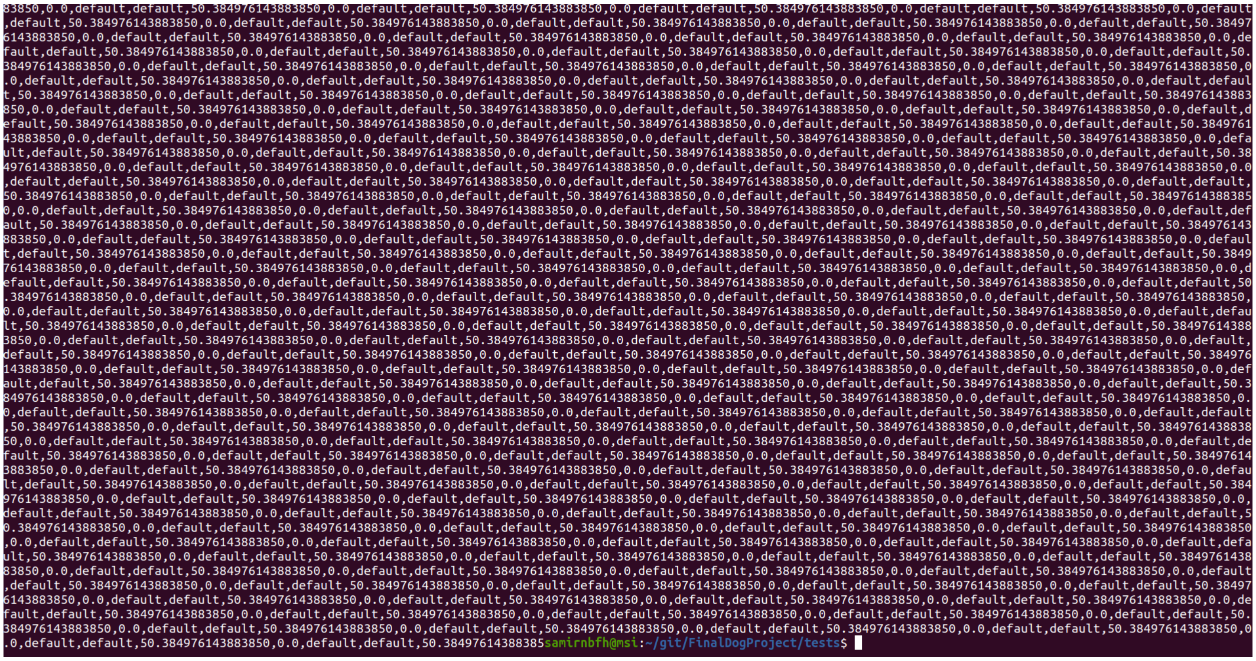
```

The server handles 100 requests correctly (100 simulated concurrent users)



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```
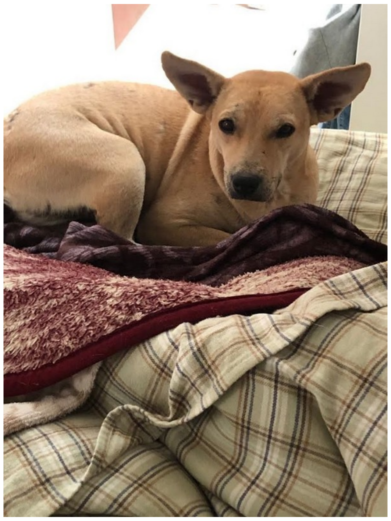
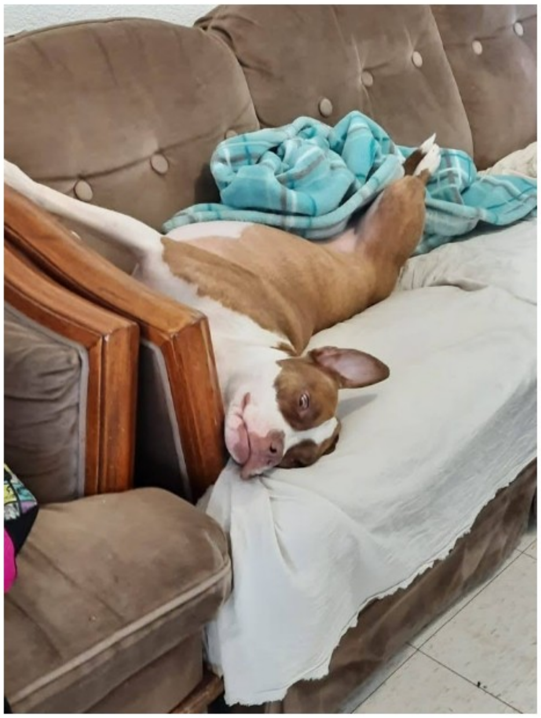

The server handles 1000 requests correctly (1000 simulated concurrent users)

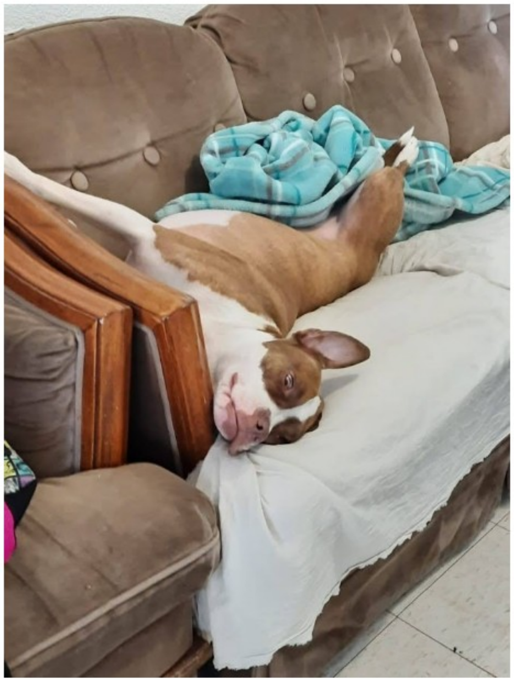
Functionality test:

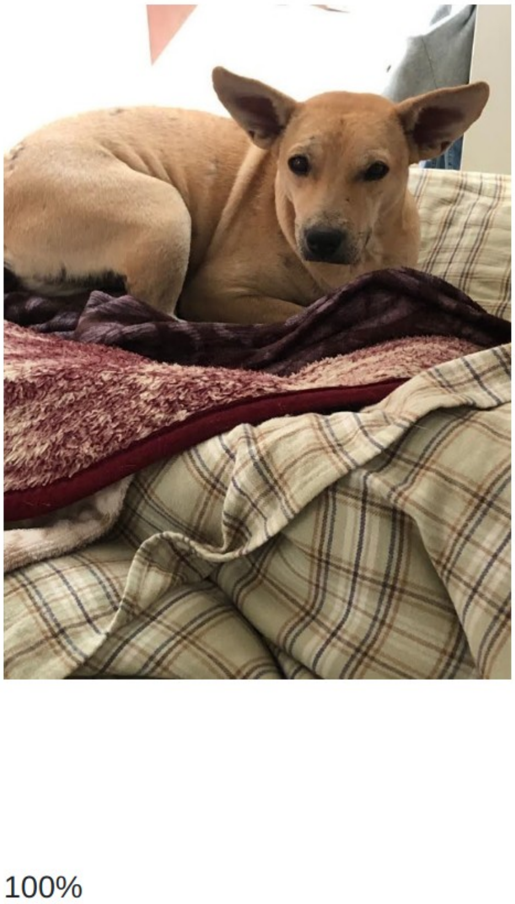
Here the main functionality of the program is tested with pictures that may be used on an adoption campaign.



Test picture

Test	*Result*
Without the picture in the database	 96%

Without any pictures in the database	 0%

With the picture in the database	 100%

Conclusion:

The development of this project made me investigate the current image and face processing applications in the market. My main idea was to implement face recognition in order to more accurately match the faces of the adopter to the dogs. This idea was soon discarded due to the lack of time for the development of this project.

The final solution which only matches pictures with the value of the colors is a simple form of image processing, but it successfully accomplished the main purpose of the project: to raise awareness of the animals in adoption. This app can be used to spark the curiosity of possible animal adopters, maybe they do not adopt the animal they match with, but they will be attracted to the event.

The success of this project when it is tested on a real-life event after the covid-19 restrictions end may spark other developers with the inspiration to create open-source projects which help with the problem of animals in adoption. I hope this project can be used to save the lives of many dogs and get them forever homes where they can be happy and loved.

Setup instructions:

Requirements:

1) Have Java Installed

https://java.com/en/download/manual.jsp

2) Have Apache running with PHP

https://www.apachefriends.org/es/index.html

3) Have PHP file upload enabled

Steps:

1) Copy *www* folder to apache

2) Run Jar in a terminal with java -jar Final.jar

3) Open localhost (apache) and the webapp should be running

Evidence.

Name	Link
GitHub	https://github.com/A01209032/FinalPL
Release v0.1	https://github.com/A01209032/FinalPL/releases
Picture matching demonstration	https://youtu.be/z6wufjWP6QU
Picture upload demonstration	https://youtu.be/aYyJA21MVQE

The following message was sent to **Segunda Oportunidad Querétaro A.C:**

Buenas tardes,

Soy Samuel Ramírez, un estudiante de ingeniería en sistemas computacionales del Tecnológico de Monterrey. Este semestre desarrollé un programa con la idea de apoyar campañas de adopción de animales. Este sistema sirve para emparejar la foto de alguna persona con un animal en adopción. Te da un porcentaje de "Parecido" para fomentar que se adopten los animalitos.

A continuación, le mando un video de cómo funciona el programa.

Este programa tiene una licencia de libre uso, pero me ofrezco a ayudarle a instalarlo y montarlo voluntariamente si es que lo quisiera usar en una campaña de adopción. Me encantaría ayudar a los animalitos y también ver mi proyecto en acción.

Le mando el sitio web donde está alojado el programa, ahí van a estar las instrucciones para descargarlo e instalarlo en caso de que lo quieran probar.

References:

Held, A. (2018, January 15). Google App Goes Viral Making An Art Out Of Matching Faces To Paintings. Retrieved November 19, 2020, from https://www.npr.org/sections/thetwo-way/2018/01/15/578151195/google-app-goes-viral-making-an-art-out-of-matching-faces-to-paintings

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