Project Experience Report

ENSE 477 - FurScan

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1.0 Project Expectations

1.1 Expected Purpose and Objectives

Our capstone project aims to develop an AI-powered mobile app that can analyse photos of animals and accurately detect health issues, such as pink eye, providing users with real-time information to ensure the well-being of their pets. At the core of our capstone project lies a profound "why" - a mission to enhance the well-being of pets and the peace of mind of their owners. Many times pet owners are faced with the dilemma of whether their beloved animals require veterinary care or not. This uncertainty can majority of the time lead to delayed treatment, potentially worsening a pet's suffering or even causing irreversible harm. Our innovation strives to make this by using artificial intelligence and computer vision. By analysing photos of animals, our app can quickly and accurately identify health problems, from common ailments like pink eye to more subtle issues that might escape the human eye. This technology not only gives pet owners critical information but also serves as a preventative measure, enabling early intervention when necessary. Ultimately, our project seeks to strengthen the human-animal bond and ensure the best possible care for our furry companions.

1.2 Expected Stakeholders and Project Audience

Our capstone project, FurScan, plans to help multiple stakeholders and target audiences, such as pet owners, veterinarians, pet care businesses, animal welfare organisations, and among others. By providing pet owners with a quick and accurate assessment of their pets' health, our app addresses the common dilemma of whether a visit to the vet is necessary or not. By making sure that we are catering to the needs of all our stakeholders and target audience, our capstone

project, FurScan, has the potential in improving the health of many beloved animals. Yet again, strengthening the human-animal bond that we have with our furry companions.

1.3 Expected Roadmap and Milestones

Our initial stages in the first couple weeks consisted of team formation and role assignment. We started doing our research on what to use to deploy our app and since we had experience using Flutter from a previous class/lab we figured this would be a good place to start. Further weeks were dedicated to adding project documentation, such as finishing Lo-Fi and Hi-Fi diagrams. MVP 1 - To be completed by December 21st, mainly consisted of the following mentioned and additionally the application giving a diagnosis on what disease the pet could potentially have given the image and/or the questionnaire. As well as detecting conjunctivitis (pink eye) for cats. MVP 2 - To be completed by March 20th, was expected to include user signup/login functionality to allow for previous usages of the app, such as past images used, questionnaires and results to be saved with a timestamp and date. Additionally also common diseases that occur for both cats and dogs. Lastly, to conduct heavy user testing with friends, families, and random people to get "unbiased" results from them.

2.0 Project Results

2.1 Actual Purpose and Objective

Throughout the duration of our capstone project, FurScan, our purpose and objectives remained the same. We successfully developed an AI-powered mobile application using Django, capable of analysing photos of animals to detect health issues such as pink eye. This technology provides users with real-time information, ensuring the well-being of their pets. Our mission is to

enhance the well-being of pets and provide peace of mind to their owners. They often face the dilemma of whether their animals need veterinary care, leading to potential delays in treatment and increased suffering. FurScan addresses this by leveraging artificial intelligence and computer vision to quickly and accurately identify health problems, ranging from common ailments like pink eye to more subtle issues that may go unnoticed by the human eye.

## 2.2 Actual Stakeholders and Project Audience

As FurScan evolved over the course of the year, the project decided to focus more on pet owners as the primary audience. This decision was made to directly address the needs and concerns of pet owners who often face challenges in identifying and understanding their pets' health issues. By focusing on pet owners, FurScan aims to provide a user-friendly and accessible platform that empowers them to take proactive steps in ensuring their pets' well-being. Additionally, while veterinarians remain important stakeholders, the app's emphasis on pet owners aligns with its mission to enhance the human-animal bond and promote better pet health outcomes.

2.3 Actual Roadmap and Milestones

      Once the project had actually started, our expected Roadmaps and Milestones were going as smoothly as we had hoped for, except for the one hiccup we had in MVP 1. This was that Flutter wasn't working exactly as we had hoped for with the AI model. Due to our limited knowledge of Flutter, even after doing research it was something that we fell short on and were confused on what to do.
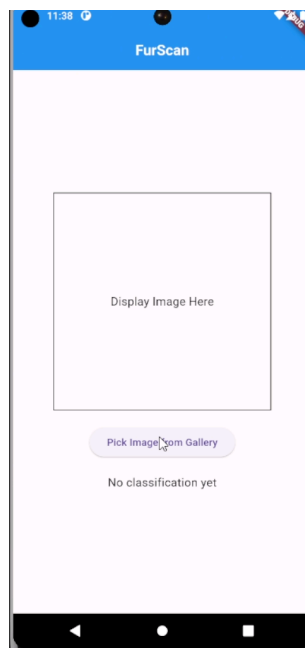
      After a bit of research on other stacks however, we came across and remembered about Django. It was our first time using Django but it already worked better than we had hoped for and was doing exactly as we planned. With our tech stack now changed, documentation was also going along well, we had finished designing Hi-Fi and had it tested by people to check on what they thought of this.

WELCOME TO FURSCAN!
Detect diseases faster

RESULTS WITH IMAGES

CHOOSE THE PET

CAT

DOG
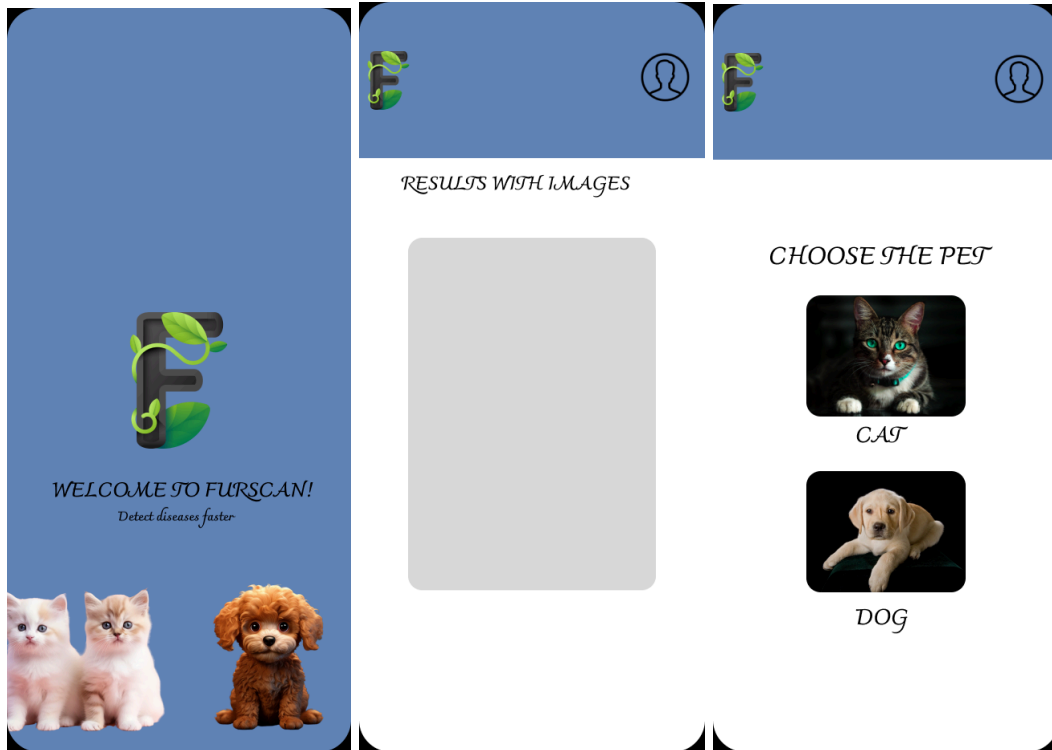
Our app was now functioning and moving in a solid direction as we had finished everything planned for MVP 1, with a few changes and slight adjustments to designs. One thing in this MVP however had to be delayed as we were planning on securing a meeting with the Owner of Careport Vet in Harbour Landing, due to a very busy time for vets she had to postpone the meeting until early January. Because of this, our plan of having a questionnaire portion done for the app was moved to MVP 2 instead.

On the 11th of January 2024 we had our meeting with the owner of Careport, Dr. Melissa Hunchak.This was the exact push we needed because she gave us some really good advice on what to look for in terms of diseases such as how time frame is very important when considering symptoms, the animal's behaviour in how they act normally vs now, are they any other pets at home? and a few common diseases we could integrate into the application for cats and dogs. Moving along everything went as expected however we had taken away the functionality of making a user login/signup and will be moving it to a future work.

3.0 Reflection

3.1 Our Achievements

Being close friends throughout the period of our *Software Systems Engineering* degree made it quite easy working together. We excelled in project management, meeting all deadlines and consistently maintaining a GREEN status in our SCRUMS. Each team member contributed their unique expertise, and we distributed tasks evenly to ensure diligent work completion. Communication was key, and our Discord server served as a central base for any discussions and support that we needed. We remained adaptable, welcoming feedback and embracing changes that came up. Working with Django for the first time was interesting and something that was new to all three of us, but it kept us motivated and provided a fresh perspective on our approach to the project.

3.2 Our Challenges

There were a few things in which we fell short on. One big thing would be our image dataset for the AI models we had trained. Although it was working as intended, the accuracy is something we weren't happy with. Some images either getting low confidence in whether they were infected or not, or other images just being resulted incorrectly. Our vision in fixing this was getting more images from the medical industry to help with the dataset, but unfortunately that didn't end up happening which hindered us a little bit. In relation to this, we had not anticipated the meeting with the Careport owner to take as long to acquire as it did. However, we are very grateful and thankful for getting that in the end as it boosted our progress quite a bit since it gave us good direction.

3.3 Our Lessons Learnt

Looking back on our project, we've learned valuable lessons that will definitely change our outlook on any future projects/work. One key and main takeaway is the importance of thorough preparation and gaining familiarity with new technologies before committing to project initiation. Capstone is meant to show the lessons and tech you have learnt throughout the years, we had decided to learn something new such as AI models. Although we are quite proud with the progress we had made, and the work we had done to achieve it, going forward we will emphasise conducting comprehensive research and acquiring the requisite expertise before moving onto similar projects.

When making an application that utilises AI, especially in medical cases, it's very important to get the accuracy of the model as high as possible. This is something we should have researched more on before moving along with the project, our biggest regret we'd say. For

example, having only a dataset of ~300 images for both infected and healthy eyes for the conjunctivitis (pink eye) portion gets the job done, but it falls short when there are images uploaded which have different lighting, positions, and other various factors that in result change the outcome of the prediction. In relation, something we had realised later on in the project was we should have also researched different types of models, as different ones do jobs differently and can get you higher or lower accuracy.

```python
# Load healthy eye images
for img_name in os.listdir(healthy_dir):
    img = cv2.imread(os.path.join(healthy_dir, img_name))
    img = cv2.resize(img, (img_width, img_height))
    healthy_images.append(img)
    labels.append(0)

# Load infected eye images
for img_name in os.listdir(infected_dir):
    img = cv2.imread(os.path.join(infected_dir, img_name))
    img = cv2.resize(img, (img_width, img_height))
    infected_images.append(img)
    labels.append(1)

# Combine the images and labels
images = np.concatenate((healthy_images, infected_images), axis=0)
labels = np.array(labels)

# Split the dataset into training and test sets
X_train, X_test, y_train, y_test = train_test_split(images, labels, test_size=0.2, random_state=42)

# Normalize pixel values between 0 and 1
X_train = X_train.astype('float32') / 255.0
X_test = X_test.astype('float32') / 255.0

# Build the CNN model
model = Sequential()
model.add(Conv2D(32, (3, 3), activation='relu', input_shape=(img_width, img_height, 3)))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Conv2D(64, (3, 3), activation='relu'))
model.add(MaxPooling2D(pool_size=(2, 2)))
model.add(Flatten())
model.add(Dense(64, activation='relu'))
model.add(Dense(1, activation='sigmoid'))
```

One big lesson that not only us, but I'm sure the other Capstone groups had also learnt is to "not be afraid of change." Even with our engineering jobs, life, or any other aspect, change is inevitable and something that will need to happen sooner or later. A group should never be afraid to implement it. Learning it especially now, it might seem like a little big of a setback to change something in a project as important as capstone, but it's best to do it sooner or later. Again yes the setback is there, but the end result could be better than you had imagined. Being flexible, open to change, and adaptable can go a long way.

4.0 Closing Remarks

4.1 Mentorship

For our capstone group, we were lucky enough to have Dr. Christine Chan and PhD student Alex Wang as the mentors. Through regular emails and zoom meetings with each other, they were able to help us keep on track incredibly well. Their insight, especially since we were using AI, was more than we could ask for and we are very grateful for it. They helped us in guiding on what to focus on more rather than focusing on things that may not be as important.

One thing that Dr. Christine Chan had made clear to us from the very first meeting we had together, was to get expert knowledge in this field. Making an app in regards to pets' health is something that can't be taken lightly as all life is important and should get the correct and right treatment, we should make sure to make the information in our application as accurate as possible. Dr. Chan gave us good feedback on what to ask industry professionals as we were planning on setting up a meeting with a doctor from a vet in Regina. Things along the lines of "they (the vets) have the knowledge to do diagnosis without any support, what kind of questions could they pass down to us which helps in terms of physical symptom traits", or a big feedback which we had immediately gone to implement which was "a firm diagnosis cannot be made only with images, should also consider physical inputs to put in". Short and quick feedback like these kept us on our toes as well as sparking critical thinking and motivation.

Finally, Dr. Melissa Hunchak helped a lot with helping us in deciding which direction to go in, giving us great insight on what to use to search diseases and symptoms, and even giving us some herself to get us started off with.

4.2 Acknowledgements