

DermAI

Skin disease detection

Team Thunder Buddies Sprint 3





Agenda

- Team Members
- Improvement
- Project Description
- Teamwork agreement
- Personas
- MVP
- Technologies
- Algorithms
- Diagrams
- Sprint 2 recap
- Product Backlog(All the Users Stories or Tasks)
- Sprint 3 Backlog (Stories or tasks committed)
- Metrics
- Retrospective
- Sprint 4(Stories planned and committed for Sprint 4)
- Project demo (Application Screenshots)
- Code snippets
- Demo Video of application
- Github link



Team Members



Bhargava Chilukuri

Front end developer and
scrum master



Kushal Arya Neela
Front end developer



Manideep Kumar Reddy Kotha
Backend developer



Jagadeesh Mekhapotula
Backend Developer and
Tester



Akshara Uppu
Backend Developer



Sai Praneeth Chagiri
Front-end Developer



Srinath Madagoni
Machine learning engineer



Manoj Kumar Madhavarapu
Machine learning engineer



Improvements after Professor's Feedback

- Product Backlog updated
- Ordering Project presentation slides
- Updates in user stories and sprint backlog
- Mentioned black circle for updated slides



Problem Statement

The diagnosis of the dermatological problem is quite complex and requires expert knowledge and accurate results. At present digital solutions lack accuracy and simplicity usage of the application. Thus ,it creates a gap between the human solution and the digital solution. So DermAI comes in place which has a user-friendly interface and employs deep learning to diagnose skin conditions and give precision results. Which empowers everyone from general public to have expert dermatologists in their hands.

Project Description

Project Name:	DermAI
Team:	Thunder Buddies
Project Description:	<p>Derm AI's deep learning technology democratizes dermatology by increasing diagnostic speed, accuracy, and accessibility, all of which improve patient outcomes and save costs.</p> <p>For dermatological problem who find lack of digital accuracy and usage of application the Artificial Intelligence solution is an AI based Mobile application that simplifies a user-friendly interface and employs deep learning to diagnose skin conditions and give precision results. unlike the traditional method of booking an appointment and visiting the dermatologist our application empowers everyone from general public to have expert dermatologists in their hands.</p>
Benefit Outcomes:	
	<ul style="list-style-type: none">Proficient Access: Derm AI empowers the general populace with advanced technology to obtain dermatological diagnoses at the level of experts.Efficient and Accurate: Implements deep learning techniques to augment the accuracy and velocity of skin condition evaluations.The provision of a user-friendly platform ensures that dermatological care is readily available to all individuals, irrespective of location.Enhanced Outcomes: Advocates for improved treatment strategies and enhances the general health and well-being of the epidermis.
Github Link:	https://github.com/htmwlw/2024S-Thunder-Bubbles

Teamwork Agreement

Team Name: Thunder Buddies

Our goal is to bring collaborative knowledge and skills together for the completion of the Computer Science Capstone Project. Our project might have challenges to tackle and we would overcome challenges and deliver the project on time.

Team Agreement

- 1.All teammates should share their opinions and even respect each other's opinions. The sharing of information should be transparent, if any of the team members is having any issue, they can react to other team members and try to solve the issue. If any teammates have new ideas and thoughts, they can share in our sprint meetings.
- 2.Team Members should be responsible for their respective tasks and deliver the required project deliverables before the due date and if they are unable to finish it before the due date, they can reach out to other members.
- 3.All the roles are given based on your strengths , ideas and commitment and there shouldn't be any conflict between team members regarding roles.
- 4.Communication between front end, backend and machine learning team should be interactive and weekly 2 meetings will be held one on Wednesday and the other on Saturday and all team members are requested to take part in the team meetings and all communications are done via Slack.
- 5.If any team member is unable to attend the meeting, then they have to prior inform the scrum master about it, and missing any team meeting is not advisable.
- 6.All members should equally take part and give their best effort.

PERSONA 1



EMMA

THE BUSY PROFESSIONAL

EDUCATION: JURIS DOCTOR (J.D.) FROM HARVARD

AGE: 29

OCCUPATION: CORPORATE LAWYER

TECH-SAVVINESS: HIGH

NEEDS: QUICK AND RELIABLE SKIN CONDITION DIAGNOSSES DUE TO HER BUSY SCHEDULE.

PAIN POINTS: LACK OF TIME TO VISIT DERMATOLOGISTS AND THE NEED FOR IMMEDIATE ADVICE ON SKIN CARE.

FITNESS ROUTINE: IN THE MORNINGS, EMMA MAKES TIME FOR 30 MINUTES OF HIGH-INTENSITY INTERVAL TRAINING WORKOUTS OR GOING FOR A JOG AROUND THE NEIGHBORHOOD TO STAY HEALTHY. THESE EXERCISES KEEP HER FEELING ENERGIZED AND FOCUSED THROUGHOUT HER BUSY DAY

PERSONA 2



DAVID
THE RURAL RESIDENT

EDUCATION: BACHELOR'S IN AGRICULTURAL SCIENCE,

AGE: 45

OCCUPATION: FARMER

TECH-SAVVINESS: MODERATE

NEEDS: ACCESS TO DERMATOLOGIST CARE, NEAREST IS FEW HOURS AWAY

PAIN POINTS: GEOGRAPHICAL ISOLATED LOCATION AND RARE COMMUTE TO CITY MAKES IT DIFFICULT FOR REGULAR CHECKUPS.

FITNESS ROUTINE: DAVID'S FITNESS IS ALL ABOUT THE HARD WORK OF FARMING. HIS DAYS ARE FILLED WITH TOUGH JOBS LIKE DIGGING, PLANTING, AND HARVESTING CROPS. THESE DEMANDING TASKS KEEP DAVID ACTIVE AND STRONG. HE DOESN'T NEED A SPECIAL WORKOUT ROUTINE BECAUSE HIS DAILY FARM CHORES PROVIDE ALL THE EXERCISE HE NEEDS. FOR DAVID, STAYING FIT ISN'T A SEPARATE ACTIVITY BUT JUST PART OF HIS REGULAR WORKDAY. THE PHYSICAL LABOR OF FARMING HELPS BUILD HIS ENDURANCE AND MUSCLE POWER.

PERSONA 3



MICHAEL
THE SENIOR CITIZEN

EDUCATION: LIFELONG LEARNER WITH A MIX OF FORMAL EDUCATION AND SELF-TAUGHT KNOWLEDGE.

AGE: 70

OCCUPATION: RETIRED

TECH-SAVVINESS: LOW

NEEDS: EASY TO USE INTERFACE TO CHECK SKIN CONDITIONS.

PAIN POINTS: PREFERS SIMPLICITY AND EASE IN TECHNOLOGY, OFTEN CAUTIOUS ABOUT TRYING OUT NEW DIGITAL TOOLS.

FITNESS ROUTINE: MICHAEL'S FITNESS ROUTINE KEEPS THINGS SIMPLE, YET EFFECTIVE. HE STARTS EACH MORNING WITH SOME EASY STRETCHES. THEN HE HEADS OUT FOR A PEACEFUL WALK AROUND THE PARK. THIS DAILY STROLL LETS HIM STAY ACTIVE AND SOCIALIZE TOO. TWICE WEEKLY, MICHAEL ATTENDS YOGA CLASSES AT THE COMMUNITY CENTER FOR SENIORS. THE CLASSES HELP HIM STAY FLEXIBLE AND STEADY ON HIS FEET. THESE ACTIVITIES ARE KEY FOR MICHAEL'S HAPPY, ENERGETIC LIFESTYLE--AS HE GROWS OLDER.



MVP (Minimum Viable Product)

- Registration and login
- Photo Upload
- Analysis of the Photo
- User Information on the photo



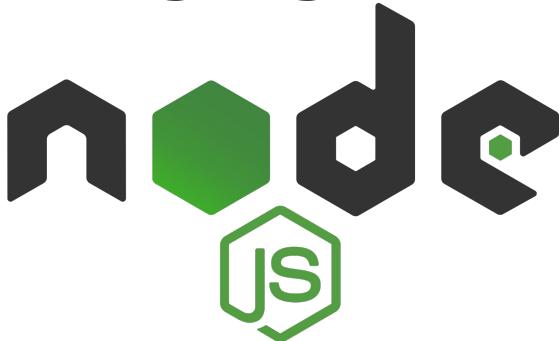
Language and Tools - Frontend



Expo is react native wrapper which makes developing an mobile application faster and it does most of complex just by **npx create-expo-app my-app**.



Language and Tools - Backend



Flask

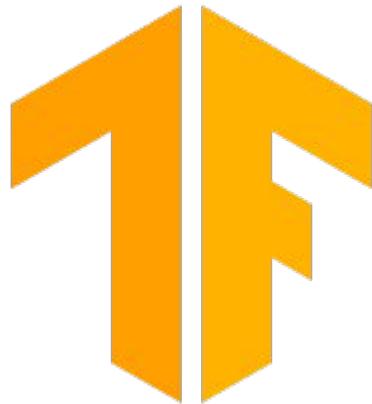
For backend both flask and node js has been used.

Flask is mainly to create a machine learning model api which is going to be connected via node js.

Node js is mainly used to do basic CRUD operations.



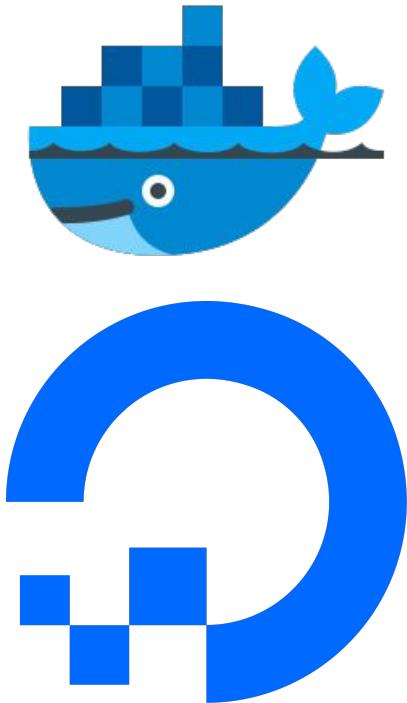
Language and Tools - Backend



Tensorflow is a machine learning framework and it is used to build Image classification model. For this project, tensorflow is used to build skin disease classification model.



Language and Tools - Other technologies

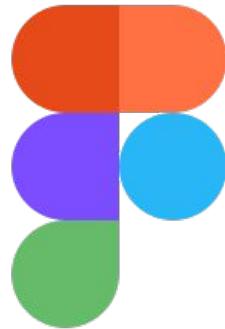


Docker is used for containerizing dependencies which ensures portability, consistency and scalability.

Firebase is used for authentication and database where as digital ocean is used of running the backend code and run those apis on cloud then in local machine.



Language and Tools - Design Tools



Those 2 are the design tools and these are mainly used for design UI and for flowcharts.
Figma is used for UI design .
Miro is used for designing charts.





Algorithms

CNN Algorithms:

- CNNs uses layered architecture to process visual data, extracting features through filters for image recognition tasks.

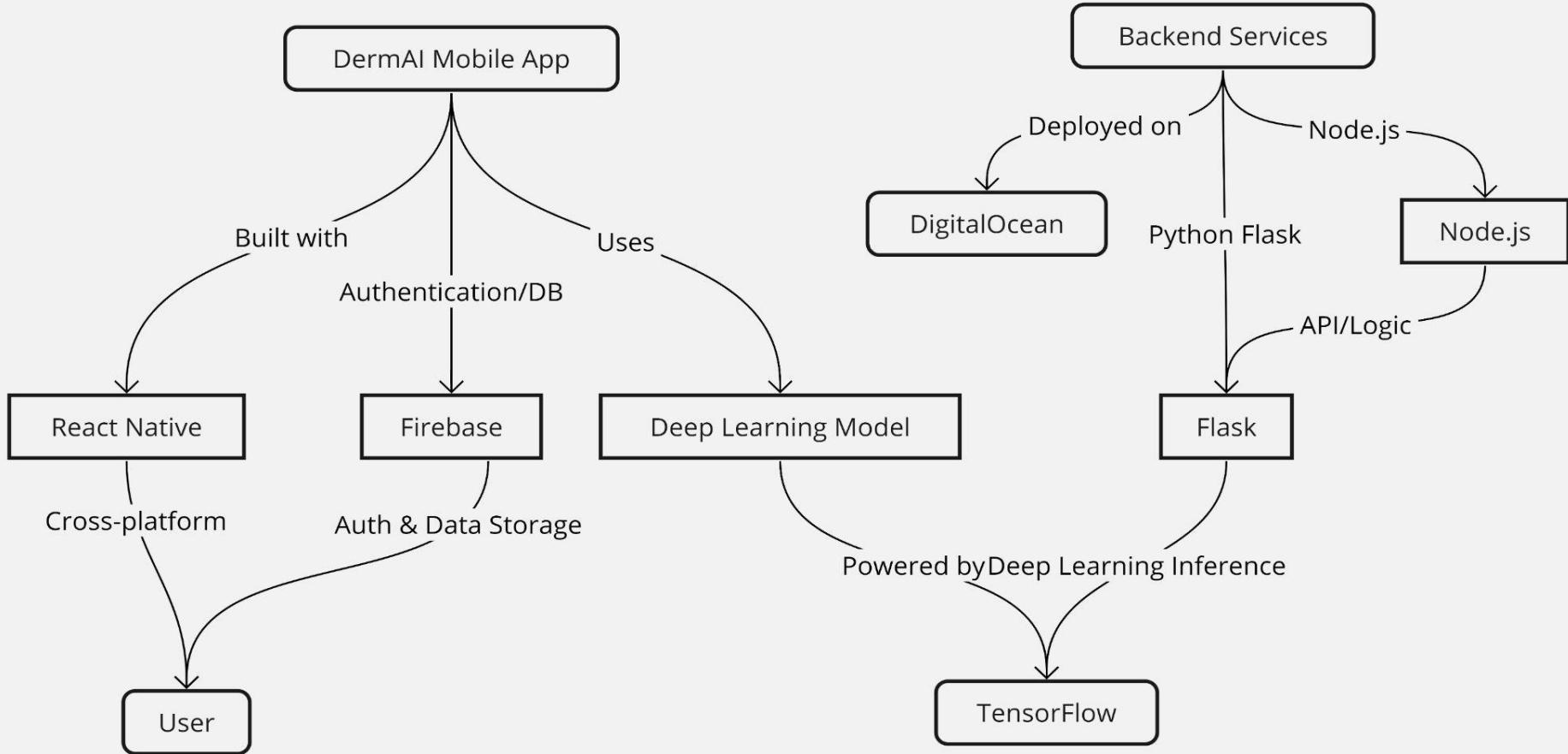
EfficientNet:

- EfficientNet scales CNNs uniformly across width, depth, and resolution, enhancing efficiency and accuracy.

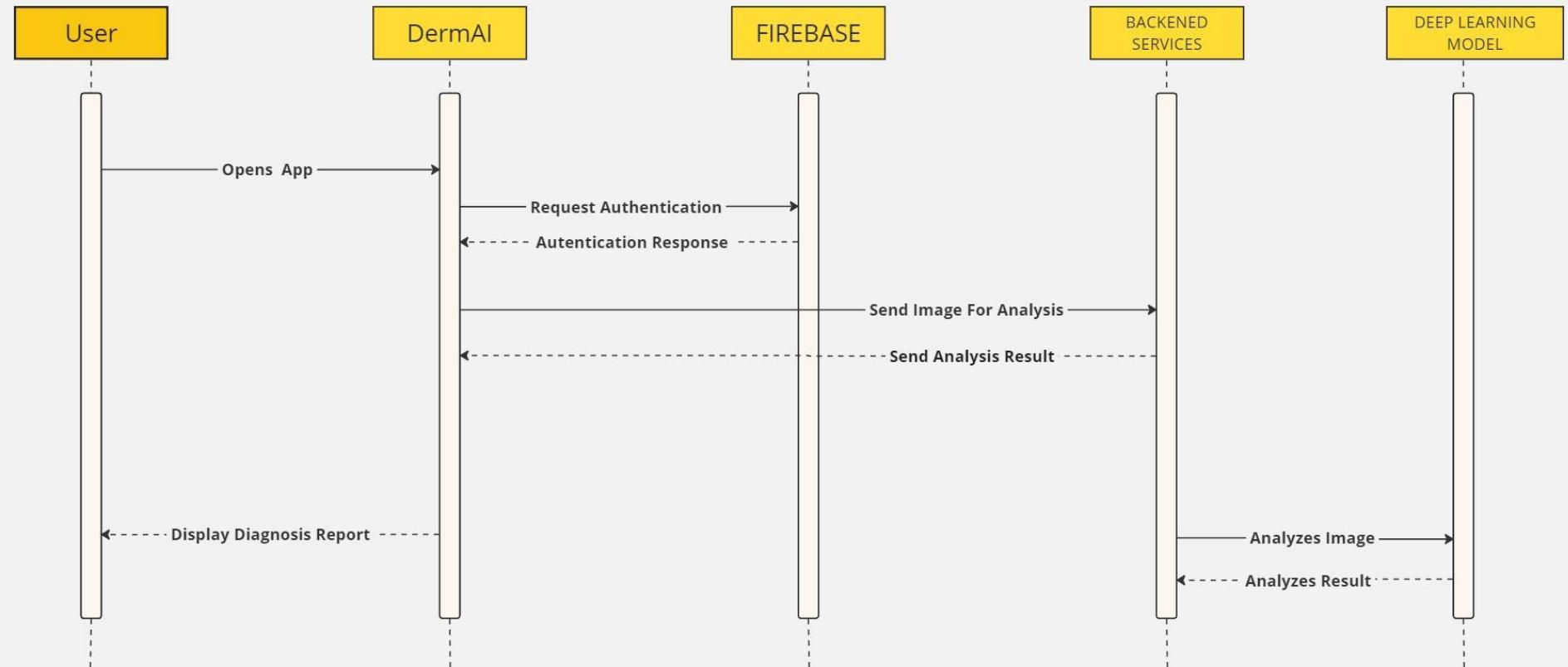
Pseudo Code: ML

```
...  
Efficient net pseudo code  
  
import tensorflow as tf  
from tensorflow.keras.applications import EfficientNetB0  
from tensorflow.keras.layers import GlobalAveragePooling2D, Dense  
from tensorflow.keras.models import Model  
  
base_model = EfficientNetB0(include_top=False, weights='imagenet')  
  
x = GlobalAveragePooling2D()(base_model.output)  
output = Dense(10, activation='softmax')(x)  
  
model = Model(inputs=base_model.input, outputs=output)  
  
model.compile(optimizer='adam', loss='categorical_crossentropy', metrics=['accuracy'])  
  
model.summary()
```

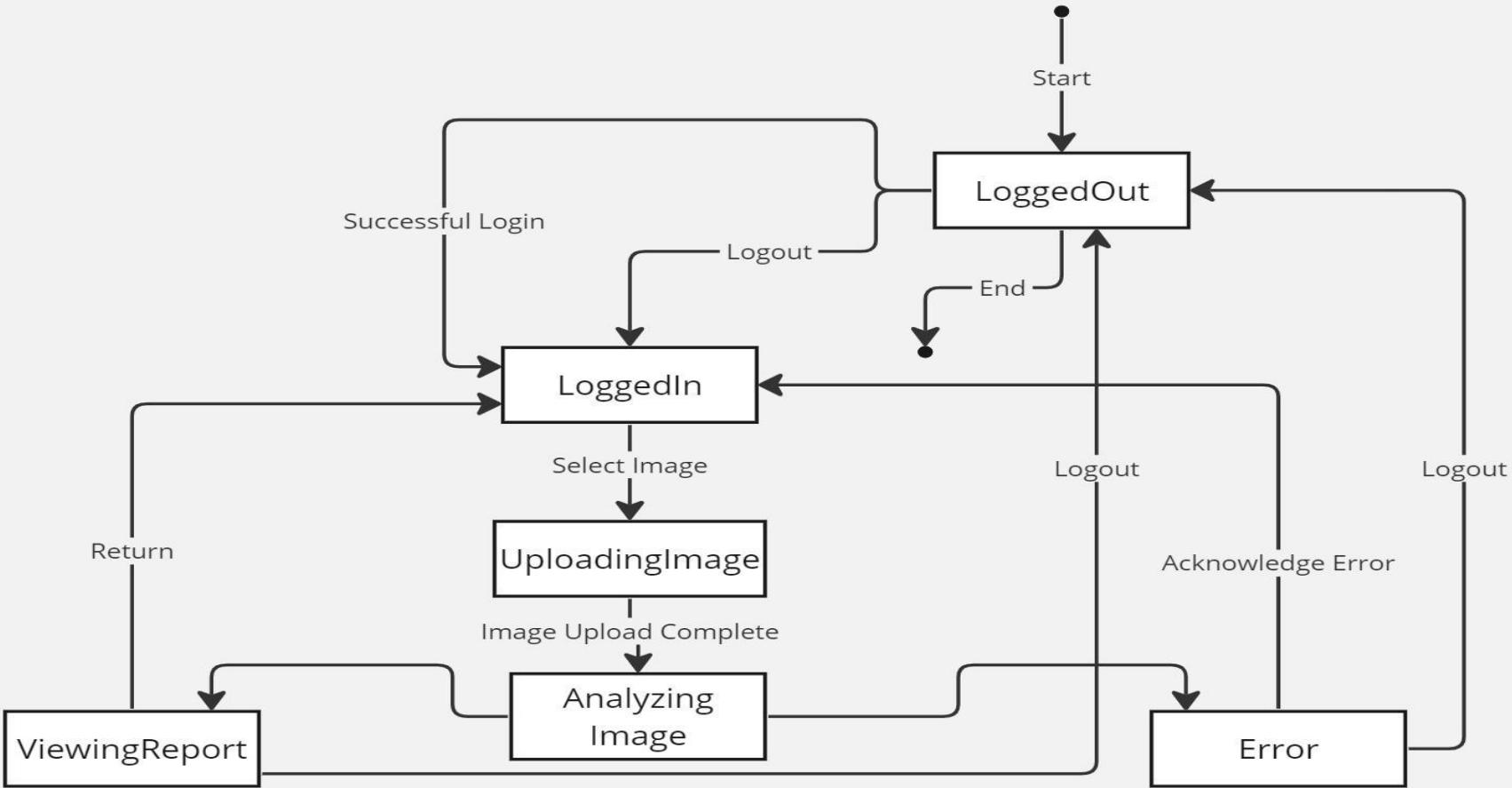
Conceptual Architectural Diagrams



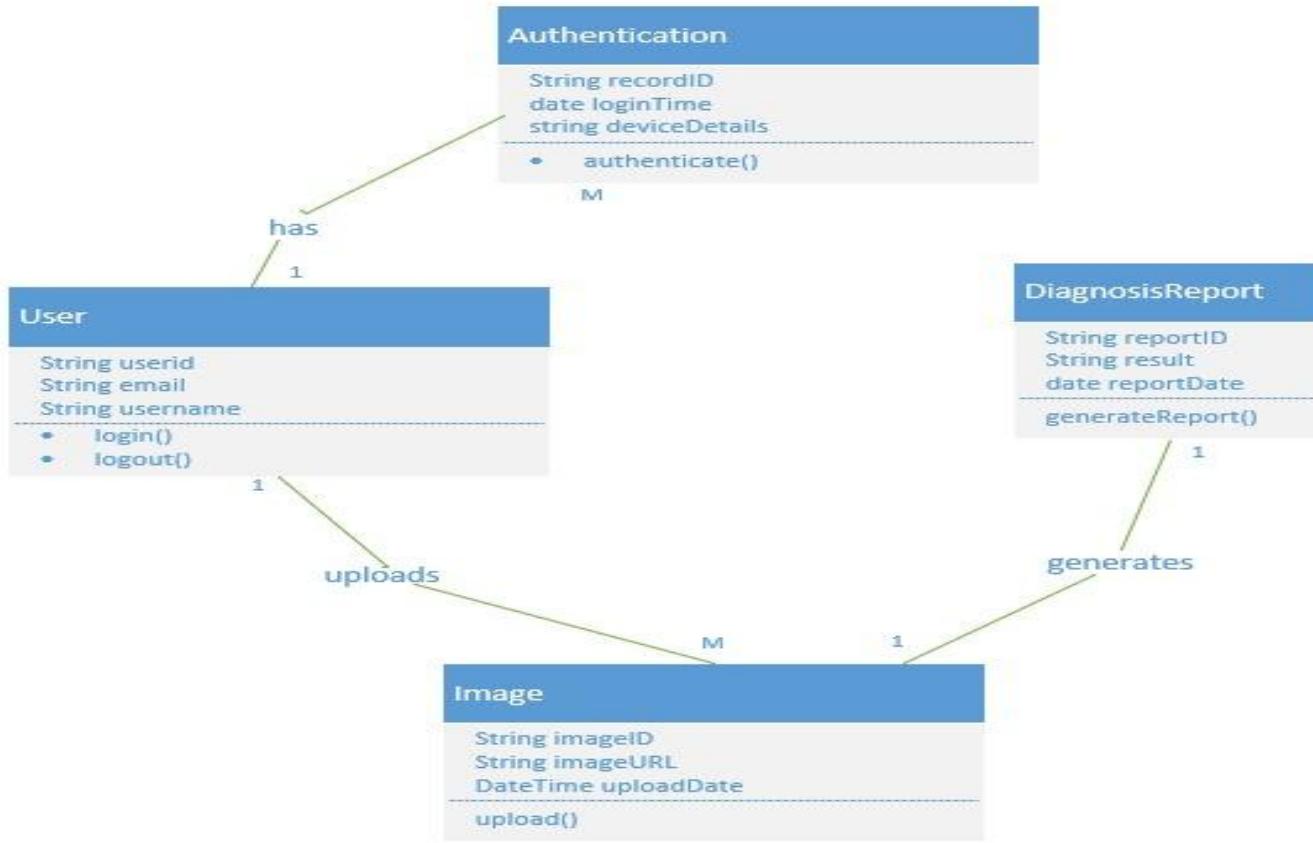
Sequence Diagrams



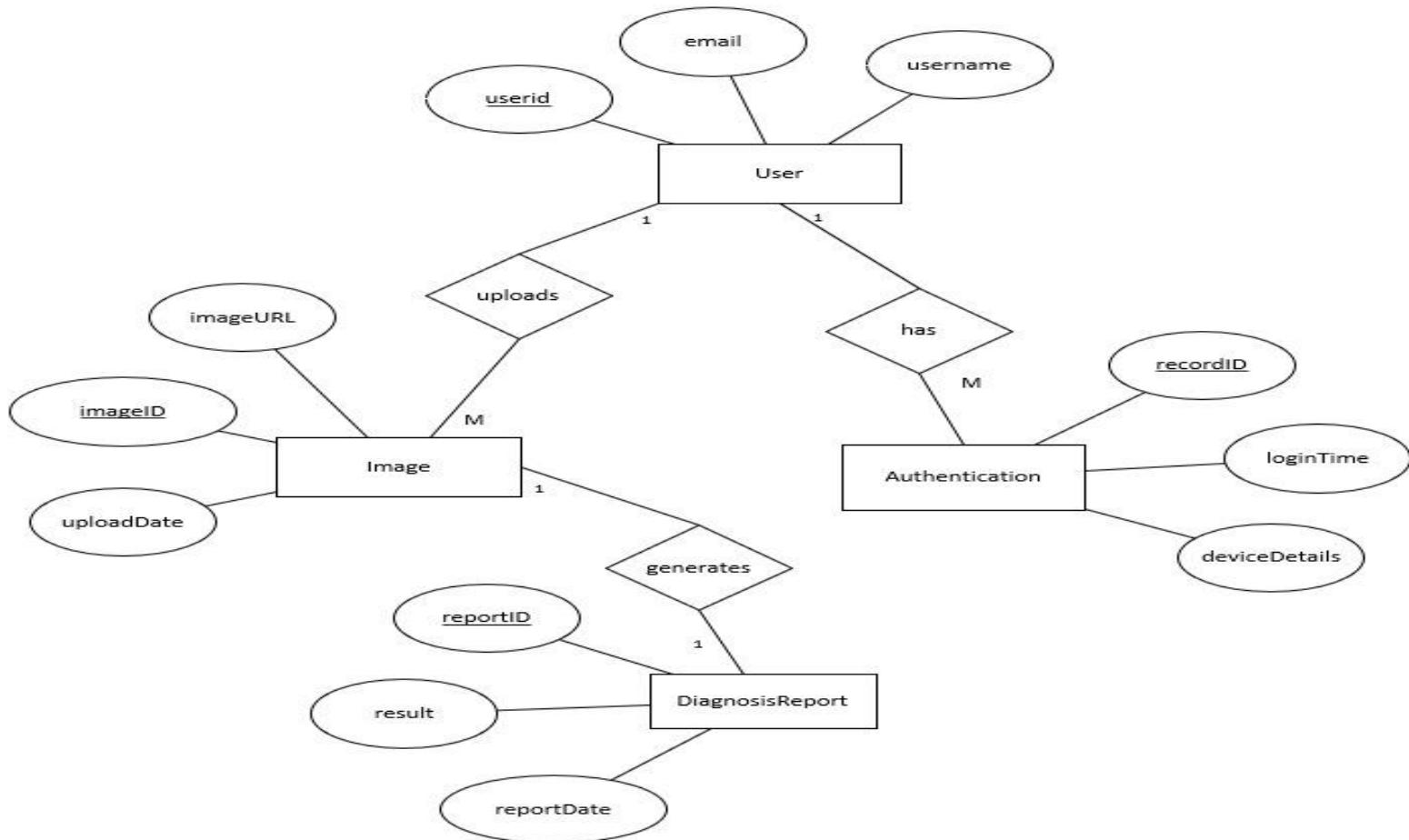
State Diagram



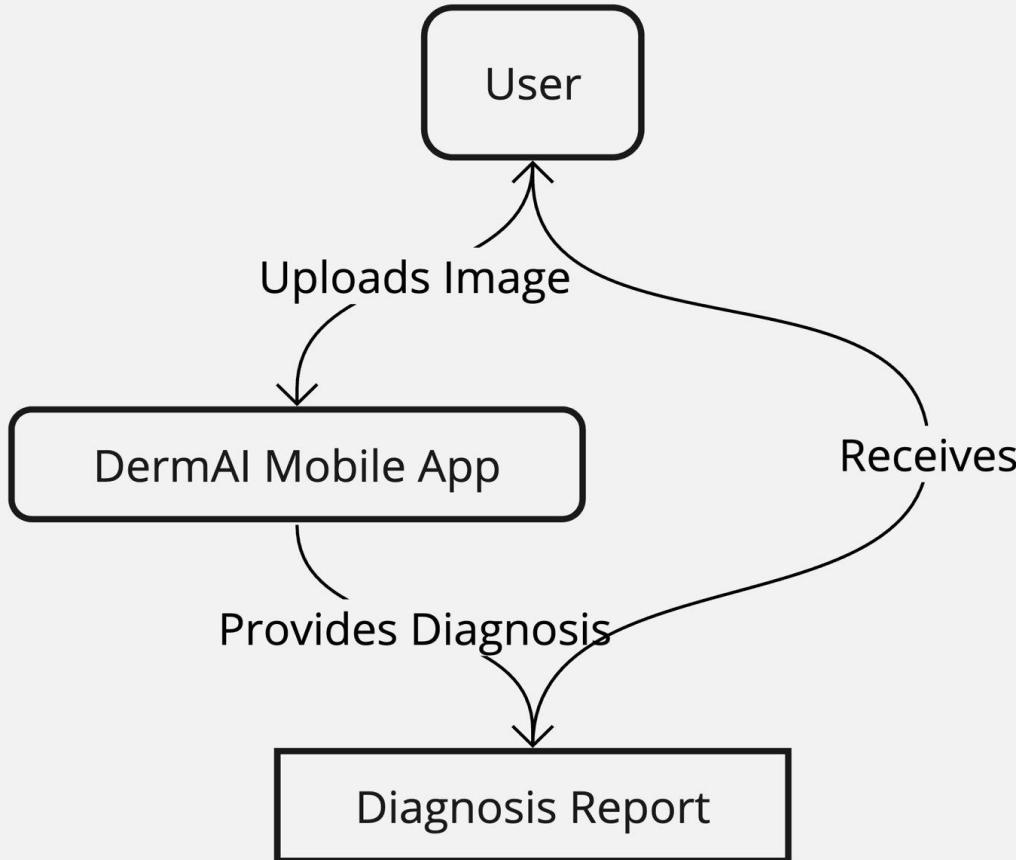
Class Diagram



Entity Relationship Diagram



Context Diagram





Sprint 2 recap

- The UI/UX work has been completed.
- The authentication for the application is also completed with firebase connection.
- EDA for dataset is also completed.
- Architecture Diagrams, Context Diagram, ER Diagrams, Sequence Diagram, State Diagrams, Class Diagrams created.
- User stories and acceptance criteria created.

Product Backlog

S.No.	Sprint	Feature	User Story	Estimate (Fibonacci)
1	2	Authentication	As a new user, I want to log in by entering my email and password to access the home screen.	2
2	2	Data Analysis	As a researcher, I want to analyze user data to refine the AI diagnosis model.	5
3	3	Image Upload	As a user, I want clear instructions to upload a quality photo for accurate diagnosis.	5
4	3	AI Diagnosis	As a user, I expect a quick and accurate diagnosis of my skin condition from the uploaded photo.	8
5	3	User Education	As a user, I want to learn about my diagnosed skin condition through the app.	5
6	3	Diagnosis Feedback	As a user, I want to give feedback on the diagnosis accuracy and usefulness.	2
7	3	Feedback Impact	As a user, I want assurance that my feedback helps improve the AI model.	2
8	3	Privacy Assurance	As a user, I need assurance that my data and photos are handled with utmost privacy.	5
9	4	Specialist Recommendation	As a user, I want recommendations for specialists based on my AI diagnosis.	5
10	4	Booking Integration	As a user, I want to schedule an appointment with a recommended specialist through the app.	3

Product Backlog

11	4	Health Resources	As a user, I want access to resources and care tips for my skin condition.	2
12	4	Consultation Preparation	As a user, I want the app to prepare a summary of my diagnosis for the specialist.	3
13	4	Specialist Feedback	As a user, after the consultation, I want to provide feedback about the specialist.	2
14	4	Diagnosis History	As a user, I want to view and manage my diagnosis history within the app.	3
15	4	Account Management (Admin)	As an admin, I want to reset passwords and manage user access for safety.	2
16	4	Activity Monitoring (Admin)	As an admin, I need to monitor user activity for compliance and app integrity.	5
17	4	Security Alerts	As a user, I want customizable security alerts to protect my account.	2
18	4	Account Security Review	As a user, I want to easily review and secure my account if suspicious activity is detected.	3

User Stories and Acceptance Criteria

S.No.	Sprint	Feature	User Story	Estimate Points	Acceptance Criteria
1	2	Authentication	As a new user, I want to log in by entering my email and password to access the home screen.	2	Login accepts credentials, validates, redirects to home, shows errors for invalid attempts.
2	2	Data Analysis	As a researcher, I want to analyze user data to refine the AI diagnosis model.	5	System provides anonymized data for analysis; insights inform AI model refinement.
3	3	Image Upload	As a user, I want clear instructions to upload a quality photo for accurate diagnosis.	5	Instructions for photo quality provided; system supports image uploads with feedback.
4	3	AI Diagnosis	As a user, I expect a quick and accurate diagnosis of my skin condition from the uploaded photo.	8	AI processes photo, presents diagnosis with confidence score quickly; includes condition information.
5	3	User Education	As a user, I want to learn about my diagnosed skin condition through the app.	5	App provides understandable information on diagnosed condition including symptoms, causes, treatments.
6	3	Diagnosis Feedback	As a user, I want to give feedback on the diagnosis accuracy and usefulness.	2	Feedback mechanism for diagnosis accuracy and usefulness available; user submissions acknowledged.
7	3	Feedback Impact	As a user, I want assurance that my feedback helps improve the AI model.	2	Users receive a message post-feedback submission reinforcing its value to AI improvement.
8	3	Privacy Assurance	As a user, I need assurance that my data and photos are handled with utmost privacy.	5	App aligns with privacy policy in handling data and photos; clear policy communication.
9	4	Specialist Recommendation	As a user, I want recommendations for specialists based on my AI diagnosis.	5	App suggests specialists relevant to AI diagnosis with profiles including credentials and reviews.
10	4	Booking Integration	As a user, I want to schedule an appointment with a recommended specialist through the app.	3	Integrated booking feature for appointments with specialists; confirmation process in place.



User Stories and Acceptance Criteria

11	4	Health Resources	As a user, I want access to resources and care tips for my skin condition.	2	App provides resources and care tips relevant to user's diagnosed skin condition.
12	4	Consultation Preparation	As a user, I want the app to prepare a summary of my diagnosis for the specialist.	3	App generates a summary of diagnosis for specialist review pre-consultation.
13	4	Specialist Feedback	As a user, after the consultation, I want to provide feedback about the specialist.	2	Post-consultation feedback feature for specialists available; includes rating and comments.
14	4	Diagnosis History	As a user, I want to view and manage my diagnosis history within the app.	3	Feature to view, search, and manage diagnosis history implemented; includes filtering options.
15	4	Account Management (Admin)	As an admin, I want to reset passwords and manage user access for safety.	2	Admin tools for password reset and user access management available; ensures security compliance.
16	4	Activity Monitoring (Admin)	As an admin, I need to monitor user activity for compliance and app integrity.	5	Admin dashboard for user activity monitoring implemented; supports app compliance and integrity.
17	4	Security Alerts	As a user, I want customizable security alerts to protect my account.	2	Customizable security alert settings available for users; includes immediate review options for suspicious activity.
18	4	Account Security Review	As a user, I want to easily review and secure my account if suspicious activity is detected.	3	Features for account review and securing actions in place; supports password changes and activity reviews.



Sprint 3 backlog

S.No.	Feature	User Story	Acceptance Criteria
3	Image Upload	As a user, I want clear instructions to upload a quality photo for accurate diagnosis.	Instructions for photo quality provided; system supports image uploads with feedback.
4	AI Diagnosis	As a user, I expect a quick and accurate diagnosis of my skin condition from the uploaded photo.	AI processes photo, presents diagnosis with confidence score quickly; includes condition information.
5	User Education	As a user, I want to learn about my diagnosed skin condition through the app.	App provides understandable information on diagnosed condition including symptoms, causes, treatments.
6	Diagnosis Feedback	As a user, I want to give feedback on the diagnosis accuracy and usefulness.	Feedback mechanism for diagnosis accuracy and usefulness available; user submissions acknowledged.
7	Feedback Impact	As a user, I want assurance that my feedback helps improve the AI model.	Users receive a message post-feedback submission reinforcing its value to AI improvement.
8	Privacy Assurance	As a user, I need assurance that my data and photos are handled with utmost privacy.	App aligns with privacy policy in handling data and photos; clear policy communication.

Test Cases for sprint-3

Test Case ID	Feature	Description	Steps	Expected Result	Outcome
TC_UI_03	Image Upload	Verify guidance for capturing diagnostic-quality photos.	1. Navigate to Image Upload section. 2. Look for photo-taking instructions.	Clear instructions on capturing diagnostic-quality photos are displayed.	Pass
TC_AD_03	AI Diagnosis	Confirm AI accurately diagnoses skin conditions from uploaded photos.	1. Upload a diagnostic-quality photo of a known skin condition. 2. Review the AI-provided diagnosis.	AI diagnosis accurately identifies the skin condition.	Pass
TC_UE_01	User Education	Ensure educational content on diagnosed skin conditions is accurate and comprehensible.	1. Receive an AI diagnosis. 2. Access educational content related to the diagnosed condition.	Educational content is both accurate regarding the condition and easily understandable.	Pass
TC_DF_03	Diagnosis Feedback	Verify users can provide specific feedback on diagnosis aspects.	1. Receive a diagnosis. 2. Navigate to the feedback section. 3. Submit specific feedback on accuracy, clarity, and helpfulness.	Specific feedback is successfully submitted and acknowledged.	Pass
TC_DF_04	Diagnosis Feedback	Check for reassurance message after feedback submission.	1. Submit specific feedback on a diagnosis.	User receives a message reassuring that their feedback contributes to app improvement.	Pass
TC_PA_01	Privacy Assurance	Validate the app's privacy assurances for user data and photos.	1. Review the app's privacy policy. 2. Upload a photo and observe how the data is handled according to the policy.	The app's handling of user data and photos aligns with its stated privacy assurances.	Pass



Stories Completed

S.No.	Feature	User Story	Status
3	Image Upload	As a user, I want clear instructions to upload a quality photo for accurate diagnosis.	Completed
4	AI Diagnosis	As a user, I expect a quick and accurate diagnosis of my skin condition from the uploaded photo.	Completed
5	User Education	As a user, I want to learn about my diagnosed skin condition through the app.	Completed
6	Diagnosis Feedback	As a user, I want to give feedback on the diagnosis accuracy and usefulness.	Completed
7	Feedback Impact	As a user, I want assurance that my feedback helps improve the AI model.	Completed
8	Privacy Assurance	As a user, I need assurance that my data and photos are handled with utmost privacy.	Completed



Team Velocity

27 Story Points



Team's Historical Velocity (Average)

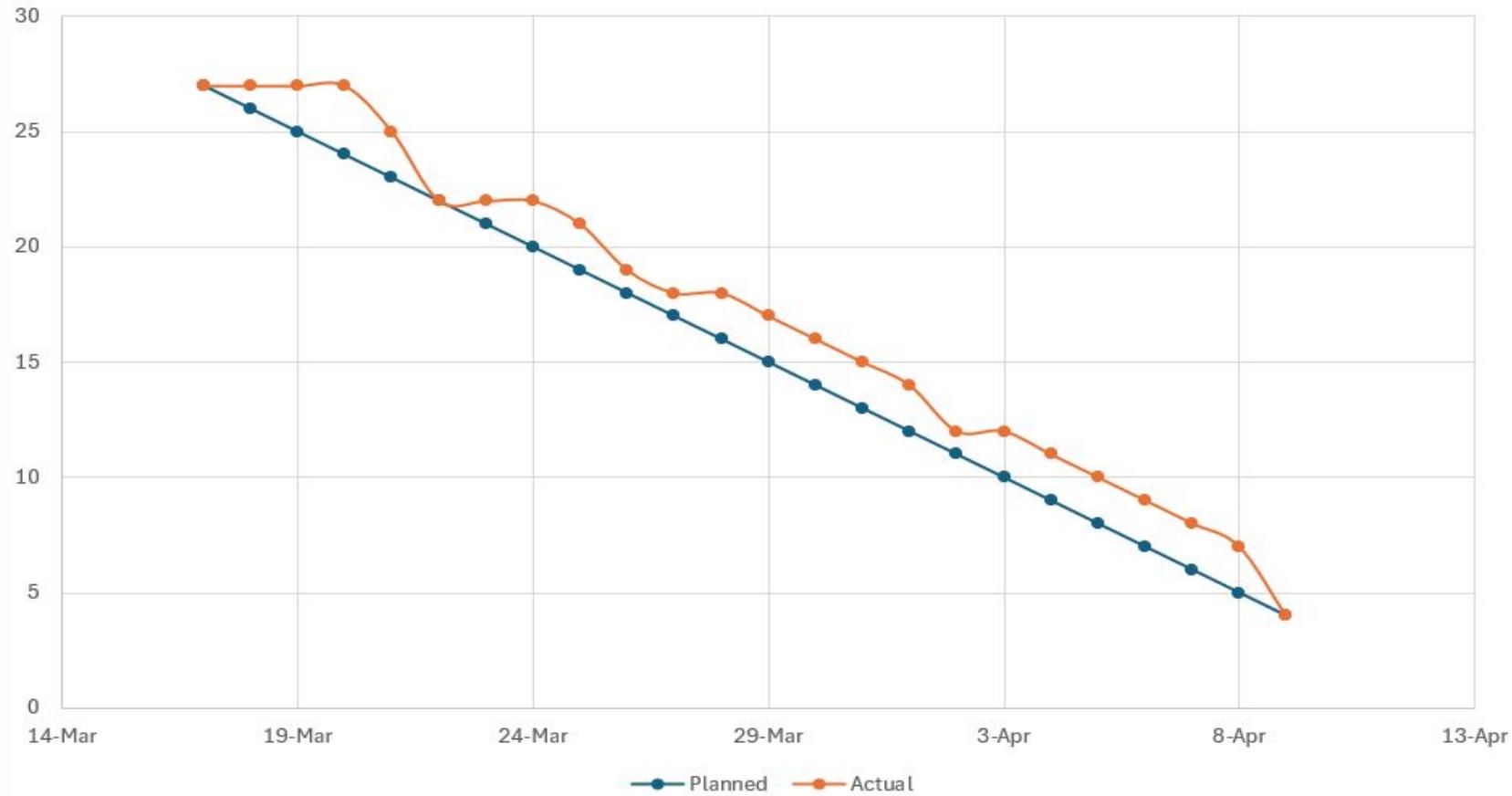
Sprint 2 Velocity: 29 story points

Sprint 3 Velocity: 27 story points

Average Velocity: $29 + 27 / 2 = 28$ points

Burndown Charts

Burndown Chart





Completed/Committed Ratio

Completed Committed Ratio for Sprint 3: 27/27 - 100%

Retrospective

thunder buddies

what went well

Team meetings	Updates in wiki page
+ 0	+ 0
KT Sessions went well	fallow-up with front end ,back end & m.l
+ 0	+ 0
UI Design	Completed assigned tasks
+ 0	+ 0
collaboration between all teams	Github commits and updates
+ 0	+ 0
physical meetup at workspace	Team lunch and discussion
+ 0	+ 0

what can be improved

Time managing for project tasks	work on project presentation
+ 0	+ 0
Git branching, push and pull requests	follow-up with team mates on updates
+ 0	+ 0
Overlapping in meetings	Remainders for teammates -due tasks
+ 0	+ 0

Action items

Division of tasks equally	Address skill gaps
+ 0	+ 0

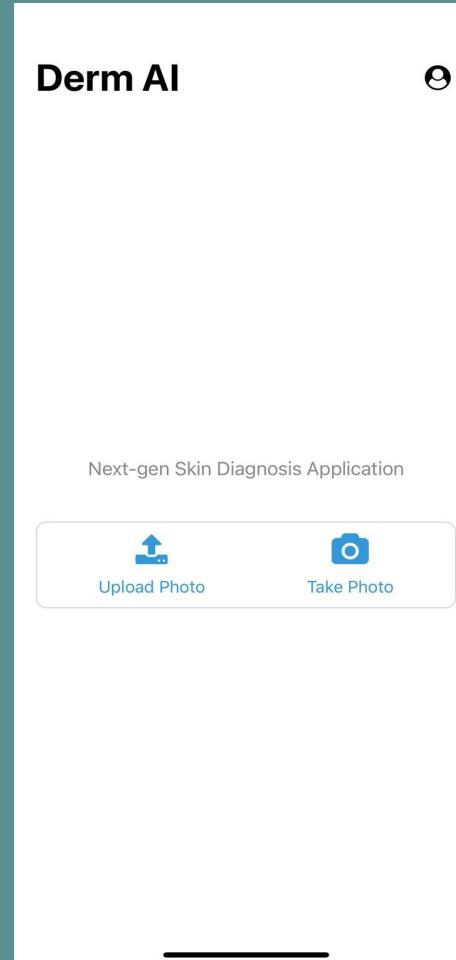
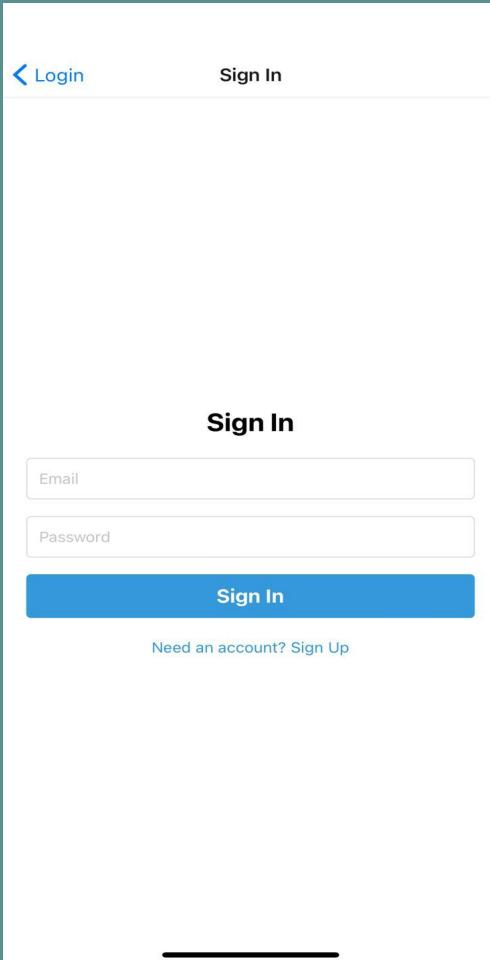
update in increased activity

+ 0

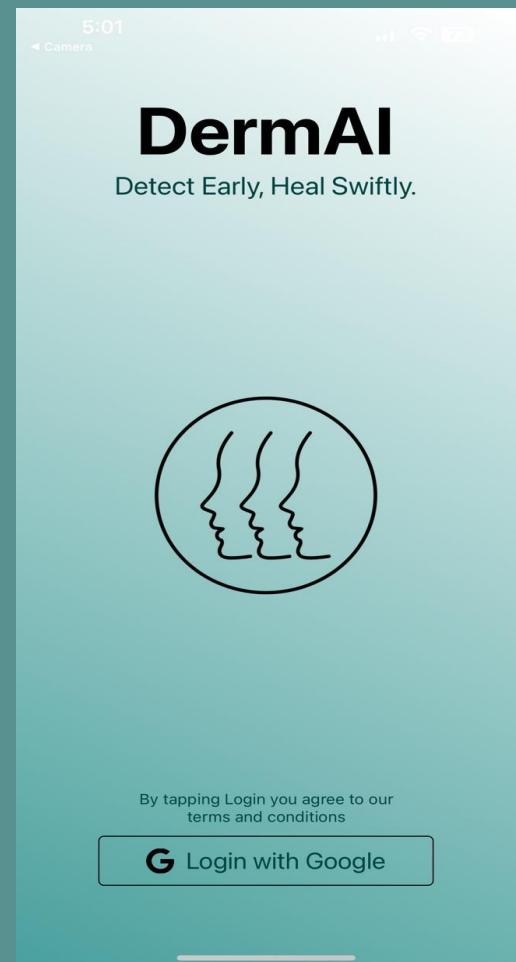
Sprint 4 - Planned and Committed Stories

S.No.	Feature	User Story	Estimate Points
9	Specialist Recommendation	As a user, I want recommendations for specialists based on my AI diagnosis.	5
10	Booking Integration	As a user, I want to schedule an appointment with a recommended specialist through the app.	3
11	Health Resources	As a user, I want access to resources and care tips for my skin condition.	2
12	Consultation Preparation	As a user, I want the app to prepare a summary of my diagnosis for the specialist.	3
13	Specialist Feedback	As a user, after the consultation, I want to provide feedback about the specialist.	2
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17	Security Alerts	As a user, I want customizable security alerts to protect my account.	2
18	Account Security Review	As a user, I want to easily review and secure my account if suspicious activity is detected.	3

Application Screenshots



Application Screenshots



[Login](#) Terms and Conditions

This application is a capstone project developed by students of CS691 at Pace University.

By accessing and using this application, you agree to abide by the terms and conditions outlined below.

- The content provided in this application is for educational purposes only.
- The developers and Pace University hold no responsibility for the accuracy or reliability of the information provided.
- Unauthorized use or reproduction of the content within this application is prohibited.

Thank you for using our application and supporting our capstone project.

[Login](#) Sign Up

Sign Up

Email

Password

Confirm Password

Sign Up

[Already have an account? Sign In](#)



Application Screenshots

3:45



Diagnosing please wait...

3:45



Detected: Melanocytic Nevi

Melanocytic nevi, commonly known as moles, are benign growths on the skin that are composed of melanocytes, the pigment-producing cells in the skin. They can appear anywhere on the body and can vary in size, shape, and color.

Most melanocytic nevi are harmless and do not require treatment. However, it's important to monitor moles for any changes in appearance, as certain changes can be a sign of melanoma, a serious type of skin cancer.

Some characteristics of normal melanocytic nevi include:

- Symmetry: The mole is symmetrical and has a regular shape.
- Border: The edges of the mole are smooth and well-defined.
- Color: The mole has a uniform color, typically brown or black.
- Diameter: The mole is usually smaller than 6 millimeters (about the size of a pencil eraser).
- Evolution: The mole remains stable and does not change significantly over time.

3:45



Detected: Melanocytic Nevi

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- Border: The edges of the mole are smooth and well-defined.
- Color: The mole has a uniform color, typically brown or black.
- Diameter: The mole is usually smaller than 6 millimeters (about the size of a pencil eraser).
- Evolution: The mole remains stable and does not change significantly over time.

If you notice any moles that display unusual characteristics or changes, such as asymmetry, irregular borders, color variations, or rapid growth, it's important to have them evaluated by a dermatologist to rule out the possibility of melanoma.

Give Feedback

3:45



ResultScreen Feedback

Feedback Form

Detected Name: Melanocytic Nevi

Enter your feedback

Submit Feedback

FIREBASE API

```
const app = initializeApp(firebaseConfig);
const auth = getAuth(app);
const db = getFirestore(app);
const storage = getStorage(app);

const saveImage = async (imageUri, imageName) => {
  const response = await fetch(imageUri);
  const blob = await response.blob();
  const imageRef = ref(storage, `images/${imageName}`);
  await uploadBytes(imageRef, blob);
};

const saveFeedback = async (userId, disease, feedback) => {
  try {
    await addDoc(collection(db, "feedback"), {
      userId,
      disease,
      feedback,
      timestamp: new Date(),
    });
    console.log("Feedback saved successfully");
  } catch (error) {
    console.error("Error saving feedback:", error);
  }
};

export { auth, saveImage, saveFeedback };
```



Flask API

```
model = load_model('skin_disease_model_efficientnet.h5')
class_labels = ['Melanoma', 'Melanocytic Nevi', 'Basal Cell Carcinoma', 'Actinic Keratosis']

@app.route('/predict', methods=['POST'])
def predict():
    file = request.files['image']
    img = image.load_img(file, target_size=(224, 224))
    img_array = image.img_to_array(img)
    img_array = np.expand_dims(img_array, axis=0)
    img_array /= 255.0
    predictions = model.predict(img_array)
    predicted_class_index = np.argmax(predictions[0])
    predicted_class_label = class_labels[predicted_class_index]
    response = {
        'class_index': int(predicted_class_index),
        'class_label': predicted_class_label
    }
    return jsonify(response)

if __name__ == '__main__':
    app.run()
```



WikiPage

<https://github.com/htmw/2024S-Thunder-Bubbles/wiki>



Application Demo

- We would be presenting application demo of our project in this presentation



Thank you