

SQUANDER

SPRING 2022 CAPSTONE PROJECT | PROF HENRY WONG

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Project Overview



Project Requirements



Design Architecture



Technologies Used



Sprint Overview



Test Cases



Project Demo (MVP)



GitHub Walkthrough



Retrospective



Conclusion

PROJECT OVERVIEW



PROJECT OVERVIEW

Squander app provides complete solution to organize and plan the disposal of waste. It uses machine learning algorithm to detect recyclable waste from image and provide way for proper disposal.

- What?
 - Image based Waste detection mobile application
- How?
 - User image submission
 - Trained machine learning-based model
 - Results and information
- Why?
 - Image-based
 - Easy tool to detect waste
 - Simple steps to undergo
 - Nearest recycling location provided along with the rates and the options to schedule a pick

PERSONA



Jill, the party host



Background Profile:

Jill, a 32 year old. He is an organiser of a well reputed company in the city. He has organised many big parties and always busy in his job. He takes all the responsibility and his duties also includes providing a good food service. He bets many clients particularly for the food he provides. His organisation is popular among the people Jill does many parties and his collected with more food waste by the end of the party. Jill would like to know the waste identified from the image uploaded, so that he can confirm the photo he uploaded was processable.

How can Squander help?

Jill being responsible for organising the party. He wants to recycle all the waste by segregating in rightful manner and help the surrounding environment. He can use an application. Squander which provides his needs by showing the results of nearest recycling company location for all the food waste from his parties that happen wherever in the city. Squander makes an efficient and easiest way in someone's life like Jill's

Simon, the mechanic



Background Profile:

Simon is a mechanic from ten years. His age is of 35 years. His jobs is to inspect and repair vehicles, machinery and light trucks. And he is known for his good service providing for his customers. He works in an indoor garage. Simon's culminated with metallic waste from his work and he wants to find a recycling location to recycle it and make some money from scrap

How can Squander help?

Simon can use the Squander application that helps him to find the nearest recycling company location for the waste to recycle from the comfort of his garage. This would allow him to find and provide easy access directly to the recycling company. He doesn't have to worry about the waste and where to recycle it. Through Squander it makes his life easier.

PROJECT REQUIREMENTS

- Upload Image
- Detect Waste
- Classify Waste
- Receive Results

PROJECT REQUIREMENTS - USER STORIES

ID	As a	I want to	so that
SQD-22	Jill, the party host	upload a photo/image of my garbage waste/ waste items	the Squander application can provide a camera feature to take or upload a photo/ image of the waste items
SQD-23	Simon, the mechanic	detect the waste from the photo/image	I can detect the waste and I can know what can be recycled and what not
SQD-37	Mark, the home owner	know what information I can obtain about this/any waste items I might find it	I can gain an understanding of what waste items are found in the image by classifying the waste into it's types
SQD-46	John, the engineer	receive the results of any waste items found	I can get the results of waste items with number of waste items found thus makes me easy to segregate and decompose the waste properly

TECHNOLOGIES USED



Machine Learning API



Backend



Google Maps

Integrated Map API



TensorFlow

Machine Learning Library



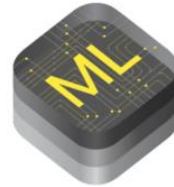
Amazon S3

Object Storage Service



Swift

iOS Development Toolkit

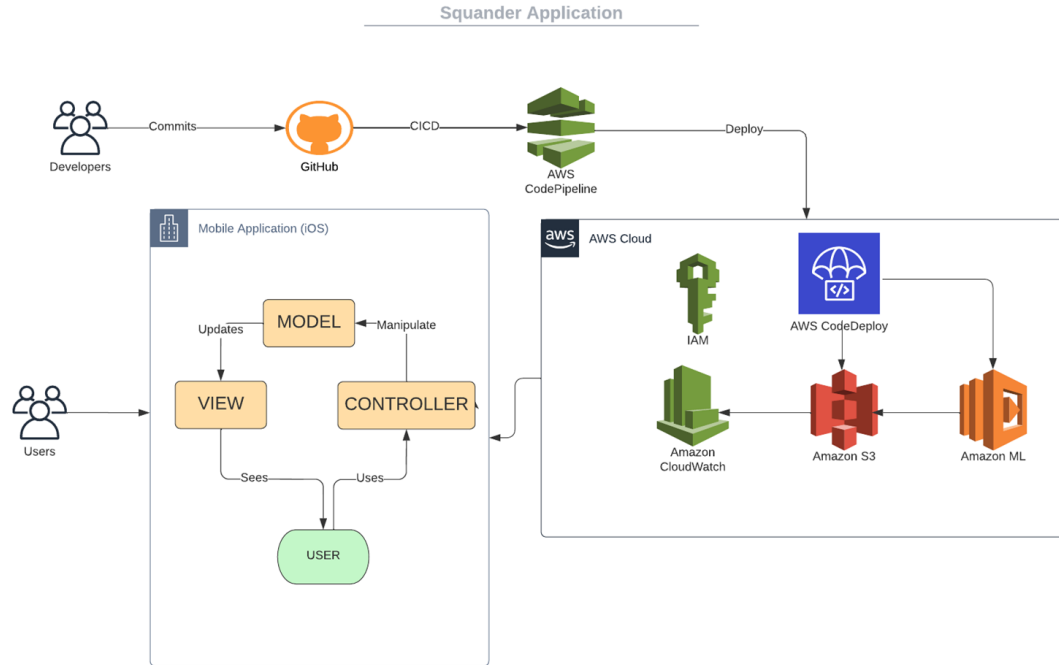


CoreML

ARCHITECTURE DESIGN



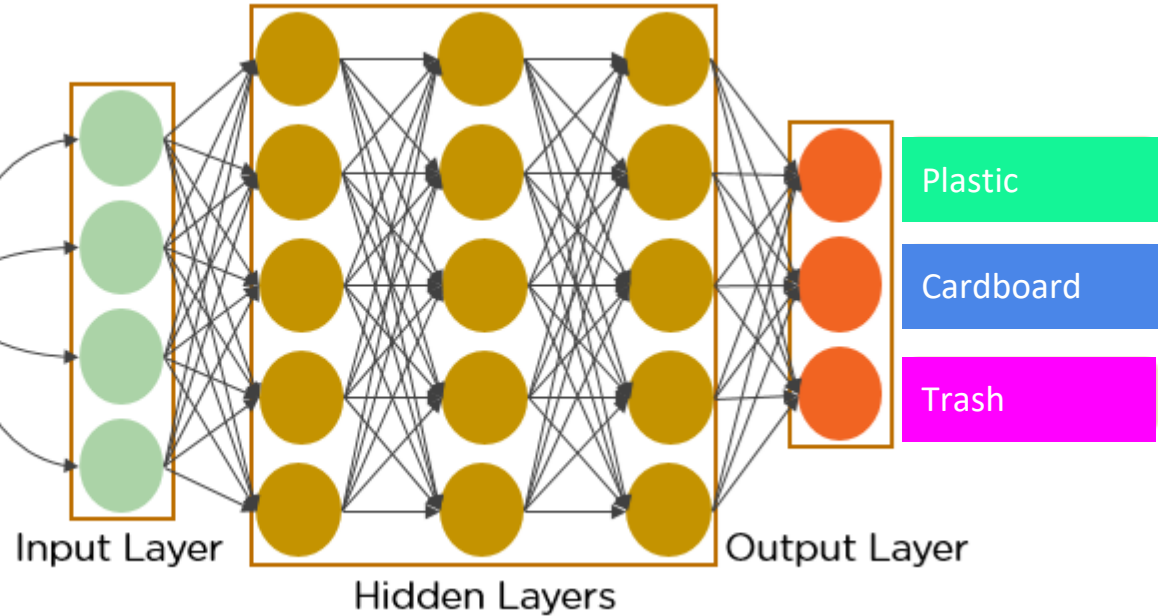
SQUANDER ARCHITECTURE



MACHINE LEARNING ALGORITHM



Pixels of image fed as input



Model: Classification

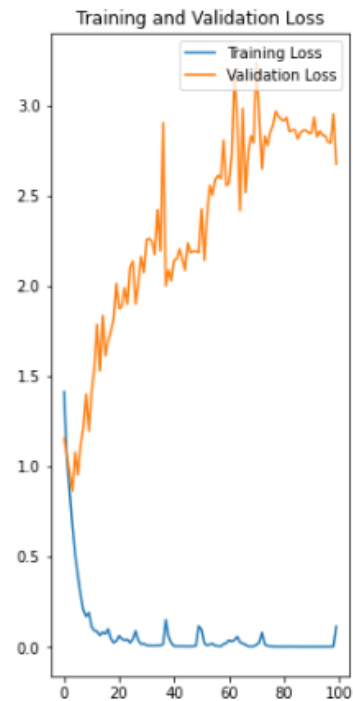
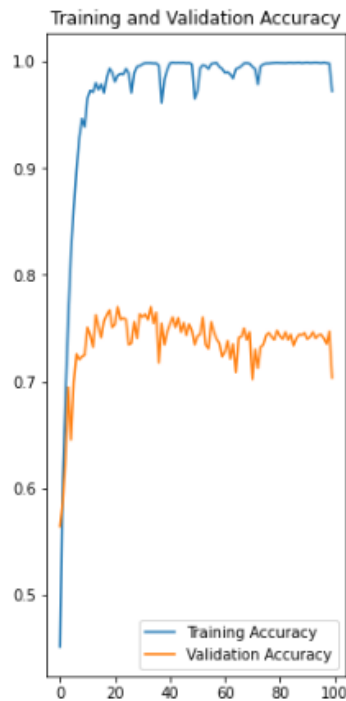
Model is able to classify trash into the following categories:

- Cardboard
- Glass
- Metal
- Paper
- Plastic
- Miscellaneous Trash

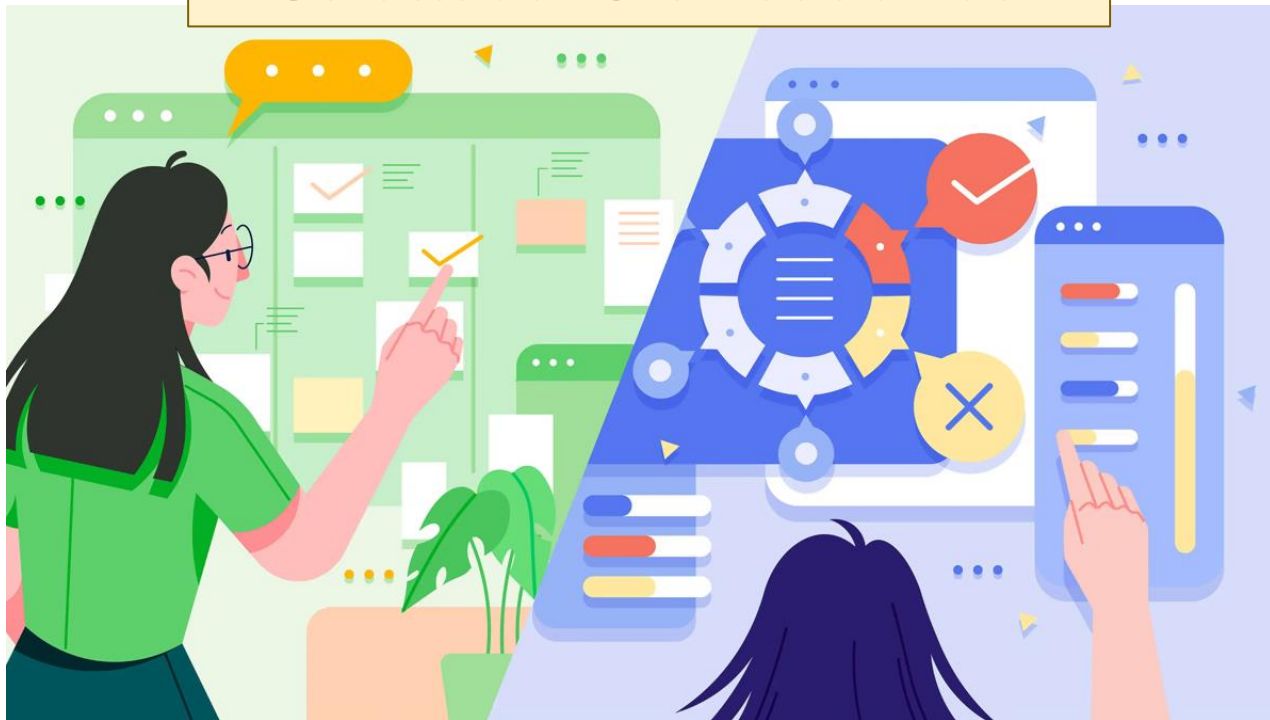


MODEL EVALUATION

This image most likely belongs to glass with a 100.00 percent confidence.

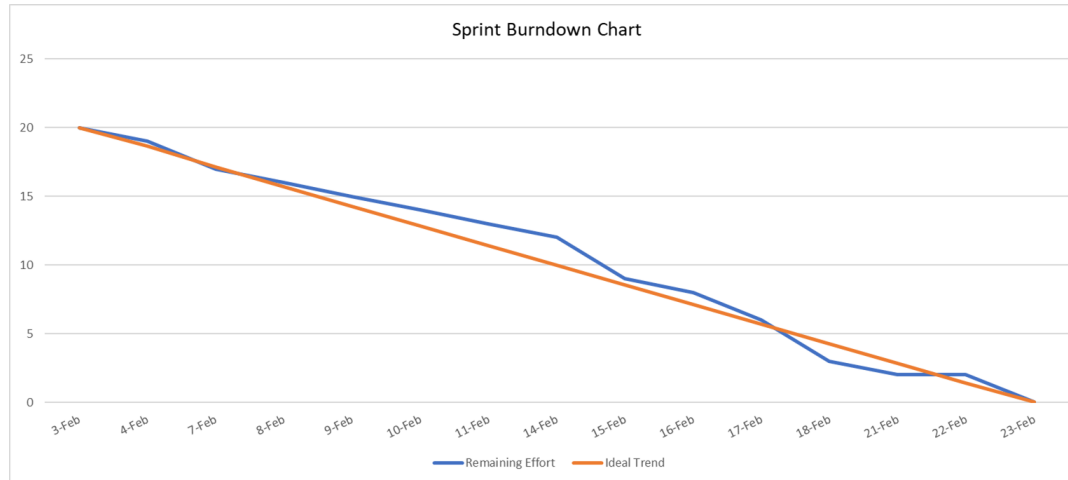


SPRINT OVERVIEW



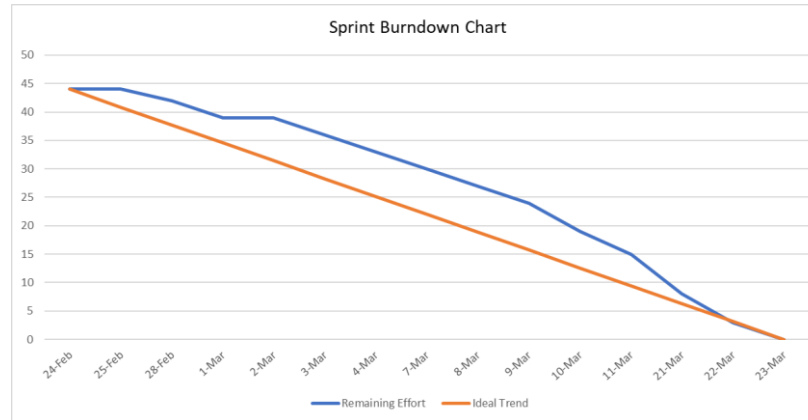
REVIEW SPRINT I

SPRINT 1(02/03 - 02/23)			
KEY	SUMMARY	PRIORITY	STATUS
SQD-1	Create Deliverable 1 Presentation	High	DONE
SQD-2	Discuss Project Idea and Brainstorming	High	DONE
SQD-3	Create Team Roles	Medium	DONE
SQD-4	Establish Weekly Meetings	Medium	DONE
SQD-5	Setup GitHub WikiPage and Jira	Medium	DONE
SQD-6	Create a significant business application idea	Medium	DONE



REVIEW SPRINT II

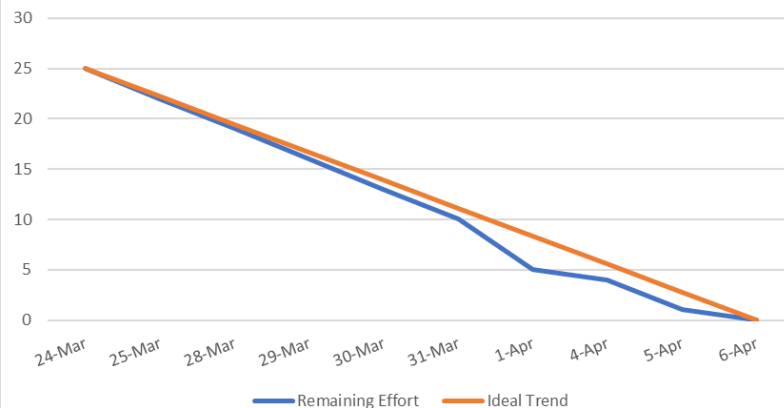
SPRINT 2(02/24 - 03/23)			
KEY	SUMMARY	PRIORITY	STATUS
SQD-7	Create Deliverable 2 Presentation/Video	High	DONE
SQD-8	Complete User Stories	High	DONE
SQD-9	Complete Test Cases	Medium	DONE
SQD-10	Complete Acceptance Criteria	Medium	DONE
SQD-11	Research framework for project	Low	DONE
SQD-12	Research data model for project	Low	DONE
SQD-13	Develop Machine Learning Algorithm	High	DONE
SQD-14	Create mock-up designs	Medium	DONE
SQD-15	Test Validate Model	High	DONE
SQD-16	Design User Interface	Medium	DONE
SQD-17	Train Model	High	DONE



REVIEW SPRINT III

SPRINT 3(03/24 - 04/06)			
KEY	SUMMARY	PRIORITY	STATUS
SQD-18	Create IEEE style Technical Paper	High	DONE
SQD-19	Complete other research paper analysis	Medium	DONE
SQD-20	Complete formatting of the Technical Paper	Medium	DONE
SQD-21	Brainstorm ideas for Technical Paper	Medium	DONE
SQD-22	As a user, I want to capture an image of garbage created by household waste so that Squander App can tell me which items, can be recycled	High	DONE
SQD-23	As a homeowner, Mark wants to upload the garbage image so that he can find recycling locations for construction leftover	High	DONE

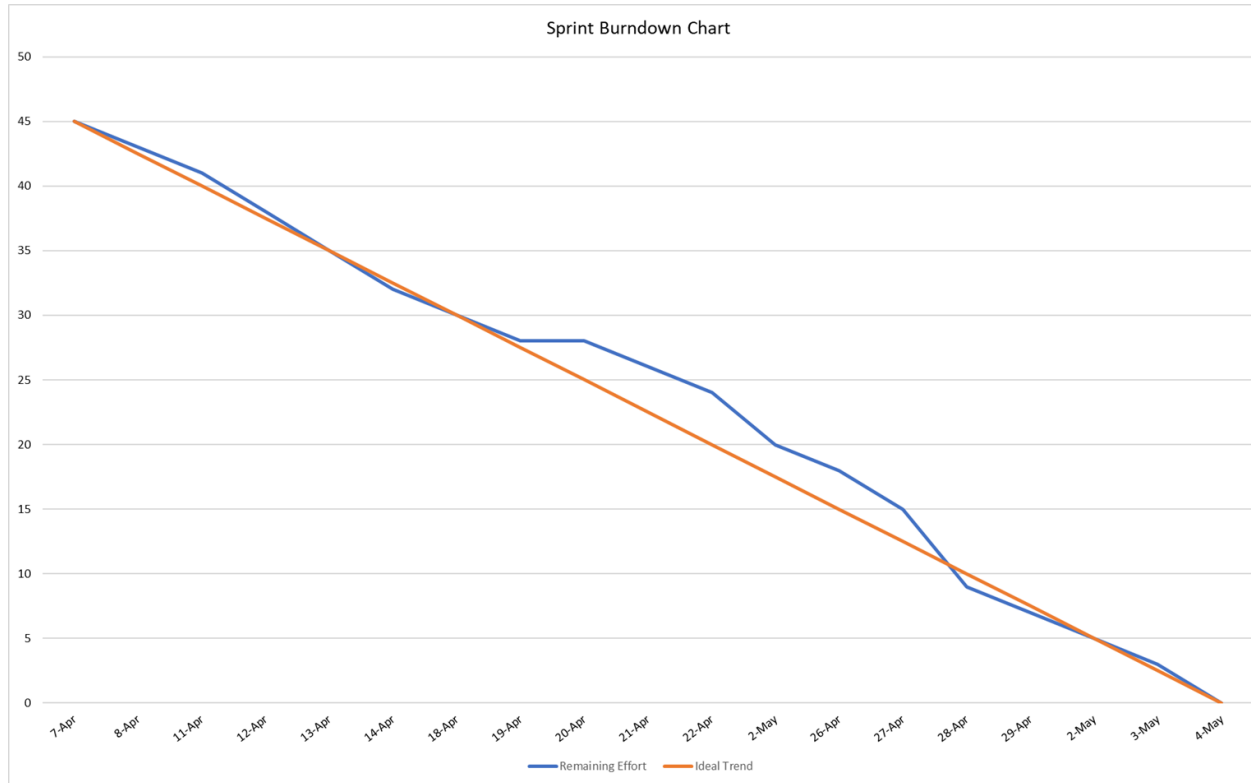
Sprint Burndown Chart



REVIEW SPRINT IV

SPRINT 4(04/07 - 05/04)				
KEY	SUMMARY	PRIORITY	STATUS	
SQD-37	As a party host, Jill wants to know the stats of the application and the amount of waste that is generated	Medium	DONE	
SQD-46	As a mechanic, Simon wants the information about the list of waste items that can be recycled	Medium	DONE	
SQD-52	As a homeowner, Mark wants to upload the garbage image to check how many items can be picked up.	Medium	DONE	
SQD-53	Create Deliverable 4 Presentation	Medium	DONE	
SQD-54	Create a video showing our MVP Demo	Medium	DONE	
SQD-55	Develop Home Screen	High	DONE	
SQD-56	Develop Result Screen	High	DONE	
SQD-57	Develop Processing Screen	Medium	DONE	
SQD-58	Develop Capture Screen	High	DONE	
SQD-59	Develop Stats Screen	High	DONE	
SQD-60	Test Home Screen	Medium	DONE	
SQD-61	Test Result Screen	Low	DONE	
SQD-62	API Gateway for model communication	Medium	DONE	
SQD-63	Test Processing Screen	Low	DONE	
SQD-64	Test Capture Screen	Medium	DONE	
SQD-65	Test Stats Screen	Medium	DONE	
SQD-66	Create a User Manual	High	DONE	
SQD-67	Create a Installation Manual	Medium	DONE	
SQD-68	Update Github Page	Medium	DONE	
SQD-69	Create Deliverable 4 Pre-Recorded Video and Edit	Low	DONE	
SQD-70	Deploy the model and the UI together	High	DONE	

REVIEW SPRINT IV - Burndown Chart



TEST CASES



TEST CASES - HOME SCREEN

Test Case Name	User Story	Test Case ID	Test Action	Expected Results	Test Result	Pass/Fail
Home Screen	SQD-22	SQD-24	Browse from the app	User should be able to access the homepage of the app	Once the user opens the app, they are directed to the home screen of Squander	PASS
		SQD-25	Locate the Recycle Button	User should be able to see the Recycle Button and it should be clickable	Once the user is on the home screen, recycle button is visible and once clicked on the button it is redirected to recycle screen	PASS
		SQD-26	Locate the Stats Button	User should be able to see the Stats Button and it should be clickable	Once the user is on the home screen, the stats button is visible, and once clicked on the button it is redirected to stats screen	PASS
		SQD-27	Locate the Contribution Button	User should be able to see the Button and it should be clickable	Once the user is on the home screen, contribution button is visible, and once clicked on the button it is redirected to contribution screen	PASS
		SQD-29	Click on the earth image	The image should be clickable	Once the user is on the home screen, click on the earth image and it is redirected and opens Camera	PASS

TEST CASES - CAPTURE SCREEN

Test Case Name	User Story	Test Case ID	Test Action	Expected Results	Test Result	Pass/Fail
Capture Screen	SQD-23	SQD-30	Locate Camera Button	User should be able to see the camera button and it should be clickable	Once the user is on the capture screen, the camera button is visible, and once clicked on the button it is open the device camera	PASS
		SQD-31	Locate Photo Library Button	User should be able to see the photo library button and it should be clickable	Once the user is on the capture screen, the photo library button is visible, and once clicked on the button it is photo gallery on the device	PASS
		SQD-32	Locate Cancel Button	User should be able to see the cancel button and it should be clickable.	Once the user is on the capture screen, the cancel button is visible, and once clicked on the button it is redirected to the home screen	PASS
		SQD-33	Locate the Camera screen	User should be able to see the camera open.	Once the user clicks on the camera button, the camera gets open and we can take the picture of the waste.	PASS
		SQD-34	Locate the Retake Button	User should be able to see the Retake Button after taking a picture of the item and it should be clickable	Once the user takes a picture of the waste, the retake button is visible and if the user clicks on the button it is redirected again to open the camera.	PASS
		SQD-35	Locate the Use Photo Button	User should be able to see the Use Photo Button after taking a picture of the item and it should be clickable	Once the user takes a picture of the waste, the use photo button is visible and if the user clicks on the button it is feed into the model.	PASS
		SQD-36	Locate Cancel Button	User should be able to see the cancel button and it should be clickable.	Once the user is on the capture screen, the cancel button is visible, and once clicked on the button it is redirected to the home screen	PASS

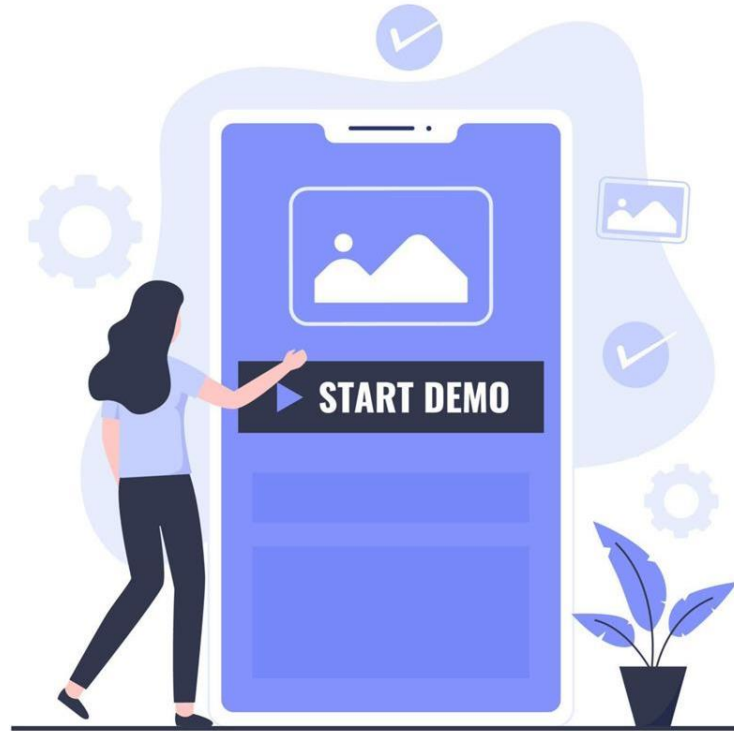
TEST CASES - STATS SCREEN

Test Case Name	User Story	Test Case ID	Test Action	Expected Results	Test Result	Pass/Fail
Stats Screen	SQD-37	SQD-38	Locate Back Button	Users should be able to see the Back Button and it should be clickable	Once the user is on the stats screen, the back button is visible, and once clicked on the button it redirects to home screen	PASS
		SQD-39	Locate the Recycle Button	Users should be able to see the Recycle Button and it should be clickable	Once the user is on the stats screen, the recycle button is visible, and once clicked on the button it redirects to the recycle screen	PASS
		SQD-40	Locate the Contribution Button	User should be able to see the Button and it should be clickable	Once the user is on the stats screen, the contribution button is visible, and once clicked on the button it redirects to the contribution screen screen	PASS
		SQD-41	Locate the Stats Button	Users should be able to see the Stats Button and it should be clickable	Once the user is on the stats screen, the stats button is visible, and once clicked on the button it redirects to the stats screen itself	PASS
		SQD-42	Locate the Household Clickable Ribbon	Users should be able to see the Household Ribbon and it should be clickable	Once the user is on the stats screen, the household ribbon is visible, and once clicked on the ribbon it will expand and contain all the details of the household like high rise societies, townhouse communities, individual houses etc who have used this application and the amount of waste they generated	PASS
		SQD-43	Locate the Public place Clickable Ribbon	Users should be able to see the Public place Ribbon and it should be clickable	Once the user is on the stats screen, the Public place ribbon is visible, and once clicked on the ribbon it will expand and contain all the details of the public places like hotels, restaurants, etc who have used this application and the amount of waste they generated	PASS
		SQD-44	Locate the Industrial Site Clickable Ribbon	Users should be able to see the Industrial Site Ribbon and it should be clickable	Once the user is on the stats screen, the Industrial site ribbon is visible, and once clicked on the ribbon it will expand and contain all the details of the industries like rubber, metal,glass, etc who have used this application and the amount of waste they generated	PASS
		SQD-45	Locate the Construction Site Clickable Ribbon	Users should be able to see the Construction Site Ribbon and it should be clickable	Once the user is on the stats screen, the Construction site ribbon is visible, and once clicked on the ribbon it will expand and contain all the details of the construction places like homes,factories, etc who have used this application and the amount of waste they generated	PASS

TEST CASES - RESULT SCREEN

Test Case Name	User Story	Test Case ID	Test Action	Expected Results	Test Result	Pass/Fail
Result Screen	SQD-46	SQD-47	Locate Back Button	Users should be able to see the Back Button and it should be clickable	Once the user is on the Result Screen, the back button is visible, and once clicked on the button it redirects to the home screen	PASS
		SQD-48	Locate the Recycle Button	Users should be able to see the Recycle Button and it should be clickable	Once the user is on the Result Screen, the recycle button is visible, and once clicked on the button it redirects to the recycle screen	PASS
		SQD-49	Display Waste Item List to be dumped	User should be able to see the waste item list having values likes Paper, Plastic, Metal, etc	Once the user is on the Result Screen, waste item list is visible and it contains data like paper, glass,metal,etc	PASS
		SQD-50	Display the waste item picture	Users should be able to see the waste item picture	Once the user is on the Result Screen, waste item picture is visible	PASS
		SQD-51	Display the confidence value	User should be available to see the confidence value	Once the user is on the Contribution Screen, it will show the total percentage of global impact on the earth due to the amount of waste generated.	PASS

PROJECT DEMO(MVP)



GITHUB WALKTHROUGH



Link : - <https://github.com/anku518/Squander/wiki>

RETROSPECTIVE



RETROSPECTIVE

01

What went well

- Completing our work on time
- Communication among team members

02

What needs improvement

- Coding Redundancies
- Tracking of User Stories and Task via Jira.

03

Future Actions

- Estimate Project velocities accurately
- Find a collaboration tool across platforms

CONCLUSION



CONCLUSION

Application Recap:

- Squander facilitates the waste materials of users
- Currently can specify cardboard, glass, metal, paper, plastic and miscellaneous trash.
- Provides:
 1. Model results
 2. Information on the wastage
 3. Location of the nearest recycling factory

Future Scope:

- Improve the algorithm to detect waste more accurately
- Increase the quantity of training data
- Implement inheritance learning, object segmentation and multiple object recognition.
- Add more features to the application such as scheduling and environmental impact tracing.
- Provide more informations to users
- Recommend recycling locations