SQUANDER

FALL 2022 CAPSTONE PROJECT | PROF HENRY WONG

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Austin Blaise
Nicholas Wong
Rajat Nagavkar
Suryadeep Nallana

AGENDA

- Team Members
- Project Overview
- Personas
- Technologies Used
- Design Architecture
- Sprint Overview
- Product Backlog
- Sprint Backlog
- Project Demo
- Future Sprint Timeline
- Retrospective
- Conclusion

TEAM MEMBER ROLES

Nicholas Wong: Machine Learning Engineer
1. Design Computer Vision Model Architecture
2. Train and Evaluate Model Performance
3. Gather representative image data for training

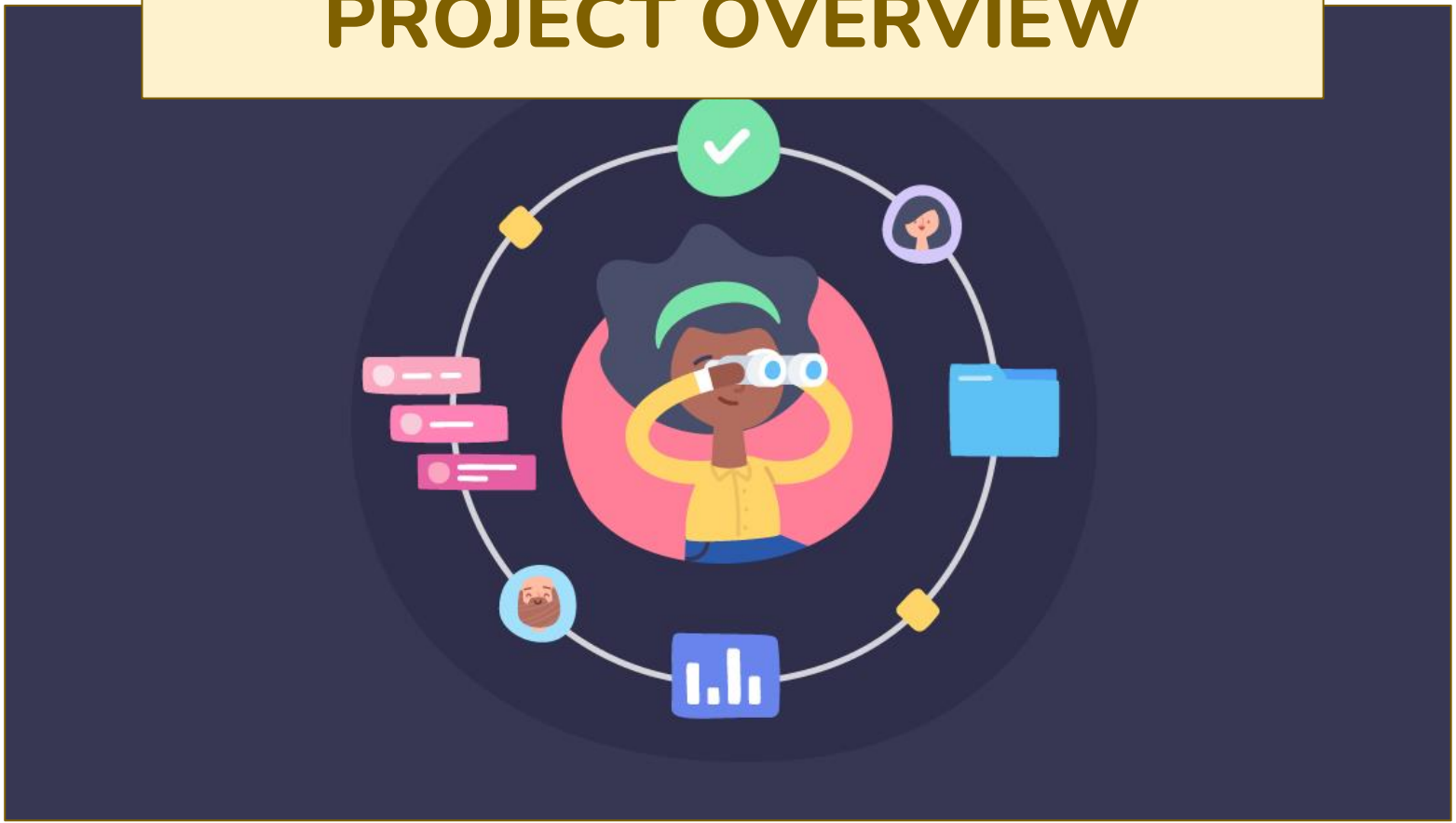
Rajat Nagavkar: Ios Developer
1. Design and Development of Application.
2. Integrating ML model to provide specified results.
3. Testing the app to provide a better user experience.

Aakansha Agarwala: Project Manager/Scrum Master
1. Led team meetings and kept the team on task
2. Maintains the project's GitHub repository and Wiki
3. Documented test cases and co-authored technical paper

Austin Blaise: Cloud Engineer
1. Contribute to the architecture of the project
2. Creates Infrastructure as code
3. Integrated features and services

Suryadeep Nallana: FullStack Developer/Quality Analyst
1. Contribution to design and development of the app layout
2. Authored technical document of the project
3. Working towards making our app user-friendly

PROJECT OVERVIEW



PROBLEM STATEMENT

As the population is increasing the amount of waste produced is also increasing.

The world produces 2.01 billion tons of urban solid waste yearly, with the United States being the highest producer of waste.

Most of the waste produced remains unprocessed due to a lack of recycling knowledge.

Squander app overcomes this problem by providing a way for waste recycling through a machine learning platform.

PROJECT DESCRIPTION

Squander app provides a complete solution to organize and plan the disposal of waste. It uses a machine learning algorithm to detect recyclable waste from images and provide 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 organizer of a well-reputed company in the city. He has organized many big parties and is always busy with his job. He takes all the responsibility and his duties also include providing a good food service. He bets many clients, particularly for the food he provides. His organization is popular among the people Jill does many parties and he collected 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 organizing 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 for 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.

David, the retiree

Background Profile:

David was a sale executive in a marketing firm. He retired from the job recently. He was successful and has been an inspiration for others in the company. After his retirement, David brought up the interest he had for quite some time to renovate his house. He wants to give a personal touch to the house and lead the rest of his life happily in his way. Now he is spending all his time taking care of the process under his supervision and making a beautiful house for himself

How can Squander help?

Squander can be helpful for David, as he is looking after the construction works for his house. The waste can generate a lot, with all the accumulated waste, he can recognize the waste under categories within the app and send it to his nearest garbage station. That’s make David being responsible for his waste and keeping the environment at a better position.

MINIMAL VIABLE PRODUCT

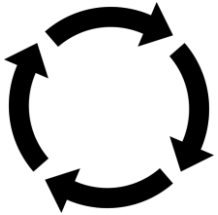
Minimal Viable Product (MVP)

- Recognition Model for Image Recognition of waste items
- Model responds with confidence values on labels of recognized waste items
- Results based on the waste items categorized with how many no of recyclable items found
- Quick and easy method for finding the nearest recycling companies location

Steps:

Uploading Image

Find Nearby Location



Processing Image

Image Results

PROJECT REQUIREMENTS

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

TECHNOLOGIES USED

Machine Learning API

Backend

Google Maps

Integrated Map API

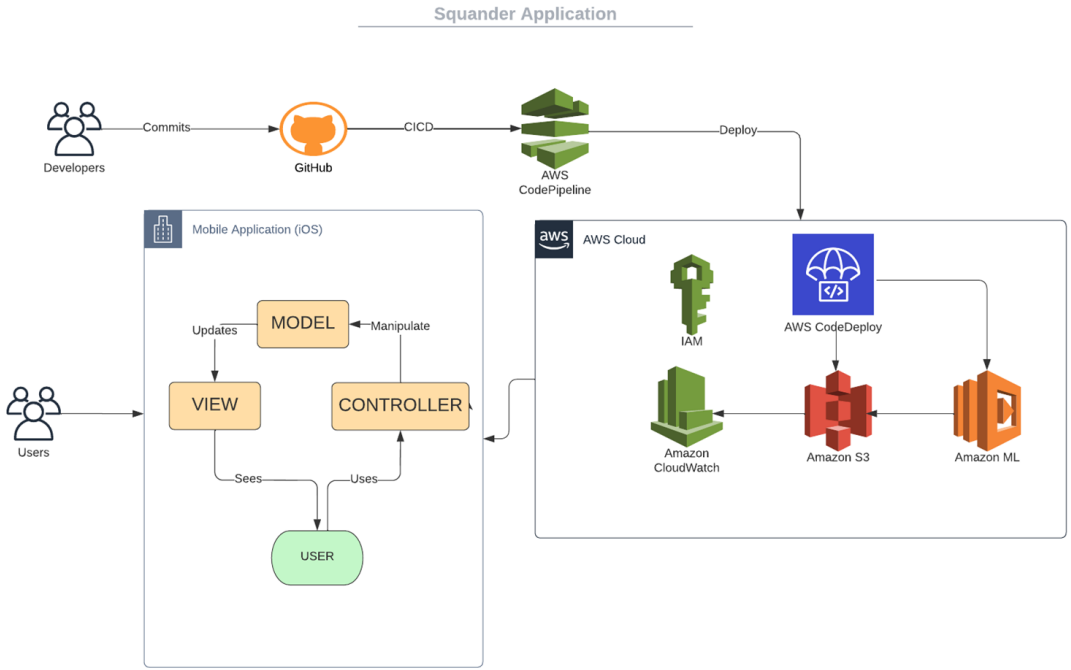
Machine Learning Library

AWS Cloudformation

iOS Development Toolkit

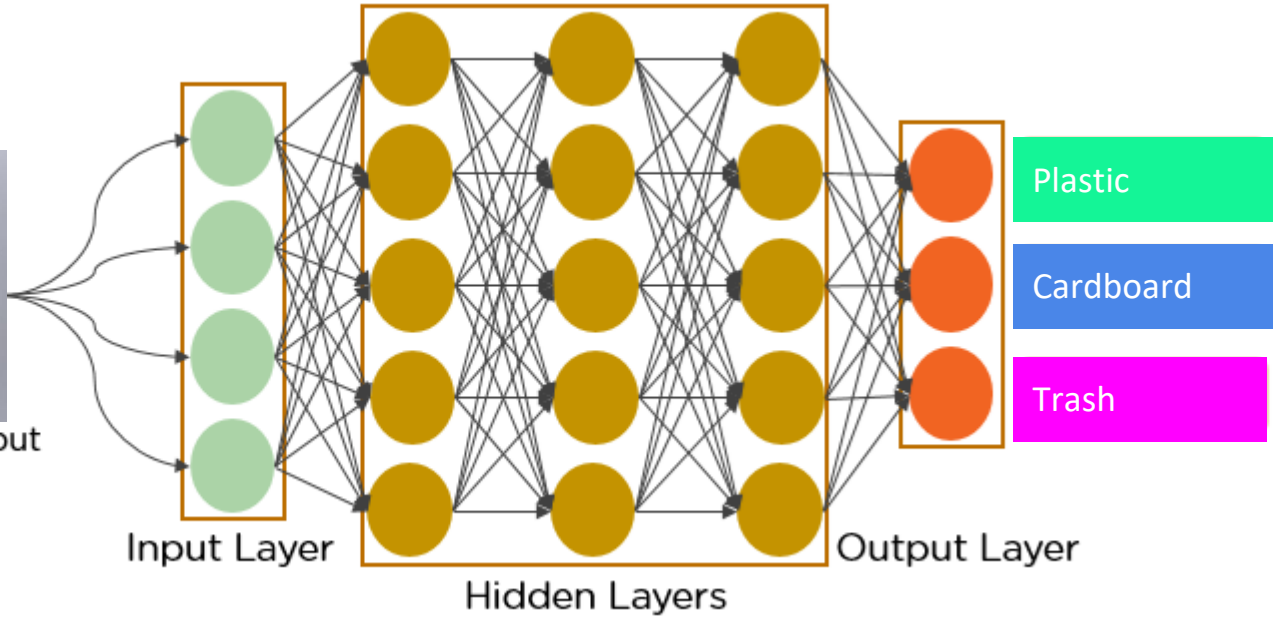
ARCHITECTURE DESIGN

SQUANDER ARCHITECTURE



MACHINE LEARNING ALGORITHM

Pixels of image fed as input



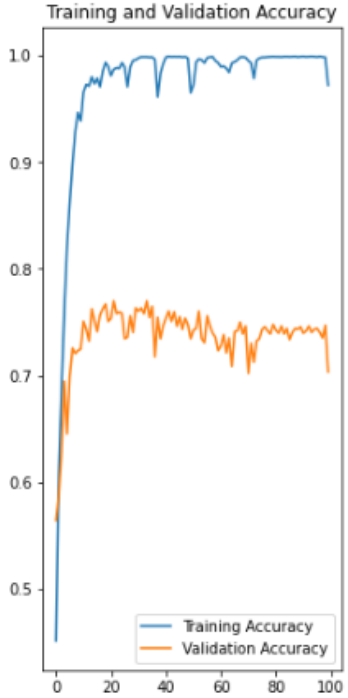
Model: Classification

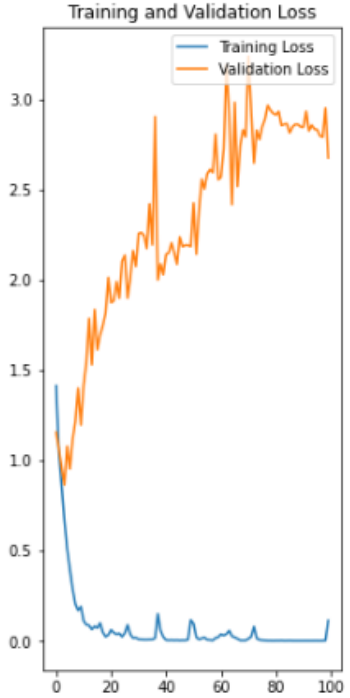
Model is able to classify trash into the following categories:

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

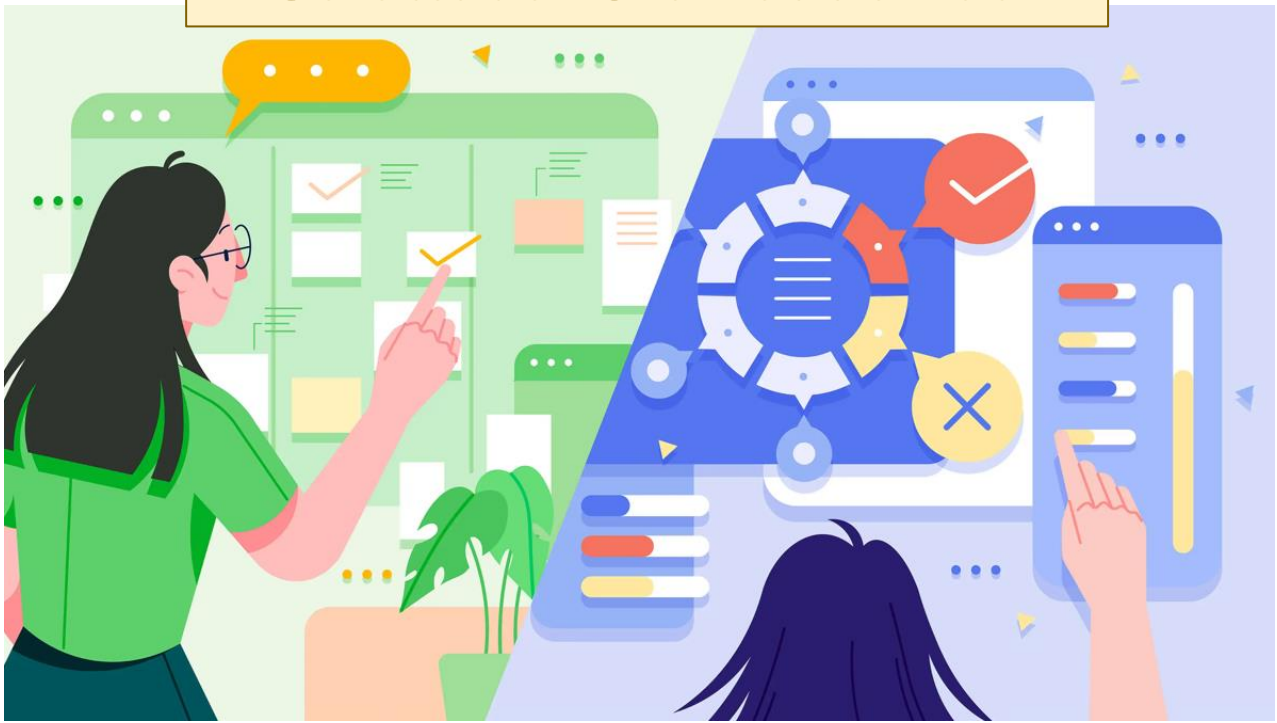
MODEL EVALUATION

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



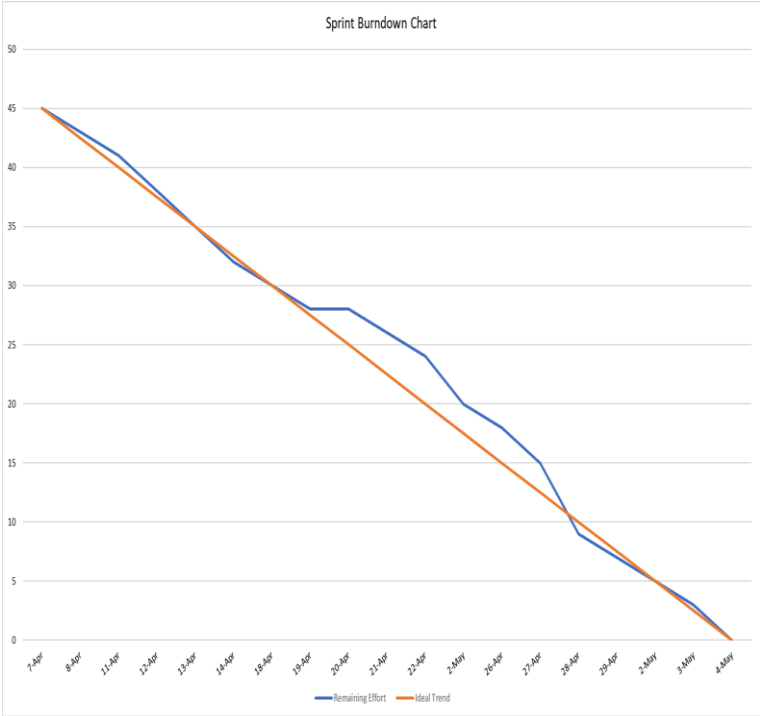


SPRINT OVERVIEW



REVIEW SPRINT 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



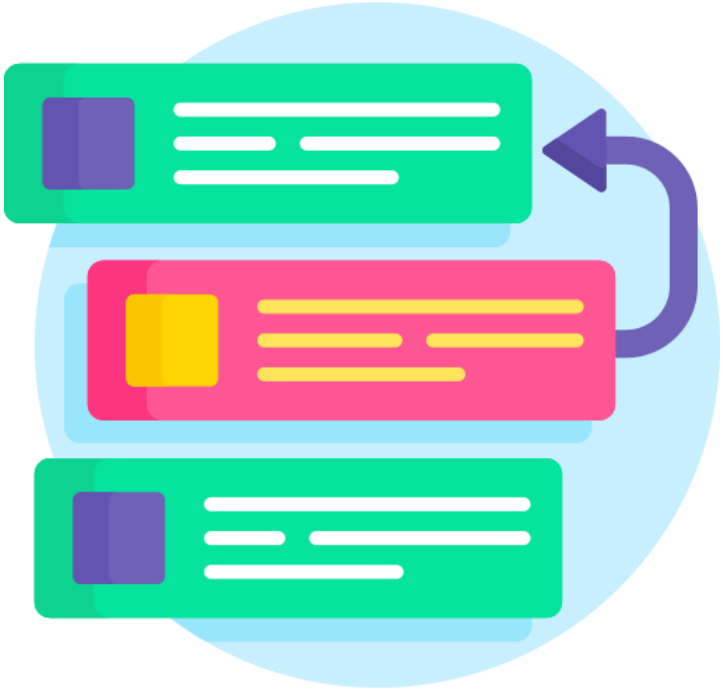
SPRINT IV vs SPRINT V

SPRINT IV	SPRINT V
Finished the first iteration of our application UI design	Determined and mapped out goals for future deliverables.
Deployed our model solution into our application architecture	Navigation Bar feature is added in our application
Recognize a larger range of trash in model	Model confidence value improved
	Researched necessary technologies to achieve our goals

IMPROVEMENT

- We want to improve both technically and with our presentation
- Technical
  - Improve our interface and add additional content for users
  - Improve our model with multiple entity recognition and more accuracy
  - Improve maintainability of the project
- Presentation
  - Try to be more concise in our verbal presenting.
  - More Energy

BACKLOG



USER STORIES & ACCEPTANCE CRITERIA

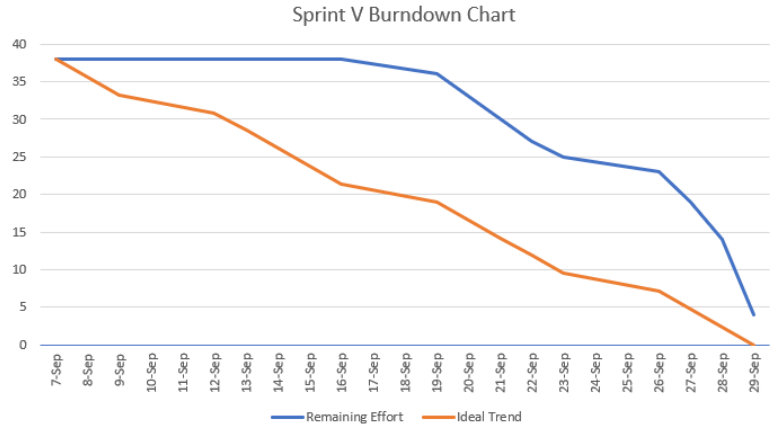
ID	As a	I want to	So that
SQD 52	Simon, the mechanic	Service to be available throughout USA	I can use the application at any work location
SQD 53	David, the retiree	Have app team contact information	I can connect with the team.
SQD 54	Mark, the home owner	to detect more items	I can scan on larger images
SQD 55	John, the engineer	Identify items correctly	I can use on items that look similar

SQD 52, and SQD 53 user stories are completed in Sprint 5, and SQD 54, and SQD 55 are planned in Sprint 6

REVIEW SPRINT V

SPRINT 5 (09/08 - 09/28)			
KEY	SUMMARY	PRIORITY	STATUS
SQD 52	As a mechanic, Simon wants the Squander Service to be available throughout USA	High	DONE
SQD 53	As a retiree, Davin wants to have the Squander app team contact information	Medium	DONE
SQD 56	Design the Navigation bar	High	DONE
SQD 57	Update GitHub and Wiki Page	Medium	DONE
SQD 58	Update Technical Paper	Medium	DONE
SQD 59	Create Deliverable 5 Presenatation	Medium	DONE
SQD 60	Create Deliverable 5 Pre-Recorded Video and Edit	Low	DONE
SQD 61	Improving the model accuracy	Medium	In-Progress
SQD 62	Working on Deploying and building the AWS Resource for the	Medium	In-Progress
SQD 63	Test Cases for Navigation Bar	Low	DONE

SQD 61 and SQD 62 are spilled into Sprint 6 as there is continuous improvement and building upon the resource



FUTURE SPRINT(SPRINT VI)

SPRINT 6 (09/29 - 10/27)			
KEY	SUMMARY	PRIORITY	STATUS
SQD 62	Working on Deploying and building the AWS Resource for the	Medium	In-Progress
SQD 61	Improving the model accuracy	Medium	In-Progress
SQD 64	As a home owner, Mark wants to scan larger items and het the information	High	TO DO
SQD 65	As a mechanic, Simon wants to identify the items correctly	High	TO DO
SQD 66	Design and Deploy AWS API End Point	High	TO DO
SQD 67	Design and Develop Location and Recycling Feature	Medium	TO DO
SQD 68	Work on UI/UX and add more feature on Navigation Bar	Medium	TO DO
SQD 69	Update Techincal Paper	Medium	TO DO
SQD 70	Update Installation Manual and User Manual	Low	TO DO
SQD 71	Update GitHub and Wiki Page	Low	TO DO

PRODUCT BACKLOG

PRODUCT BACKLOG				
KEY	SUMMARY	PRIORITY	SPRINT	STATUS
SQD 72	Create FAQ Page	Medium	Sprint 7	TO DO
SQD 73	Create Feedback Page	Medium	Sprint 7	TO DO
SQD 74	Find Recycling Location	High	Sprint 7	TO DO
SQD 75	Redesign the UI/UX	Low	Sprint 7	TO DO
SQD 76	Update Techincal Paper	High	Sprint 7, Sprint 8	TO DO
SQD 77	Update Installation Manual and User Manual	Medium	Sprint 7, Sprint 8	TO DO
SQD 78	Update GitHub and Wiki Page	Medium	Sprint 7, Sprint 8	TO DO
SQD 79	Design Squander to be User Friendly	Medium	Sprint 8	TO DO
SQD 80	Optimize Squander Code	Medium	Sprint 8	TO DO

No task has been removed; we have only added new tasks like
SQD 80, SQD 75, SQD 79

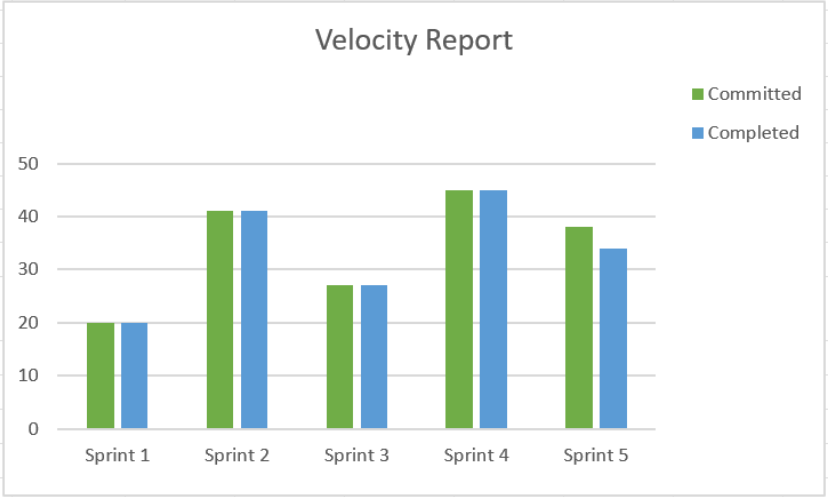
TEST CASES

TEST CASES

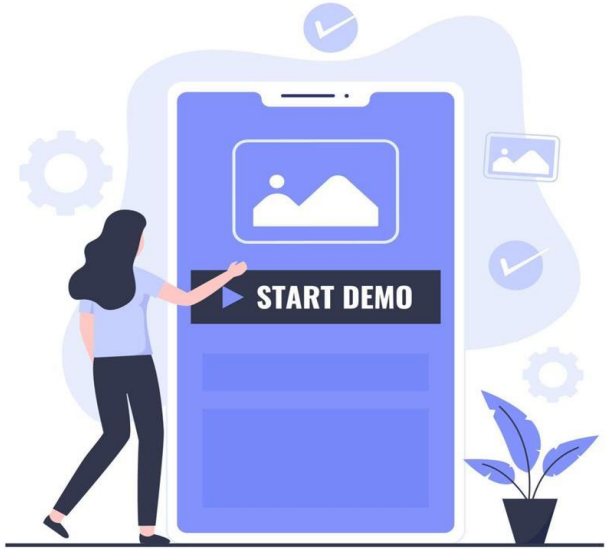
Test Case Name	User Story	Test Case ID	Test Action	Expected Results	Test Result	Pass/Fail
About Us Screen	SQD-53	SQD-81	Locate the Info Button	Users should be able to see the Info Button in the home screen navigation bar and it should be clickable	Once the user is on the Home Screen, the info button is visible, and once clicked on the button it redirects to the About Us screen	PASS
		SQD-82	Locate the Recycle Location Link	Users should be able to see the Recycle Location link and it should be clickable	Once the user is on the About Us Screen, the recycle location link is visible, and once clicked on the button it redirects to the recycle location	PASS
		SQD-83	Locate the Contact Team Link	Users should be able to see the Contact Team link and it should be clickable	Once the user is on the About Us Screen, the contact team link is visible, and once clicked on the button it redirects to the team info	PASS
		SQD-84	Locate the Back Button	User should be able to see the Back Button in the About Us Screen and it should be clickable	Once the user is on the About Us Screen, the back button is visible, and once clicked on the button it redirects to the home screen	PASS

VELOCITY CHART

SPRINT	Committed	Completed
Sprint 1	20	20
Sprint 2	41	41
Sprint 3	27	27
Sprint 4	45	45
Sprint 5	38	34

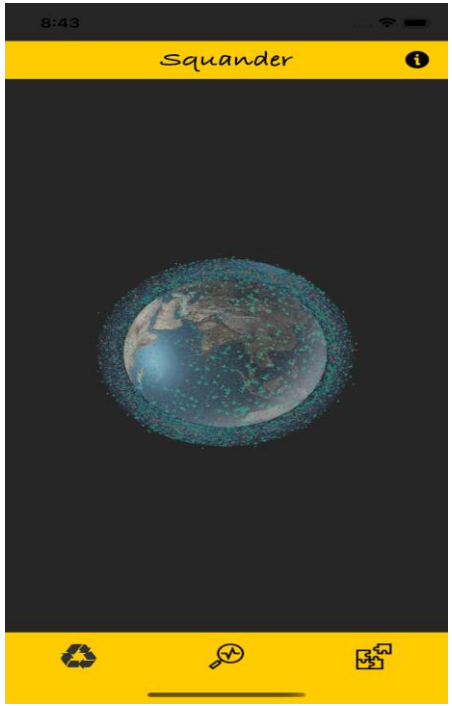


PROJECT DEMO



GitHub Link: - https://github.com/anku518/Squander/wiki

App Screenshots

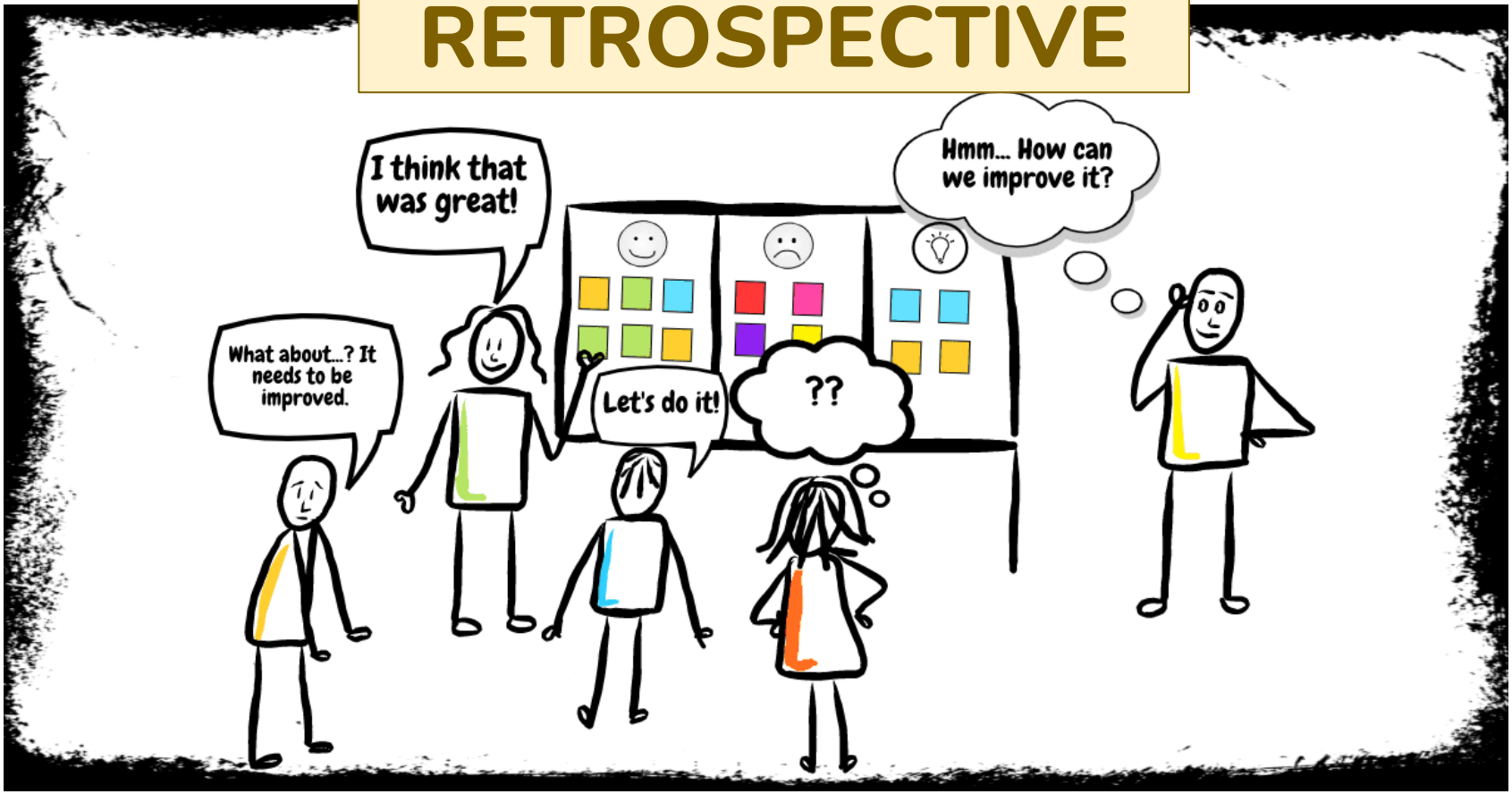


Home Screen Info button added at navigation bar

Continue...

About Screen showing info about the app and recycling guide

RETROSPECTIVE



RETROSPECTIVE

01 What went well

- Deliverable deadlines
- Talk distribution and scrum master resolving blockers

02 What needs improvement

- Code Maintainability
- Story commitment with velocity

03 Future Actions

- Reduce technical debt
- Better estimation of deadline

CONCLUSION

CONCLUSION

Application Recap:

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

Future Scope:

- Improve model accuracy to detect more waste By increasing quantity of training data.
- Implement inheritance learning, object segmentation and multiple object recognition.
- Showing recycling locations nearest to user location.
- Add more features to the application such as scheduling and environmental impact tracing.
- Keeping track of users contribution towards waste recycling.