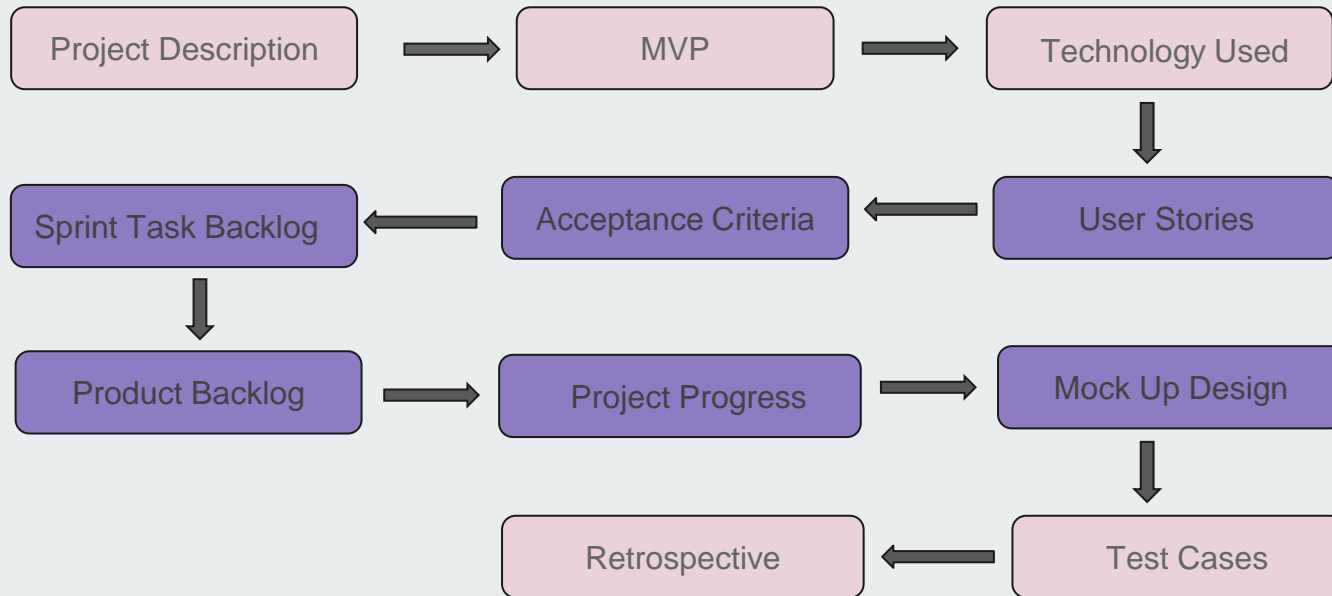




SPRING 2022 CAPSTONE PROJECT | PROF HENRY WONG

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Austin Blaise
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Rajat Nagavkar
Suryadeep Nallana

Agenda



Project Description



Squander is an application that aims to help users organize and plan the disposal of their waste.

App uses Machine Learning Algorithm to recognize waste from images taken from places such as households, construction sites, and public places to enable users to distinguish recyclable waste and provide a way for its proper disposal.

Users can analyze what amount of waste they are producing so that they can minimize or recycle the waste effectively.

It also provides a mechanism to know individual contribution to environment protection and how its global impact can save our environment.

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



Processing Image

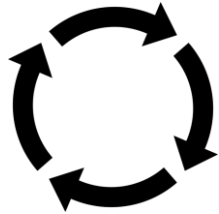


Image Results



Find Nearby Location



Technology Used



Frontend



Machine Learning API



Backend



Google Maps

Integrated Map API



TensorFlow

Machine Learning Library



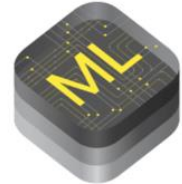
Amazon S3

Object Storage Service



Swift

iOS Development Toolkit



CoreML

User Stories




- User Stories - Sample
- User Story Backlog
- Tasks (Enablers) - Sample
- Tasks Backlog

Stories Description

Projects /  Squander /  MVP /  SQN-14

Capture Image

 Attach

 Add a child issue

 Link issue



Description

As a user, Mark wants to capture garbage image so that he can decide which images he want the recycling analysis is to be done.

Activity

Show:

All

Comments

History































Newest first ↓

AB

Add a comment...

Pro tip: press **M** to comment

Stories


 SQN-14 Capture Image		TO DO ▾	
 SQN-13 Image Upload		TO DO ▾	
 SQN-18 View Image		TO DO ▾	
 SQN-15 Select Image from Gallery		TO DO ▾	
 SQN-16 List of recyclable Items		TO DO ▾	
 SQN-17 Find Recycle Location		TO DO ▾	
 SQN-21 View uploaded Image		TO DO ▾	
 SQN-22 Nearest Recycle location		TO DO ▾	
 SQN-24 Feedback		TO DO ▾	
 SQN-27 Recycling Stats		TO DO ▾	

Tasks (Enablers) Description

 MVP /  SQN-25

Train ML Model

 Attach

 Add a child issue

 Link issue



Description

Train Machine Learning models with modified algorithms that could identify and classify the wastes from Images.

Acceptance

- The algorithm could be ensembled to reduce True Negatives or False Positives
- Should be trained on variety of data to avoid over fitting.
- Testing and validation over the provided dataset should have above 75% Precision.

Activity

Show: All Comments History

Newest first 



Pro tip: press **M** to comment

Tasks (Enablers)

<input checked="" type="checkbox"/> SQN-20	API Gateway for model communications	=	TO DO ▾	AB
<input checked="" type="checkbox"/> SQN-19	Model Fetch Image	=	TO DO ▾	NW
<input checked="" type="checkbox"/> SQN-25	Train ML Model	=	TO DO ▾	NW
<input checked="" type="checkbox"/> SQN-26	Test and validate Model	=	TO DO ▾	NW
<input checked="" type="checkbox"/> SQN-23	Recycle location Backend	=	TO DO ▾	AB

Acceptance Criteria

SQN-13

As a user I want to capture image of garbage created by household waste so that squander app can tell me which items can I recycle.

Scenario

Capture Image of garbage

Given

User tries to capture image of items to be recycled

When

Capture image button is clicked

Then

Image of garbage waste is captured

Acceptance Criteria (Continued..)

SQN-14

As a homeowner, Mark needs to upload garbage image so that he can find recycling Locations for construction leftover

Scenario

Upload Image

Given

Mark has captured image of garbage or selected from gallery

When

Clicks on image capture

Then

Garbage Image is uploaded for Processing.

Acceptance Criteria (Continued..)

SQN-18

As a user, Mark wants to view image uploaded so that he can verify the uploaded image.

Scenario

View Image

Given

Mark capture Image of items to be recycled

When

Clicked on Capture Button

Then

Mark is able to view uploaded Image

Acceptance Criteria (Continued..)

SQN-15

As a user, Jill wants to select image already in the gallery so that he upload the image to the app to find which items to recycle.

Scenario

Select Image From gallery

Given

Image is available in the gallery.

When

Clicked on gallery icon capture screen.

Then

Select image from gallery

Acceptance Criteria (Continued..)

SQN-16

As a user, Jill wants to get list of items that can be recycled with name so that he can know recyclable item name.

Scenario

List of recyclable items

Given

User uploads photo of garbage to be recycled.

When

Processing of uploaded image is successful.

Then

List of items with their name is available.

Acceptance Criteria (Continued..)

SQN-17

As a party host, Jill would like to know a good place to dispose off organic waste, so that he feels good about managing the waste.

Scenario

Find Compost Location

Given

Jill knows what amount of recyclable waste is available.

When

Clicks Recycle Button

Then

Gets list of good place to dispose of organic waste.

Acceptance Criteria (Continued..)

SQN-21

As a user. I want to view the results of the uploaded image with tag on items that can be recycled so that I can distinguish between recyclable and non recyclable waste.

Scenario

View Uploaded Image

Given

User uploads photo of garbage to be recycled

When

Processing of Image is successful

Then

Should be able to see tags on image of recyclable items.

Acceptance Criteria (Continued..)

SQN-22

As a mechanic, Simon wants to find the nearest recycling location for metallic waste, so that he can get money for scraps.

Scenario

Nearest Recycle Location

Given

Results of items that can be recyclable are available.

When

Processing of Image is successful

Then

Simon should get recycling Locations near to current locations.

Sprint Task Backlog

▼ SQUANDER Sprint 2 24 Feb – 10 Mar (6 issues)

0 0 0

Complete sprint



✓ SQN-6 Complete Deliverable 2 PPT/Video

= TO DO ▼

✓ SQN-7 Complete User Stories

= TO DO ▼

✓ SQN-8 Complete Acceptance Criteria

= TO DO ▼

✓ SQN-9 Complete Test Case

= TO DO ▼

✓ SQN-10 Research Framework for project

= TO DO ▼

✓ SQN-11 Research data model for project

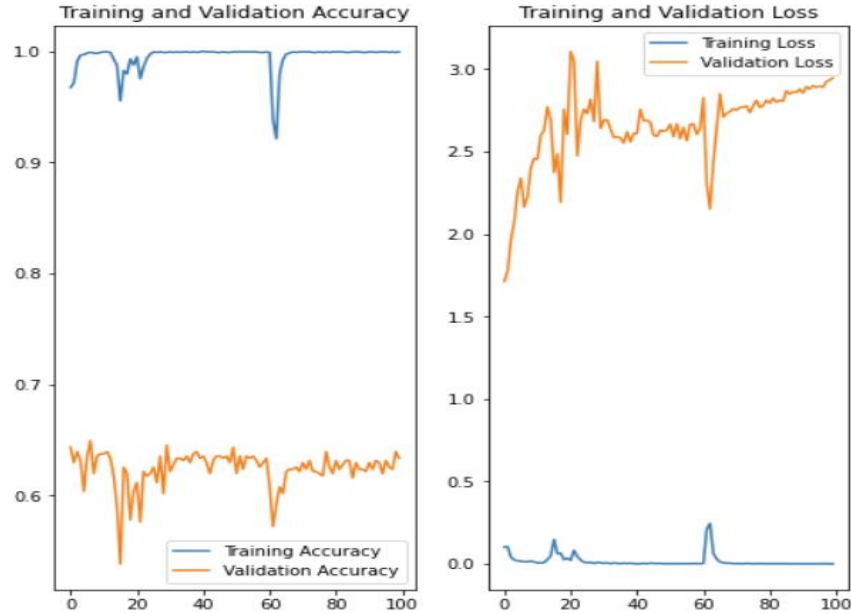
= TO DO ▼

+ Create issue

Product Backlog

Feature	Task	Progress	Priority	Sprint
Recognize Garbage and Classify		In progress	Must	
	Develop ML Algorithm	DONE	Must	2
	Train Model	DONE	Must	2
	Test Validate Model	DONE	Must	2
	Allow Model to Analyze Videos	In Progress	Could	3
	Allow Model to analyze more than one object per image	In Progress	Should	3
Create Application to Use Model		In Progress	Must	
	Design User Interface	DONE	Must	2
	Create Mock up Design	DONE	Must	2
	Develop Application	In Progress	Must	3
	Set up API Gateway for Model communication	In Progress	Must	3

Project Progress



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



Image Breakdown

- Cardboard - 201 Images
- Glass - 250 Images
- Metal - 205 Images
- Paper - 297 Images
- Plastic - 241 Images
- Trash - 71 Images



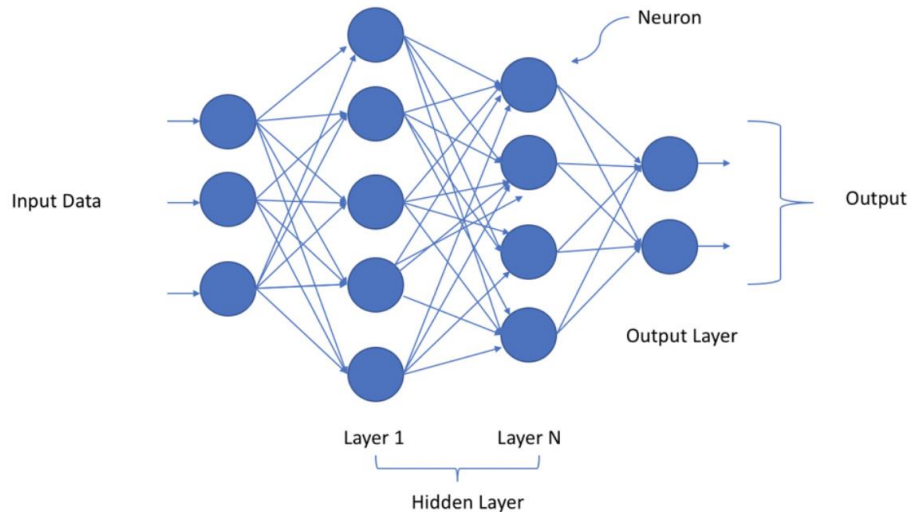
Deeper Model

```
In [16]: model.summary()
```

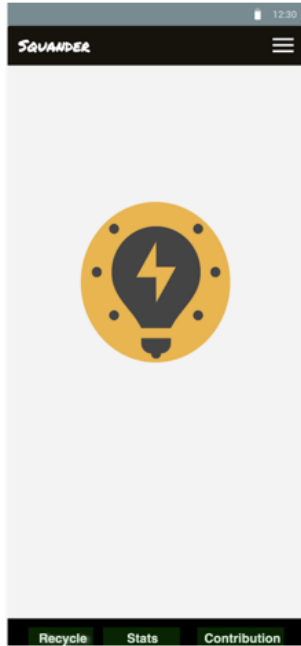
Model: "sequential"

Layer (type)	Output Shape	Param #
rescaling_1 (Rescaling)	(None, 180, 180, 3)	0
conv2d (Conv2D)	(None, 180, 180, 16)	448
max_pooling2d (MaxPooling2D)	(None, 90, 90, 16)	0
conv2d_1 (Conv2D)	(None, 90, 90, 32)	4640
max_pooling2d_1 (MaxPooling2D)	(None, 45, 45, 32)	0
conv2d_2 (Conv2D)	(None, 45, 45, 64)	18496
max_pooling2d_2 (MaxPooling2D)	(None, 22, 22, 64)	0
flatten (Flatten)	(None, 30976)	0
dense (Dense)	(None, 128)	3965056
dense_1 (Dense)	(None, 6)	774

=====
Total params: 3,989,414
Trainable params: 3,989,414
Non-trainable params: 0
=====



Mock Up Design

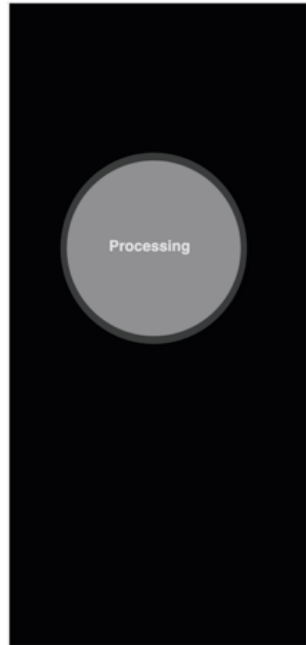


Home Screen

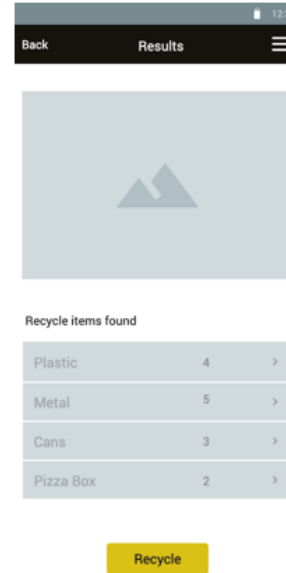


Capture Screen

Mock Up Design (Continued...)

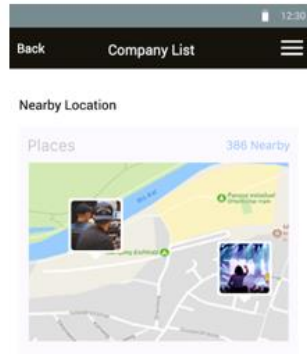


Processing Screen

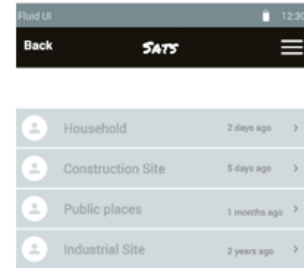


Result Screen

Mock Up Design (Continued...)



Company List Screen



Stats Screen

Test Cases

Key	Test Cases	Test Data	Expected Results
SQD-1	Browse from the app	Home Screen	Users should be able to access the homepage of the app
SQD-2	Locate the Recycle Button	Home Screen	Users should be able to see the Recycle Button and it should be clickable
SQD-3	Locate the Stats Button	Home Screen	Users should be able to see the Stats Button and it should be clickable
SQD-4	Locate the Contribution Button	Home Screen	User should be able to see the Button and it should be clickable
SQD-5	Locate the NavBar	Home Screen	Users can move to all screens on-site using the NavBar
SQD-6	Click on the earth image	Home Screen	The image should be clickable
SQD-7	Locate Capture Button	Camera Screen	The capture button should be present on the middle bottom side of the screen
SQD-8	Locate photos Button	Camera Screen	The photo link which will be used to upload images from the gallery should be present on the bottom left side of the screen
SQD-9	Locate Cancel Button	Camera Screen	The Cancel Button should be present on the top right side of the screen
SQD-10	Locate the word Stats	Stats Screen	The text should be displayed on the middle top side of the screen
SQD-11	Locate the NavBar	Stats Screen	Users can move to all screens on-site using the NavBar
SQD-12	Locate Back Button	Stats Screen	Users should be able to see the Back Button and it should be clickable
SQD-13	Locate the Recycle Button	Stats Screen	Users should be able to see the Recycle Button and it should be clickable

Test Cases (Continued..)

Key	Test Cases	Test Data	Expected Results
SQD-14	Locate the Contribution Button	Stats Screen	User should be able to see the Button and it should be clickable
SQD-15	Locate the Stats Button	Stats Screen	Users should be able to see the Stats Button and it should be clickable
SQD-16	Locate the Household Clickable Ribbon	Stats Screen	Users should be able to see the Household Ribbon and it should be clickable
SQD-18	Locate the Public place Clickable Ribbon	Stats Screen	Users should be able to see the Public place Ribbon and it should be clickable
SQD-19	Locate the Industrial Site Clickable Ribbon	Stats Screen	Users should be able to see the Industrial Site Ribbon and it should be clickable
SQD-17	Locate the Construction Site Clickable Ribbon	Stats Screen	Users should be able to see the Construction Site Ribbon and it should be clickable
SQD-20	Locate the word Contribution	Contribution Screen	The text should be displayed on the middle top side of the screen
SQD-21	Locate the NavBar	Contribution Screen	Users can move to all screens on-site using the NavBar
SQD-22	Locate Back Button	Contribution Screen	Users should be able to see the Back Button and it should be clickable
SQD-23	Locate the Recycle Button	Contribution Screen	Users should be able to see the Recycle Button and it should be clickable
SQD-24	Locate the Contribution Button	Contribution Screen	User should be able to see the Button and it should be clickable
SQD-25	Locate the Stats Button	Contribution Screen	Users should be able to see the Stats Button and it should be clickable
SQD-26	Locate the Global Impact text	Contribution Screen	user should be able to see the text

Retrospective



- What went well
- What needs Improvement
- Action Items
- Board

What went well



- Communications between the team and setting the right expectation
- Kept proper track of tasks for each team member
- Quality of work good and organized

What needs improvement



- Better meeting timings
- Involving in each other task so that knowledge is enhanced collectively

Action Items



- Work on rescheduling the meetings more effectively
- Find a convenient Backup meeting timing
- Communicate apart from meetings

Idea Board

Squander Retrospective

What went well +

Planning and coordinating everyone's parts was effective + 0	Kept proper track of task of each team member + 5
Quality of work was good and organized + 3	Explored new technologies by working together. + 2
Technology integrations + 0	Communications between the team and setting the right expectation. + 5

What can be improved +

Meeting timings + 5	Need more team work + 0
Involving in each other task so that knowledge is enhanced collectively + 5	Add in-personal meeting time + 0

Action Items +

Communicate apart from just the meeting times, so when people miss meetings it isn't as detrimental + 2	Share everyones calender + 0
Work on rescheduling meetings more effectively. Find a convenient backup timing + 3	