



Girls in ICT 2020

Ms; Earth Yooha Bae, Yeeun Sohn, Jeongmin Yoo

Content

01

Backgrounds

How Clean Bottle
was created?

02

Solutions

What Clean Bottle
will do?

03

Vision

How Clean Bottle can
be improved?

Backgrounds

How Clean Bottle was created?

01

Plastic's Pollution
on the Earth

02

How to Recycle
PET Bottles

03

Upcoming Policy
Related to PET Bottle



Plastic's Pollution on the Earth



Weight of Plastic

- About 300 million tons of plastic waste are produced every year in the world.



Plastic Bottles Per Day

- One million plastic bottles are purchased every minute around the world.



PET Bottle Recycling

- Only 10% of PET bottles are recycled with high quality in Korea.



How to Recycle PET Bottles?



PET
(POLYETHYLENE
TEREPHTHALATE)



pet
plastic
bottles

chips

fiber

yarn

fabric

1



2



3



4



Empty and Wash

Remove the Seal

Crush and Close the Lid

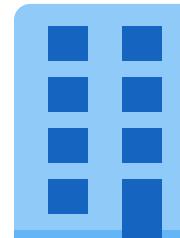
Send out to PET Bottle
Recycling Bin



Upcoming Policy Related to PET Bottle



From
2020/12



From
2021/12



In Korea, transparent PET bottles must be disposed of separately, not plastic.

Apartments will start from December and detached houses from next December.

Solutions

What Clean Bottle will do?

01

Hardware Conception

Reverse Vending Machine

02

Software Conception

CNN with Tensorflow

03

Prototype

Hardware + Software



Hardware Conception: Reverse Vending Machine

Vending Machine
+ Recycling Plastic Bottles
Reverse Vending Machine

- ▼ Accept used and empty beverage containers and return money to the user.
- ▼ Are popular in places that have mandatory recycling laws or container deposit legislation.

Reverse Vending Machine
+ Machine Learning
 CLEAN BOTTLE

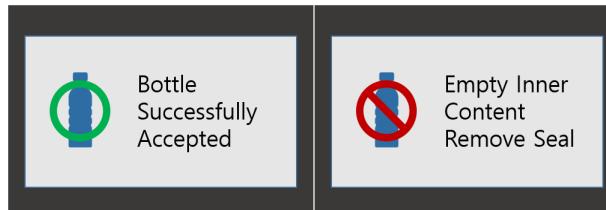
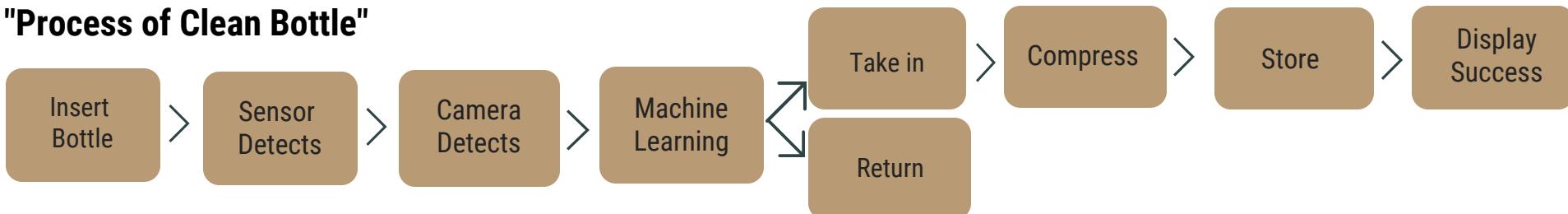


TOMRA H10 AND H11



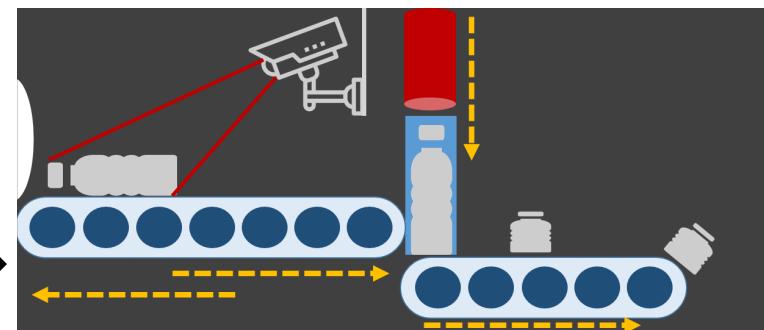
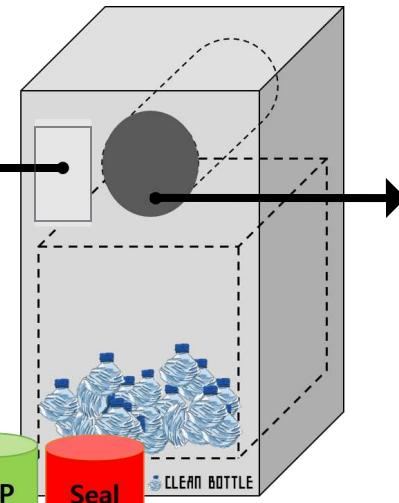
Hardware Conception: Reverse Vending Machine

"Process of Clean Bottle"



Panel

Left: when bottle is **ACCEPTED**
Right: when bottle is **DENIED**

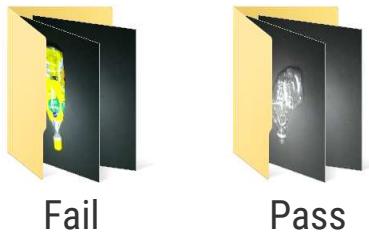


Infrared sensor detects bottle & picture is taken
Accepted: Conveyor belt moves **forward**, bottles are crushed and stored.
Denied: Conveyor belt moves **backward**, bottles are returned.

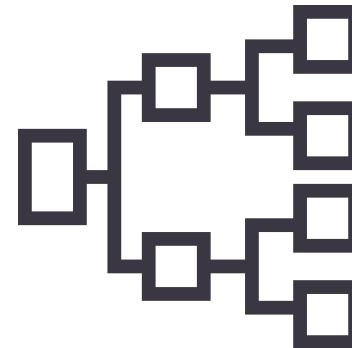




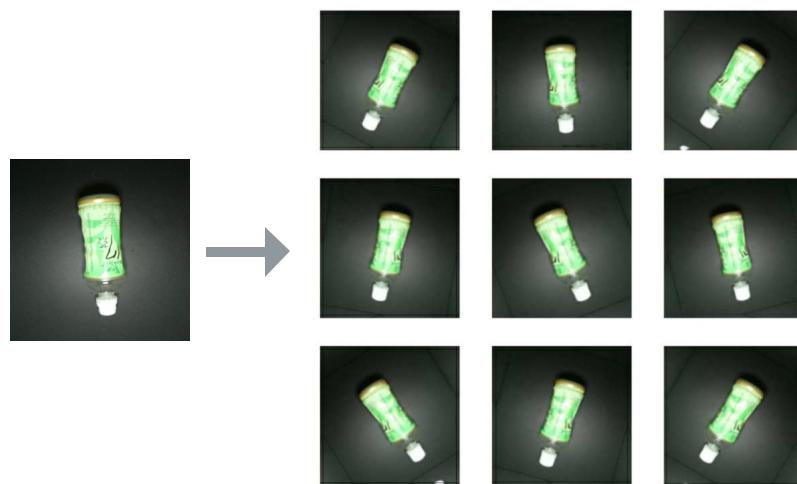
Software Conception: Convolutional Neural Network



70%
Training Data
30%
Validation Data

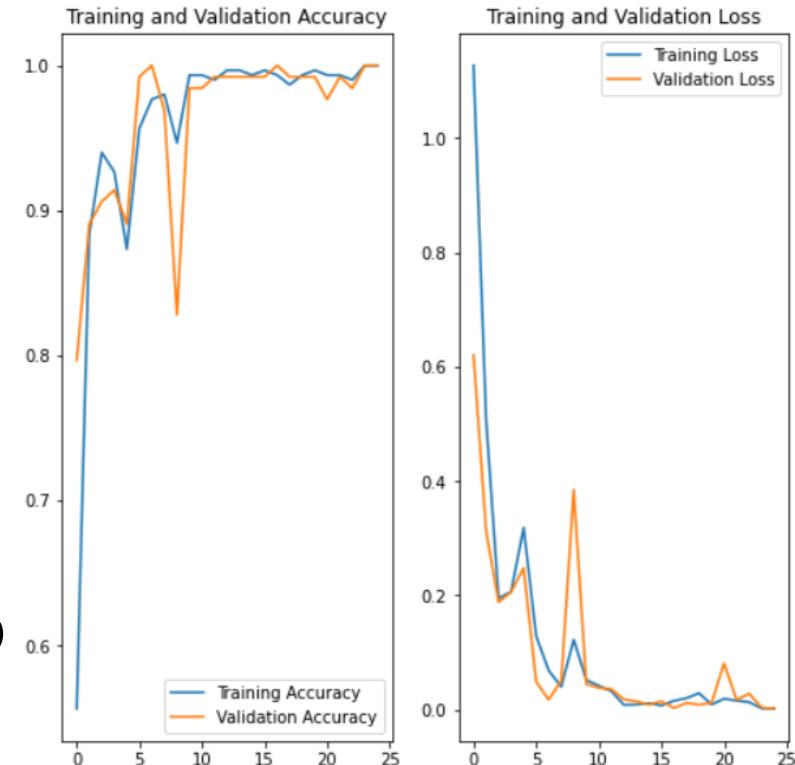
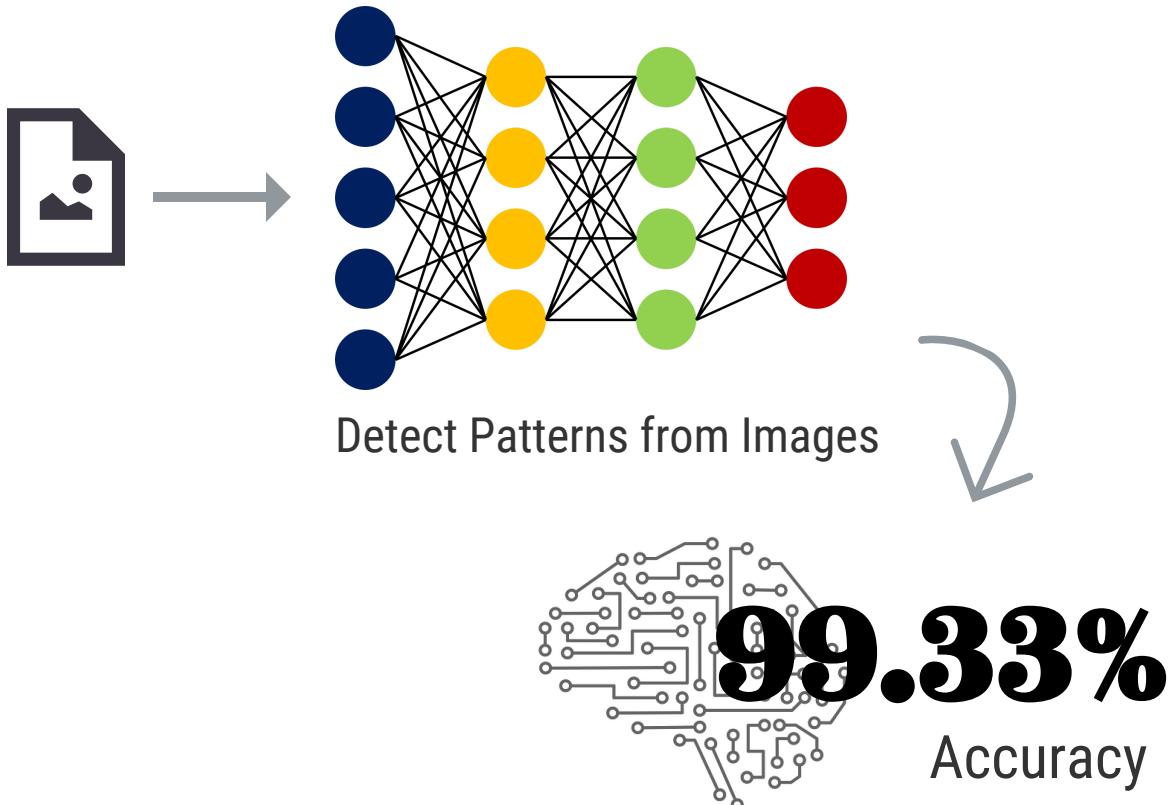


Data
Augmentation





Software Conception: Convolutional Neural Network





Software Conception: CNN with Tensorflow



Pass/99.99%



Pass/99.94%



Fail/99.99%



Pass/99.96%



Fail/99.99%

99%

Accuracy for Images
from Raspberry Pi



Prototype: Hardware + Software

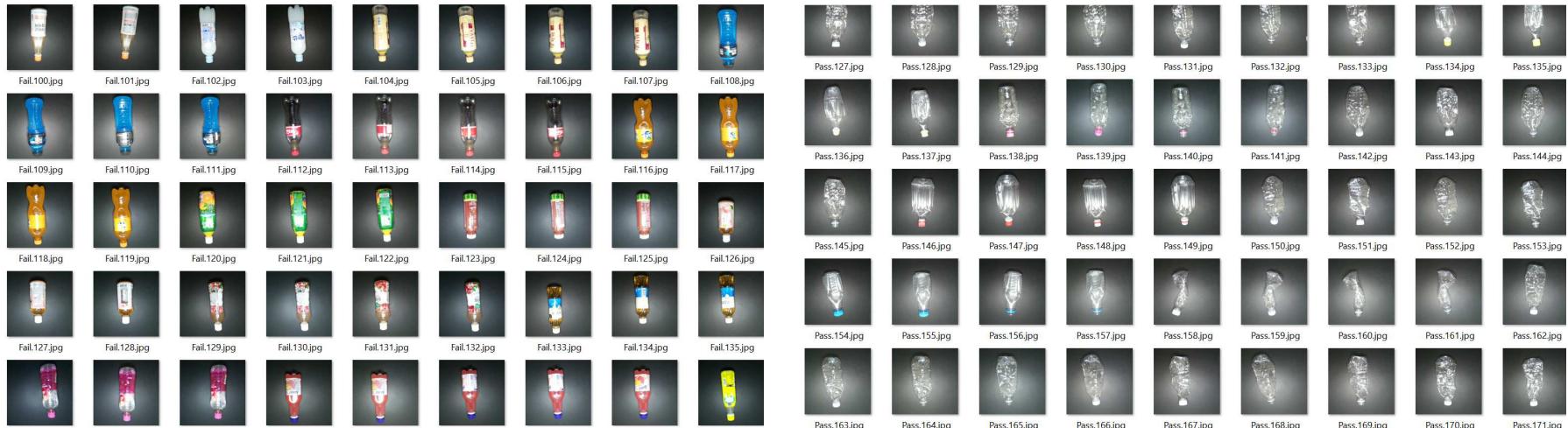


Fail
215 pictures



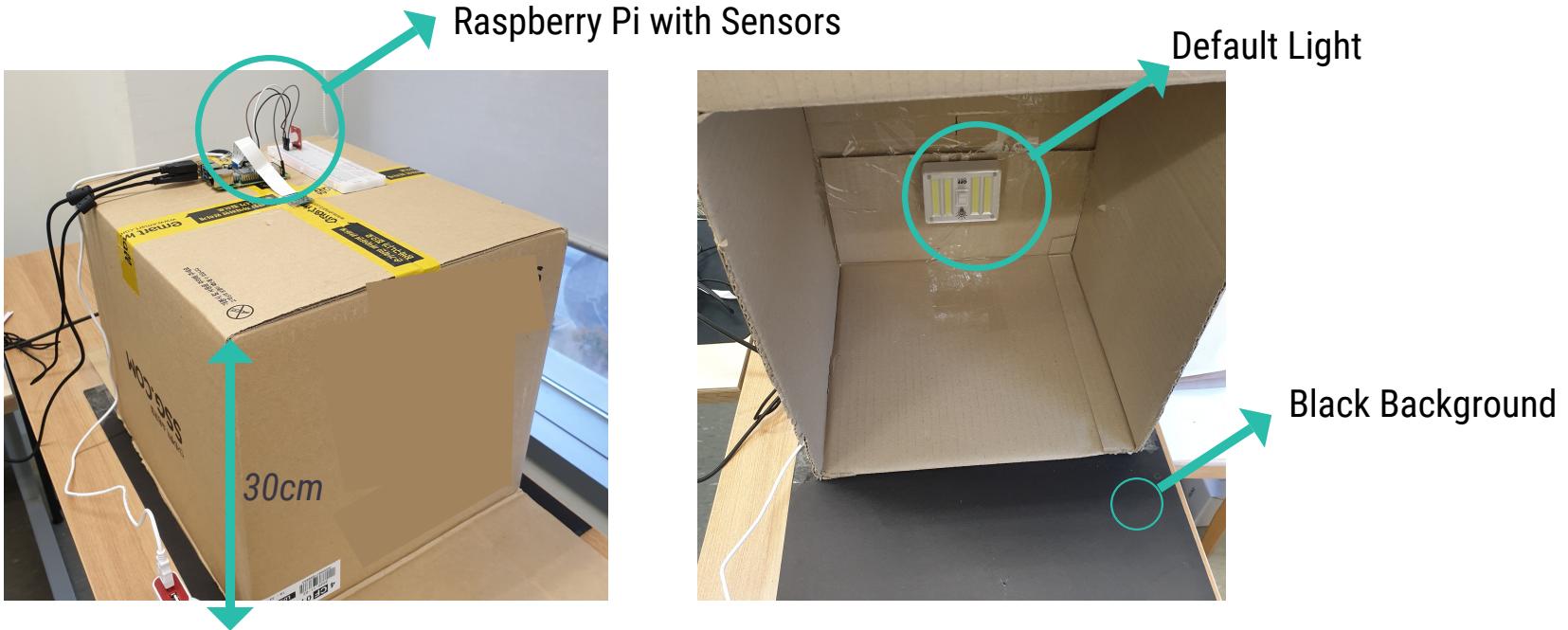
Pass
213 pictures

- Build datasets in the following specified environments
- Create datasets with an equal amount of images for both classifications
- Produced on the assumption of various conditions by differentiating the degree of crushing and the amount of contents in the bottle.





Prototype: Hardware + Software



- Lighting is blocked from the outside
- Construct a stationary situation assuming that the conveyor belt has stopped
- Creating a fixed distance between the object and the camera

Vision

How Clean Bottle can be improved?

01

Future Improvement
Reverse Vending Machine



Future Improvement

Papers

Remove Substances
Bundle Them in a Certain Volume



Styrofoam

Remove Substances
Remove Stickers

Cans

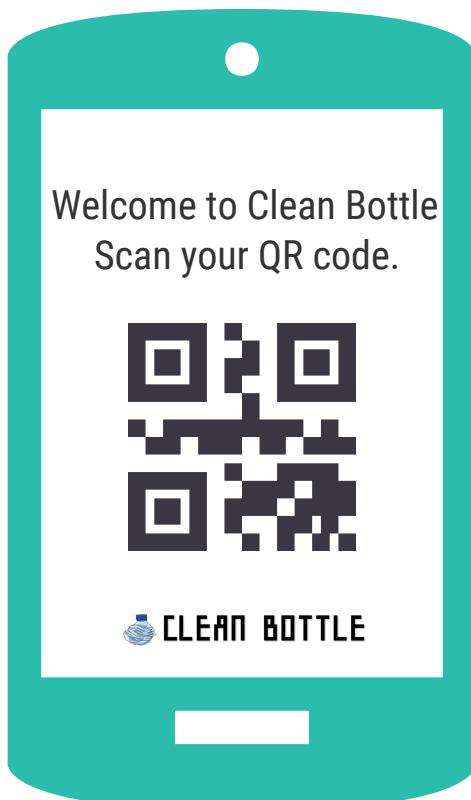
Remove Substances
Remove Seals
Compress Them

Glass Bottles

Remove Substances
Remove Seals



Future Improvement



1

QR Code Detection

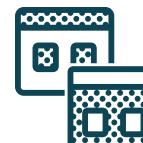
By authenticating mobile phone, you have your own QR code. If you scan your code then you can insert plastic bottles in the Clean Bottle machine



2

Provide the Location of the Machine

The application will show the locations of the clean bottle machines that you have visited before. It will also show you the closest clean bottle machine locations



3

Pie Graph regarding rate of Pass and Fail

You can check your status regarding recycling. It keeps track of how much plastic bottles you have recycled and your success rate of pass. It also shows why you had fail plastic bottles.



References

- <https://sciencing.com/the-effect-of-recycling-plastic-water-bottles-on-the-environment-5147392.html>
- <http://futurechosun.com/archives/42928>
- <https://www.youtube.com/watch?v=lM-yrEm3pPM>
- <https://me.go.kr/home/web/board/read.do?boardMasterId=1&boardId=1095380&menuId=286>
- https://en.wikipedia.org/wiki/Reverse_vending_machine
- <https://bukgu.gwangju.kr/menu.es?mid=a10406060000>
- <http://www.incomrecycle-rvm.com/data/upload/ueditor/20190329/5c9d78dd6001a.pdf>

Thank you