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(ASEAN IVO)

Development of IoT Reverse Vending Machine and its Feasibility Study to Improve Recycling

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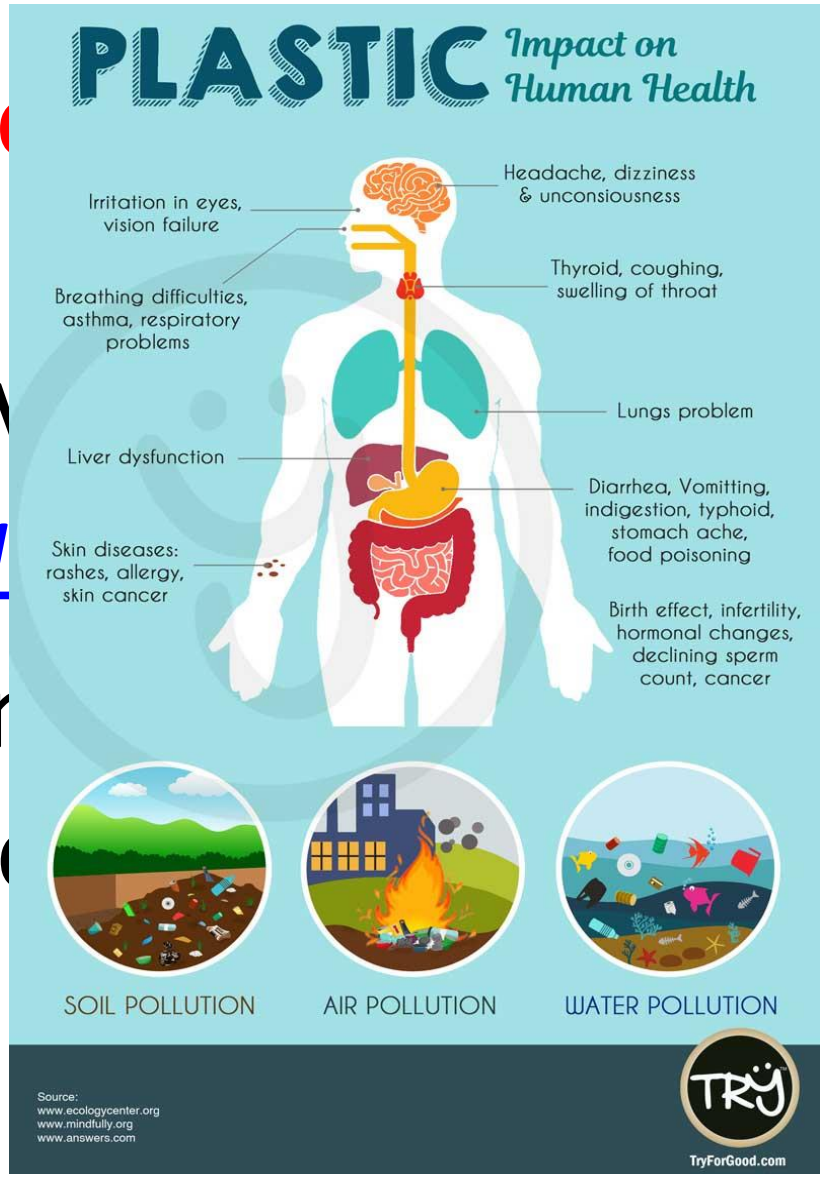
The Problem

PLASTIC WASTE FOOTPRINT
MORE THAN 5 TRILLION PLASTIC PIECES AFLOAT
6.6% RECYCLED PLASTIC USED IN THE BOTTLES
WEIGHING MORE THAN 250,000 TONNES
2M TONNES A YEAR PLASTIC BOTTLES SOLD BY THE TOP 6 GLOBAL FIRMS
MARINE ORGANISMS 10KM DEEP HAD INGESTED PLASTIC FRAGMENTS
NONE HAVE COMMITMENTS TO REDUCE THE AMOUNT OF SINGLE-USE BOTTLES
"IT'S CLEAR THAT IF WE'RE GOING TO PROTECT OUR OCEANS WE NEED TO END THE AGE OF THROWAWAY PLASTIC. THESE COMPANIES NEED TO TAKE DRASTIC ACTION NOW." – LOUISE EDGE, FROM GREENPEACE
SOURCES:
http://www.bbc.com/news/science-environment-39279392 | March 2017
http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0111913
https://www.theguardian.com/environment/2017/feb/13/extraordinary-levels-of-toxic-pollution-found-in-10km-deep-mariana-trench | February 2017
http://www.independent.co.uk/news/uk/home-news/government-plastic-bottle-tax-tackle-household-waste-public-beaches-landfills-environment-a7537686.html | January 2017

Science Matters
Plastic is a sinister ocean pollutant
Plastic water bottles, foam cups, discarded plastic toys – many of them reach the oceans, where they take decades to break down.
Floating mass of plastic waste in central Pacific Ocean
Plastic rope
Plastic ball
Plastic bottles
Fishing nets and floats
Seal tangled in plastic fishing net, which can easily kill it; this seal was rescued and freed
How plastic chemicals move through food chain
Single-cell plankton
Shrimp, krill, small animals
Small fish
Predatory fish (such as tuna, mackerel)
Source: SEAPLEX expedition, Scripps Institution of Oceanography, Agalita Foundation
Graphic: Belinda Long-Ivey, Sun Sentinel, Helen Lee McComas
© 2009 MCT


PLASTIC Impact on Human Health
Irritation in eyes, vision failure
Headache, dizziness & unconsiousness
Breathing difficulties, asthma, respiratory problems
Thyroid, coughing, swelling of throat
Lungs problem
Liver dysfunction
Diarrhea, Vomitting, indigestion, typhoid, stomach ache, food poisoning
Skin diseases: rashes, allergy, skin cancer
Birth effect, infertility, hormonal changes, declining sperm count, cancer
SOIL POLLUTION
AIR POLLUTION
WATER POLLUTION
Source:
www.ecologycenter.org
www.mindfully.org
www.answers.com
TRY
TryForGood.com

Local Issue

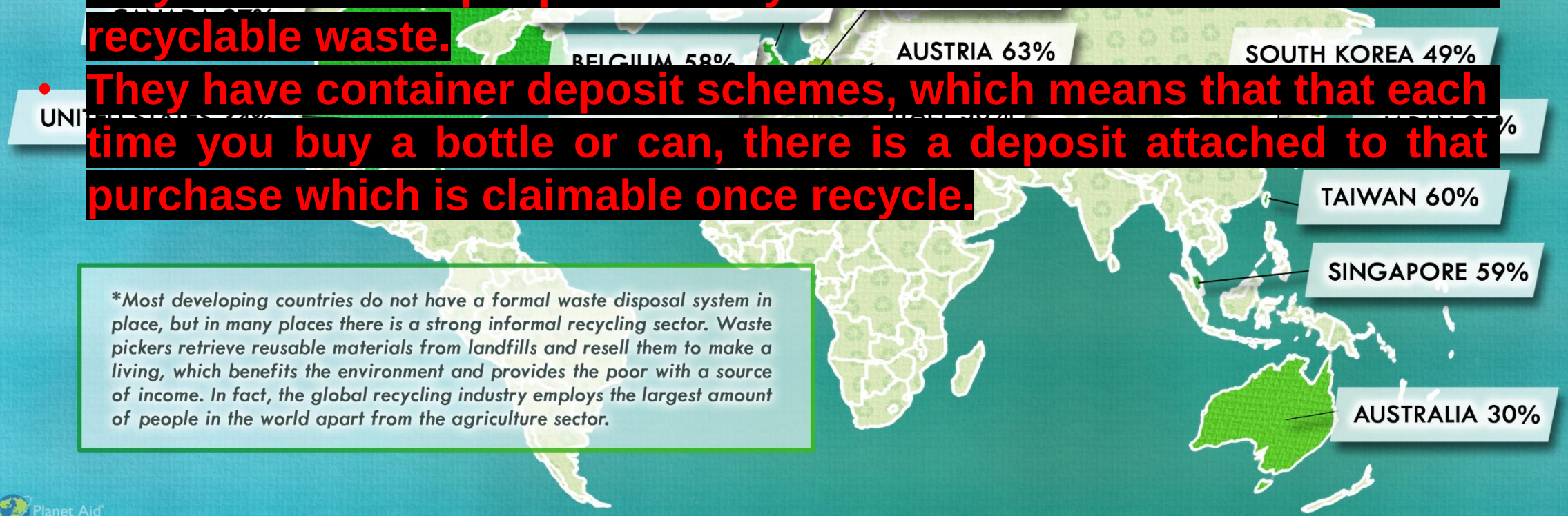
- Malaysia recycling rate is 17 % and current local recycling practice :
  - Dispose recycle item into recycle bin → **No Reward**

  - Collect recycle material and sell to recycle centre → **Bulk collection, manual system to get reward**

RECYCLING RATES *around the world*

DID YOU KNOW? → Austria has the highest recycling rate in the world, with 63% of all waste diverted from the landfill. **The United States produces 25% of the world's waste.** Humans have consumed more resources in the last 50 years than in all previous history. **75% of the nearly 1 billion tons of aluminium ever produced has been recycled and is still in productive use.** About 1% of the urban by

- First-world countries such as Norway, Sweden and Germany saw the highest rate of recycled PET bottles (93.5%) in 2015 because they incentivise people to recycle even with small amount of recyclable waste.
- They have container deposit schemes, which means that that each time you buy a bottle or can, there is a deposit attached to that purchase which is claimable once recycle.



*Most developing countries do not have a formal waste disposal system in place, but in many places there is a strong informal recycling sector. Waste pickers retrieve reusable materials from landfills and resell them to make a living, which benefits the environment and provides the poor with a source of income. In fact, the global recycling industry employs the largest amount of people in the world apart from the agriculture sector.

Planet Aid

Current Local Solution

iCYCLE

Recycle for Life by cenviro

Moni

RVM in Kuching

World Wide

Envipco, USA

Zeleno, India

P'PET, Thailand

EcoCreation, Korea

TOMRA, Norway

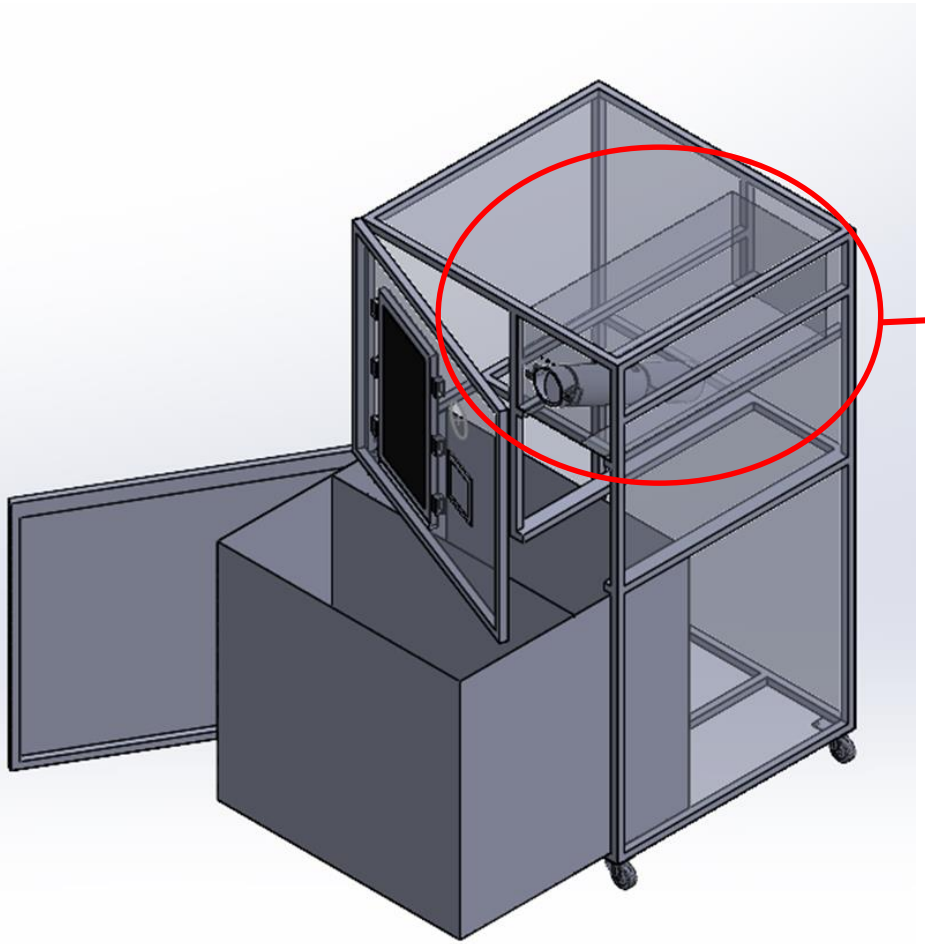
PROPOSED SOLUTION

From waste to Point with Interactive Display

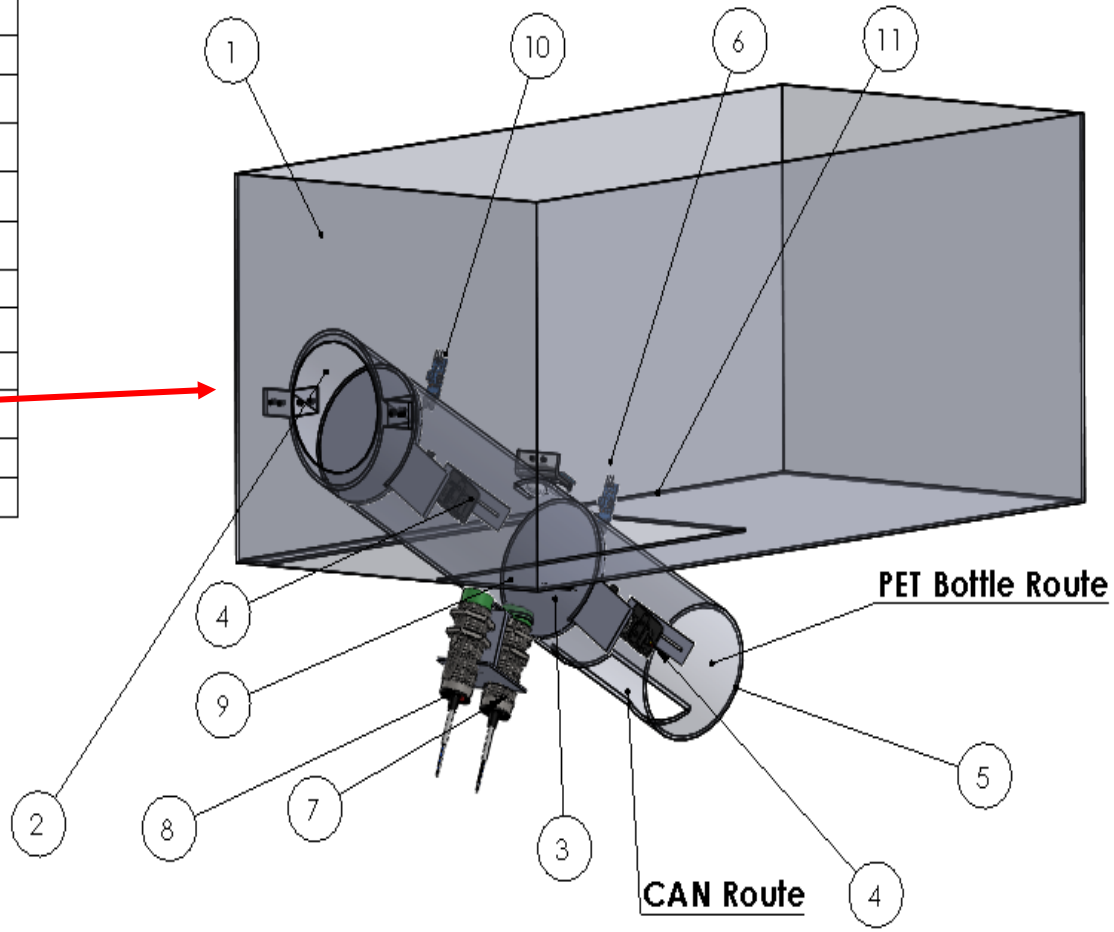
Reward Monitoring & Redemption

- **Custom made** system & body design
- **With/without registration** and phone flexible user identification
- Automatic PET Bottle and Aluminum Can **recognition & sorting.**
- Online data transaction recording and redemption

MODULAR CONFIGURATION



ITEM NO.	PART NUMBER
1	Chute Box
2	Trap Door 1
3	Trap Door 2
4	Servo Motor
5	PVC Pipe 100mm
6	Ultrasonic Sensor
7	Capacitive Sensor
8	Inductive Sensor
9	Laser Transceiver
10	IR 1
11	IR 2



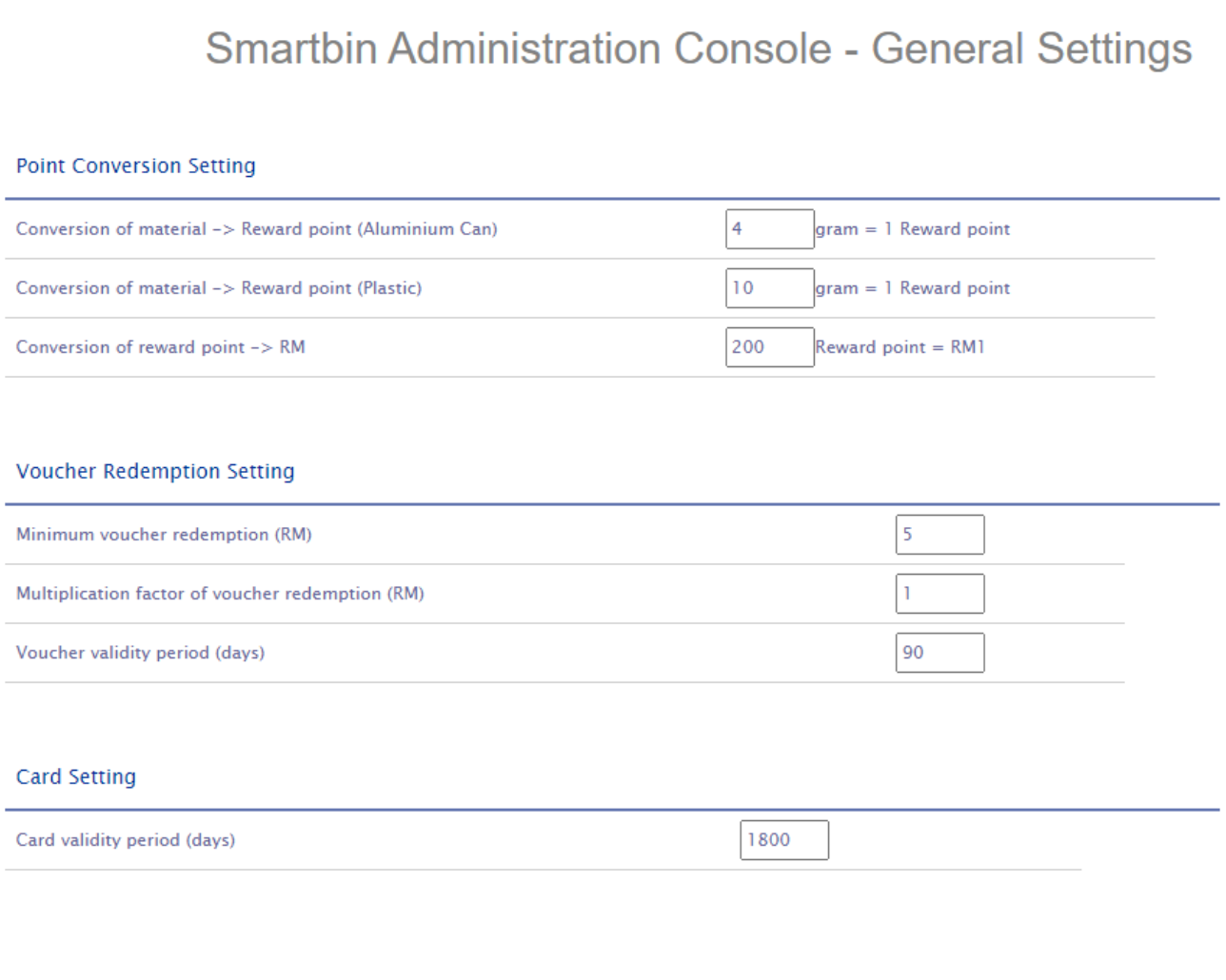
System Bill Of Materials

Mini PC

SOAP/ XML

Database

WEB BASED SNAPSHOT



Smartbin Administration Console - General Settings

Point Conversion Setting

Conversion of material –> Reward point (Aluminium Can)	4	gram = 1 Reward point
Conversion of material –> Reward point (Plastic)	10	gram = 1 Reward point
Conversion of reward point –> RM	200	Reward point = RM1

Voucher Redemption Setting

Minimum voucher redemption (RM)	5
Multiplication factor of voucher redemption (RM)	1
Voucher validity period (days)	90

Card Setting

Card validity period (days)	1800

22nd May 2017 12:50:03 PM	SWCorp Cyberjaya		129	1
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya		102	51
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	203	203
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	102	10
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya		102	1
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	203	20
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	195	20
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	383	38
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	74	7
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	129	13
22nd May 2017 12:50:03 PM	Kantin SK Ayer Hitam	plastic/plastik	84	8
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	195	20
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	134	134
22nd May 2017 12:50:03 PM	Kantin SK Ayer Hitam	plastic/plastik	84	84
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	134	13
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	102	10
22nd May 2017 12:50:03 PM	SWCorp Cyberjaya	plastic/plastik	203	20

RESULT

WORKING PROTOTYPE

bit.ly/RVMUTHM

SYSTEM INSTALLATION

SWCorp Office (Indoor), CYBERJAYA

MPBP Office (Outdoor), Batu Pahat

FINDINGS

SWCorp, Putrajaya

- 3 months and used by SWCorp staff .
- Machine is fully occupy with recycle waste
- Problem (1) : the recycle item stuck inside the chute route before entering
- Problem (2) : smell from the recycle items especially coffee container is quite strong and attract flies

MPBP, Batu Pahat

- 3 Months for public use.
- Able to attract user to use it for first time especially during launching and collect many waste
- Less usage in the following month
- No unpleasant smell when place outdoor but body become dusty

CONCLUSION

- RVM alone unable to attract the continuously recycling activities, it need to be pair with some promotion events, law enforcement and perhaps more interesting incentive to encourage the public to use the machine
- System can be improve upgrading the sensing mechanism to accept more type of waste, using bigger screen display, and offer interesting reward system such as free wifi or introduce recycling game.

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SWCorp
MALAYSIA

Sumitomo