



ICT Virtual Organization of ASEAN Institutes and NICT  
(ASEAN IVO)

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

Razali Tomari



# 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-39273892> | March 2017
- <https://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-47537686.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**

Labels in image: 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

Labels in image: Irritation in eyes, vision failure; Headache, dizziness & unconsciousness; Breathing difficulties, asthma, respiratory problems; Thyroid, coughing, swelling of throat; Liver dysfunction; Lungs problem; Skin diseases: rashes, allergy, skin cancer; Diarrhea, Vomiting, indigestion, typhoid, stomach ache, food poisoning; Birth effect, infertility, hormonal changes, declining sperm count, cancer

SOIL POLLUTION      AIR POLLUTION      WATER POLLUTION

Source: [www.ecologycenter.org](http://www.ecologycenter.org), [www.mindfully.org](http://www.mindfully.org), [www.answers.com](http://www.answers.com)

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

- **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.*

BEIJING 58%

AUSTRIA 63%

SOUTH KOREA 49%

TAIWAN 60%

SINGAPORE 59%

AUSTRALIA 30%

# Current Local Solution

iCYCLE

Recycle  
for Life  
by cerviro

MONJI

RVM in Kuching

**STEP 1**  
Collect recycling items in your home.

**STEP 2**  
Paste your icycle barcode sticker over the recycle packaging (sign up our zero waste program to call driver).

**STEP 3**  
Drop the recyclables packaging at iCYCLE bin (Press iDrop button if you own a mobile app account).

**STEP 4**  
Check RP at [www.icycle-global.com](http://www.icycle-global.com) and redeem exclusive items.



Empty the bottle.

Insert the bottle into the machine.

Play and Enjoy the game.

The image shows a vertical recycling machine with a screen. The instructions are displayed on the screen. Below the text, there are three small images: a hand holding an empty bottle, a hand inserting the bottle into the machine, and a hand playing a game on the screen. At the bottom, there is a photograph of the machine in a public space.



# World Wide

Envipco, USA



Zeleno, India



P'PET, Thailand



EcoCreation, Korea

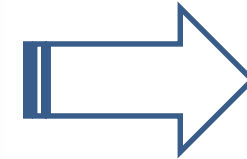
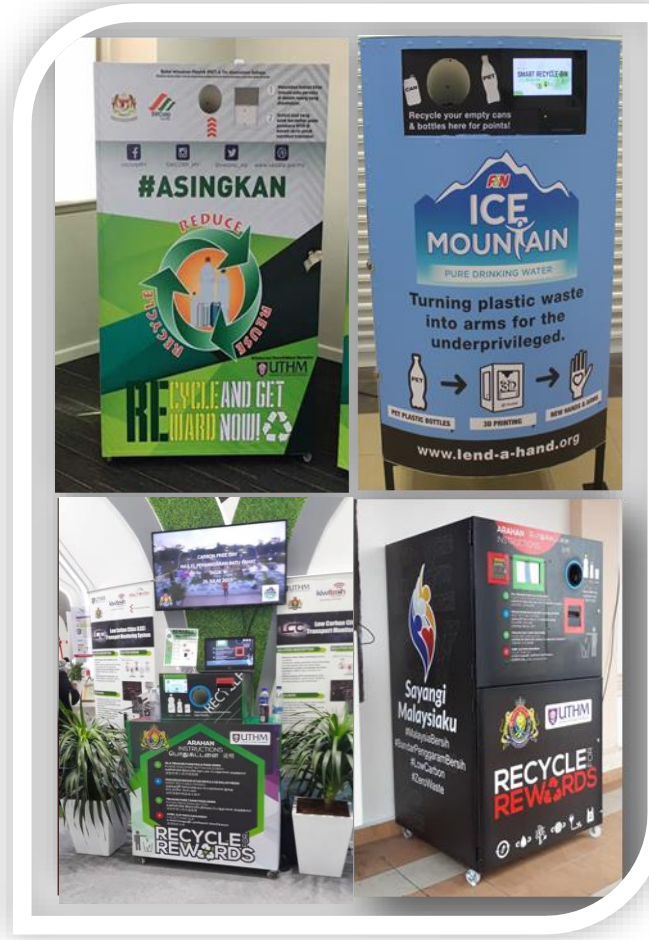


TOMRA, Norway

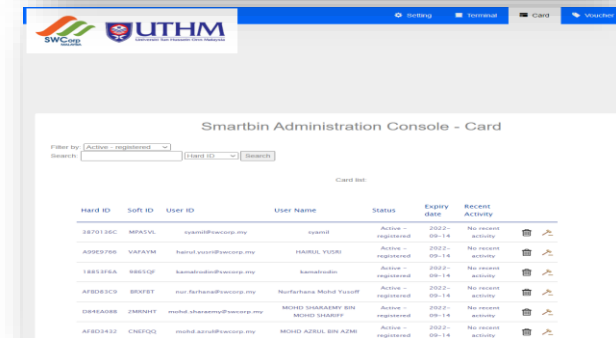
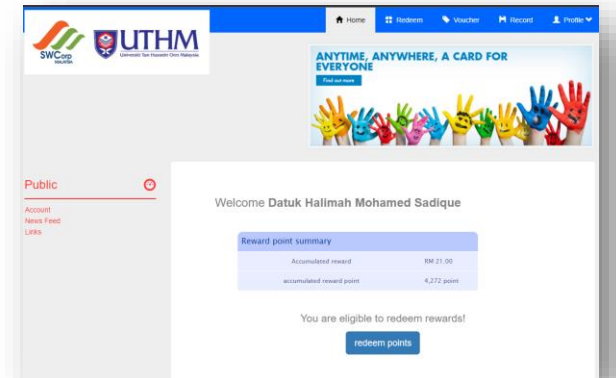


# PROPOSED SOLUTION

## From waste to Point with Interactive Display

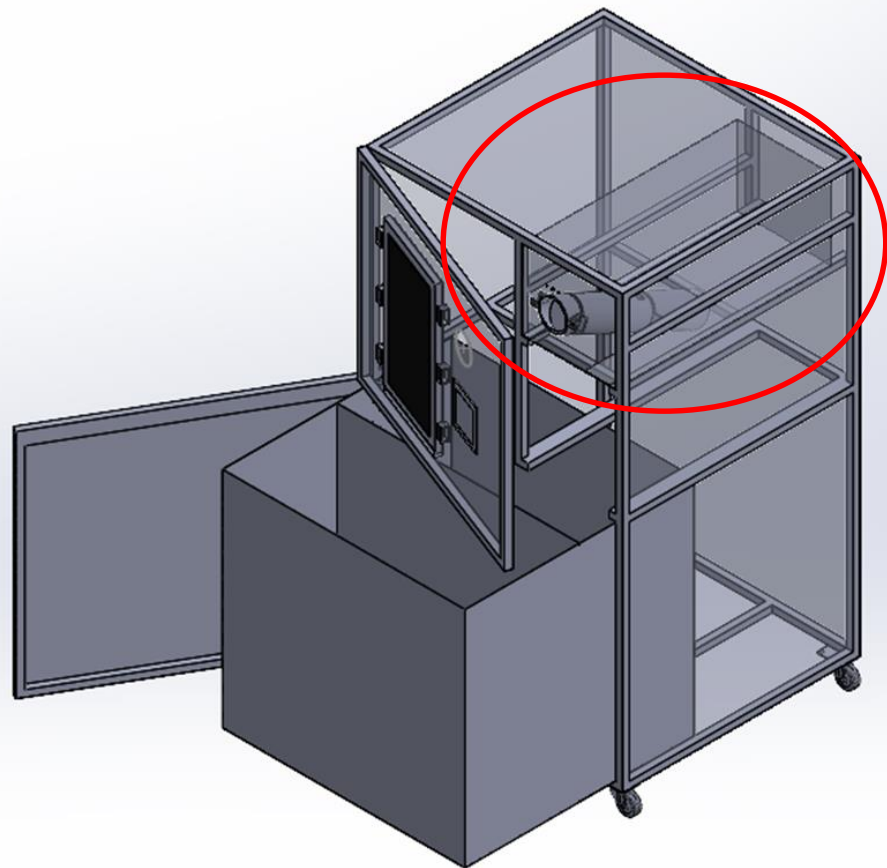


Reward Monitoring  
& Redemption

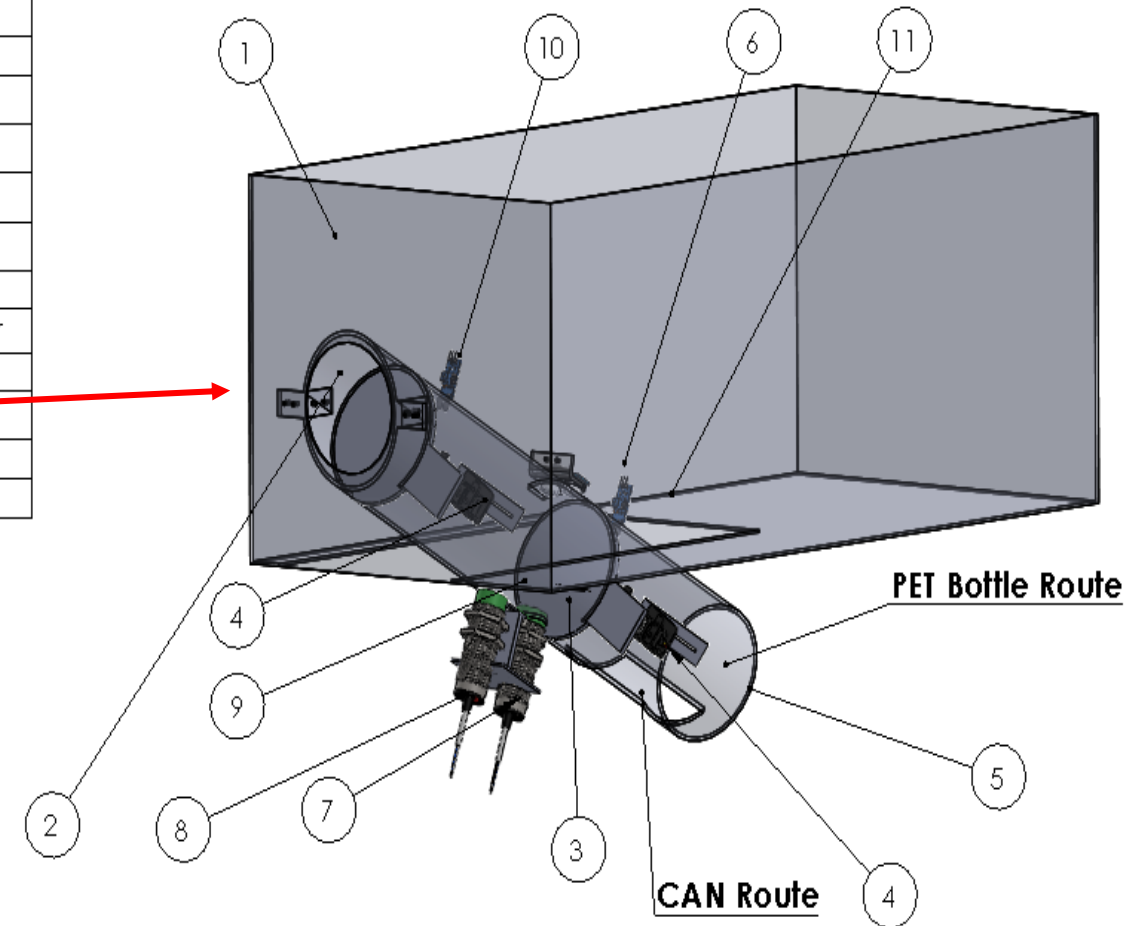


- **Custom made** system & body design
- **With/without registration** and phone flexible user identification
- Automatic PET Bottle and Aluminum Can **recognition & sorting.**
- Online data transaction recording and redemption

# MODULAR CONFIGURATION

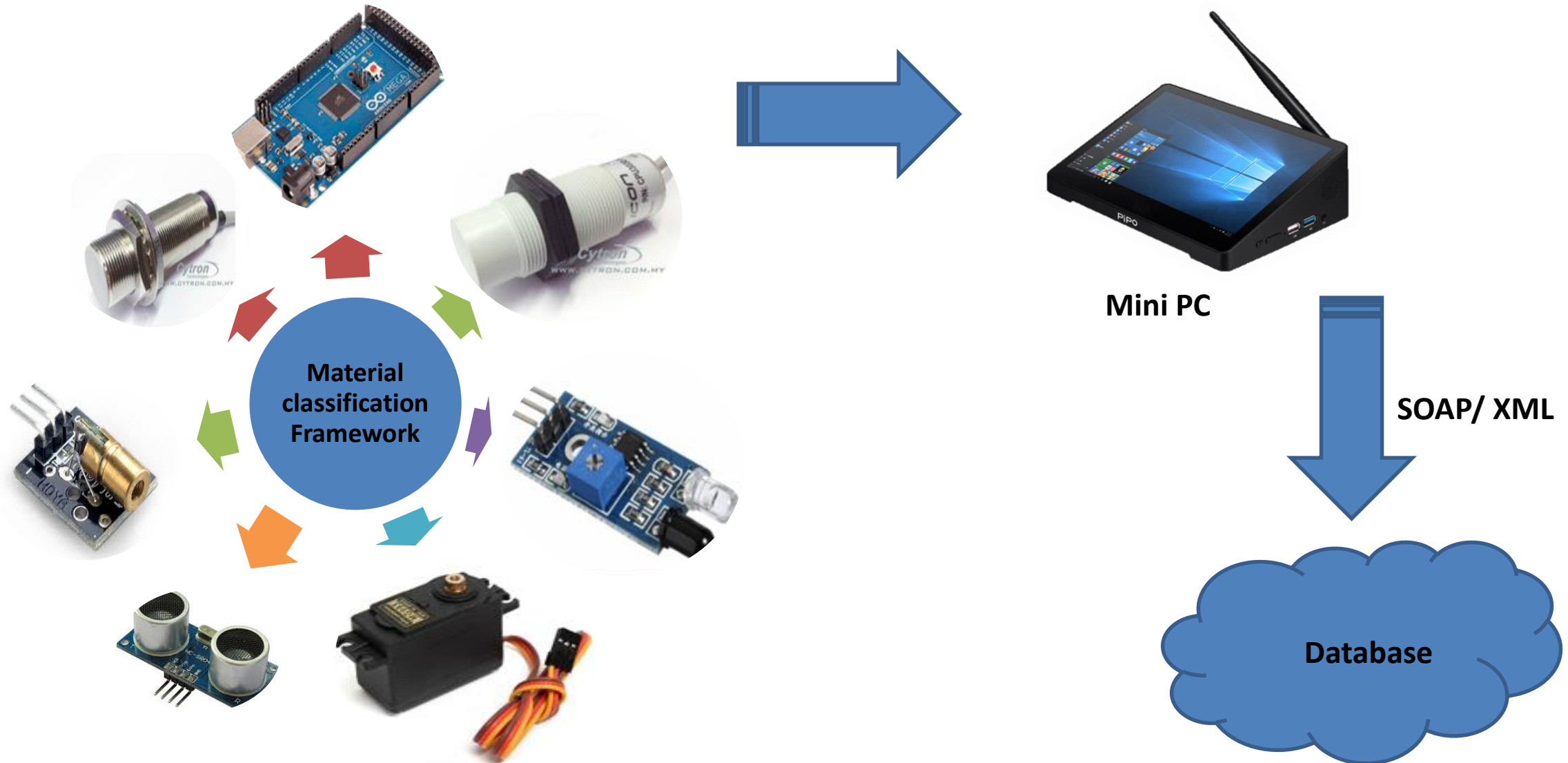


ITEM NO.	PART NUMBER
1	Chute Box
2	Trap Door 1
3	Trap Door 2
4	Servo Motor
5	PVC Pipe 100mm
6	Ultrasonic Sensor
7	Capacitive Sensor
8	Inductive Sensor
9	Laser Transceiver
10	IR 1
11	IR 2





# SYSTEM BILL OF MATERIALS



## Smartbin Administration Console - General Settings

### Point Conversion Setting

Conversion of material -> Reward point (Aluminium Can)	<input type="text" value="4"/>	gram = 1 Reward point
Conversion of material -> Reward point (Plastic)	<input type="text" value="10"/>	gram = 1 Reward point
Conversion of reward point -> RM	<input type="text" value="200"/>	Reward point = RM1

### Voucher Redemption Setting

Minimum voucher redemption (RM)	<input type="text" value="5"/>
Multiplication factor of voucher redemption (RM)	<input type="text" value="1"/>
Voucher validity period (days)	<input type="text" value="90"/>

### Card Setting

Card validity period (days)	<input type="text" value="1800"/>
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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



[bit.ly/RVMUTHM](http://bit.ly/RVMUTHM)

# SYSTEM INSTALLATION



SWCorp Office (Indoor), CYBERJAYA



MPBP Office (Outdoor), Batu Pahat

## 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**



- **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.

A word cloud of the word "thank you" in various languages and scripts, including:

- danke (German)
- 謝謝 (Chinese)
- ngiyabonga (Xhosa)
- teşekkür ederim (Turkish)
- спасибо (Russian)
- Баярлалаа (Mongolian)
- faafetai lava (Tongan)
- merci (French)
- baraka (Arabic)
- welal in tack (Tswana)
- dank je (Dutch)
- misaotra matondo (Malagasy)
- paldies (Dutch)
- grazzi (Italian)
- mahalo (Hawaiian)
- tapadh leat (Irish Gaelic)
- хвала (Serbian/Croatian)
- asante (Swahili)
- manana (Tagalog)
- obrigada (Portuguese/Spanish)
- bedankt (Dutch)
- nandi (Zulu)
- nandi (Zulu)
- kiitos (Finnish)
- dankie (Afrikaans)
- mauruuru (Māori)
- koszonom (Hungarian)
- vinaka (Samoan)
- спасиби (Ukrainian)
- blagodaram (Serbian/Croatian)
- dank je (Dutch)
- akun dankan aciu (Yoruba)
- djere dieuf (Dutch)
- tau (Dutch)
- mochchakkeram (Tamil)
- murakoze (Tamil)
- tenki (Bengali)
- dziękuję (Polish)
- sobodi (Zulu)
- dekuji (Zulu)
- chnorakaloubtoun (Arabic)
- gratias ago (Latin)
- gracies (Catalan)
- sulpay (Hindi)
- go raibh maith agat (Irish Gaelic)
- amun (Zulu)
- sukriya (Urdu)
- kop khun krap (Lao)
- taiku (Malay)
- arigato (Japanese)
- takk (Tamil)
- dakujem (Slovak)
- trugarez (Breton)
- obrigado (Portuguese/Spanish)
- meso (Catalan)
- didi madloba (Zulu)
- kam sah hammida (Arabic)
- rahal (Arabic)
- terima kasih (Malay/Indonesian)
- najis tuke (Hindi)
- tanemirt rahmet (Arabic)
- grazie (Italian)
- diolch (Welsh)
- dhanyavadagalu (Tamil)
- shukriya (Arabic)
- merce (Catalan)
- mercsi (Hungarian)
- তোমাকে ধন্যবাদ (Bengali)
- 감사합니다 (Korean)
- xiexie (Chinese)
- ευχαριστώ (Greek)
- mercii (Malay)

