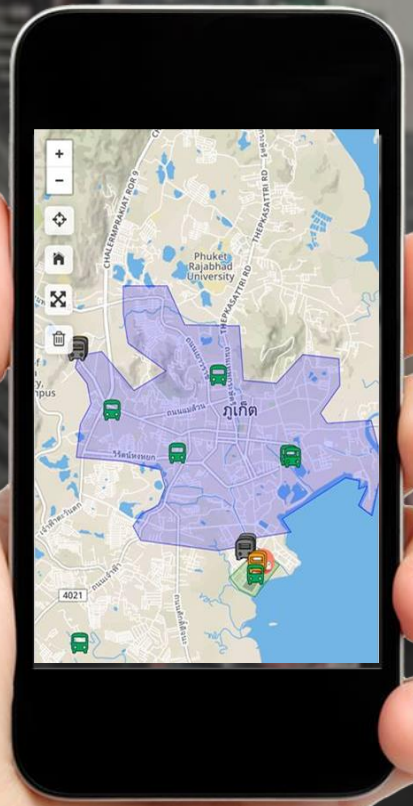
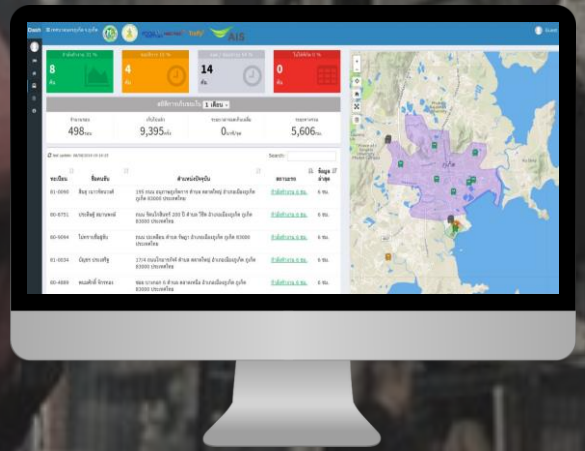
Traffy Waste

Smarter way to collect waste





ดร. วสันต์ ภัทรอธิคม
086-901-6124
wasan@nectec.or.th

Overview Traffy Waste

Garbage Truck

- Real-time Location
- Dynamic Route

Garbage Trash

- Real-time waste volume
- Alert full garbage

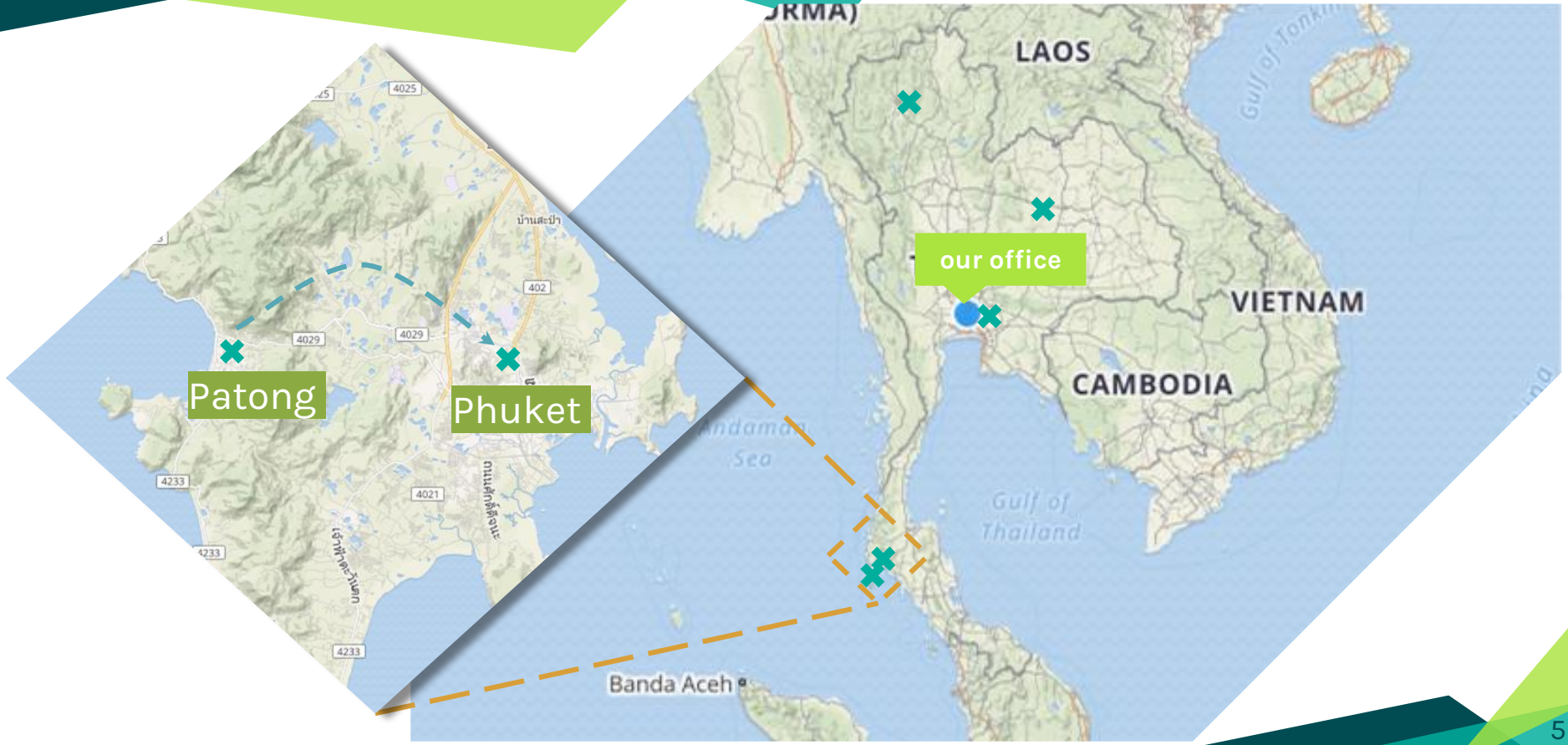
Application for report problem

- Report waste problem

Analysis Dashboard

- Management Dynamic Route
- Analytic and Statistic informations
- Show Real-time Truck and Trash

Implementations



Trash Level Sensor

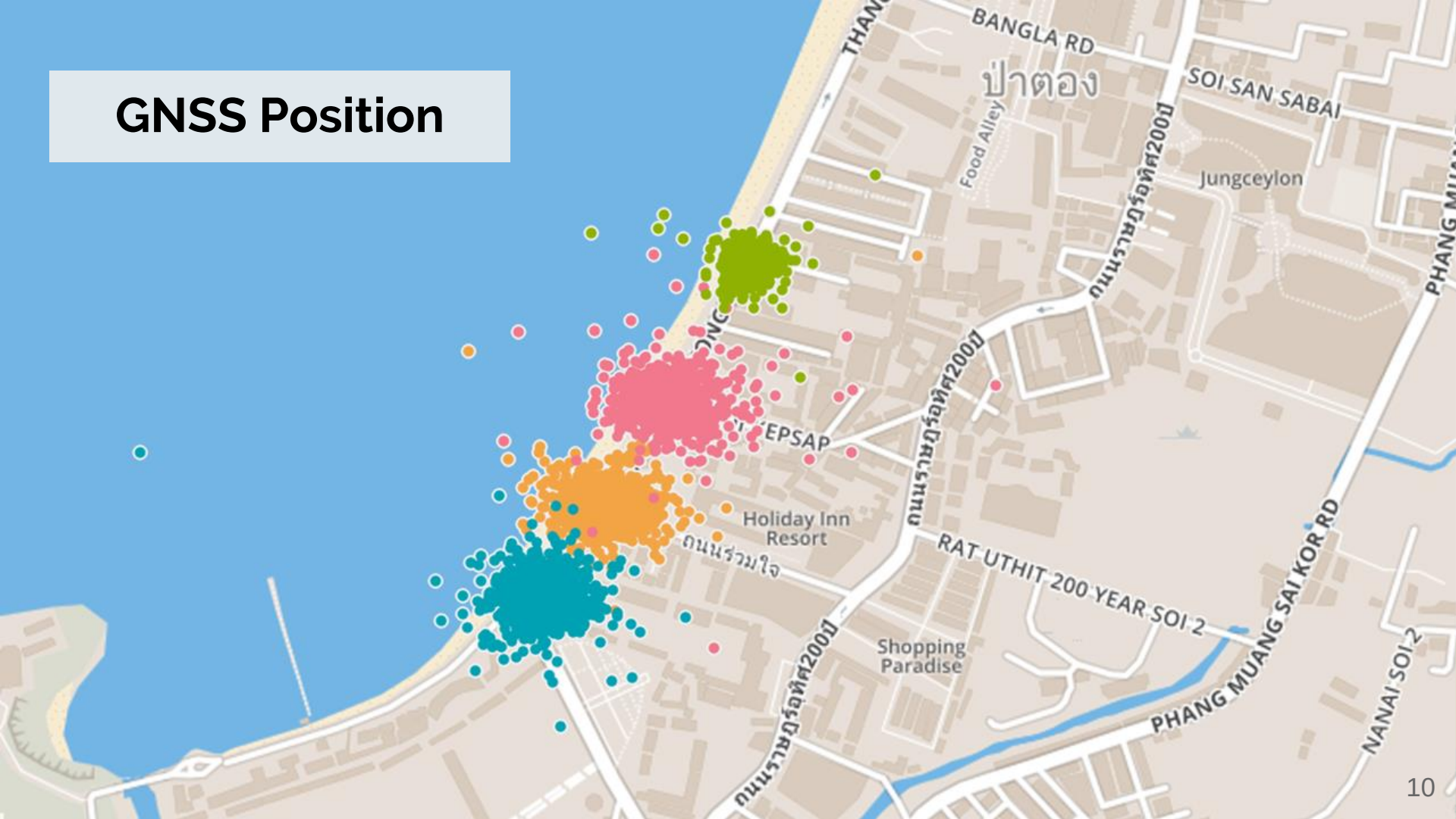
Detect Trash Level

Bin positioning

ATGM336H-5N-3X Module

- GPS + BeiDou
- Positioning Precision (CEP)：2.5 Meter

GNSS Position

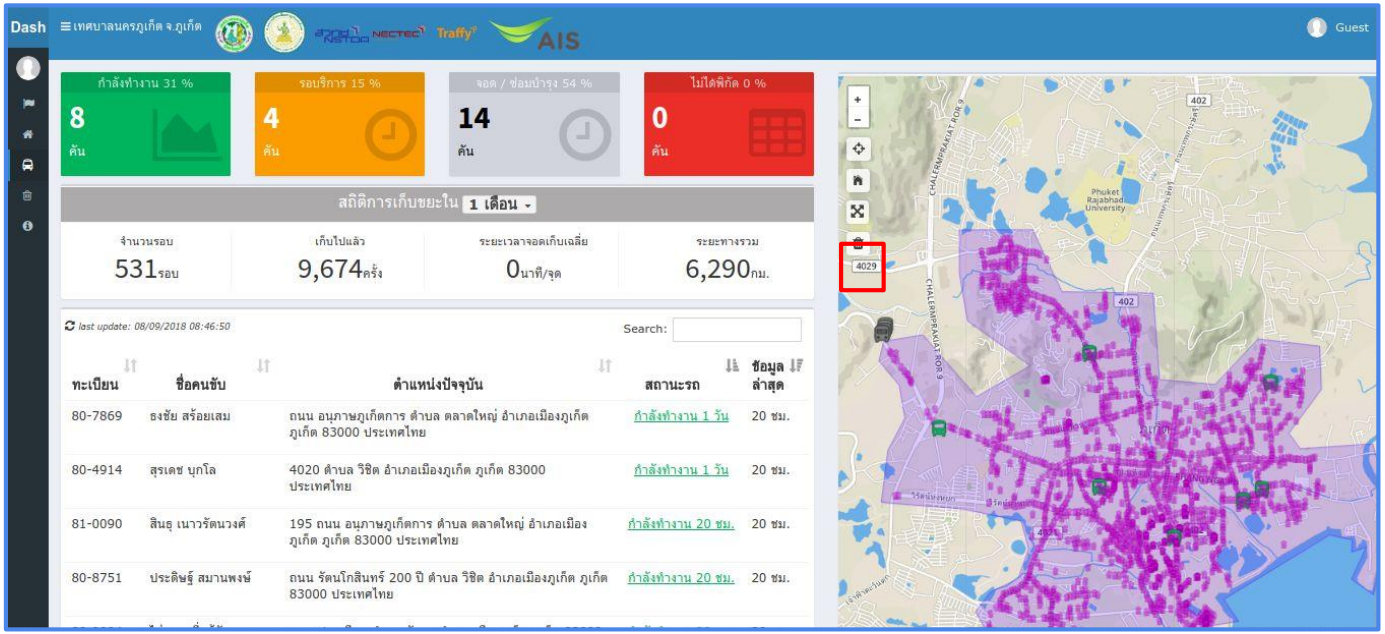


Activity Recognition of Garbage Collection Truck

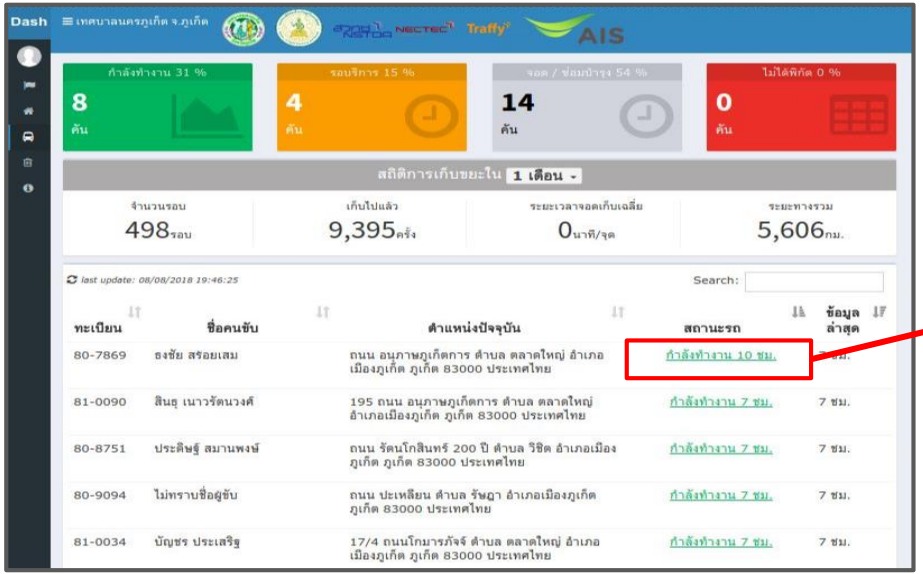
Traffy

- High resolution: 10 Hz data sampling
- ~1m accuracy in open sky
- Supported satellites
  - 32 GPS
  - 24 GLONASS
  - 21 BeiDou
  - 11 GALILEO
- Support Satellite-Based Augmentation System (SBAS)
- Better positioning under imperfect

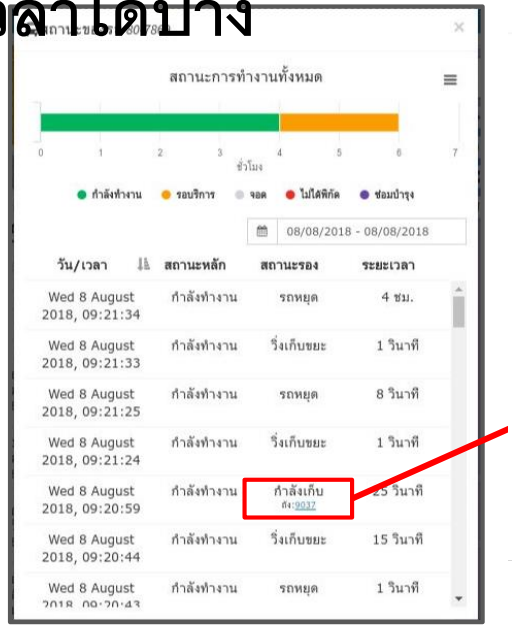
Auto-generated Pick-up Collection Location

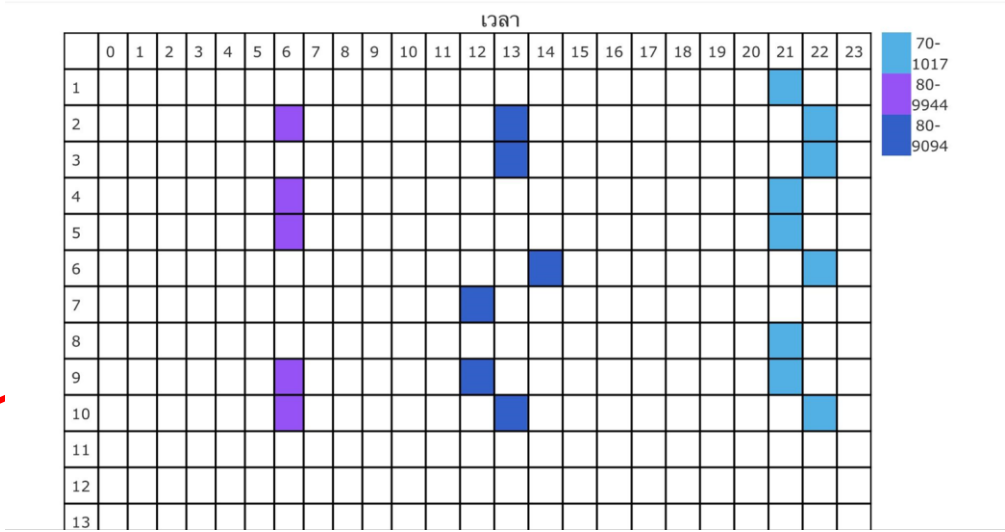


Detailed Garbage Truck Behaviors



6. จุดที่รถเก็บขยะจุดนั้นมีการเก็บขยะมาแล้วกี่ครั้ง ถูกเก็บวันไหน เวลาใดบ้าง



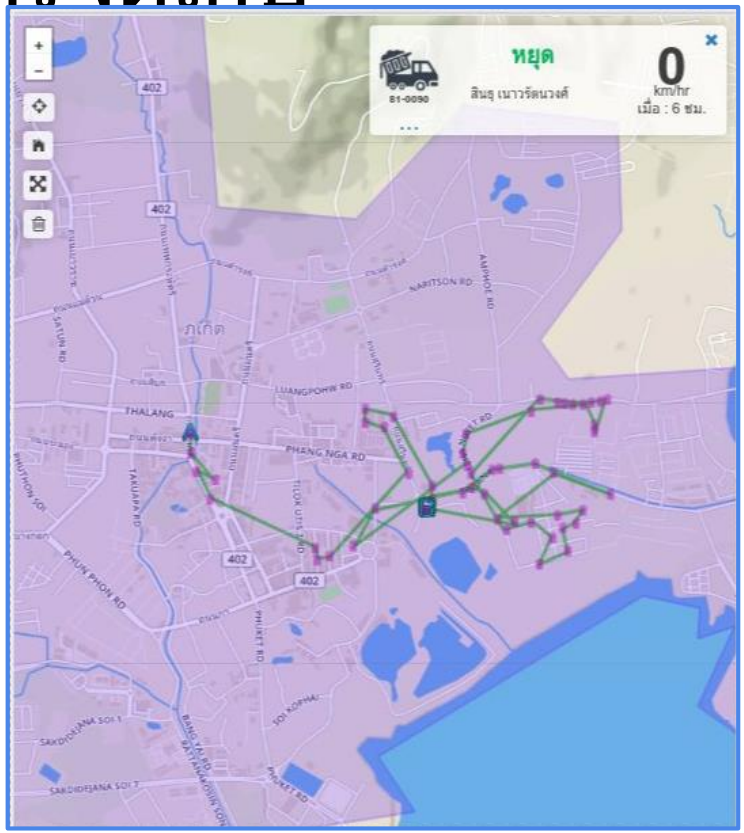


2.รายละเอียดระบบจัดการการจัดเก็บ

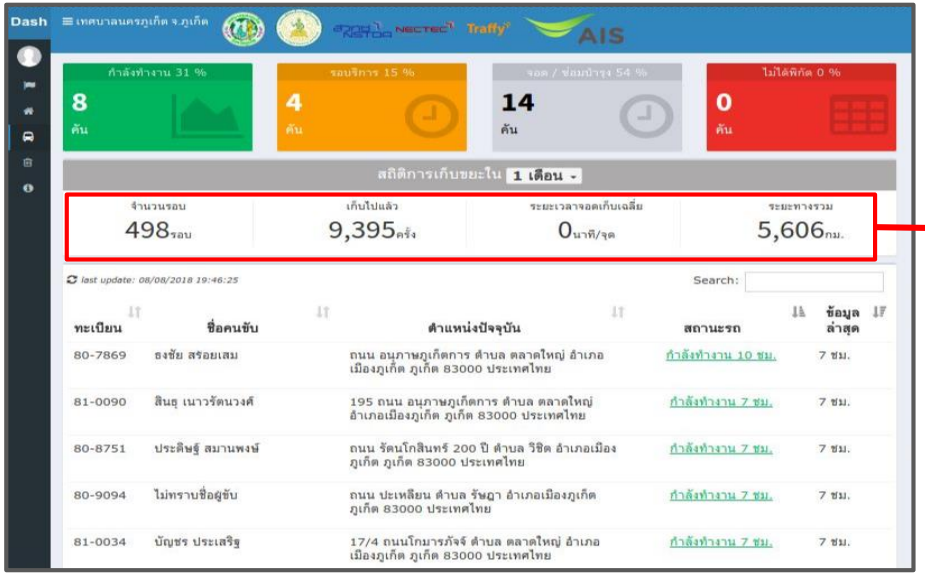
- บริหารจัดการเส้นทางเก็บขยะ

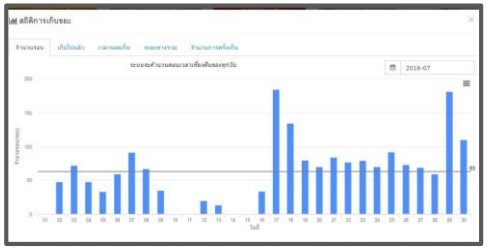
ขยะ แสดงข้อมูลสถิติย้อนหลังสำหรับผู้บริหาร

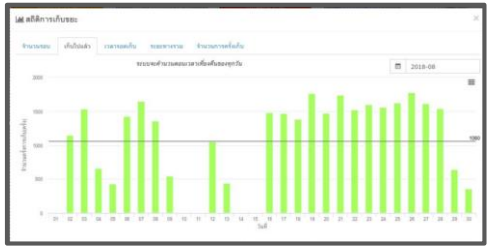
- แสดงข้อมูลเส้นทางการเก็บขยะย้อนหลัง
- ระบบวิเคราะห์เส้นทางการจัดเก็บขยะอัจฉริยะ และเช็คสถานะถังเก็บอัตโนมัติ

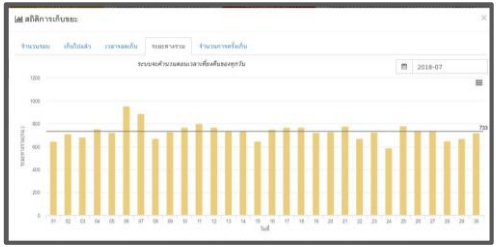


Garbage Collection Statistics

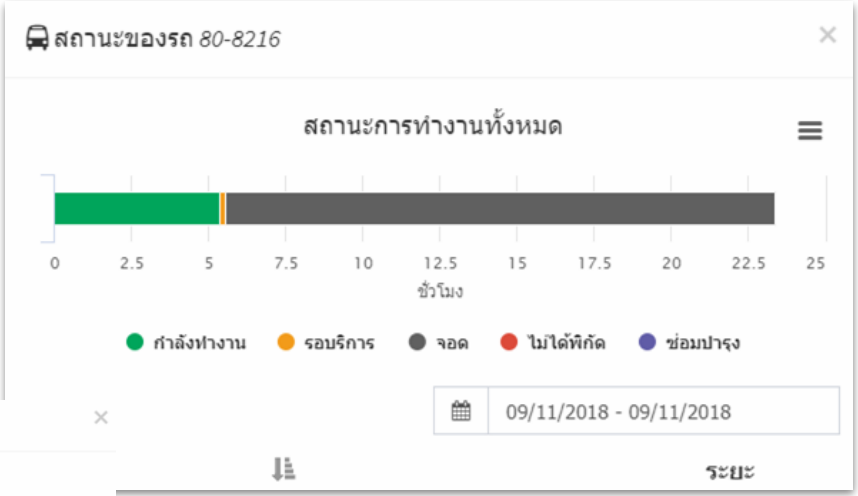


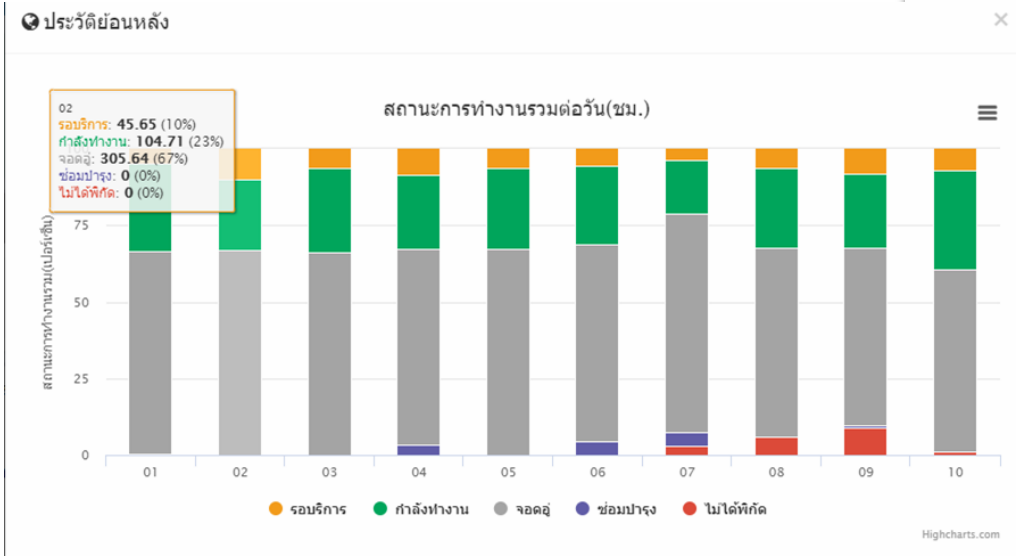






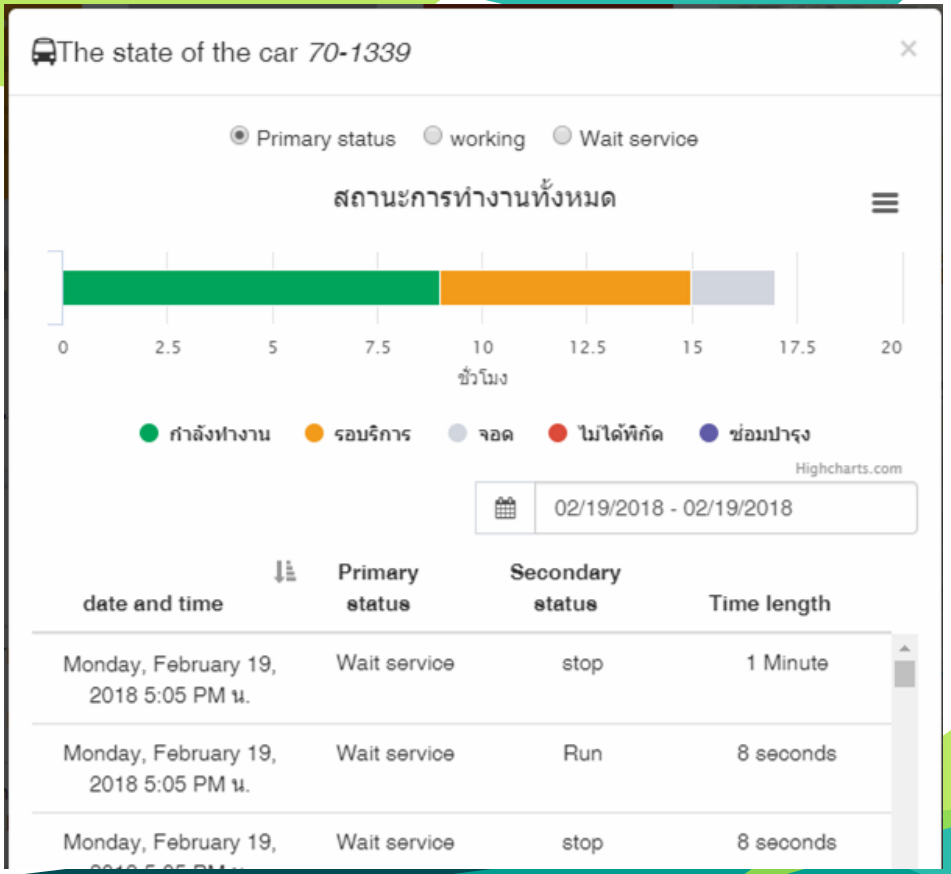
Daily Truck Statistics



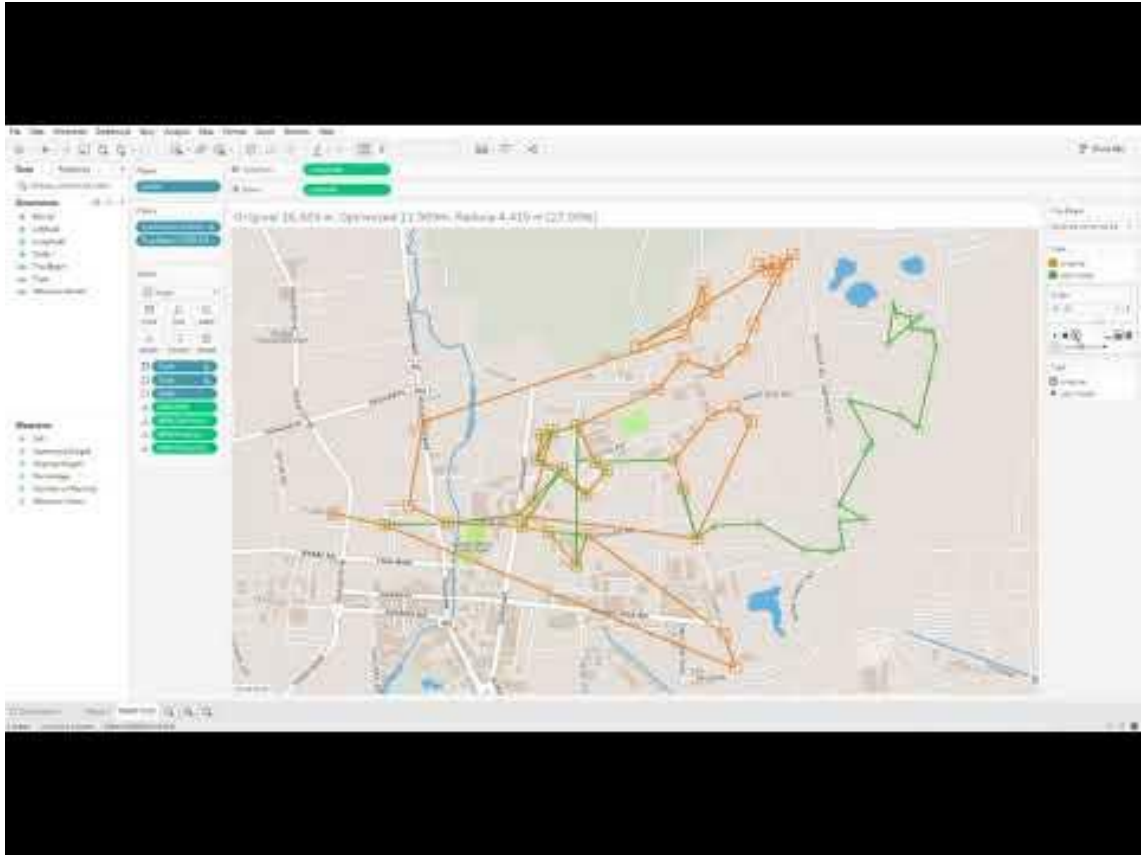


Garbage truck state detection (3)

- Show each truck state in detail
- Historical state information is available

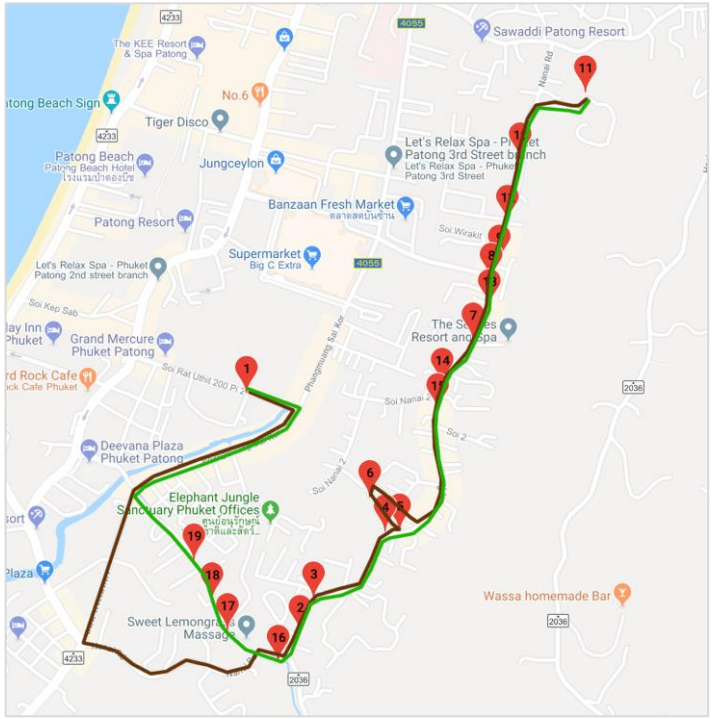


Route Improvement - 27% Distance Reduced

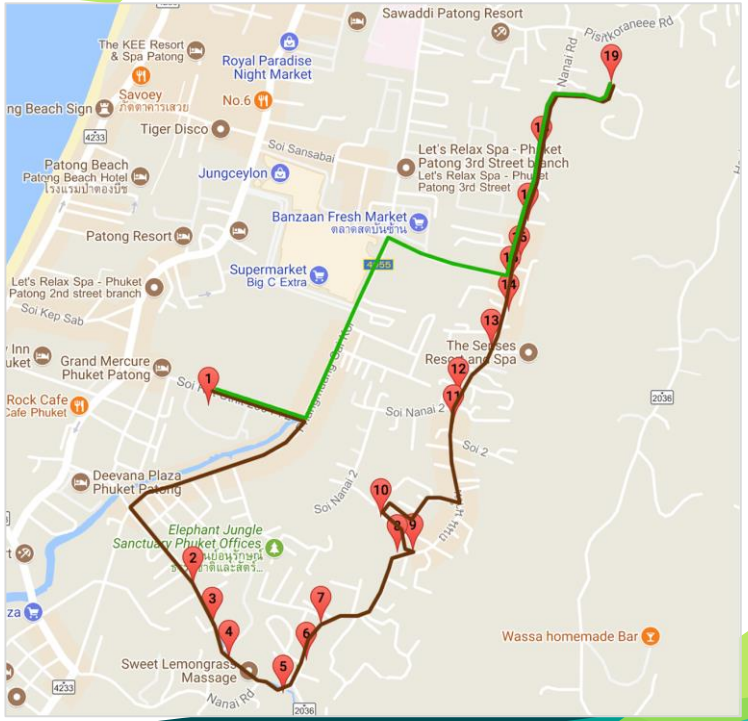


Comparison of the two methods

Existing Route



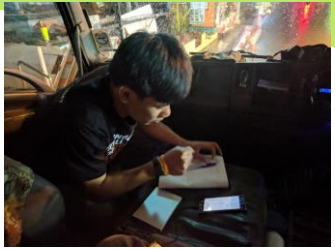
Proposed Route with TSP method



Garbage truck state detection (3)

Performance;

- Precision is ~83%
- Some **invalid** states come **from unknown bin** location
- It's **easy to improve** …



Pickup location detection

- Make use of the garbage truck states
- In Patong area;
  - We found ~884 pickup locations, in 16 km²
  - Usually dense at the attractive areas
  - The points far from each other around 36 m

Pickup Location Detection (2)

- Criteria:
  - Truck is in ***working*** states
  - Logging the position of ***stop-while-run-2-collect***
  - There is no other pickup location there
  - If the #of occurrences >= **X**, within **Y** days, they will be determined as a new pickup location
  - If there is no visiting these locations for a long time, they will be discarded

Automatic pickup location detection (3)

Verifying…

- We randomly verify the locations
- It's ~90% correct

Comparison of the two methods

Existing Route

No.	Origin Bin ID	Destination Bin ID	duration (second)	distance (meter)
1	terminal	[2072]	294	1730
2	[2072]	[2440]	16	96
3	[2440]	[2089]	54	282
4	[2089]	[2242]	7	35
5	[2242]	[1982]	60	136
. .	. .	. .	. .	. .
17	[1986]	[1988]	24	92
18	[1988]	[1989]	24	113
19	[1989]	terminal	171	879
			1490	**6937**

Proposed Route with TSP method

No.	Origin Bin ID	Destination Bin ID	duration (second)	distance (meter)
1	terminal	[1989]	175	879
2	[1989]	[1988]	24	113
3	[1988]	[1986]	23	92
4	[1986]	[1985]	41	160
	[1985]	[2072]	25	96
	. .	. .	. .	. .
17	[1980]	[2831]	36	174
18	[2831]	[1979]	80	309
19	[1979]	terminal	333	1573
			1137	**4973**

Save
- 25% in duration
- 26% in distance

Comparison of the two methods

From these seven sample datasets, we found that distance and duration are decreased 25.63% and 26.52% on average respectively.

Distance (meter)			
No.	Existing Route	Propose method	Decrease
1	18859	14475	23.24 %
2	14118	9269	34.35 %
3	10353	8277	20.05 %
4	5921	3627	38.74 %
5	13857	10214	26.29 %
6	12783	9140	28.50 %
7	8192	7518	8.23 %
Average			**25.63 %**

Duration (second)			
No.	Existing Route	Propose method	Decrease
1	3264	2315	29.07 %
2	2382	1460	38.71 %
3	2040	1718	15.78 %
4	1453	962	33.79 %
5	2316	1649	28.80 %
6	2415	1793	25.76 %
7	1689	1457	13.74 %
Average			**26.52 %**

Conclusion

- **Traffy Waste** uses **multi-GNNS** for **garbage-collection trucks** and **trash sensor**
- It can **detect** the **truck activities**, and **suggest an optimal route**
- To help municipal and collecting providers to **reduce operation cost**, and **improve collecting performance**

Thank you for your attention :)