



# PHASE-II CONSULTING REPORT

3 x Zones



## Problems Encountered Without Real-Time Detection

45<sub>min</sub>

People **trapped** inside an **elevator** at Muritala Mohammed Airport

\$100K

Suspects **stole** approximately \$100K **equipment** from Daniel K. Inouye Airport

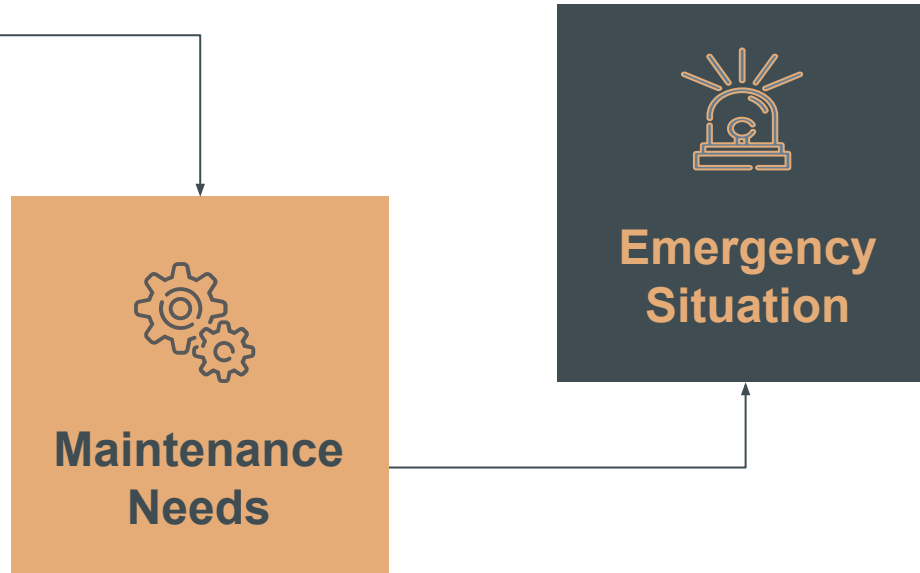
Killed

A guest was killed by a landing airline **on runway** at AUS airport

2 Hrs

Crowds of **fans gathered** at boarding gates to meet celebrities in airports, causing flight delays and congestion

## Enhance Detection & Response Efficiency



## O Detect Abnormal Movement & Density



### Signal 1

Anomalous  
Flow of Customer  
Traffic



### Signal 2

Long Staying  
Within Facilities  
e.g. Elevators



### Signal 3

Unrecorded  
Devices in  
Restricted Areas



### Signal 4

Unusual  
Movement of  
Facilities



## ○ Detect Abnormal Movement & Density (cont.)

### Abnormal Flow

①.

"When there's a **fire** incident or **bomb** threat, people stay away from the site."

②.

"When the restroom or other **facilities** needs **maintenance**, the guests would not go there."

③.

"When there's a **medical-related emergency**, the crowd will be gathering at one location."



④.

### Elevator Stuck

"When the device remains within an elevator for over **five minutes**, someone may be stuck in the elevator"

⑤.

### Restricted Area

"If non-airport devices appear in restricted areas, that might be guests entering either **by mistake or on purpose**"

⑥.

### Missing Device

"An airport device moves out of its normal range may be associated with **equipment stealing**."



## ○ Real Time Analysis Brings Business Values

Prevent maintenance issue to ensure airport's operational continuity

**OPERATION**

**EFFICIENCY**

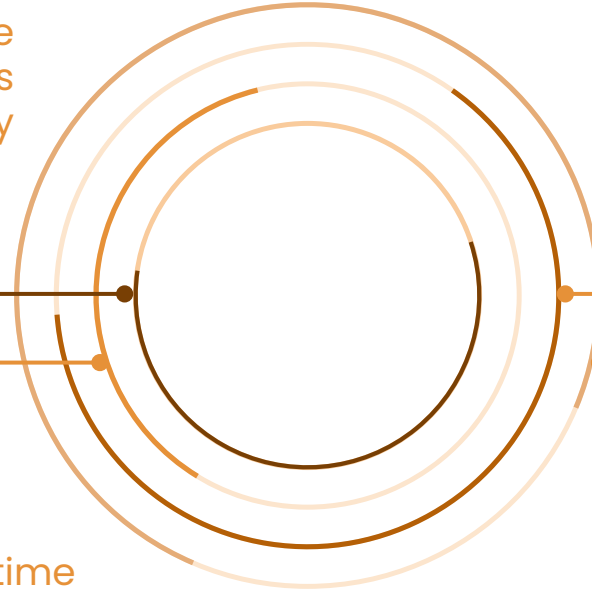
Reduce response time for emergency

Ensure airport's and passengers' safety

**SAFETY**

**COST**

Reduce manual labor cost & security cost



## ○ Technique Approach When Applying to Four Scenarios



### Density

Use Regression model to predict daily density



### Facility

When detect MAC address stay in elevator area more than 5 minutes, alert!



### Restricted Area

Pattern tracking to detect unauthorized presence in restricted area



### Missing Device

Locate anomalous location when fixed devices are out of specific range





Density



Facility



Restricted  
Area



Missing  
Device



**WARNING! Abnormal Density!**

Location

TPS1 Level 2  
Block 3

Time

Monday  
9/9/2019

21:00

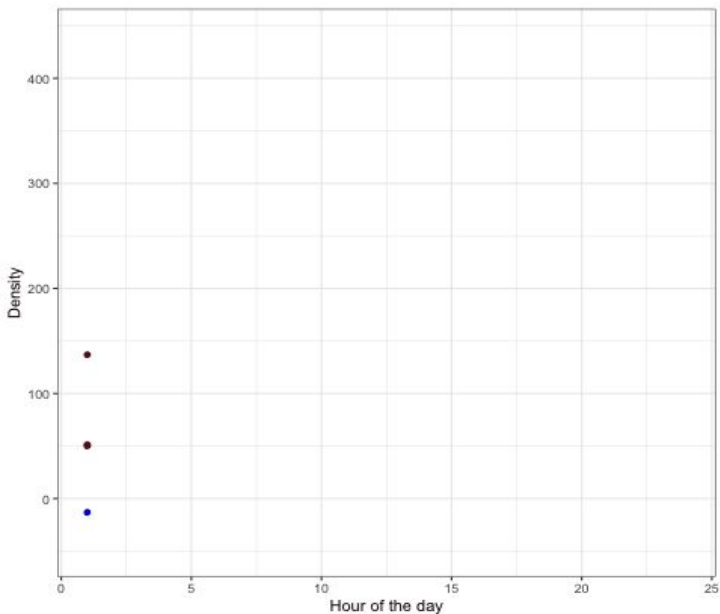
Density

Extremely  
high/low

RIOgaleão



factor(type) count lower predict upper







Density



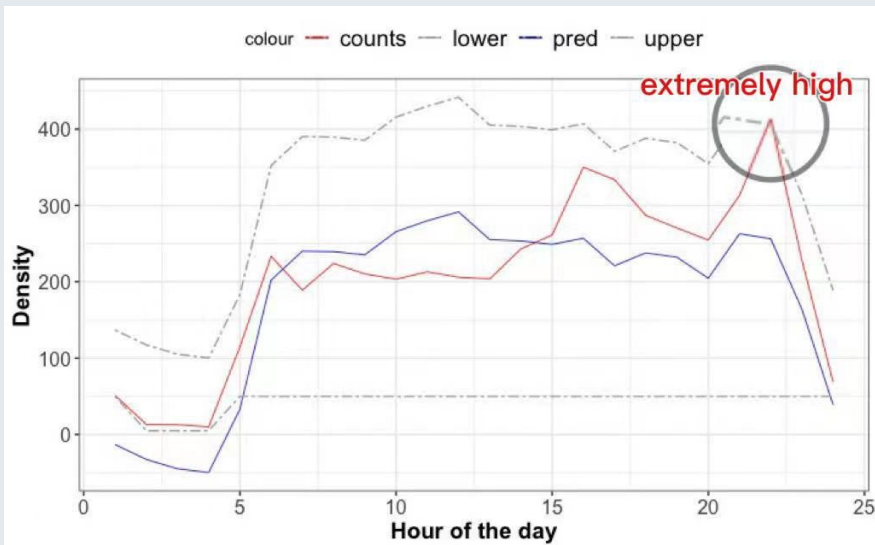
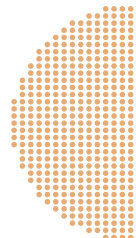
Facility



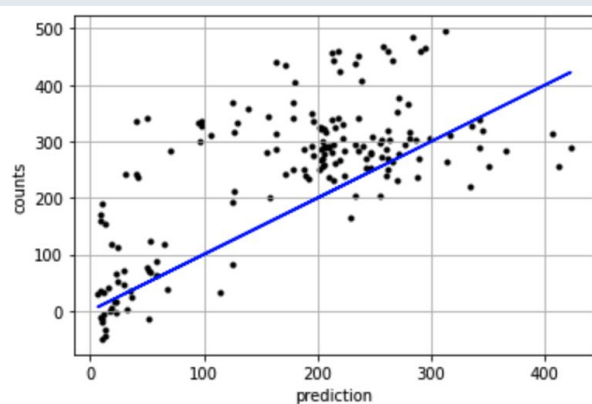
Restricted  
Area



Missing  
Device



Counts ~ weekday+hour



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Density



Facility



Restricted  
Area



Missing  
Device



**WARNING! People trapped in elevator!**

Location

TPS1 Level 2  
Elevator 4

Time

Enter  
11:00

Duration  
00:06:51

Mac

fake\_MAC\_1  
a1:b2:c3:e4:f5:g6

RIOgaleão



normal  
operating  
of elevator

elevator  
malfunction:  
trapped in  
the elevator



Density



Facility



Restricted  
Area



Missing  
Device



**WARNING! Unrecognized device!**

Location

TPS1 Level 2  
Room 4

Time

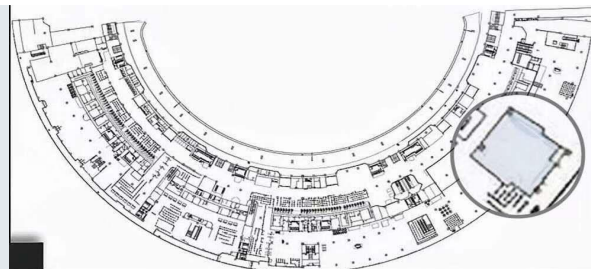
Enter  
17:42

Leave  
17:51

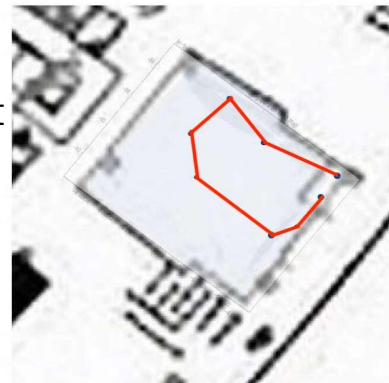
Mac

fake\_MAC\_2  
a4:ee:57:bf:c5:86

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Movement  
trajectory





Density



Facility



Restricted  
Area



Missing  
Device



**WARNING! Abnormal device movement!**

Location

TPS1 Level 2  
Block 3

Time

Leave  
11:17

Duration  
00:01:58

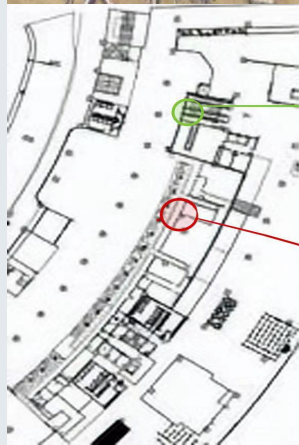
Mac

fake\_MAC\_1

RIOgaleão



When fixed devices  
are out of range, a  
warning message will  
be sent to security  
department



**regular location range**

(-22.811991 ~ -22.811881,  
-43.250160 ~ -43.250090))

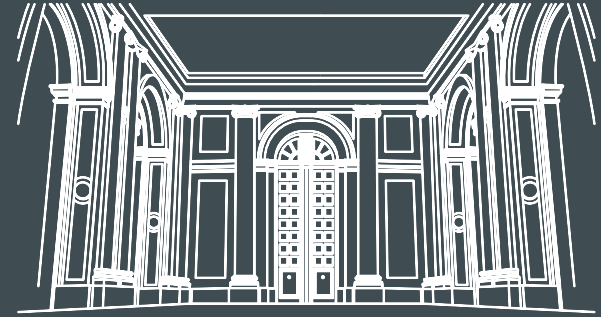
**anomalous location**

(-22.811750, -43.249980)

## Our Model Can Also Be Applied To



**Shopping Mall**



**Metro/Train Station**

## ..... Appendix Page .....



### Facility

This is the information regarding person who has been trapped in elevator:

	MAC	Duration	enter_time
0	a1:b2:c3:d4:e5:f6 0 days	00:06:29.990000	2021-04-26 11:00:03.305

```
Lng_min = -43.250449761376935
Lng_max = -43.25040236518285
Lat_min = -22.81199147082277
Lat_max = -22.811875200399562
duration = 5
```

## Appendix Page



Restricted  
Area

There is unrecognized device occurring in the restricted area!

Activities within the room:

Building	Level	MAC	LAT	LNG	Time	Date
TPS1	Level 2	fake_MAC_2	-22.811846	-43.250202	07:05:13.288	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811896	-43.250222	07:23:11.865	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811851	-43.250214	08:51:45.248	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811936	-43.250322	09:36:58.605	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811852	-43.250304	10:28:42.233	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811859	-43.250358	11:51:34.357	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811866	-43.250213	14:14:01.341	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811879	-43.250310	15:39:26.992	2019-09-11
TPS1	Level 2	fake_MAC_1	-22.811859	-43.250200	17:42:30.365	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811885	-43.250212	17:47:29.949	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811895	-43.250289	17:50:05.776	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811860	-43.250268	17:51:50.114	2019-09-11

Activities after leaving the room:

Building	Level	MAC	LAT	LNG	Time	Date
TPS1	Level 2	fake_MAC_2	-22.811905	-43.250557	17:53:45.659	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811890	-43.250949	17:55:10.217	2019-09-11
TPS1	Level 2	fake_MAC_2	-22.811921	-43.251347	17:58:28.825	2019-09-11
TPS1	Level 1	fake_MAC_2	-22.811653	-43.251544	18:03:29.631	2019-09-11
TPS1	Level 1	fake_MAC_2	-22.811875	-43.251812	18:04:57.942	2019-09-11

MAC Address: ['fake\_MAC\_2', 'fake\_MAC\_1']

## Appendix Page



Missing  
Device

Anamolous location of fixed device:

	Building	LAT	LNG	Level	MAC	Time
0	TPS1	-43.250123	-43.250122	Level2	00:05:9e:97:19:b0	05:40:39.168
1	TPS1	-22.811968	-43.250122	Level1	00:05:9e:97:19:b1	22:56:29.161
2	TPS1	-22.811967	-22.811968	Level2	00:05:9e:97:19:b2	09:14:07.306

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## Resources

1. <https://www.bellanaija.com/2012/05/power-outage-at-muritala-mohammed-airport-lagos-traps-people-inside-elevator-for-45-minutes/>
2. <https://mashable.com/2016/09/08/amtrak-elevator-fail/>
3. [https://www.wikiwand.com/en/Airport\\_security#/Notable\\_incidents](https://www.wikiwand.com/en/Airport_security#/Notable_incidents)
4. <https://www.khon2.com/local-news/over-100k-worth-of-equipment-stolen-from-airport-construction-site/>
5. <https://www.nbcchicago.com/news/local/more-crowds-form-at-ohare-as-officials-continue-to-warn-against-holiday-travel/2379167/>
6. <http://baijiahao.baidu.com/s?id=1606107012482867982>



# THANK YOU

—3 x Zones

