An IoT-based Public Transport Data Collection Framework using Bluetooth Proximity Beacons

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ASEAN IVO

outline

- Improving Urban Mobility for developing countries
- IoT-based bus tracking: deployment experience and insights
- Making an impact and future work

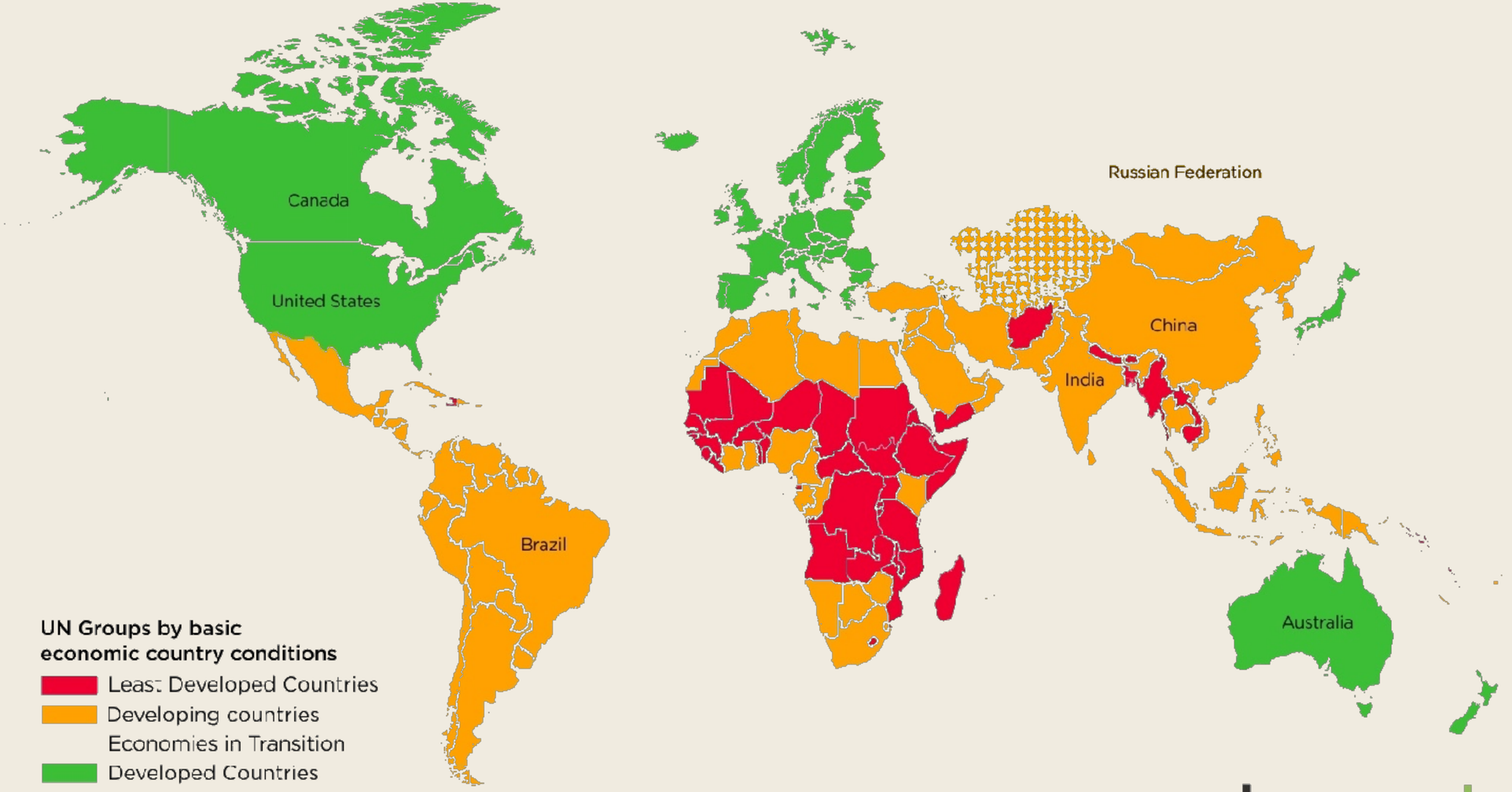
in developing countries

Bukit Bintang Kuala Lumpur (Malaysia)

Tampoi, Johor (Malaysia)

can we improve the public transport using IoT?

Countries Grouped by United Nations

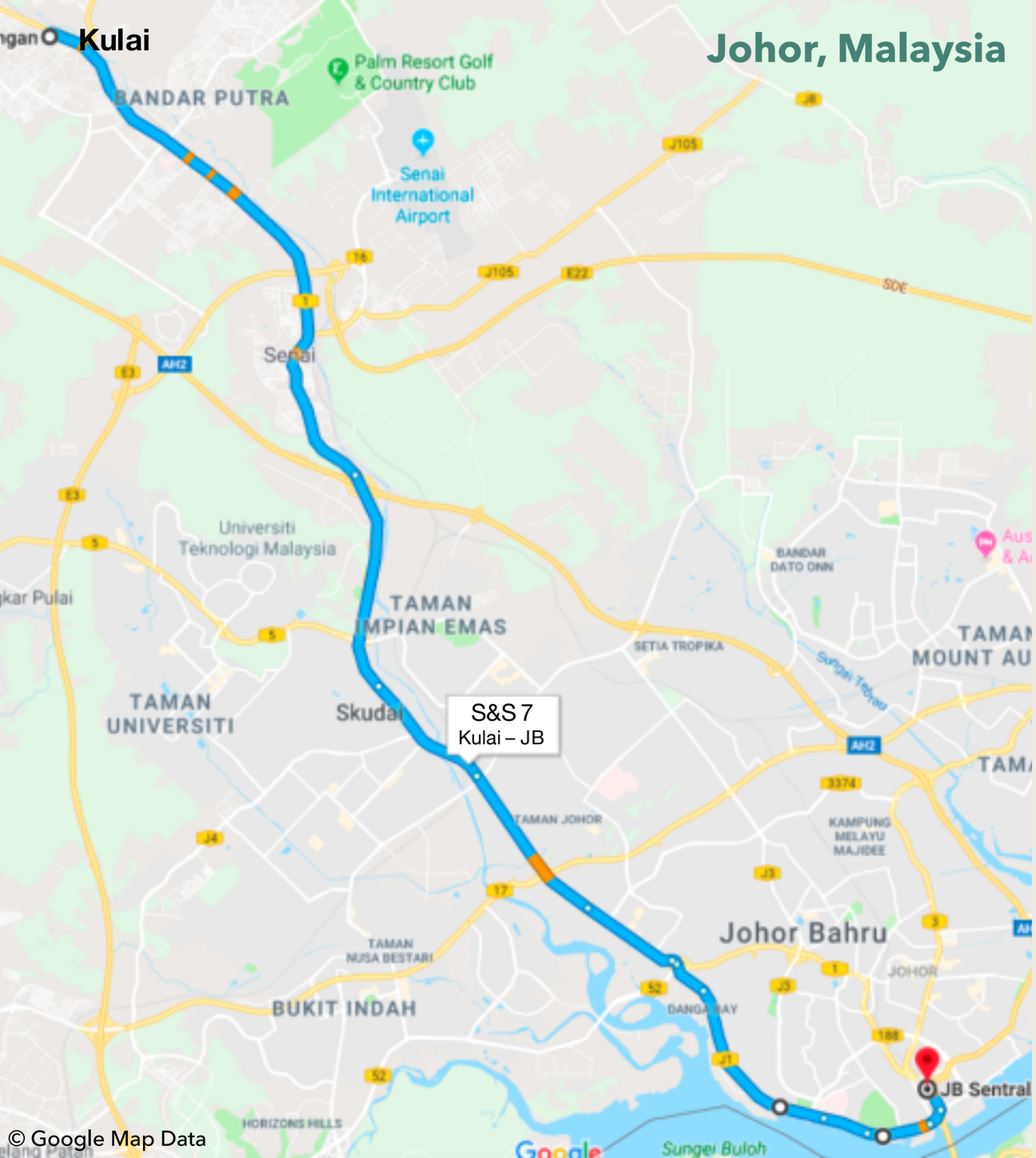


Source: http://www.howmuch.net/articles/countries-groups-by-united-nations

howmuch.net

urban mobility challenges

- Purchase new bus fleet, less consideration on the software infrastructure.
- Bus frequency is considered low, this is worse in rural areas.
- Reliability is affected due to traffic congestion, no bus lane.
- Lack of bus drivers, due to regulatory policy that the driver must be a citizen.
- Most of the time, there is no adherence to the service schedule.
- Typically the drivers wait until the bus is 80% filled before departing.
- If the driver calls in sick, the bus service is disrupted especially those serving the rural areas.
- Long waiting time for the passengers.



improving our public bus service!

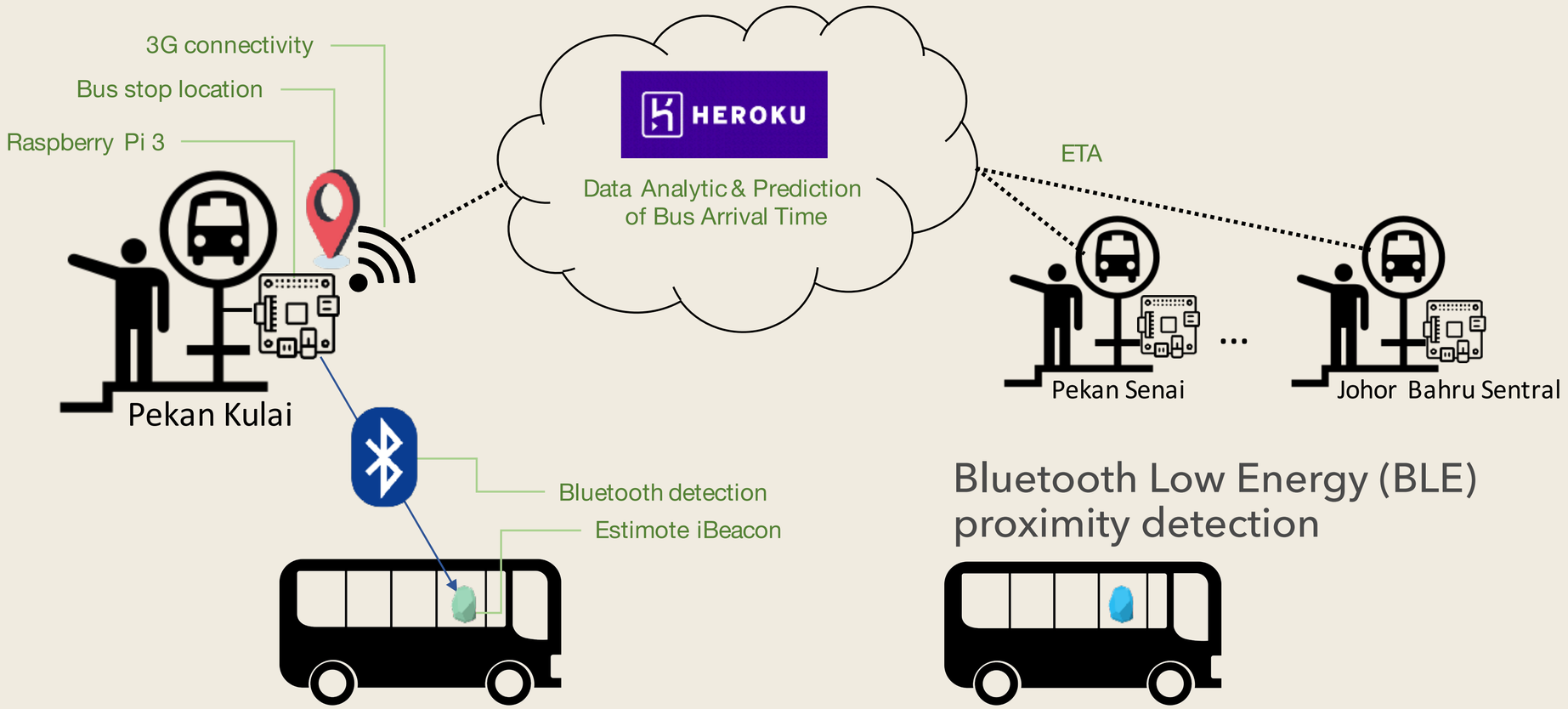
- Collaborated with a bus operator, operating **Kulai – Johor Bahru Sentral** route in Malaysia.
- A very competitive route with 2 to 3 bus operators.
- Aimed to provide bus fleet tracking and bus arrival information to passengers.

Raspberry Pi 3

BLE Beacon - Estimote

Heroku Cloud Platform

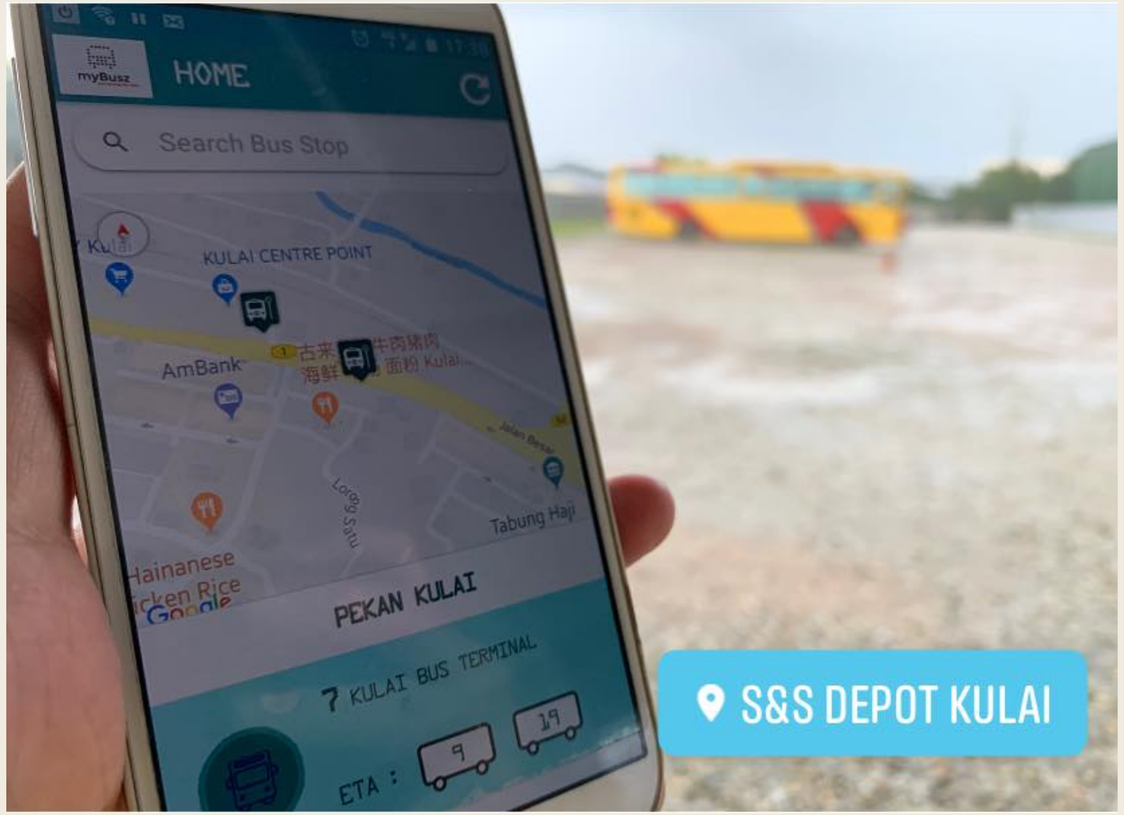
myBusz 2.0 architecture

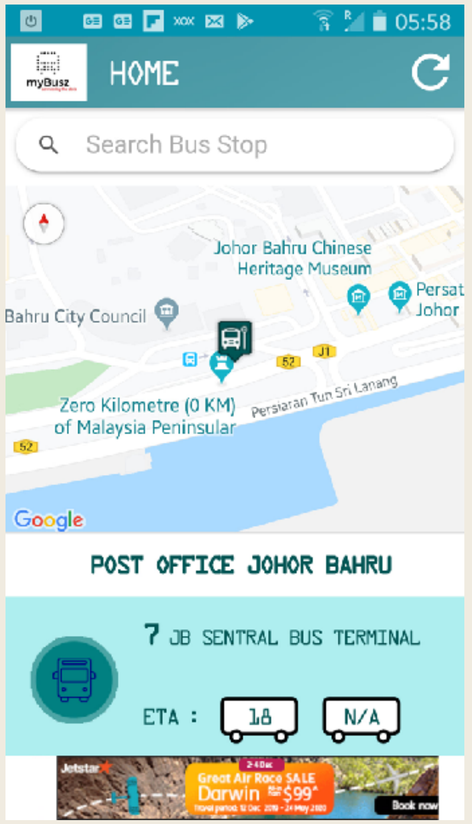


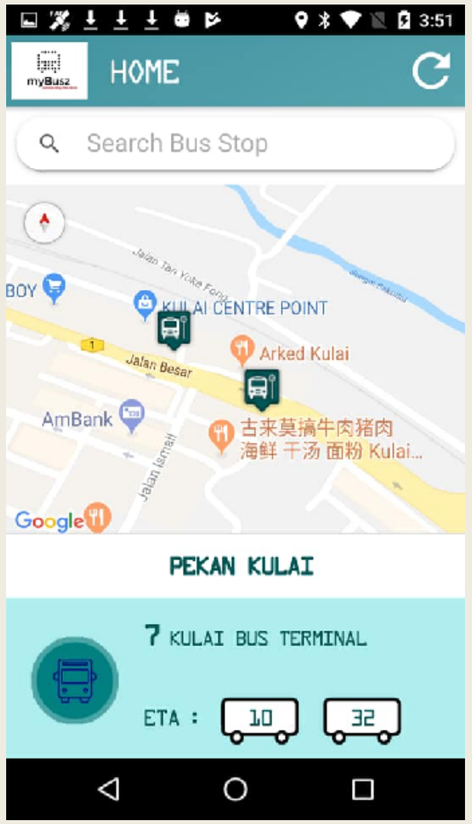
S. Gunady and S. L. Keoh, "A Non-GPS based Location Tracking of Public Buses using Bluetooth Proximity Beacons,"
IEEE 5th World Forum on Internet of Things (WF-IoT), Limerick, Ireland, 2019

myBusz
connecting the dots

revamped mobile app (android & ios)



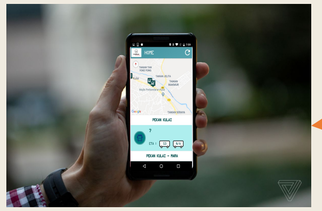




mobile app with google advertisements

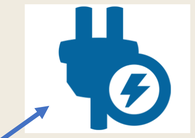
field trial & deployment

Info Panel on Bus Arrival Time



myBusz Mobile App

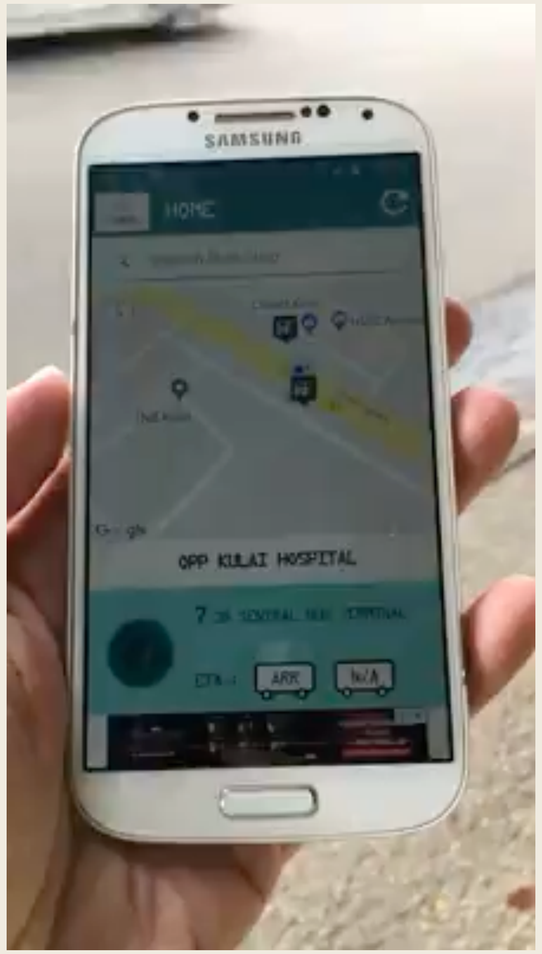
Bus Stop Opposite Kulai Hospital



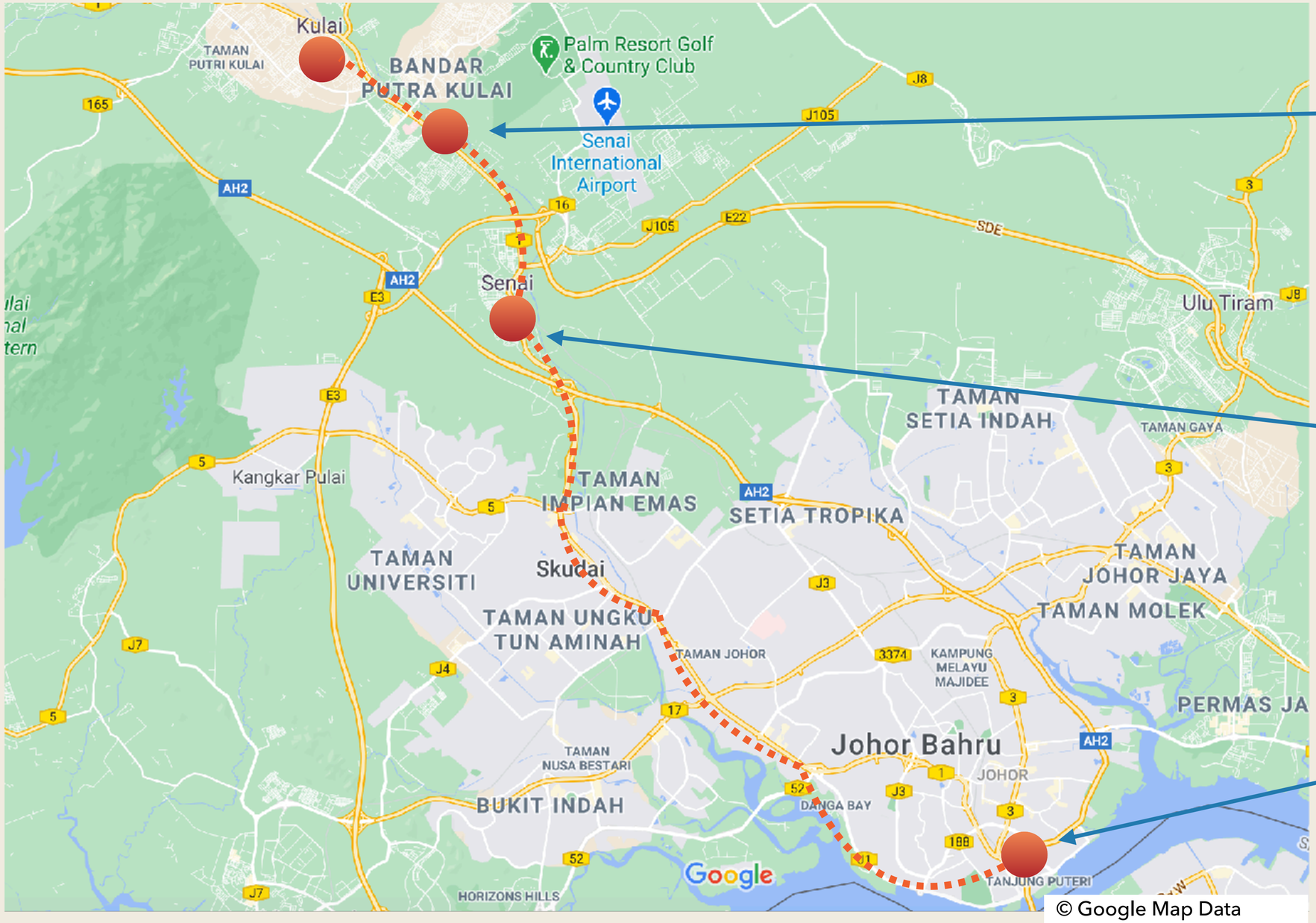
Installation of power supply

Installation of Raspberry Pi for detection of bus

Internet Connectivity



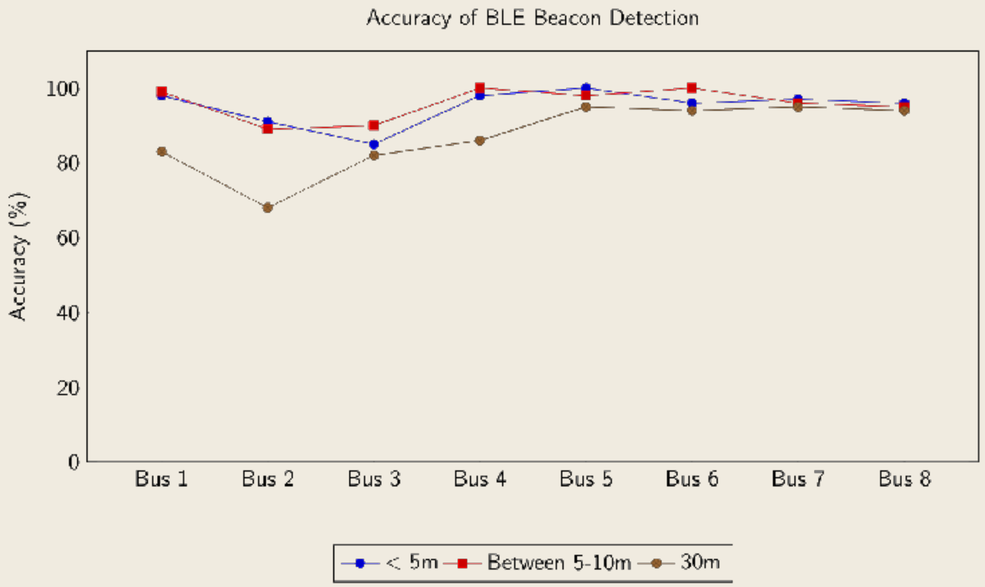
- Accuracy up to ± 3 minutes in non-congested time, as the system does not take into account traffic information yet.


Kulai
TAMAN PUTRI KULAI
BANDAR PUTRA KULAI
Palm Resort Golf & Country Club
Senai International Airport
Senai
Ulu Tiram
TAMAN SETIA INDAH
TAMAN GAYA
Kangkar Pulai
TAMAN IMPIAN EMAS
SETIA TROPIKA
TAMAN UNIVERSITI
Skudai
TAMAN UNGKU TUN AMINAH
TAMAN JOHOR JAYA
TAMAN MOLEK
TAMAN JOHOR
KAMPUNG MELAYU MAJIDEE
PERMAS JA
Johor Bahru
JOHOR
TAMAN NUSA BESTARI
BUKIT INDAH
DANGA BAY
TANJUNG PUTERI
HORIZONS HILLS
Google
© Google Map Data


RESTORAN KIM WAH


THANK YOU!
11:28AM
POINT

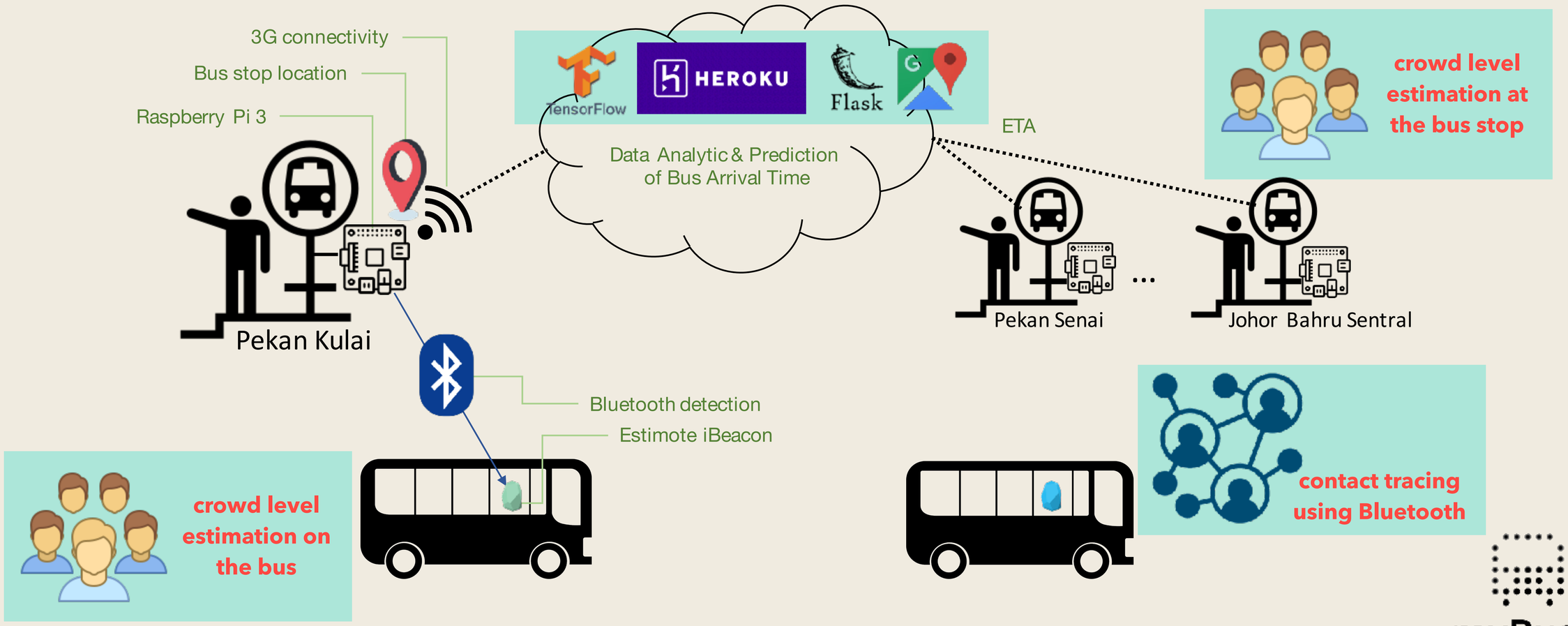
reliability & transmission range



TX Power (dBm)	Max Range (m)
-20	3.5
-12	5.5
-4	14.2
4	20.5
10	33.7

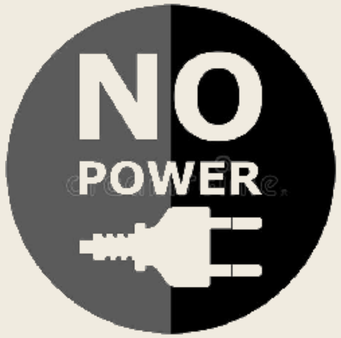
- Detection of BLE beacons is very accurate, i.e. approximately 90% and above when the distance is < 10 metres.
- For detection of bus that is 30 m away, the accuracy is between 80% - 90%.
- Bus id 2 had a less detection accuracy due to
  - Non-stopping at the bus stop
  - Fast speed
- Our tests reveal that when setting the beacon's *"broadcasting power level"* to the highest level, detection at the range of > 30m can be achieved.

myBusz 3.0 (upcoming)



challenges in deploying iot applications

- myBusz 1.0: QR code went gone within days.
- Beacon on the bus were missing.
- Power source to Raspberry Pi unplugged.
- Internet connectivity was unreliable.
- Human behaviour.
- Coordination with the bus operator, regulatory bodies, bus drivers.
- Small install base of myBusz mobile app.
- Cyber security issues.



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Thank you

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www.facebook.com/myBusz

Image Source: Singapore Institute of Technology