

Qualcomm Innovate in Taiwan Challenge 2021

5G Communication Module of AI
base on Quantum Microcomputer
in Wireless Vehicular Network

A Good Intention AI Co., Ltd.
Quantum Computer of RD Department
AGAI Bullrun701 Team
<http://www.free-powerpoint-templates-design.com>



How to improve our live with
5G Communication of Network?



Ans

IoT

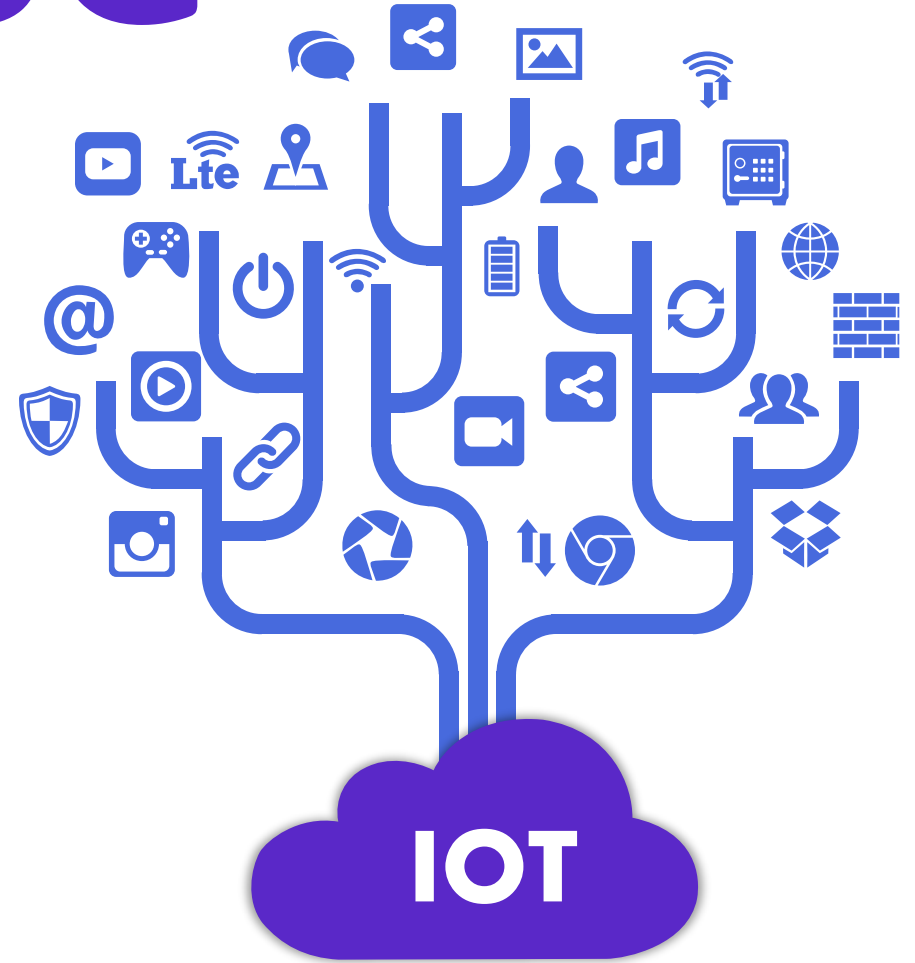
AI

Wireless Vehicular Network

Vehicular Internet Of Topics

- ✓ Prevent collision
- ✓ Locate pedestrian
- ✓ Speed up the localization
- ✓ Improve efficiency of the facility

5G AI IoT





What Vehicles can prevent collision and locate pedestrian, even the accident can be reduced and lives can be safer?

01 Sensor + GPS

Prevent Collision

02 AI + Computer Vision

Locate Pedestrian

03 Edge Computing

Accident Reduced

<https://www.automan.tw/news/newsContent.aspx?id=2725>

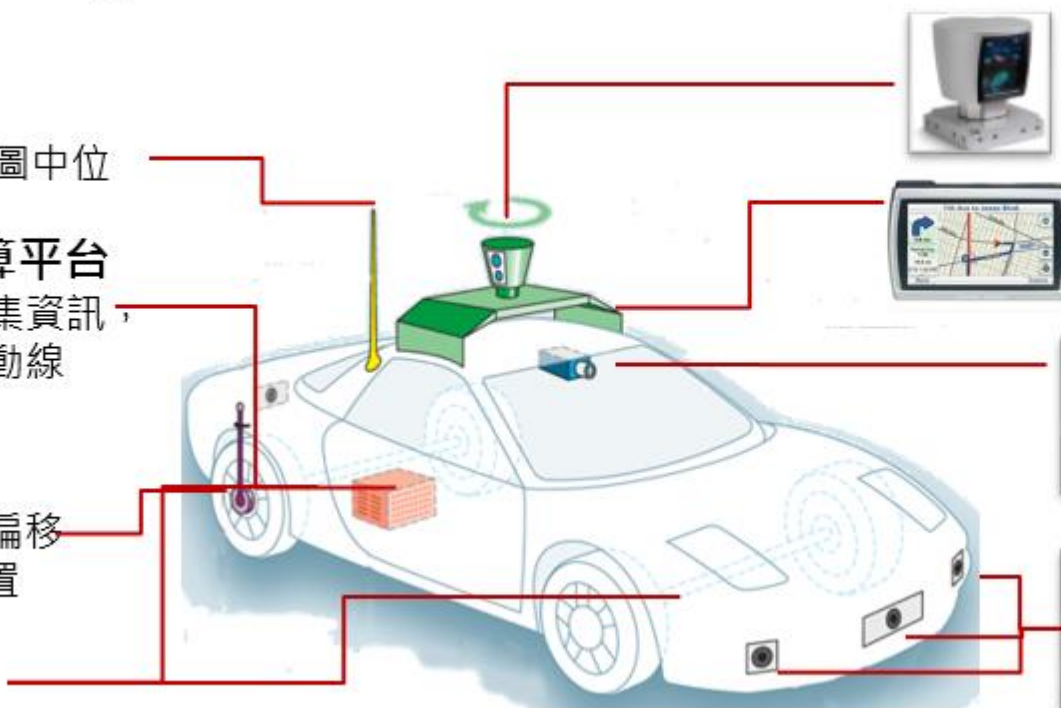
序號⑤~⑧：執行「決策與控制」程序

⑤ GPS接收器
辨識車輛於地圖中位置

⑥ 電腦資料運算平台
透過感應器蒐集資訊，
決定車輛行進動線

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監控車輛是否偏移
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(X-by-wire)



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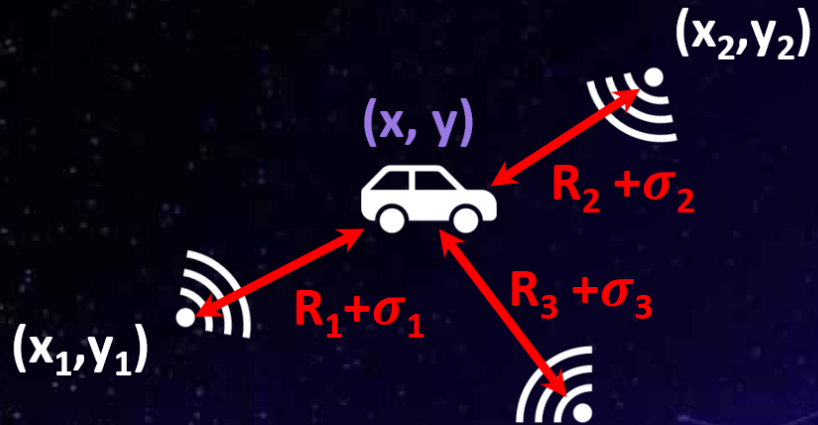
② 慣性動作感測器
因應GPS訊號微弱時，
提供航位推算功能

③ 攝影機
負責判讀交通號誌，
並偵測移動障礙物

④ 毫米波雷達
判斷車輛遠距離
物體位置與距離

What can be solved or support by Quantum Computing?

Quantum Algorithm can support computing Vehicle Localization



$$\min \left| \sum_{i \in I} (x_i - x)^2 + (y_i - y)^2 - (R_i^2 + \sigma_i) \right|$$

Car's position = (x, y)

Sensor's position = (x_i, y_i)

Sensor's noise = σ_i

Problem Type

Optimization problem

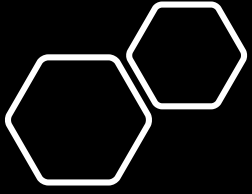
Method

Quantum approximate Optimization Algorithm

Quantum Advantage

Solve NP problem in Classical Computer

Speedup your Computing Time



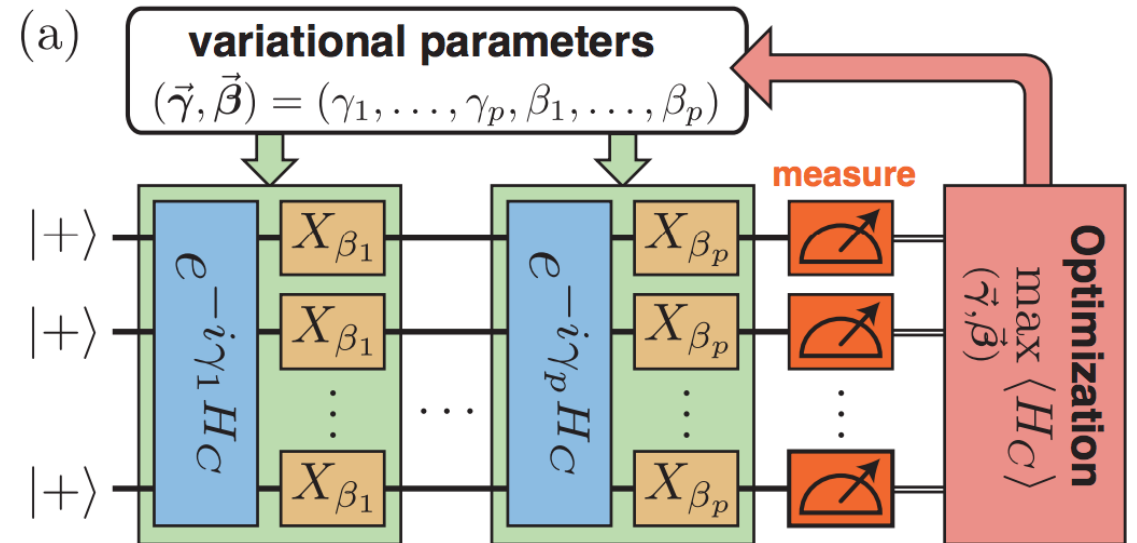
Quadratic Problem

- NP-hard problem
- Can be mapping into QAOA (Quantum Approximate Optimization Algorithm)

$$\min \left| \sum_{i \in I} (x_i - x)^2 + (y_i - y)^2 - (R_i^2 + \sigma_i) \right|$$

QAOA

- hybrid quantum-classical variational algorithm
- designed to tackle combinatorial optimization problems





- How does we Integration 5G Communication of Wireless Vehicular Network & Quantum Computing to IOT Application scenarios?
- How does we create this 5G Communication of Network Product?

How to Integration 5G Communication and Quantum Computing?

- We only need to using Evaluation Board and 5G Chip and antenna, building an Communication Module.
- We should install quantum computer SDK on Microcomputer Chip.
- Combine this Communication Module and Microcomputer Chip to a Sensor Device

Our Idea Production

5G Quantum Microcomputer Sensor



Evaluation Board

All antennas can be customized as required



5G Antennas



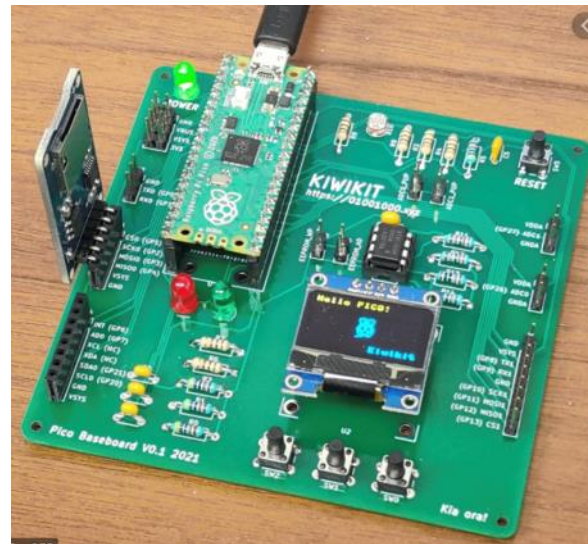
Quantum SDK

5G Chip



Final Creation

5G Quantum Microcomputer Sensor



How does we create this 5G Communication of Network Product?

1. Finding a sample of 5G Communication Module
2. Following this sample to Copy-DIY our Microcomputer
3. Install Qiskit and our Quantum Code on Microcomputer

Finding a sample 5G Communication Module



AGAI Sensor Device

Copy-DIY our Microcomputer

All antennas can be customized as required

Embedded



5G Antennas



Evaluation Board

Embedded

5G Chip(communication+AI)



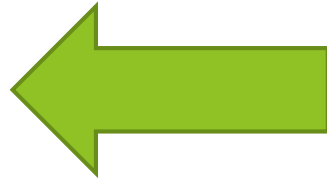
Picture source by google Image Search

Install Qiskit on Microcomputer

<https://medium.com/qiskit/rasberry-quantum-computing-is-the-coolest-project-for-raspberry-pi-3f64bec5a133>



Evaluation Board



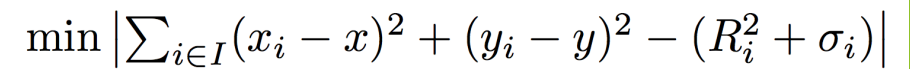
```
RasQberry — pi@raspberrypi: ~/rasqberry — -bash — 85x31
Successfully installed MarkupSafe-1.1.1 Send2Trash-1.5.0 attrs-19.3.0 backcall-0.2.0
bleach-3.1.5 certifi-2020.6.20 cffi-1.14.0 chardet-3.0.4 cryptography-2.9.2 cycl...
10.0 decorator-4.4.2 defusedxml-0.6.0 dill-0.3.2 dlx-1.0.4 docplex-2.14.186 entrypoin
ts-0.3 fastdtw-0.3.4 fastjsonschema-2.14.4 idna-2.10 importlib-metadata-1.7.0 inflect
ion-0.5.0 ipykernel-5.3.0 ipython-7.16.1 ipython-genutils-0.2.0 ipywidgets-7.5.1 jedi
-0.17.1 jinja2-2.11.2 joblib-0.15.1 jsonschema-3.2.0 jupyter-client-6.1.3 jupyter-cor
e-4.6.3 kiwisolver-1.2.0 marshmallow-3.6.1 marshmallow-polyfield-5.9 matplotlib-3.2.2
mistune-0.8.4 more-itertools-8.4.0 mpmath-1.1.0 nbconvert-5.6.1 nbformat-5.0.7 nest-
asyncio-1.3.3 networkx-2.4 notebook-6.0.3 ntlm-auth-1.5.0 pandas-1.0.5 pandocfilters-
1.4.2 parso-0.7.0 pexpect-4.8.0 pickleshare-0.7.5 pillow-7.1.2 ply-3.11 prometheus-cl
ient-0.8.0 prompt-toolkit-3.0.5 psutil-5.7.0 ptyprocess-0.6.0 pycparser-2.20 pydot-1.
4.1 pygments-2.6.1 pylatexenc-2.5 pyparsing-2.4.2 pyrsistent-0.16.0 python-constraint-1.4.0 python-da
teutil-2.8.1 pytz-2020.1 pyzmq-19.0.1 qiskit-0.19.6 qiskit-aer-0.5.2 qiskit-aqua-0.7.
3 qiskit-ibmq-provider-0.7.2 qiskit-ignis-0.3.3 qiskit-terra-0.14.2 quandl-3.5.0 requ
ests-2.24.0 requests-ntlm-1.1.0 scikit-learn-0.23.1 seaborn-0.10.1 sympy-1.6 terminad
o-0.8.3 testpath-0.4.4 threadpoolctl-2.1.0 tornado-6.0.4 traitlets-4.3.3 urllib3-1.25
.9 wcwidth-0.2.5 webencodings-0.5.1 websockets-7.0 widgetsnbextension-3.5.1 zipp-3.1.
0
(rasqberry) pi@raspberrypi:~/rasqberry/libcint/build $ pip list | grep qiskit
qiskit                0.19.6
qiskit-aer            0.5.2
qiskit-aqua           0.7.3
qiskit-ibmq-provider  0.7.2
qiskit-ignis          0.3.3
qiskit-terra          0.14.2
(rasqberry) pi@raspberrypi:~/rasqberry/libcint/build $ export ENDDATE=`date`
(rasqberry) pi@raspberrypi:~/rasqberry/libcint/build $ echo; echo "start Qiskit insta
ll: " $STARTDATE; echo "end   Qiskit install: " $ENDDATE

start Qiskit install:  Sun Jun 28 13:45:32 BST 2020
end   Qiskit install:  Sun Jun 28 14:10:24 BST 2020
```

burn code

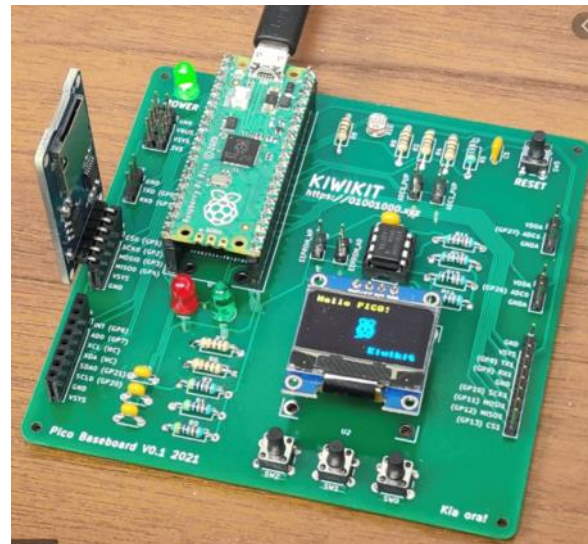


Quantum Approximate Optimization Algorithm



Final DEMO

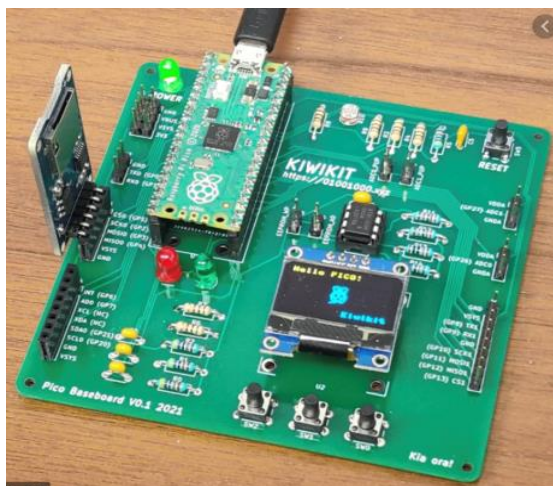
5G Quantum Microcomputer Sensor



Future work

5G Quantum Microcomputer Sensor deploy

<https://www.automan.tw/news/newsContent.aspx?id=2725>



01

Sensor + GPS

02

AI + Computer Vision

03

Edge Computing

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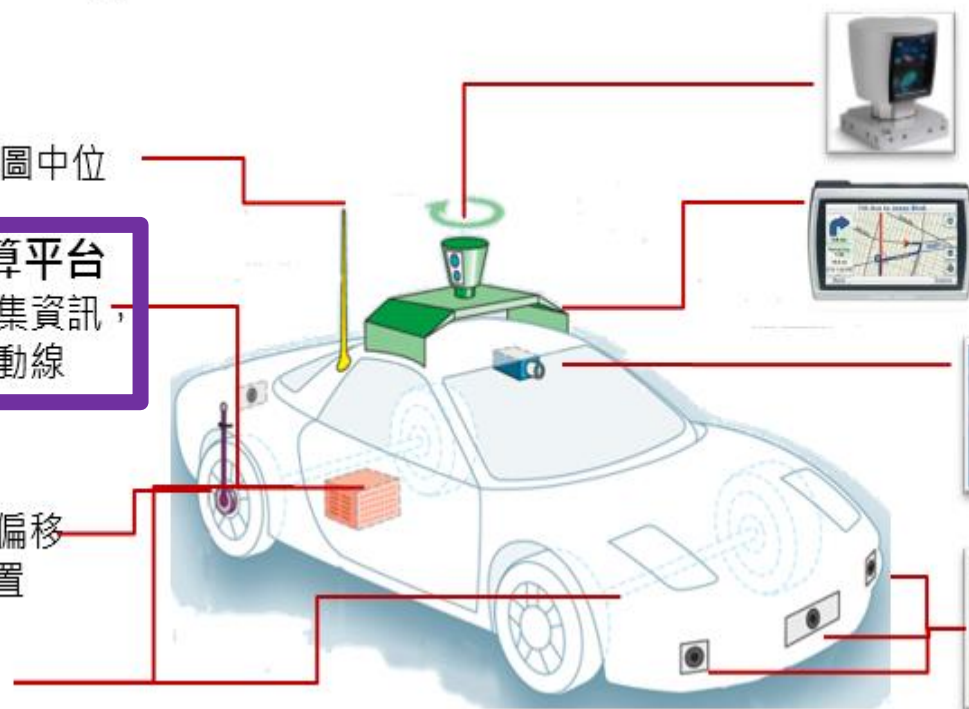
因應GPS訊號微弱時，
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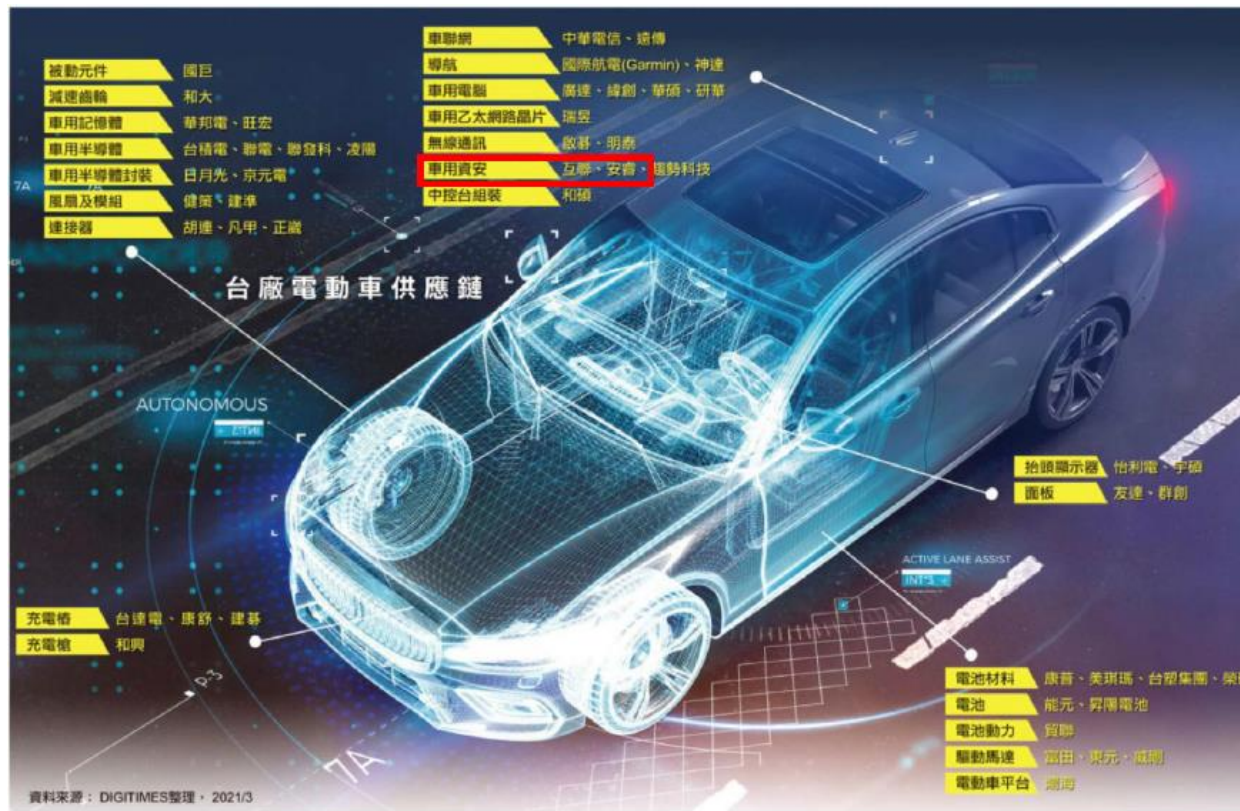
④ 毫米波雷達

判斷車輛遠距離
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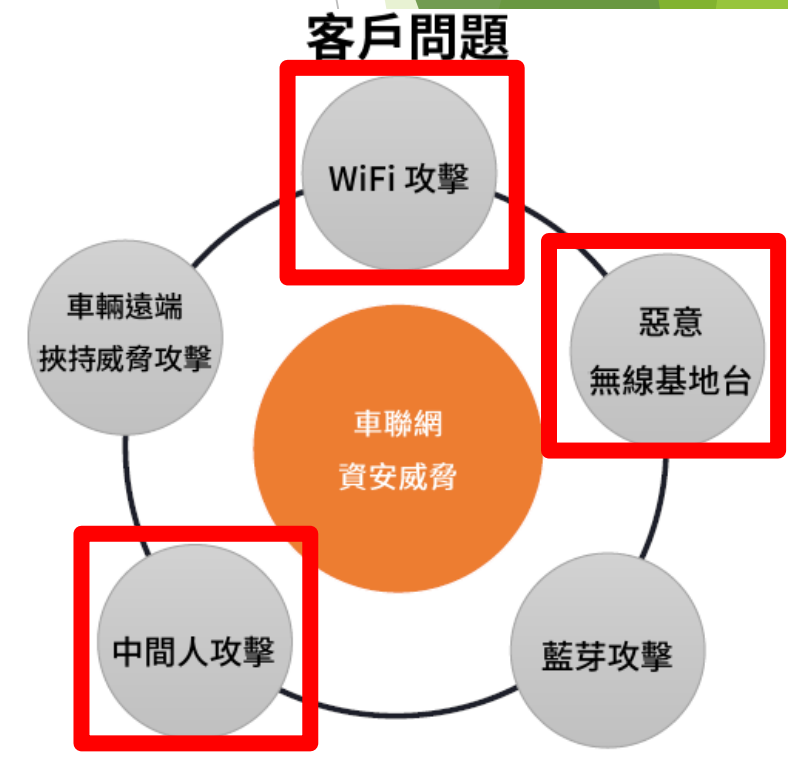
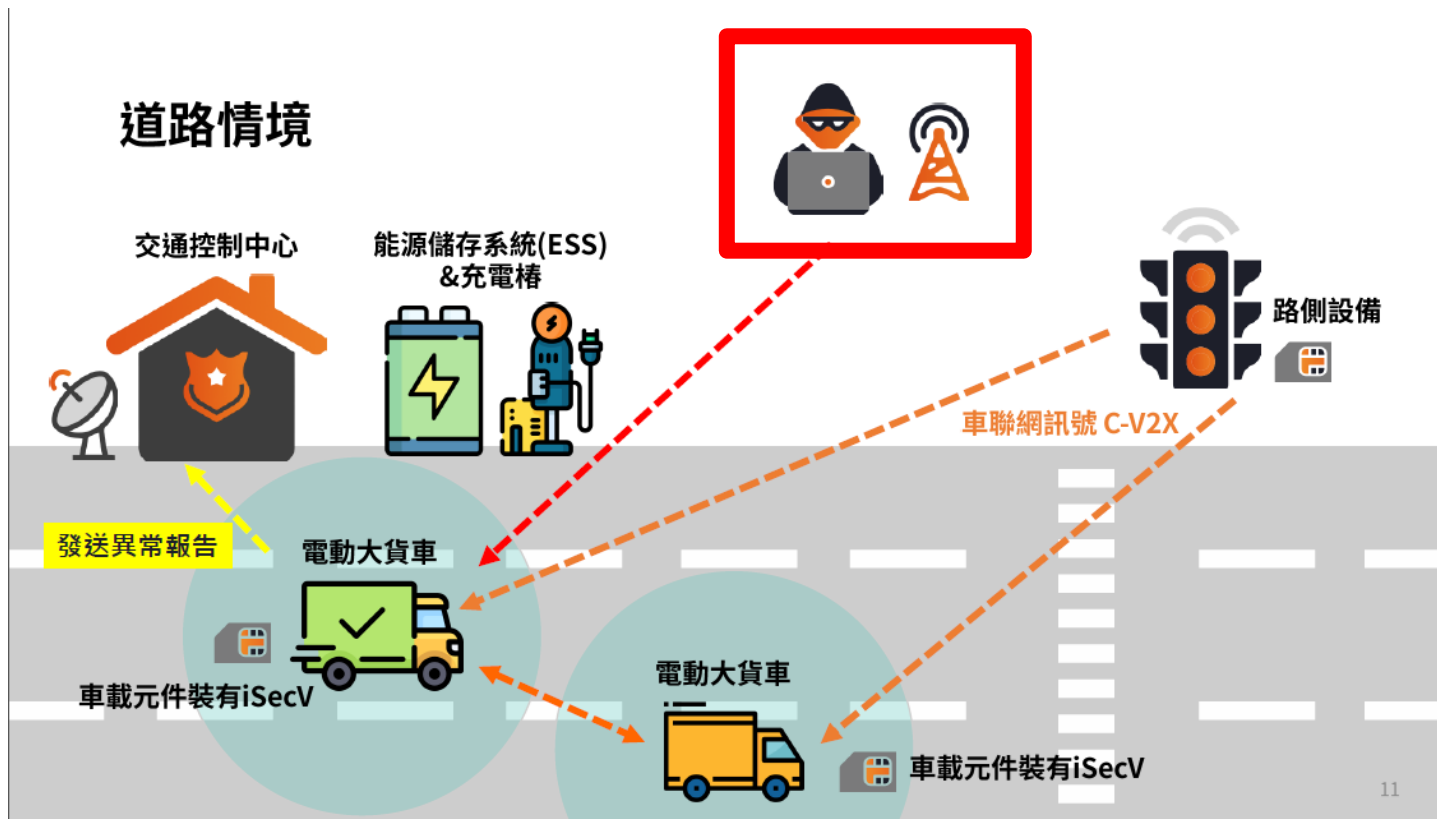


Future work

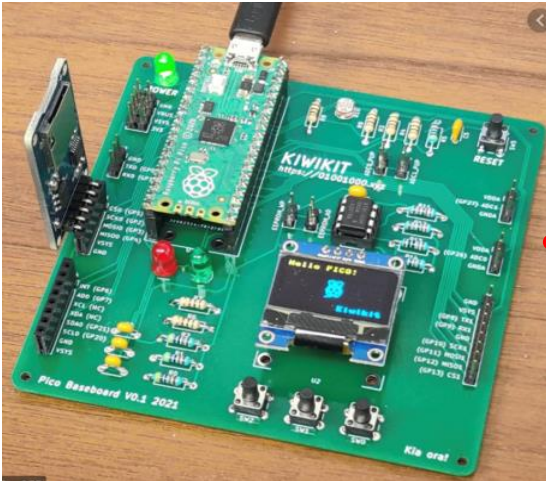
Wireless Vehicular Network Security on 5G



Wireless Vehicular Network Security Scenarios on 5G



Our Cooperative manufacturer can used 5G Quantum Microcomputer Sensor deploy on Their 5G Security Solution Consultant



車聯網場域 資安對策

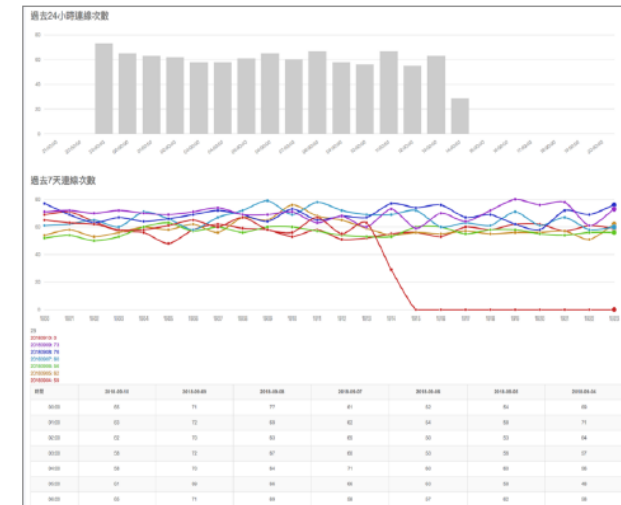
透過軟硬整合，有效達成資安防護

• 硬體-感測器



應用於多元化領域: 4G路由器、
網路影像監視器、Kiosk、
智慧裝置；Open SDK

• 軟體-監控平台

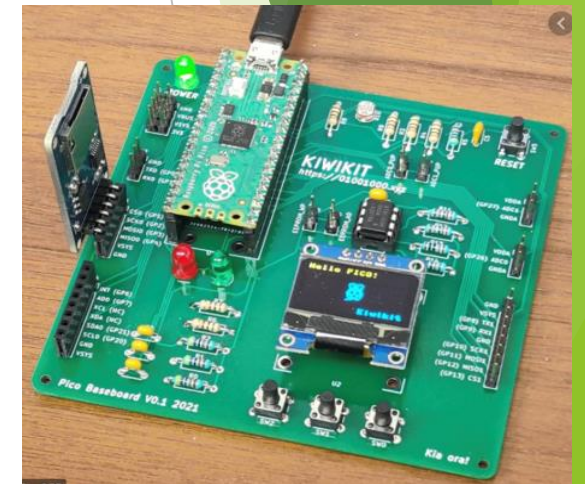


ARCRAN INC.

5G Quantum Microcomputer Sensor has Expansion Module

功能

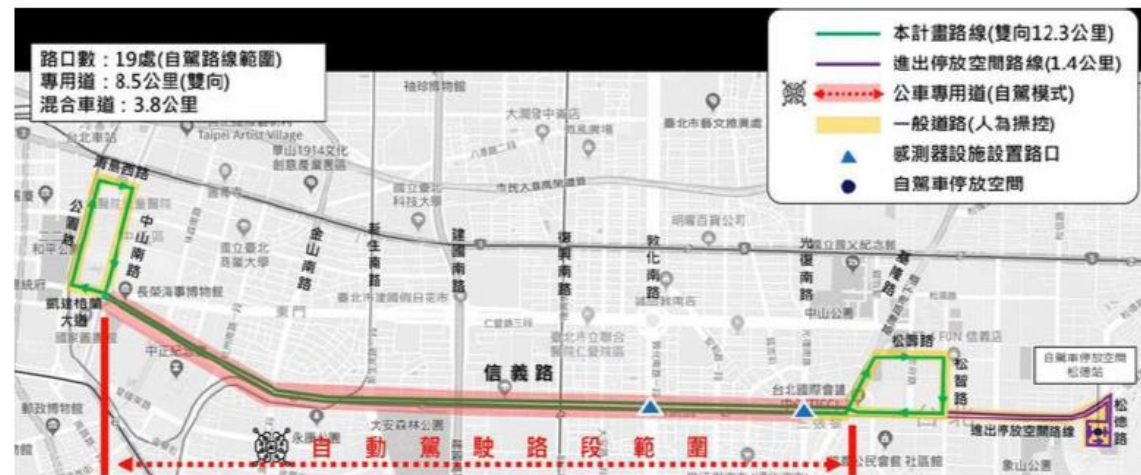
- 支援訊號種類:
 - 藍芽
 - 802.11a, b, g, n, ac, ax
 - 短距無線通訊DSRC(802.11p) , 蜂巢式車聯網 C-V2X, etc.
- 為自駕車通訊系統提供資安威脅預防系統 (情境包含: 車間通訊V2V, 車與路側設備/基礎設施互聯V2I, 車與雲端互聯V2C, 車與行人互聯 V2P, etc.)



We can Application on 5G Wireless Vehicular Network Security Market with Our Cooperative manufacturer

[案例] 台北信義區 自駕巴士

- 臺灣智慧駕駛與北市政府合作，於信義區公車專用道進行自駕巴士試煉
- 試煉路線全長共12.3公里，包含雙向公車專用道及混合車道，途經19個路口
- 互聯安睿提供iSecV車聯網資安威脅偵測器，於測試期間進行即時數據收集、資安防護
- 本案證實iSecV可於實際道路應用，維護乘客安全及公共交通安全，避免因系統漏洞、駭客攻擊等資安威脅，使自駕巴士無法正常行駛，造成人員傷亡、財物損失



We can Application on 5G Wireless Vehicular Network Security Market with Our Cooperative manufacturer

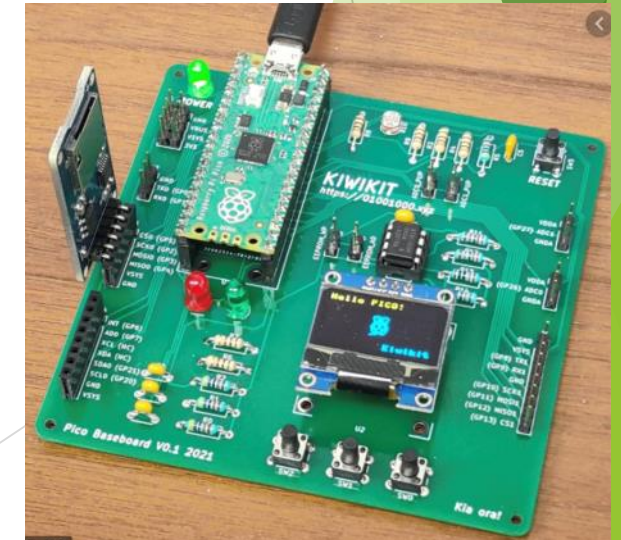
[案例] 桃園虎頭山 創新園區

- 虎頭山創新園區為首座結合「車聯智駕中心」與「資安物聯網中心」的測試研發基地，提供智慧駕駛及自駕車研發環境及測試場域，**園區面積4.7公頃**
- **互聯安睿**受邀進駐該園區，為智慧駕駛廠商提供專業資安輔導，**進行資安防護系統建置與實際場域試煉**，有效提升智慧駕駛之創新服務能量，為整體產業鏈加值



Conclusions

- We Integration 5G Communication of Wireless Vehicular Network and Quantum Computing to IOT Application scenarios.
- Final We create a 5G Communication of Network Product by Copy-DIY
- IN the future, we deploy to Wireless Vehicular Network Security on 5G with our Cooperative manufacturer.



The background features abstract, overlapping green geometric shapes in various shades of green, creating a modern and dynamic look. The shapes are primarily located on the left and right sides of the slide, framing the central text.

Thank you for your attention!

We are AGAI Bullrun701 Team