

LTE CATM1, Azure IoT Central로 Connected Car 컨셉 제작

CodeZoo

e4ds_{news}

muRata
INNOVATOR IN ELECTRONICS



vodafone

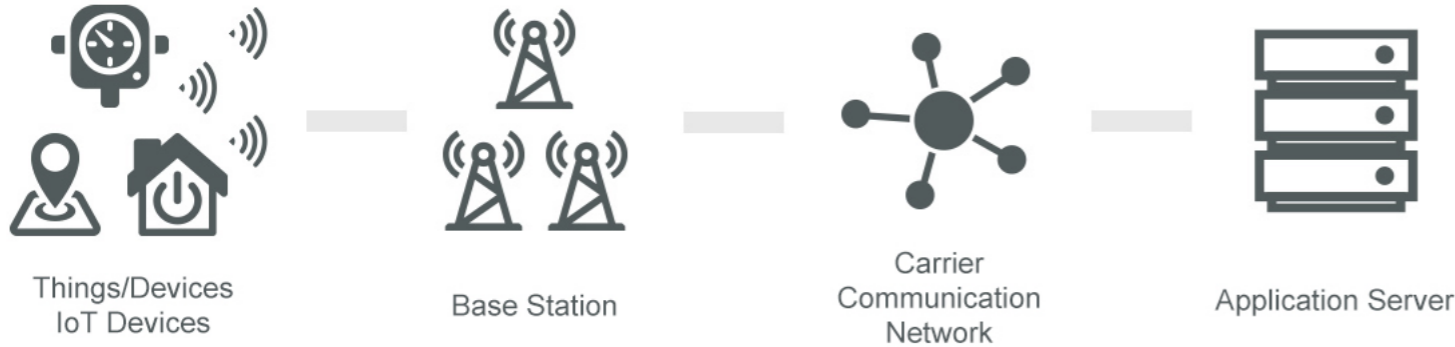
ASI A-SUNG
International CO.,LTD.

CodeZoo

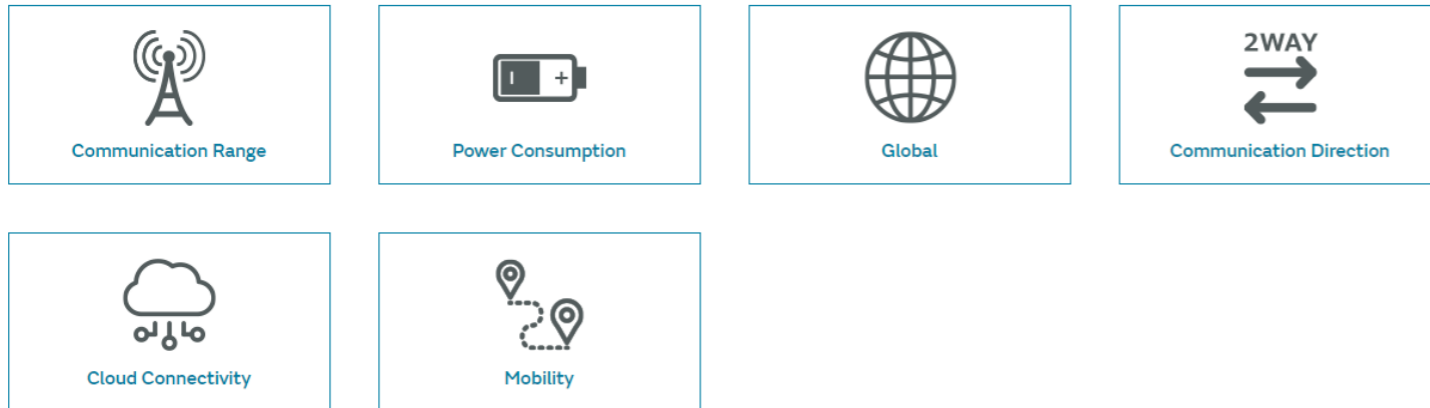
1. LTE Cat.M1 통신
2. 제품 및 부품 소개
3. Vodafone Global IoT Sim 소개
4. Connected Car 동작방식
5. H/W, S/W 셋업
6. Azure IoT Central Cloud 설정
7. 펌웨어 연결 코드 입력, 모니터링 및 제어명령 추가
8. 테스트 결과
 - 데이터 실제 사용량 (with Vodafone)
 - 배터리 소모량
9. More Connected Car
 - 아이디어

1. LTE Cat.M1통신

LTE 이동통신망 기반의 저전력 광역 통신 기술 표준 LPWA(Low Power Wide Area)



- ☑ 통신 인프라가 없어도 사용가능
- ☑ 초소형 기기 설치 가능
- ☑ 저전력 기기 적합
- ☑ 보안이 강화된 무선통신
- ☑ 저렴한 통신 비용



이미지 출처 : <https://www.murata.com>

국내 주요 IoT 기술 비교

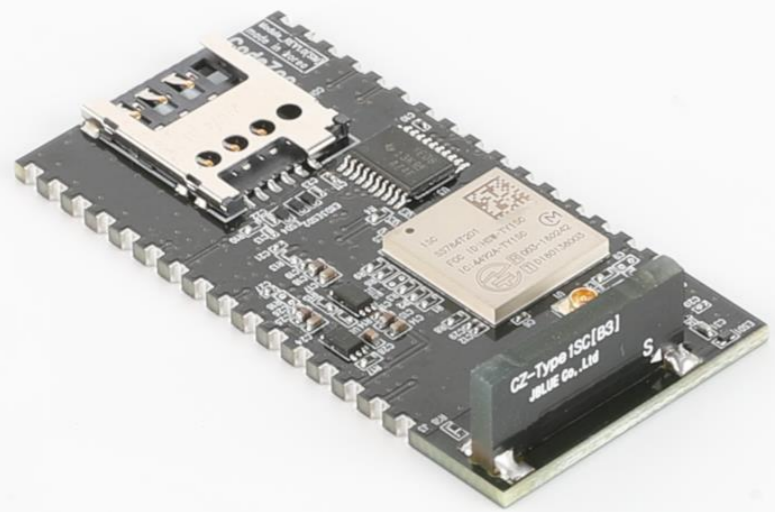
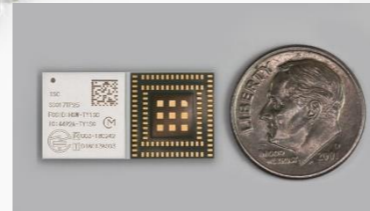
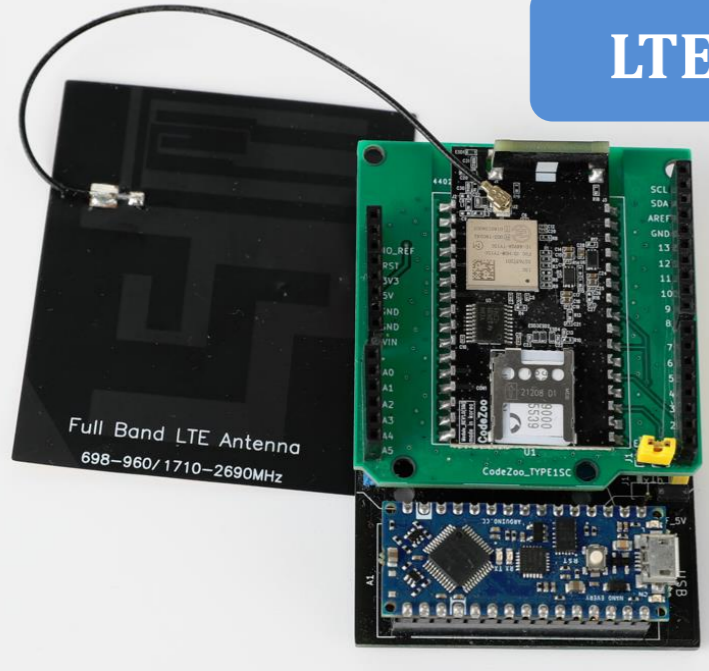
	LTE Cat.M1	LTE-M	LoRa	NB-IoT
주파수	LTE 대역 내 0~1.08MHz 가변	LTE 대역 내 0~20MHz 가변	비면허 대역 125kHz*8채널	LTE 대역 내 180kHz 고정
전송 속도	~300Kbps	~10Mbps	~5.4kbps	~27kbps
가능 서비스	데이터, 음성, 사진	데이터, 음성, 영상	센서 측정치 등 소량 데이터	센서 측정치 등 소량 데이터
배터리 수명	수 년 이상	수 개월	수 년 이상	수 년 이상

※전송 속도는 다운로드 기준 최대 속도

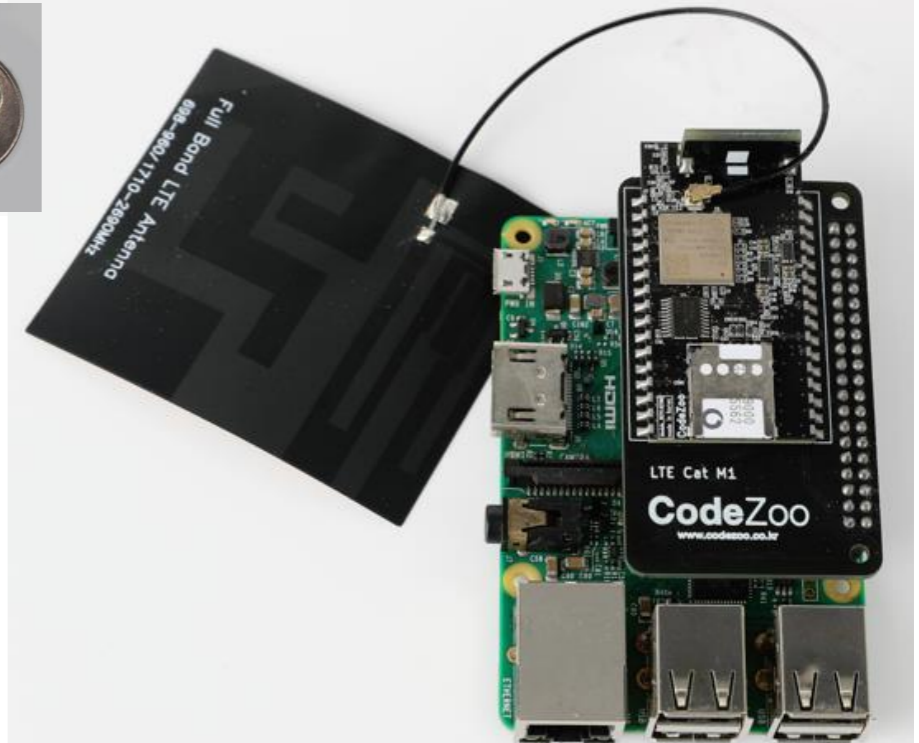
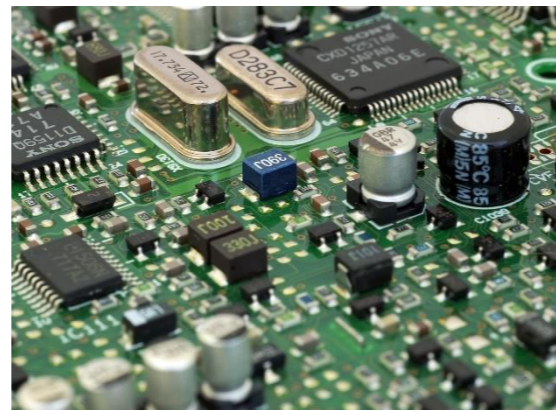
자료=SK텔레콤

2. 제품 및 부품 소개

LTE-CatM1 내장형 모뎀



200+ Companies design



전자/로봇/기계부품 분야 1위 쇼핑몰
DEVICEMART

<https://url.kr/u8ipdj>

GitHub

<https://url.kr/lif94s>

Murata CatM1 Module (Type 1SC)

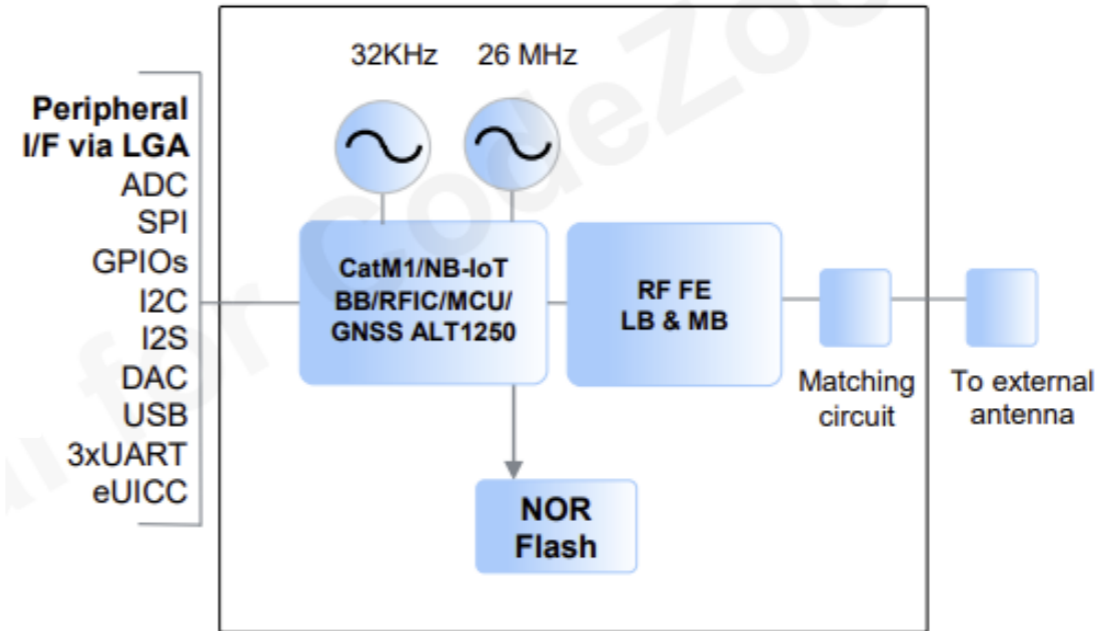
Features

- LTE Cat M1 – 23 dBm
- NB-IoT (NB1) Rel. 13 (Rel. 14 – SW Upgrade)
- Built-in ARM Cortex M4 core with 128KB RAM and 16MB flash (June '18 – SW release)
- GNSS, VoLTE
- Dimension: 11.1 x 11.4 x 1.5 mm
- Package: LGA
- Antenna configurations: external
- SIM card: external
- 3GPP eDRX and PSM modes
 - Hibernation current: 3 uA
 - eDRX current: <25 uA @ 8 hyperframes
 - PSM current: dormant window configurable
- Operating temperature range: -40 °C to 85 °C
- OTA firmware upgrade
- RoHS compliant
- Regulatory certificate: FCC/IC/ETSI/TELEC (plan)
- Carrier Certifications: GCF, Verizon, ptcrb, AT&T, Softbank, KDDI, Docomo (Plan)

Applications

- Wearables
- Building automation/Security
- Medical/Healthcare
- Asset Tracking

Module Block Diagram



Type 1SC (MP)

PN: LBAD0XX1SC
Altair ALT1250
11.4 x 11.1 x 1.5mm

Available for AT Command



FCC/IC/CE/Japan Certified



Type 1WG (MP)

PN: LBAD0XX1WG
Altair ALT1250
12.2 x 12.0 x 1.6mm

Available for AT Command
(JP Market only)



Japan Certified

Type 1SE (TBD)

PN: LBAD0ZZ1SE
Altair ALT1250 + STMicro STM32L462
15 x 17 x 1.5mm

Available for Open MCU



FCC/IC/CE/Japan Certified





1992년 설립



2,200억원 매출



4개국, 16개 거점
(한국, 중국, 베트남, 인도)



200명 임직원



1,500 고객사수



20개 이상의
글로벌 벤더

기술 지원



자체 AE, FAE 운영 및 (주)코드주를 통한
글로벌 Tier1 벤더 제품 기술 지원

효율성 향상

다양한 전자 부품, 자동화 제품 소싱

Hardware, Software 지원 및 외주개발 서비스
(벤더 별 사전 협의 필수)

안정성 신뢰

31년 업력으로 안정적인 재무구조

신뢰할 수 있는 B2B 엔지니어 및 영업 전문가 보유

☎ 연락처 070.4235.1156

✉ 이메일 주소 asungmaster@asung.com

📍 서울시 강남구 테헤란로 114길24 아성빌딩

3. Vodafone Global IoT Sim 소개



<https://url.kr/m2yie6>

CodeZoo
www.codezoo.co.kr

Vodafone Global Sim
IoT 디바이스 연동 기술지원 서비스

CodeZoo
www.codezoo.co.kr

Vodafone Global Sim
SimCard, Data Plan 판매

Global IOT SIM?

1. 해외 시장 개척 시 유리

하나의 SIM으로 180개국 이상에서 로밍(roaming)하여 사용할 수 있으므로 해외에서 진행하는 프로젝트에 쉽게 적용 (각국 통신사 협의 불필요)

2. Time to market

복잡한 인증 절차를 Global SIM 기반 글로벌 표준 인증(3GPP)만으로 여러나라 통신사의 서비스 지원

3. KT LTE-M 서비스 지원

KT망 연결시 PSM 모드를 포함한 LTE-M 서비스 지원

4. IoT 전문업체에서 기술 지원

IoT H/W, S/W 10년이상의 경험을 지닌 CodeZoo에서 기술 지원

4. Connected Car 동작방식

Devices > smartkey > CarGateWay

CarGateWay
Connected | Last data received: 2/20/2023, 3:09:15 PM
Status: Provisioned | Organization: smartkey

About Overview **Commands** Raw data Mapped aliases Files

smartkey / KeyUnlock 🕒 ^

Run

To see response, please check the [command history](#).

smartkey / KeyLock 🕒 ^

Run

To see response, please check the [command history](#).

Devices > smartkey > CarGateWay

CarGateWay
Connected | Last data received: 2/20/2023, 3:09:15 PM | Status: Provisioned | Organization: smartkey

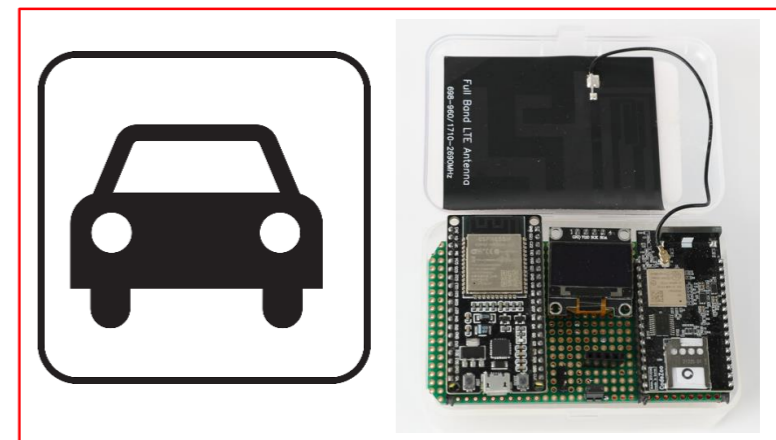
About **Overview** Commands Raw data Mapped aliases Files

Last known value (LKV) ↗

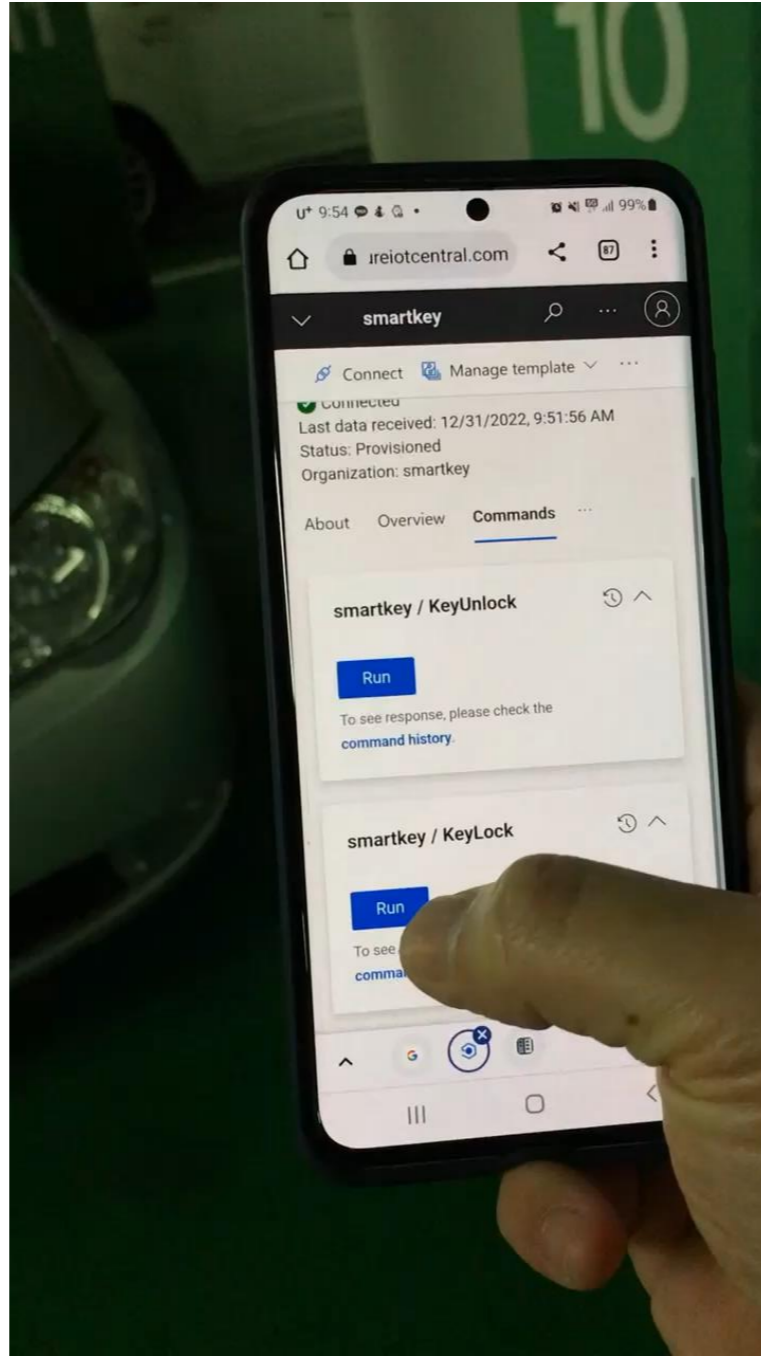
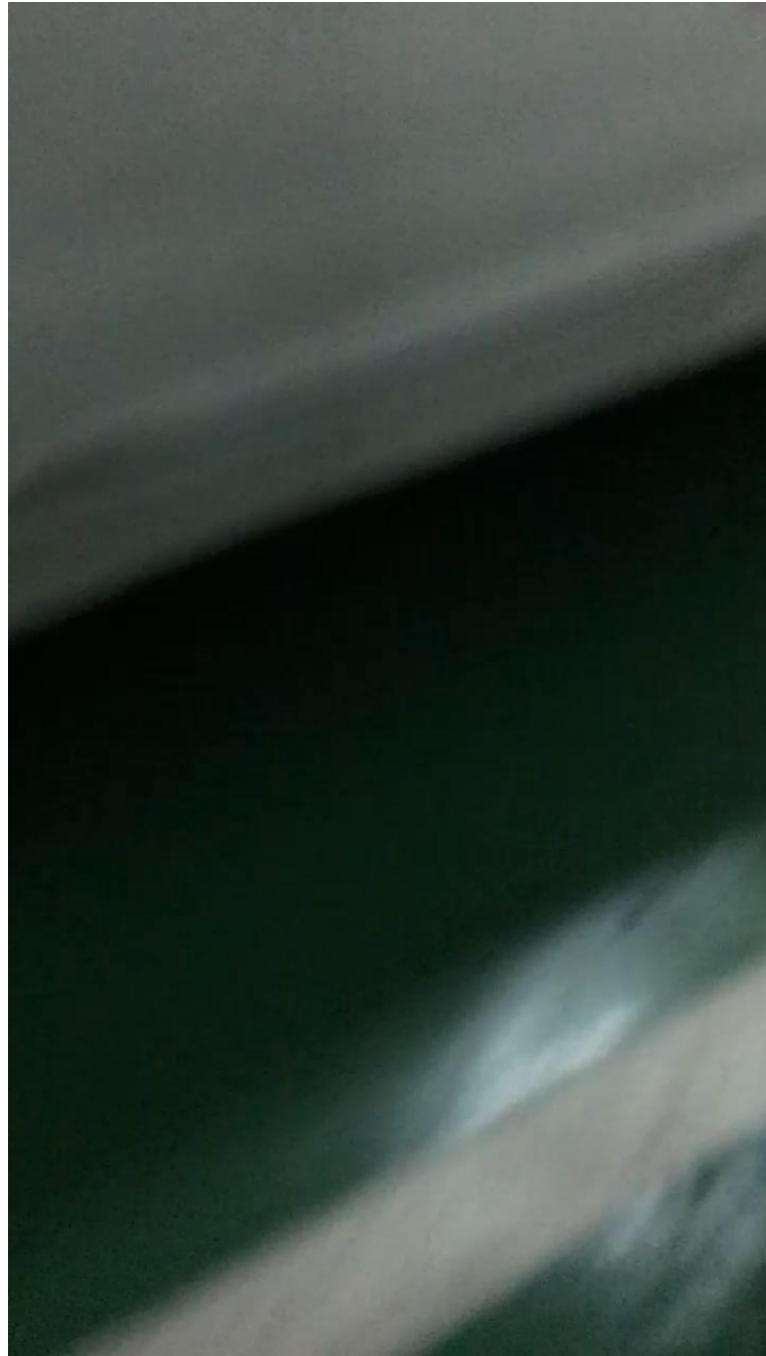
KeyUnlock

Line chart ↗

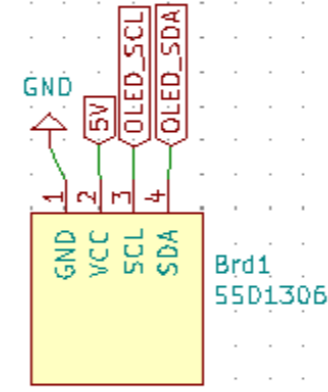
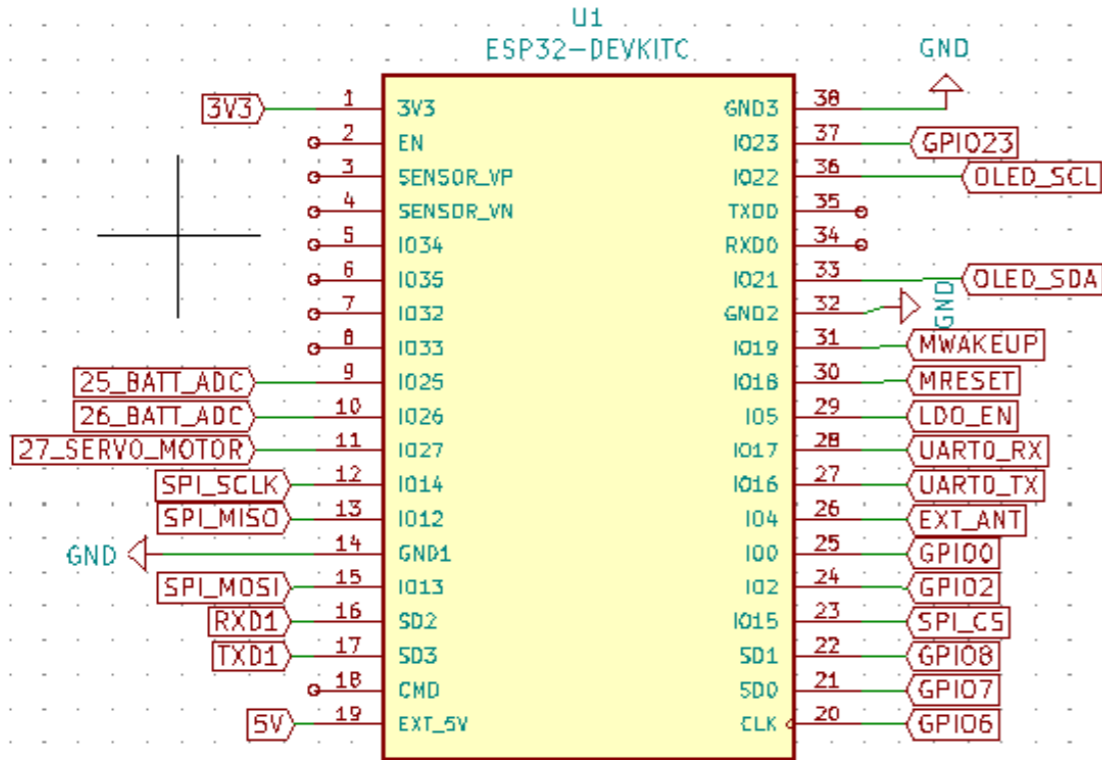
Time	Battery Level
2023.02.17. 03:00	10,874.49
2023.02.17. 04:00	~13,000



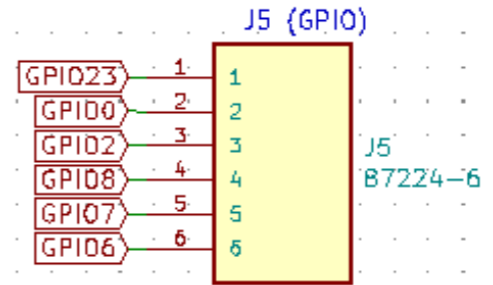
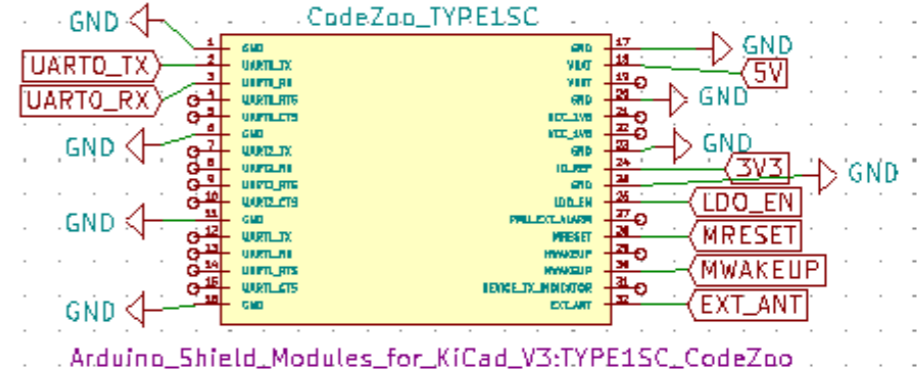
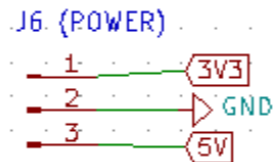
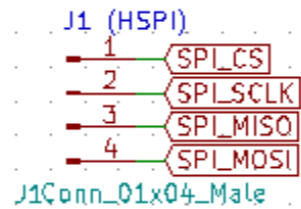
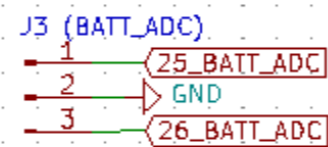
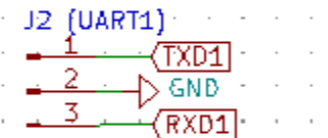
4. Connected Car 동작방식



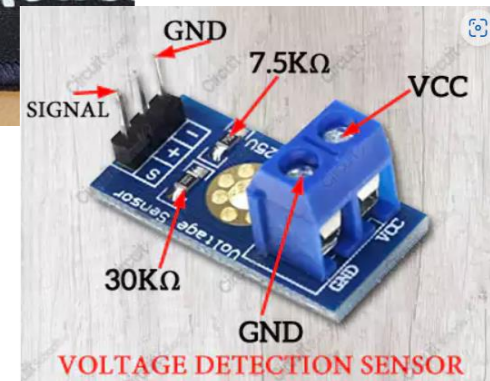
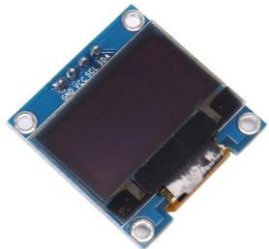
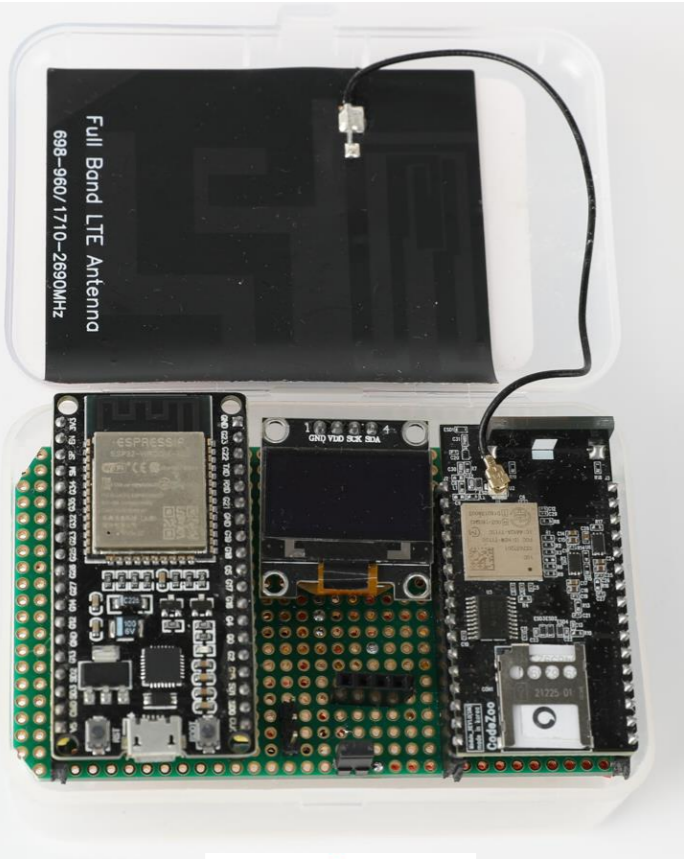
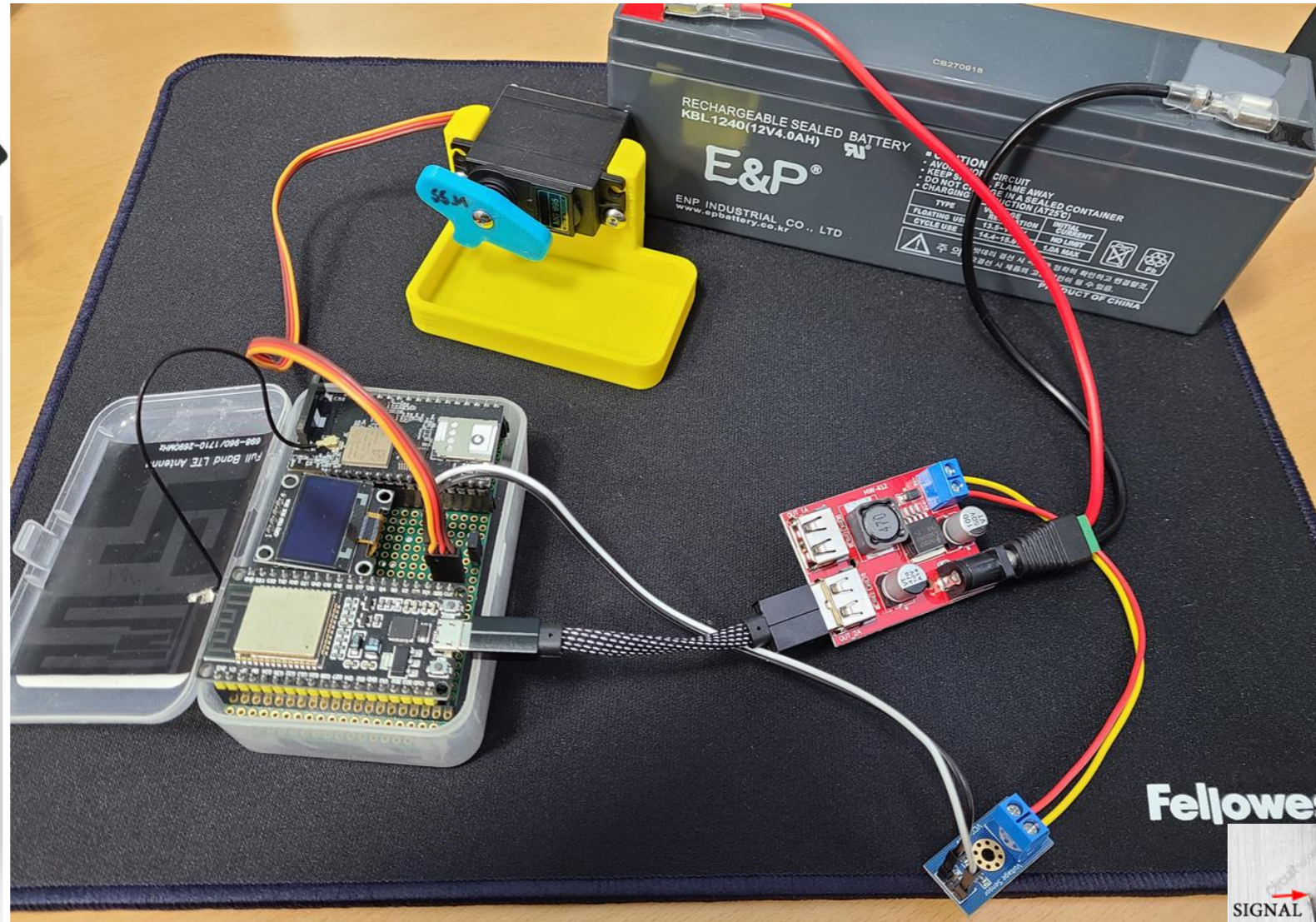
5. H/W, S/W 셋업



- H1 3.2mm M3 Hole
- H2 3.2mm M3 Hole
- H3 3.2mm M3 Hole
- H4 3.2mm M3 Hole



5. H/W, S/W 셋업



5. H/W, S/W 셋업

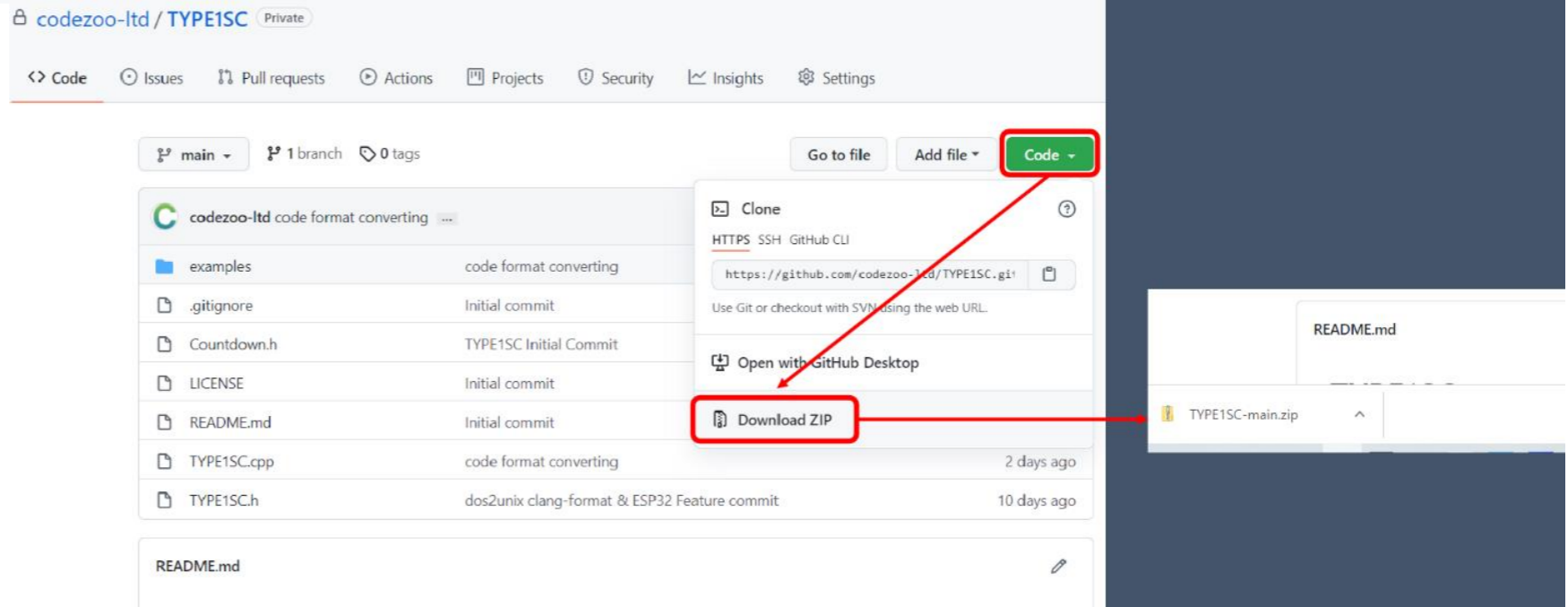
✓ 기본설정

LTE-CATM1_내장형모뎀_ESP32_핸즈온.pdf <https://url.kr/7vrgiz>

✓ CodeZoo CATM1 Library Install

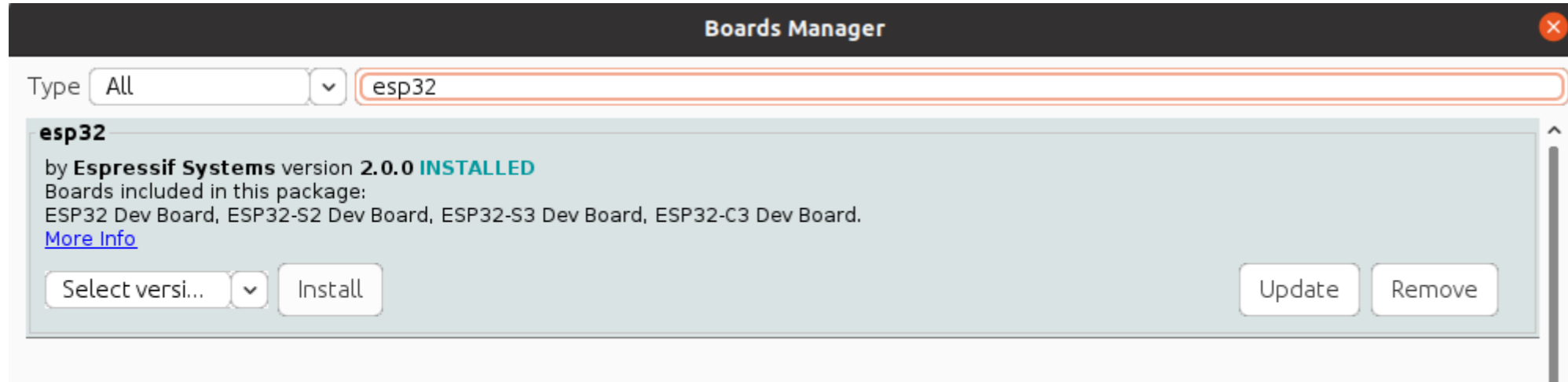
[codezoo-ltd / TYPE1SC](https://github.com/codezoo-ltd/TYPE1SC) (Public) <https://url.kr/79edo3> (기본설정)

[codezoo-ltd / pposclientSecure](https://github.com/codezoo-ltd/pposclientSecure) (Public) <https://url.kr/et5nv1> (핸즈온과 동일한 방법으로 설치)

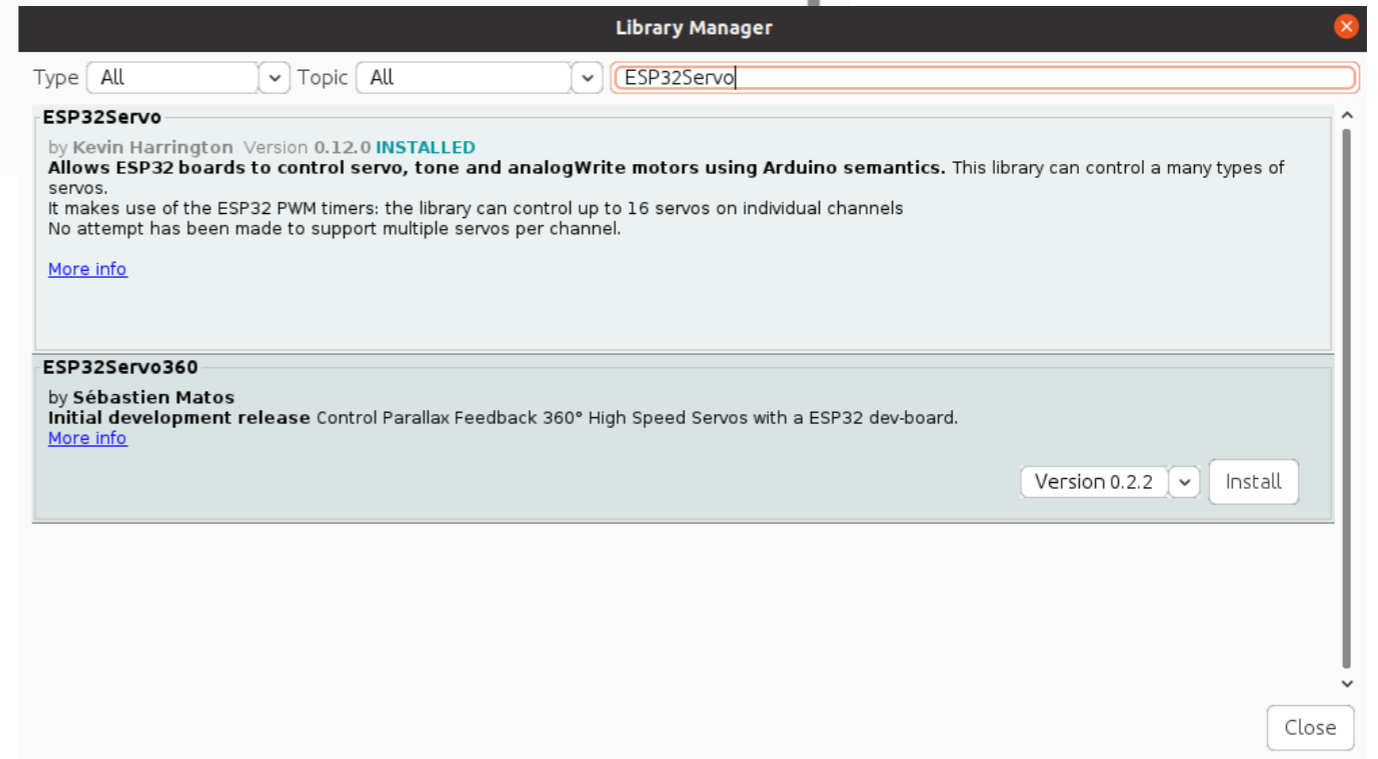


5. H/W, S/W 셋업

✓ Arduino ESP32 2.0.0 SDK Install (pppos enabled)

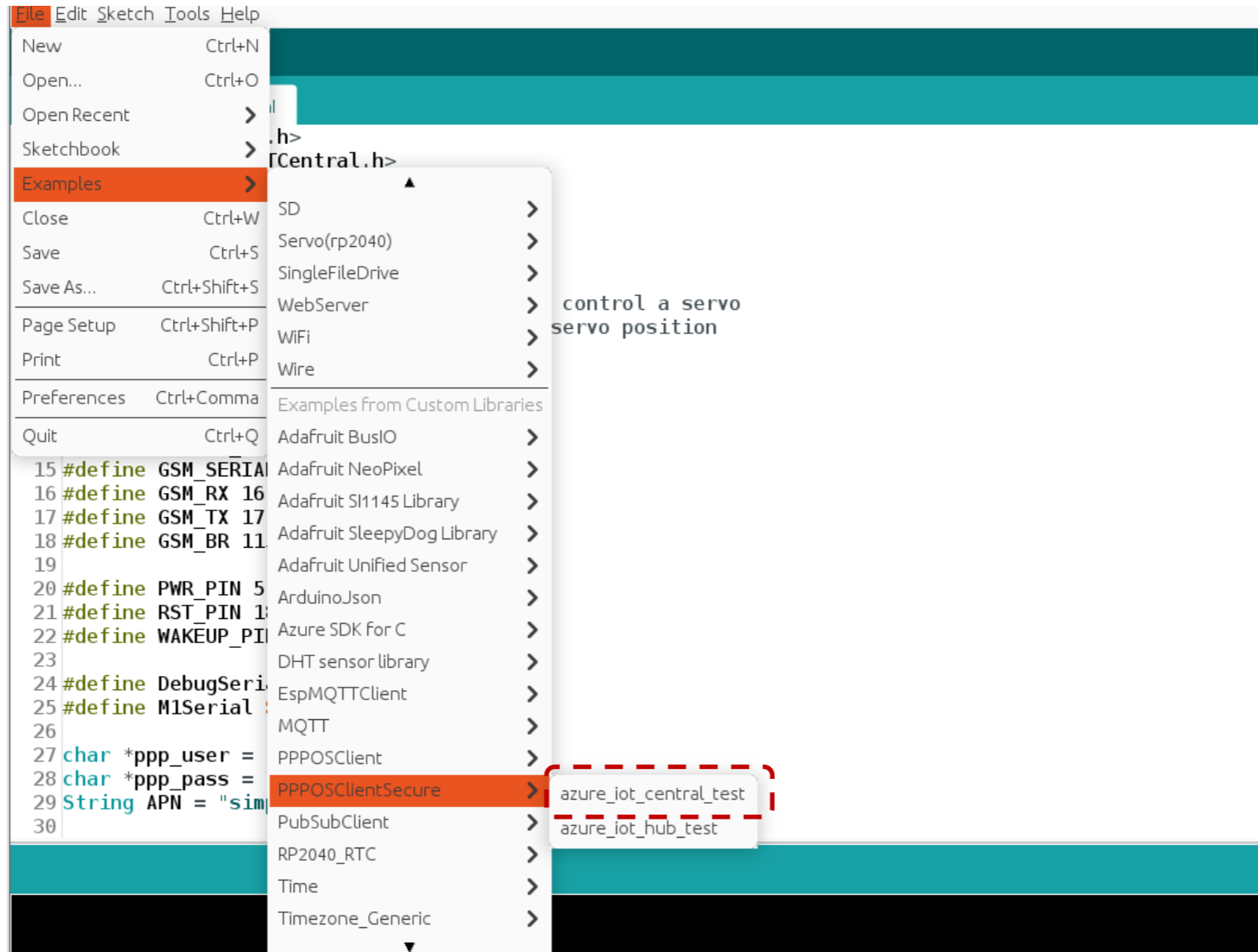


✓ Arduino ESP32Servo Library Install



5. H/W, S/W 셋업

✓ Examples --> PPPOSClientSecure --> azure_iot_central_test 선택



6. Azure IoT Central Cloud 설정

✓ 가격정책

Pricing Tier	Standard Tier 0	Standard Tier 1	Standard Tier 2
Use Case	For devices sending a few messages per day	For devices sending a few messages per hour	For devices sending a message every few minutes
Price per device per month	\$0.08 per Month	\$0.40 per Month	\$0.70 per Month
Monthly device message allocation*	400 messages	5,000 messages	30,000 messages
Included free quantities per application	2 free devices (800 included messages)	2 free devices (10,000 included messages)	2 free devices (60,000 included messages)
Overage pricing per 1K messages ¹	\$0.07 per 1K messages	\$0.015 per 1K messages	\$0.015 per 1K messages

* Total message allocation is shared across all devices in an IoT Central Application

¹ The standard message size is 4KB. For example, if the device sends a 4.5KB message it will be billed as 2 messages.

6. Azure IoT Central Cloud 설정

1) 프로젝트 설정

Resource name : 고유값
Application URL: 고유값

Microsoft Azure Search resources, services, and docs (G+/)

Home > IoT Central Application ...

Basics Tags Review + create

Create an IoT Central application with an application template. IoT Central is an IoT app platform that allows you to rapidly build enterprise-grade IoT solutions on a secure, reliable and scalable infrastructure. [Learn more](#)

Project details

Select the subscription to manage the deployed IoT Central resource and costs. Use resource groups like folders to organize and manage all your resources.

Subscription * ⓘ Azure subscription 1

Resource group * ⓘ Cellular
[Create new](#)

Instance details

Resource name * smartkey ✓

Application URL * smartkey ✓
azureiotcentral.com

Template * ⓘ Custom application

Region * Japan East

Pricing plan * ⓘ Standard 0

Review + create < Previous Next : Tags > [Give feedback](#)

6. Azure IoT Central Cloud 설정

2) 프로젝트 생성

Home >

Microsoft.IoTCentral-20221214151241 | Overview

Deployment

Search << Delete Cancel Redeploy Download Refresh

Overview Inputs Outputs Template

Deployment is in progress

Deployment name: Microsoft.IoTCentral-20221214151... Start time: 2022. 12. 14. 오후 4:24:25
Subscription: [Azure subscription 1](#) Correlation ID: 59110ffd-4651-430a-ae3e-9c0166f27ef4

Resource group: Cellular

Deployment details

Resource	Type	Status	Operation details
smartkey	Microsoft.IoTCentral/iotA...	Created	Operation details




Give feedback

[Tell us about your experience with deployment](#)

6. Azure IoT Central Cloud 설정

3) IoT Central Application URL 생성

Home > Microsoft.IoTCentral-20221214151241 | Overview >

 smartkey  
IoT Central Application

Overview

Tags

Settings

Identity

Networking

Properties

Monitoring

Metrics


Diagnostic settings

Workbooks

Automation

Tasks (preview)

Export template

 Delete

Essentials

Resource group (move) : [Cellular](#)

Location : Japan East

Subscription (move) : [Azure subscription 1](#)

Subscription ID : 473a66c6-b0b7-4427-96b6-683e1ce83494

Status : Succeeded

Tags (edit) : [Click here to add tags](#)

IoT Central Application U...

<https://smartkey.azureiotcentral.com>

JSON View

주소로 이동

6. Azure IoT Central Cloud 설정

4) Device Template 제작

smartkey

디바이스 검색

+ 새로 만들기 ← 가져오기

모든 디바이스

디바이스 템플릿
템플릿을 추가, 검색 또는 수정합니다. 디바이스 데이터를 구성하는 정사진입니다.

디바이스를 연결하여 IoT Central 시작

디바이스는 사용자가 보고 분석하고 내보낼 수 있도록 데이터를 IoT Central에 보냅니다.

5분 안에 시작 및 실행

IoT가 처음이신가요? 휴대폰을 연결하려면 모바일 앱을 사용하세요. 그런 다음 라이브 데이터를 사용하여 몇 가지 주요 IoT Central 기능을 사용해 볼 수 있도록 도와드리겠습니다.

휴대폰을 장치로 사용

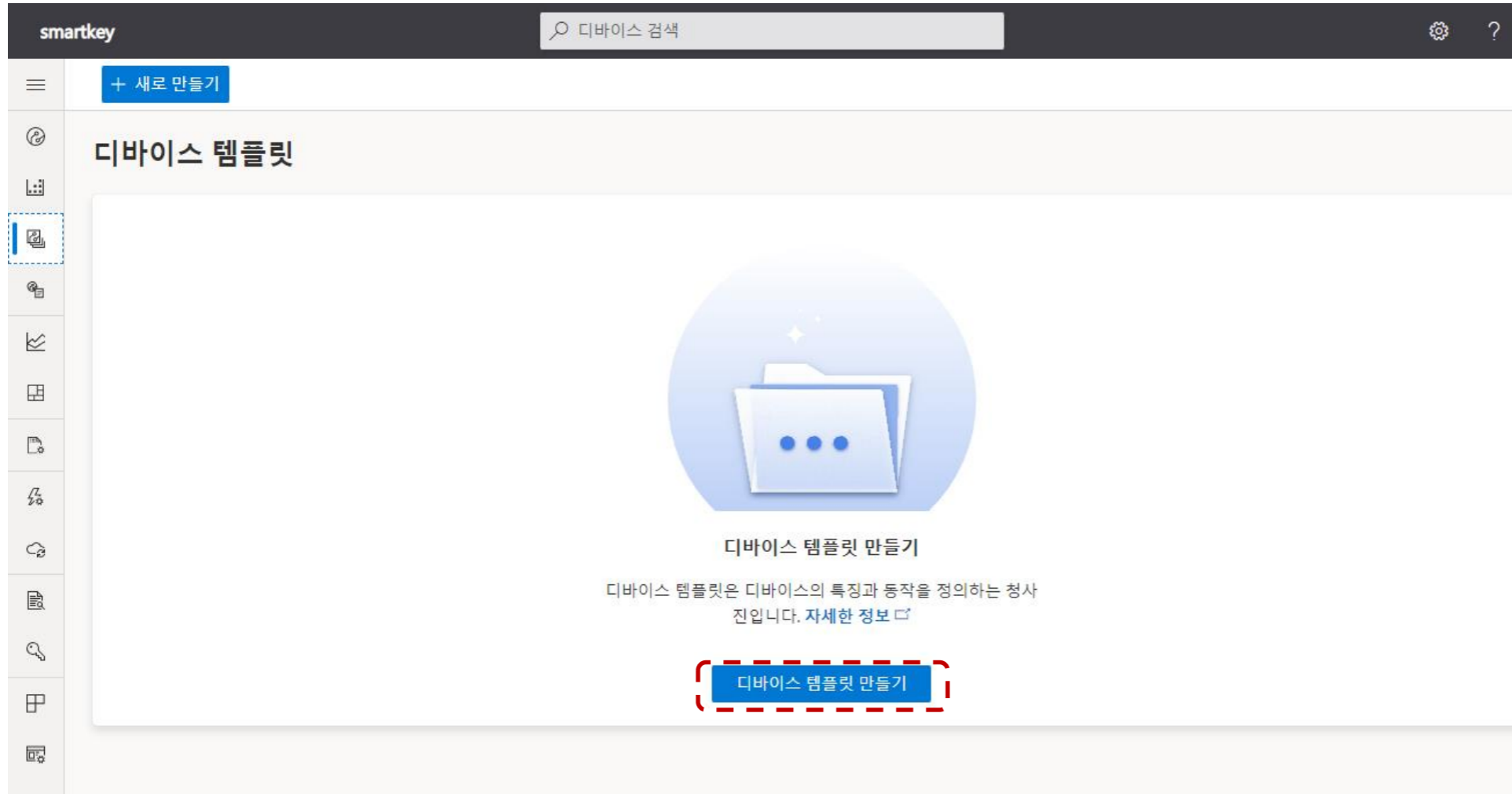
IoT 솔루션 개발 시작

카탈로그에서 Azure 지원 장치를 선택하거나 사용자 지정 장치를 연결하세요. 자동 감지와 같은 내장 도구를 사용해 장치 데이터에서 템플릿을 생성하세요.

디바이스 추가

6. Azure IoT Central Cloud 설정

4) Device Template 제작



4) Device Template 제작

디바이스 템플릿 > 새 디바이스 템플릿 만들기

유형 선택
디바이스 템플릿은 청사진과 유사합니다. 애플리케이션에 연결하는 디바이스의 특징과 동작을 정의합니다.

유형 선택

- 유형 선택
- 사용자 지정
- 검토

사용자 지정 디바이스 템플릿 만들기

IoT 디바이스
저로부터 기능 모델 또는 빌드 기능을 가져옵니다.

Azure IoT Edge
Azure IoT Edge 및 게이트웨이 시나리오를 제공하는 템플릿을 만듭니다.

주요 디바이스 템플릿

- Azure IoT Central**
Cascade-500
The Rigado Cascade-500 IoT gateway balances flexible connectivity with edge computing power in a secure and cost-effective customizable package. Packed...
- Azure IoT Central**
Cascade-500W
The Rigado Cascade-500W IoT gateway balances flexible connectivity with edge computing power in a secure and cost-effective customizable package. Packed...
- Azure IoT Central**
IoT Plug and Play mobile
The IoT Plug and Play phone app lets you quickly get started exploring Azure IoT capabilities without the need to configure a dedicated IoT device.

다음: 사용자 지정

6. Azure IoT Central Cloud 설정

4) Device Template 제작

smartkey

디바이스 검색

디바이스 템플릿 > 새 디바이스 템플릿 만들기

사용자 지정

디바이스 템플릿 이름*

smartkey

이제 게이트웨이 디바이스입니다.
자세히 알아봅니다.

이전

다음: 검토

6. Azure IoT Central Cloud 설정

4) Device Template 제작

smartkey

디바이스 검색

디바이스 템플릿 > 새 디바이스 템플릿 만들기

검토

기능 및 인터페이스를 추가할 수 있도록 빈 템플릿을 만듭니다. 처음부터 인터페이스를 가져오
업이 완료되면 템플릿을 게시하고 디바이스를 연결할 수 있습니다.

기본 정보

디바이스 템플릿 유형	IoT 디바이스
디바이스 템플릿 이름	smartkey

이전 **만들기**

smartkey.azureiotcentral.com/device-templates/new/review

6. Azure IoT Central Cloud 설정

4) Device Template 제작

The screenshot shows the Azure IoT Central interface for a device template named 'smartkey'. At the top, there is a search bar labeled '디바이스 검색' and a navigation menu with icons for '버전', '테스트 디바이스 관리', '게시', '이름 바꾸기', and '삭제'. Below the search bar, the breadcrumb '디바이스 템플릿 > smartkey' is visible. The main content area is titled '모델 만들기' (Create model) and includes the instruction '사용자 지정 모델을 처음부터 빌드하거나 기존 모델을 가져옵니다.' (Build a user-defined model from scratch or import an existing model). There are two main options presented in blue boxes: '사용자 지정 모델' (User-defined model), which is circled in red, and '모델 가져오기' (Import model). The '사용자 지정 모델' option includes the text '빈 모델로 시작하고 처음부터 디바이스를 형성합니다.' (Start with an empty model and form the device from scratch). The '모델 가져오기' option includes the text '먼저 모델 파일을 가져옵니다.' (First, import the model file).

6. Azure IoT Central Cloud 설정

4) Device Template 제작

The screenshot shows the Azure IoT Central interface for a device template named 'smartkey'. The breadcrumb navigation is '디바이스 템플릿 > smartkey > 모델 > smartkey'. The device icon is a car with an upward arrow. Below the name, it says '애플리케이션이 업데이트됨: Never' and '인터페이스가 게시됨: Never'. There are two tabs: '루트' (selected) and '초안'. A message states: '이 디바이스 모델과 관련된 기능을 추가합니다. 자세한 정보'. Below this, there are several action buttons: '저장', '+ 기능 추가' (circled in red), 'ID 편집', '내보내기', and '삭제'. At the bottom of the modal, there is a '+ 기능 추가' button.

6. Azure IoT Central Cloud 설정

4) Device Template 제작

smartkey Root Published

Add capabilities specific to this device model. [Learn more](#)

Save + Add capability Edit identity Export Delete ...

Edit DTDL

Display name	Name *	Capability type * ⓘ	Semantic type ⓘ	
KeyUnlock	KeyUnlock	Command		× ↓
KeyLock	KeyLock	Command		× ↓
KeyStatus	KeyStatus	Telemetry	None	× ^

Schema * Define Boolean

Color

True name ⓘ KeyLock

False name ⓘ KeyUnlock

Unit None

Display unit

Comment

Description

Battery	Battery	Telemetry	Electric Charge	× ^
---------	---------	-----------	-----------------	-----

Schema * Define Float

Color

Min value ⓘ

Max value ⓘ

Decimal places ⓘ

Unit None

Display unit

Comment

Description

6. Azure IoT Central Cloud 설정

4) Device Template 제작

The screenshot shows the Azure IoT Central interface for a device template named 'smartkey'. At the top, there is a search bar and a toolbar with options: Version, Manage test device, Publish, Rename, and Delete. The breadcrumb navigation indicates the path: Device templates > smartkey > Views > New. Below this, the 'smartkey' application details are shown, including 'Application updated: Never' and 'Interfaces published: Never'. A dropdown menu is open under the 'Views' icon, listing 'Model', 'smartkey', 'Raw data', and 'Views'. The 'Views' option is circled in red. Below the dropdown, three view templates are displayed:

- Editing device and cloud data**: Use this view to create a form to edit and view properties defined in your capability model and solution model.
- Visualizing the device**: Use this view to create a rich dashboard of the capability model using an array of charts, gauges and metrics tiles.
- Generate default views** (circled in red with a '2.' next to it): Generate default device views to quickly begin displaying device information within an intuitive dashboard experience.

6. Azure IoT Central Cloud 설정

4) Device Template 제작

The screenshot shows the Azure IoT Central interface for a device template named 'smartkey'. The breadcrumb navigation is 'Device templates > smartkey > Views > Generate'. The 'smartkey' application is shown with 'Application updated: Never' and 'Interfaces published: Never'. A modal dialog is open with the title 'Select the applicable views to be generated.' and the following options:

- Commands - provides a view with device commands allowing dispatching them to the device. On
- Overview - provides a view with device telemetry, displaying charts and metrics. On
- About - provides a view with device information, displaying its properties. On

A blue button labeled 'Generate default dashboard view(s)' is highlighted with a red circle at the bottom of the modal.

6. Azure IoT Central Cloud 설정

4) Device Template 제작

The screenshot displays the 'Edit view' interface in Azure IoT Central. On the left, there is a sidebar with 'View settings' (View name: Overview) and 'Add a tile' options (Key Performance Indicator (KPI), Last known value (LKV), Line chart, Bar chart, Pie chart, Heat map). The main canvas shows two tiles: 'Last known value (LKV)' and 'Line chart'. A 'Configure last known va...' dialog box is open on the right, with a red dashed border. The dialog shows the title 'Last known value (LKV)' and a 'KeyStatus' dropdown menu. Below the dialog, there are settings for 'Capability', 'Tile Format', 'Text size' (20 pt), 'Decimals', 'Abbreviate values' (Off), 'Wrap text' (Off), and 'Show telemetry increase/decrease' (Off). At the bottom of the dialog are 'Update' and 'Cancel' buttons.

6. Azure IoT Central Cloud 설정

4) Device Template 제작

The screenshot displays the Azure IoT Central 'Edit view' interface. On the left, the 'Edit view' sidebar includes a 'View settings' section with a 'View name' field set to 'Overview'. Below this is the 'Add a tile' section, which offers two options: 'Start with a visual' (selected) and 'Start with devices'. A list of visual types is provided, including Key Performance Indicator (KPI), Last known value (LKV), Line chart, Bar chart, Pie chart, and Heat map. The main canvas contains two tiles: 'Last known value (LKV)' and 'Line chart'. A 'Configure line chart' dialog box is open on the right, enclosed in a red dashed border. This dialog allows for configuring the line chart's title (set to 'Line chart'), legend visibility (On), X-axis visibility (On), and Y-axis visibility (On). It also includes settings for the display range (Past 1 day) and interval (1 hour). A 'Telemetry' section is expanded, showing a 'Battery' tile with an 'Average' aggregation type and an option to 'Assign custom color'. At the bottom of the dialog are 'Update' and 'Cancel' buttons.

6. Azure IoT Central Cloud 설정

4) Device Template 제작

The screenshot shows the Azure IoT Central interface for a device template named 'smartkey'. The 'Publish' button is highlighted with a red circle. The interface includes a search bar, a navigation menu on the left, and a main content area with a table of capabilities.

IoT Hub and DPS are updating their TLS certificates with a new Microsoft Certificate Authority (CA) chained under a new CA root - DigiCert Global G2 Root. You will need to take action to e...

Version Manage test device **Publish** Rename Delete

Device templates > smartkey > Model > smartkey

smartkey
Application updated: Never Interfaces published: Never

smartkey **Root** Draft
Add capabilities specific to this device model. [Learn more](#)

Save Add capability Edit identity Export Delete ... Edit DTDL

Display name	Name *	Capability type * ⓘ	Semantic type ⓘ
KeyUnlock	KeyUnlock	Command	
KeyLock	KeyLock	Command	
KeyStatus	KeyStatus	Telemetry	Current

+ Add capability

6. Azure IoT Central Cloud 설정

5) Device Template 적용

smartkey Search for devices

IoT Hub and DPS are updating their TLS certificates with a new Microsoft Certificate Authority (CA) chained under a new CA root - DigiCert Global G2 Root. You will need to take action to e...

Connect

- Devices
- Device groups
- Device templates
- Edge manifests

Analyze

- Data explorer
- Dashboards

Manage

- Jobs

Extend

- Rules
- Data export

Security

- Audit logs
- Permissions

Settings

- Application

+ New Import

All devices

To get started with IoT Central, connect a device
Devices will send data to IoT Central for you to view, analyze and export.

Get up and running in 5 minutes
New to IoT? Grab our mobile app to connect your phone. Then we'll help you try out a few key IoT Central features using live data.
Use phone as a device

Start IoT solution development
Choose an Azure-ready device from our catalog, or connect a custom device. Try built-in tools like auto-detect to generate a template from device data.
Add a device

6. Azure IoT Central Cloud 설정

5) Device Template 적용

IoT Hub and DPS are updating their TLS certificates with a new Microsoft Certificate Authority (CA) chained under a new CA root - DigiCert Global G2 Root. You will need to take the following steps to update your devices.

+ New ← Import

Create a new device

To create a new device, select a device template, a name, and a unique ID. [Learn more](#)

Device name * ⓘ
smartkey

Device ID * ⓘ
smartkey

Organization * ⓘ
smartkey

Device template *
smartkey

Simulate this device?
A simulated device generates telemetry that enables you to test the behavior of your application before you connect a real device.
 No

Azure IoT Edge device?
Azure IoT Edge moves cloud analytics and custom business logic from the cloud to your devices.
 No

Create Cancel

6. Azure IoT Central Cloud 설정

6) Commands 확인

The screenshot displays the Azure IoT Central interface for a device named 'smartkey'. The left sidebar contains navigation options: Connect (Devices, Device groups, Device templates, Edge manifests), Analyze (Data explorer, Dashboards), Manage (Jobs), Extend (Rules, Data export), Security (Audit logs, Permissions), and Settings (Application). The main content area shows the device's status (Registered) and organization (smartkey). Below this, there are two command execution panels. The first panel is titled 'smartkey / KeyUnlock' and features a text input field containing 'NONE' and a blue 'Run' button. The second panel is titled 'smartkey / KeyLock' and also features a text input field containing 'NONE' and a blue 'Run' button. Both 'Run' buttons and their respective input fields are highlighted with a red dashed border. A yellow notification banner at the top indicates that IoT Hub and DPS are updating their TLS certificates with a new Microsoft Certificate Authority (CA) root.

6. Azure IoT Central Cloud 설정

7) Device 등록정보 확인

smartkey

IoT Hub and DPS are updating their TLS certificates with a new Microsoft Certificate Authority (CA) chained under a new CA root - DigiCert Global G2 Root. You will need to take action to ensure your devices can continue to connect. See [here](#) for details.

Connect Manage template Manage device

Devices > smartkey > CarGateWay

CarGateWay
| Last data received: N/A | Status: Registered | Organization: smartkey

About Overview Commands Raw data Mapped aliases Files

Device connection groups

ID scope ①
0n-

Device ID ①
CarGateWay

Choose the connection type for this device. You can change this later if you need to.

Authentication type
Shared access signature (SAS)

Key QR code

Shared Access Signatures (SAS) use security tokens and keys to connect to IoT Central. Use the SAS keys from the default enrollment group shown below to register your device. [Learn more](#)

Primary key ①
+ [masked]

Secondary key ①
[masked]

Close

ID scope
Device ID
Primary key

펌웨어
소스코드에 입력

7. 펌웨어 연결 코드 입력, 모니터링 및 제어명령 추가

1) Azure IoT Central 접속 정보 입력

```
iot.configs("", // ID scope  
"", // Device ID  
"" // Primary key  
);
```

ID scope
Device ID
Primary key

펌웨어 소스코드에 입력

```
185 iot.configs(  
186     "One[REDACTED]35C", // ID scope  
187     "CarGateWay", // Device ID  
188     "+19aaD[REDACTED]6VkU2F0NpiA=" //Primary key  
189 );  
190
```

2) 서보모터 각도 제어

```
68 void servoInit() {
69   myservo.attach(servoPin, 1000, 2000); // attaches the servo on pin 27 to the servo object
70   // using default min/max of 1000us and 2000us
71   // different servos may require different min/max settings
72   // for an accurate 0 to 180 sweep
73   for (pos = 0; pos <= 70; pos += 1) { // goes from 0 degrees to 70 degrees
74     // in steps of 1 degree
75     myservo.write(pos); // tell servo to go to position in variable 'pos'
76     delay(5); // waits 5ms for the servo to reach the position
77   }
78   myservo.detach();
79 }
80
81 void servoUp() {
82   myservo.attach(servoPin, 1000, 2000); // attaches the servo on pin 27 to the servo object
83   // using default min/max of 1000us and 2000us
84   // different servos may require different min/max settings
85   // for an accurate 0 to 180 sweep
86   for (pos = 70; pos <= 120; pos += 1) { // goes from 70 degrees to 120 degrees
87     // in steps of 1 degree
88     myservo.write(pos); // tell servo to go to position in variable 'pos'
89     delay(5); // waits 5ms for the servo to reach the position
90   }
91   for (pos = 120; pos >= 40; pos -= 1) { // goes from 120 degrees to 40 degrees
92     myservo.write(pos); // tell servo to go to position in variable 'pos'
93     delay(5); // waits 5ms for the servo to reach the position
94   }
95   myservo.detach();
96 }
97
98 void servoDown() {
99   myservo.attach(servoPin, 1000, 2000); // attaches the servo on pin 27 to the servo object
100   for (pos = 0; pos <= 70; pos += 1) { // goes from 0 degrees to 70 degrees
101     // in steps of 1 degree
102     myservo.write(pos); // tell servo to go to position in variable 'pos'
103     delay(5); // waits 5ms for the servo to reach the position
104   }
105   myservo.detach();
106 }
```

사용할 스마트키에 맞춰서
기구설계와 테스트를 진행하며
어느정도 각도로 좌우로 움직일지
설정



3) Azure IoT Central로 보낼 데이터 설정

```
void setTelemetryValue(String name, int value) ;  
void setTelemetryValue(String name, float value) ;  
void setTelemetryValue(String name, double value) ;  
void setTelemetryValue(String name, bool value) ;  
void setTelemetryValue(String name, const String& value) ;  
void setTelemetryValue(String name, JsonVariant value) ;  
  
bool sendMessage() ; // 셋팅한 데이터를 클라우드로 전송
```



- ✓ 동일한 함수명으로 오버로딩 되어 있습니다. String으로 name을 쓰고 거기에 맞는 데이터 타입의 변수를 넣으면 됩니다.
- ✓ name과 type은 AzureIoTCentral에 사용하는 템플릿의 name과 type과 맞아야 정상적으로 데이터가 업로드됩니다.

```
float battery_voltage = readBattery();  
iot.setTelemetryValue("Battery", battery_voltage);
```

```
iot.setTelemetryValue("KeyStatus", true);  
iot.setTelemetryValue("KeyStatus", false);
```

```
iot.sendMessage();
```

4) Azure IoT Central 제어명령 처리 설정

```
191 iot.addCommandHandle("KeyUnlock", [](String payload) { // Add handle 'KeyUnlock' command
192     int valueInt = payload.toInt(); // Convert payload in String to Number (int)
193     servoDown();
194     delay(1000);
195     Serial.println("KeyUnlock");
206 iot.addCommandHandle("KeyLock", [](String payload) { // Add handle 'KeyLock' command
207     int valueInt = payload.toInt(); // Convert payload in String to Number (int)
208     servoUp();
209     delay(1000);
210     Serial.println("KeyLock");
```

- ✓ Azure 클라우드에서 해당 명령을 받았을때 처리하는 부분입니다. 다양한 명령을 추가하려면 위 형식으로 처리
- ✓ `payload.toInt()` 이 부분은 명령에 따라오는 `payload`가 있을때 각각의 데이터타입에 맞춰서 변환해 주는 부분 (`KeyLock`, `KeyUnlock`에서 `payload`를 사용하지 않지만 명령+설정값 형태로 제어할 경우 사용)

8. 테스트 결과

1) 데이터 실제 사용량 (with Vodafone)

901288007616609 Active.Live 89882390000485923216 Codezoo_30MB_UptoT1 

2022-12-24 2:57 ~ 2022-12-25 1:16 22 hour(s), 19 minute(s)

Uploaded 854.25 KB - 0 B test, 854.25 KB live / Downloaded 758.32 KB - 0 B test, 758.32 KB live

22시간 기준 데이터 사용량 약 1.58MB

(Connected & Battery Voltage report every hour & Door Test a little)

2023-01-07 12:33 2023-01-08 8:47 20 hour(s), 14 minute(s)

Uploaded 794.78 KB - 0 B test, 794.78 KB live Downloaded 761.5 KB - 0 B test, 761.5 KB live

20시간 기준 데이터 사용량 약 1.56MB

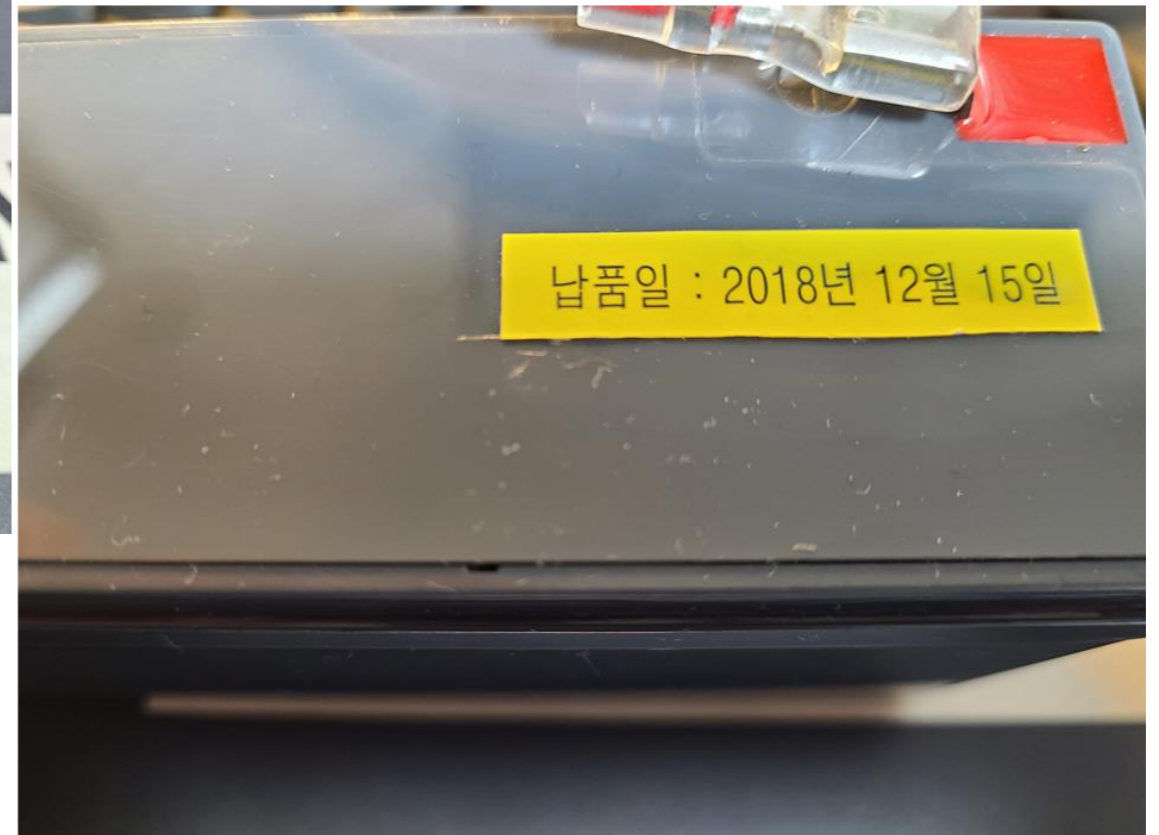
(Connected & Battery Voltage report every hour & Door Test a little)

8. 테스트 결과

2) 배터리 사용량 (12V, 4000mAh, *배터리에 따라 측정값이 달라질 수 있음*)

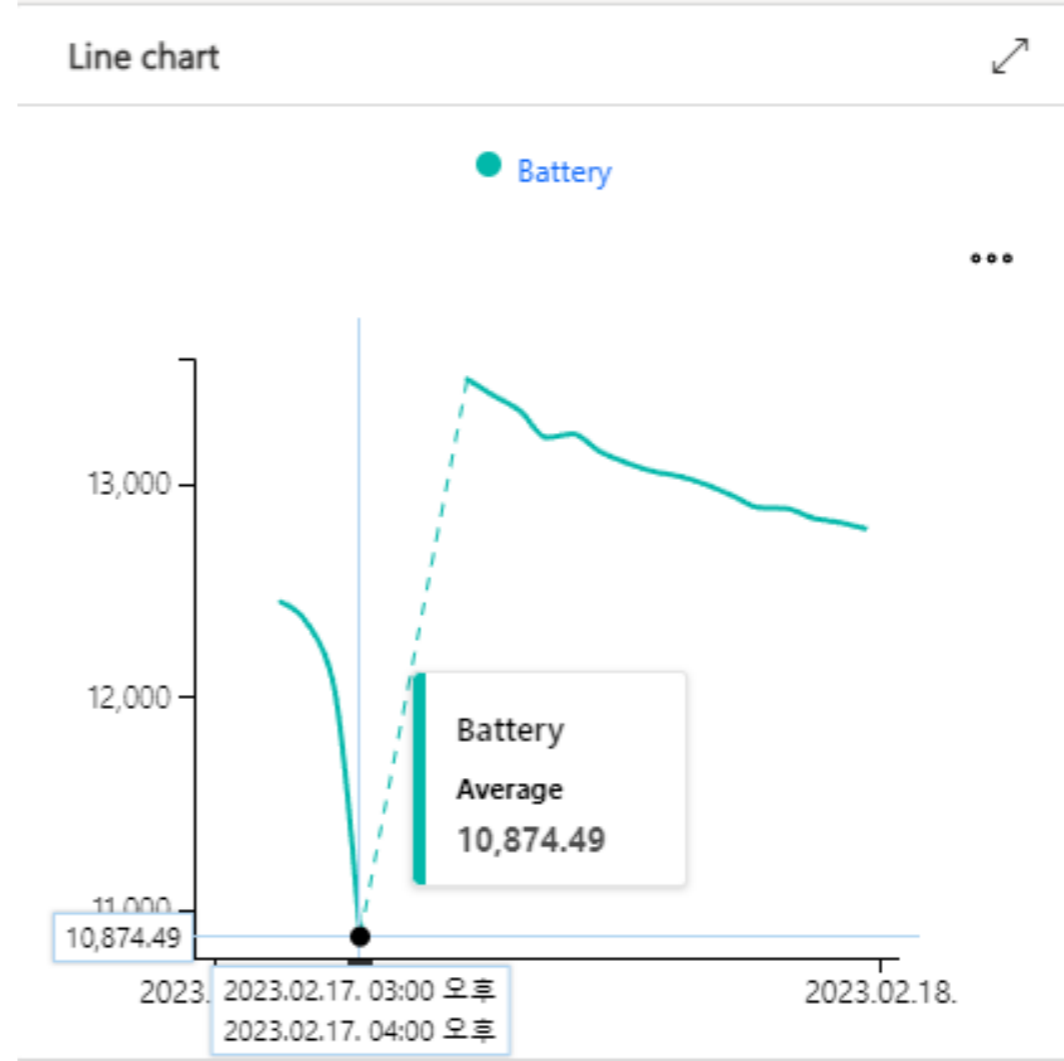
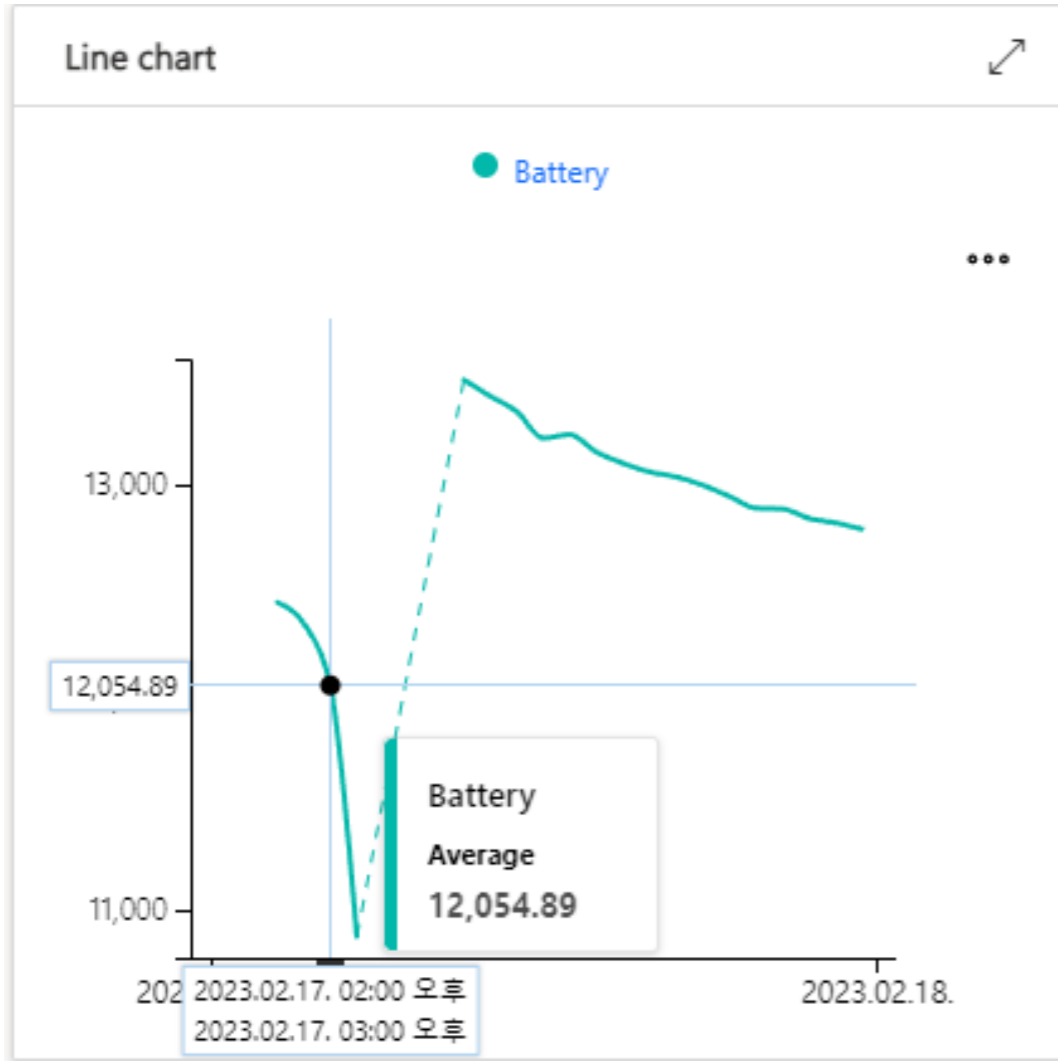


ESP32 동작클럭 : 80Mhz
LCD : OFF
Servo Motor : Ready
Battery Voltage Sensing : Ready



8. 테스트 결과

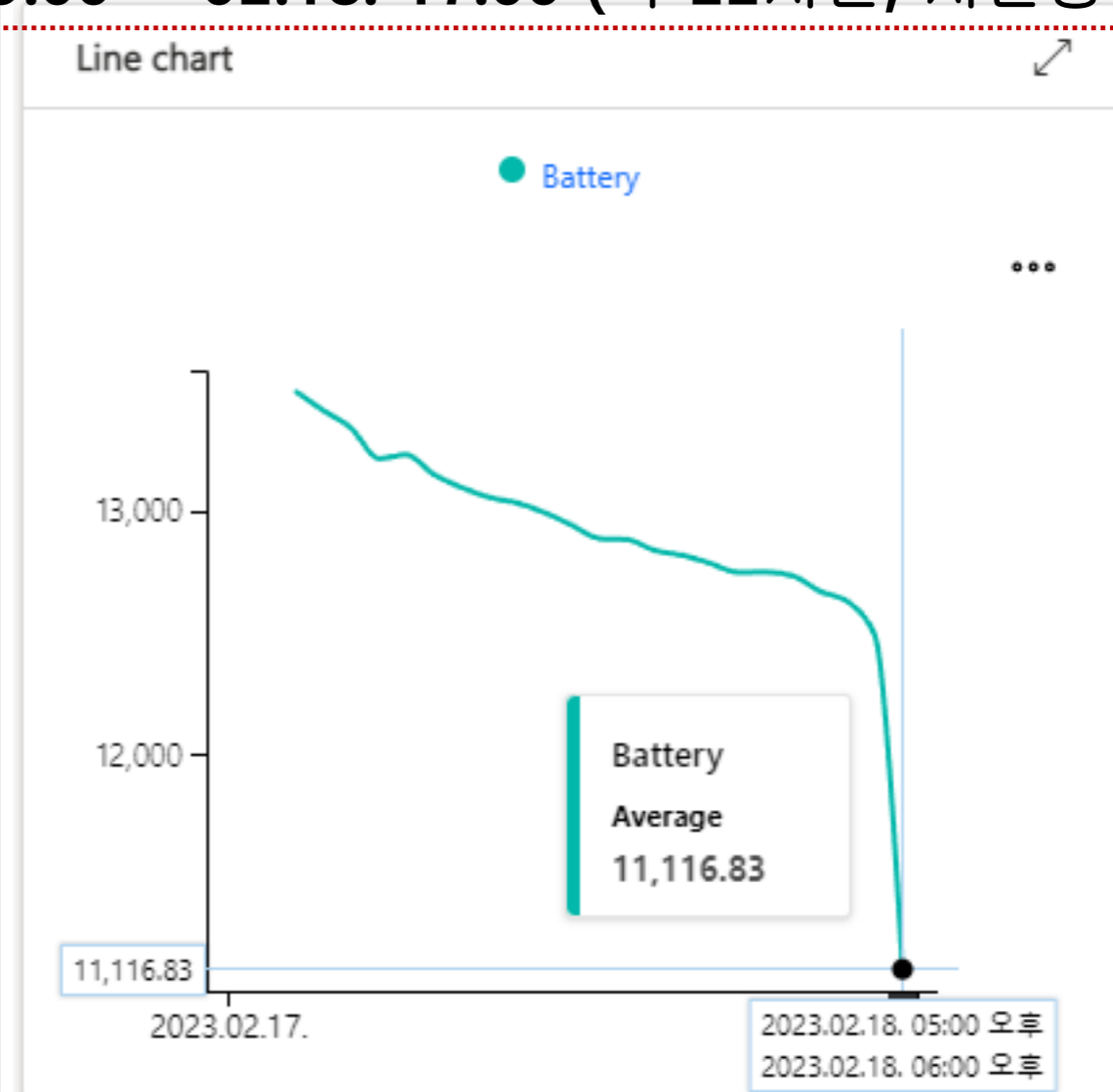
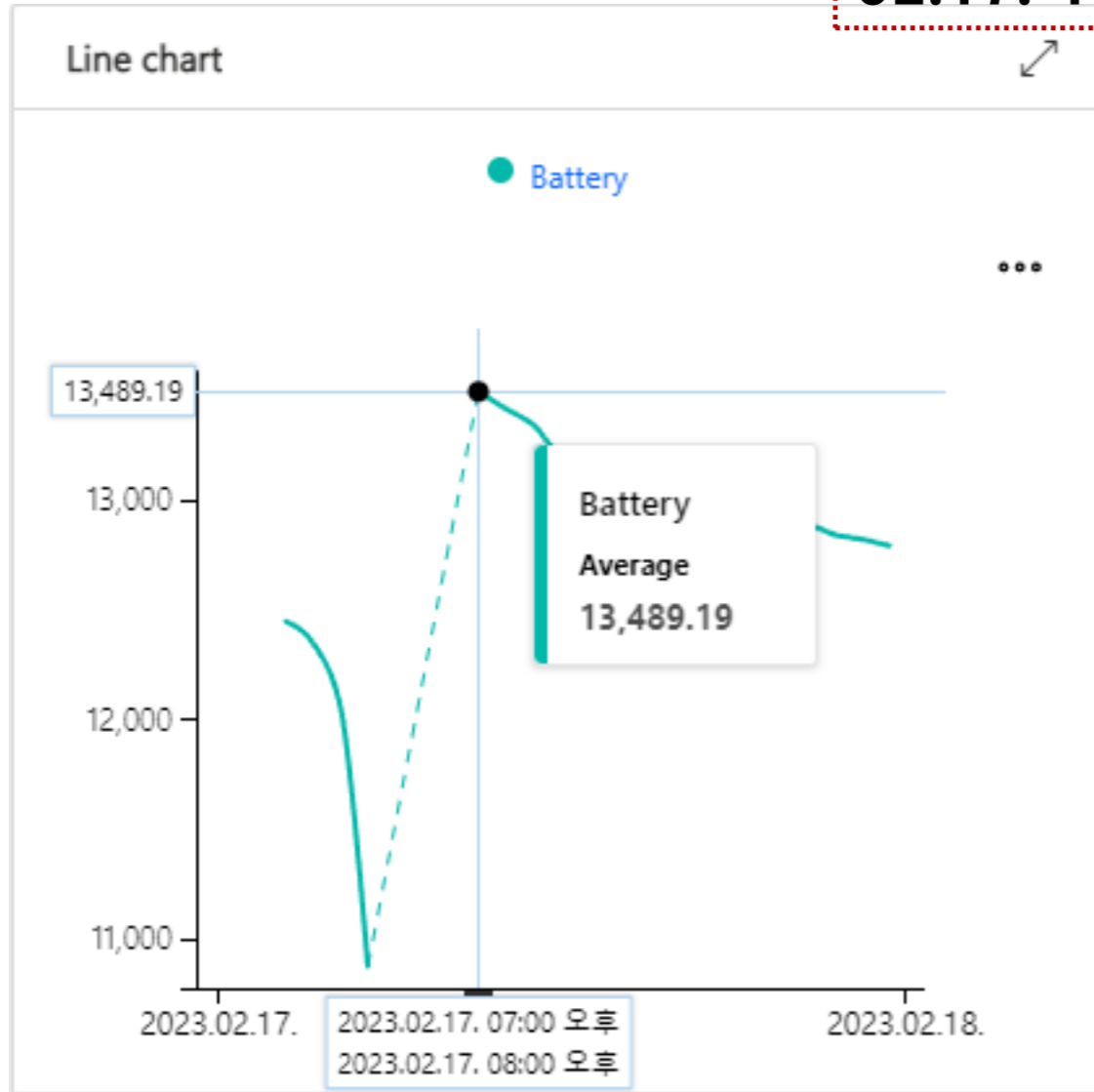
2) 배터리 사용량 (12V, 4000mAh)



8. 테스트 결과

2) 배터리 사용량 (12V, 4000mAh)

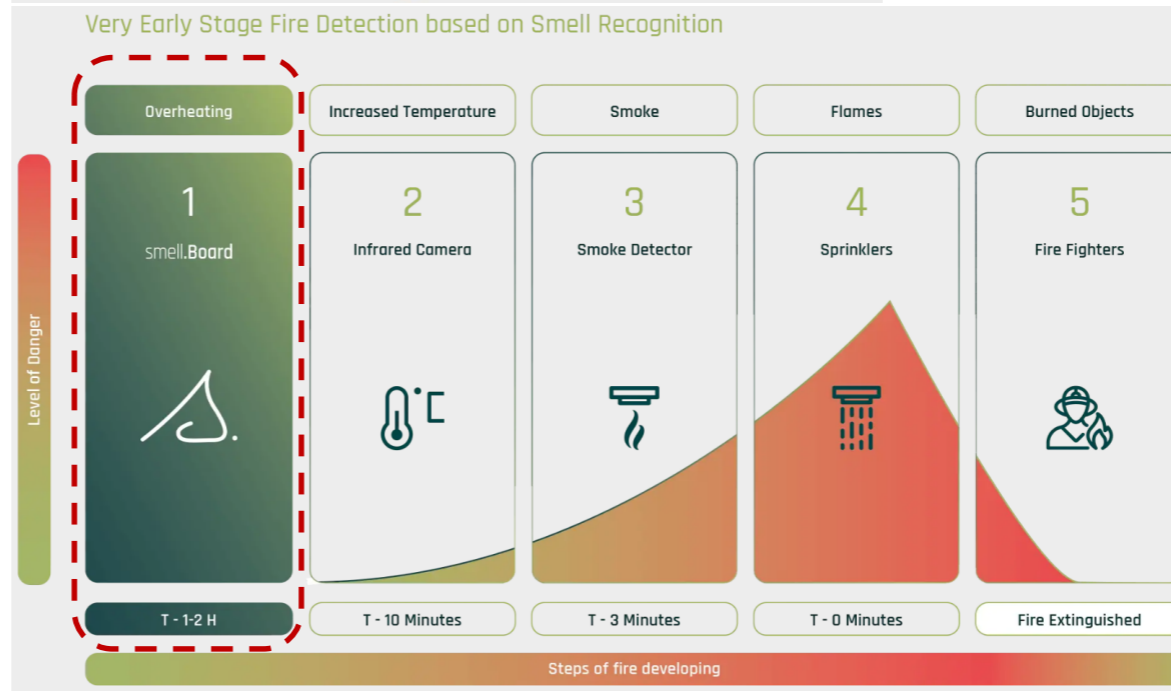
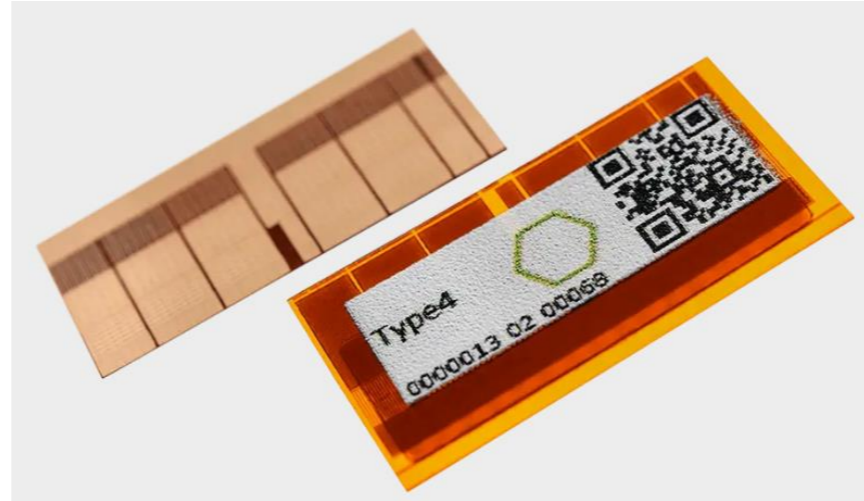
02.17. 19:00 ~ 02.18. 17:00 (약 22시간, 시간당 180mAh)



9. More Connected Car

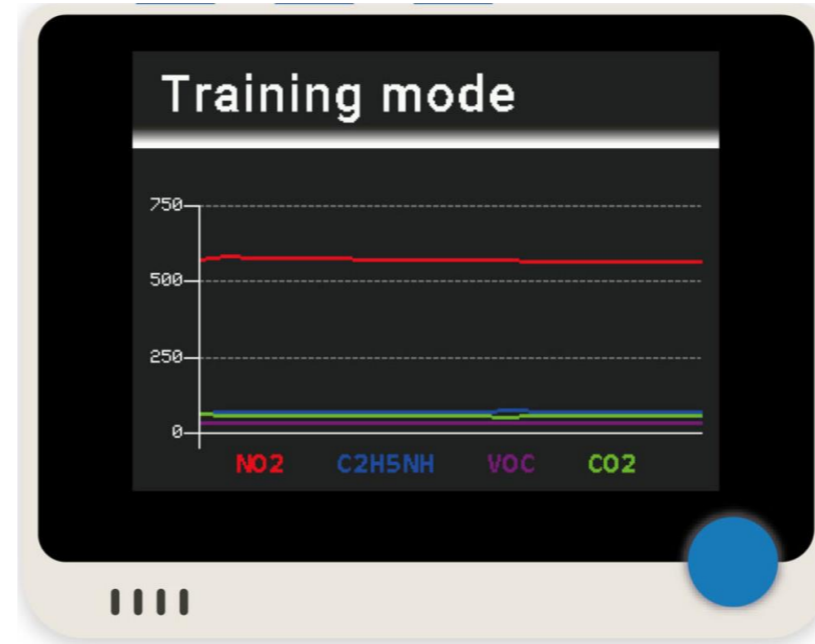
1) 차량 내 특정한 냄새 인식 (신소재 센서)

출처 : <https://smart-nanotubes.com/>



9. More Connected Car

2) 차량 내 특정한 냄새 인식 (딥러닝을 활용한 화학센서)



Last training performance (validation set)

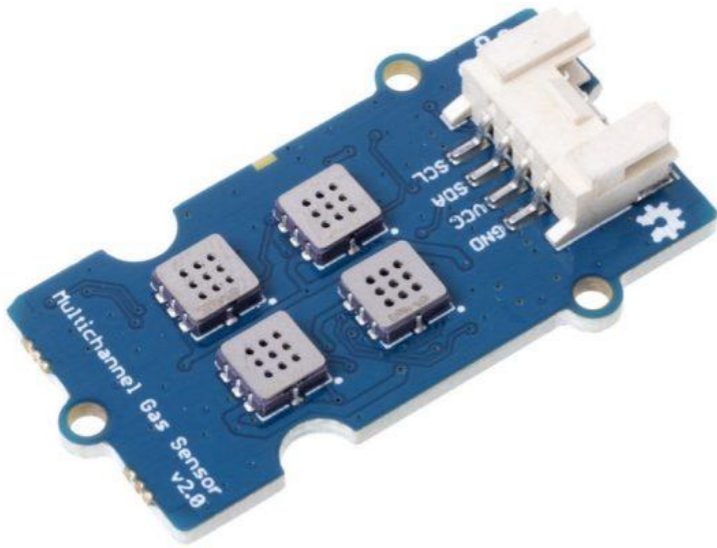
ACCURACY
97.1%

LOSS
0.06

Confusion matrix (validation set)

	AMBIENT	COFFEE
AMBIENT	98.3%	1.7%
COFFEE	5.7%	94.3%
F1 SCORE	0.98	0.95

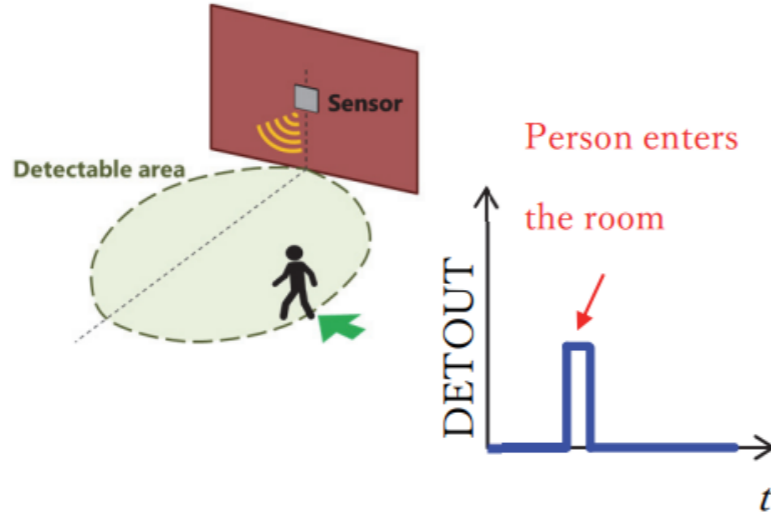
출처 : <https://makezine.com/projects/second-sense-build-an-ai-smart-nose/>



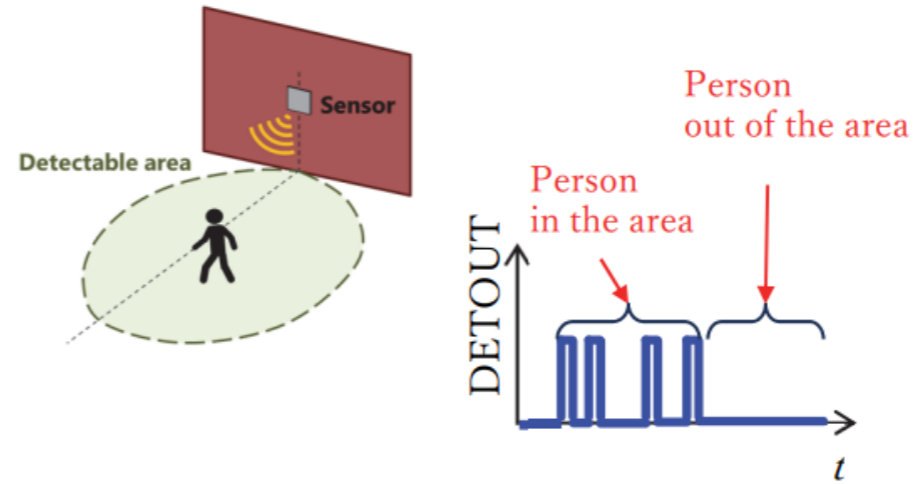
9. More Connected Car

3) 차량 주위 탐지 (Radar 24/60GHz)

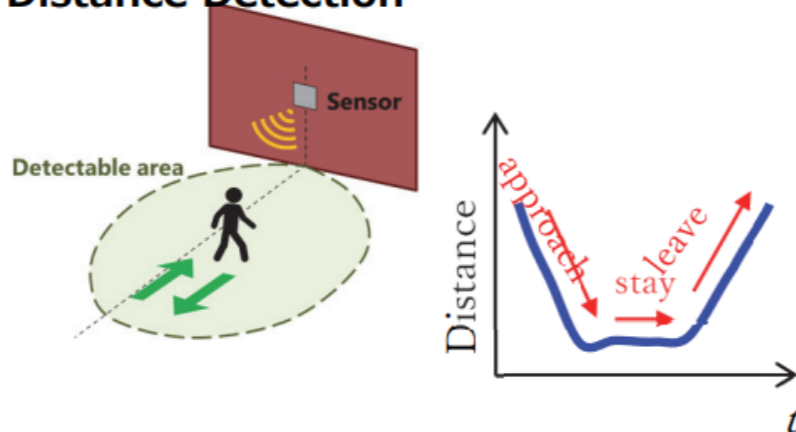
1-1. Entry Motion Detection



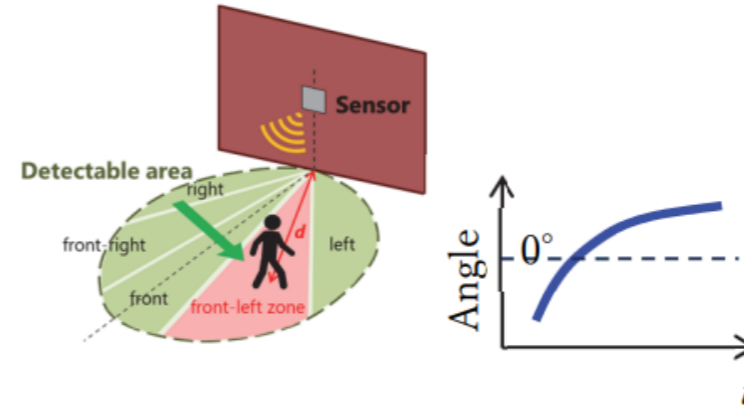
1-2. Presence Detection



2. Distance Detection

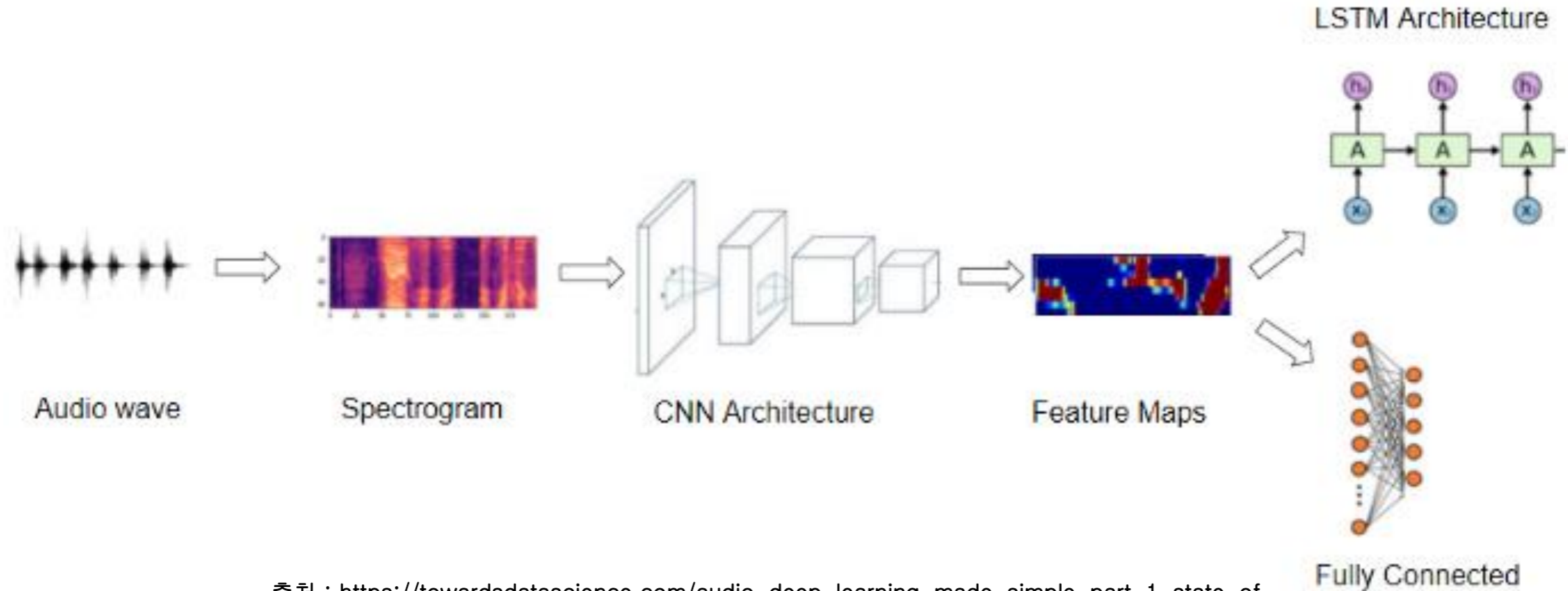


3. Angle Detection (SC1233AR3 Only)



9. More Connected Car

4) 차량 내 특정소음 또는 진동 인식 (Edge AI)



출처 : <https://towardsdatascience.com/audio-deep-learning-made-simple-part-1-state-of-the-art-techniques-da1d3dff2504>

5) More Idea

anything you want

감사합니다

e4ds_{news}

muRata

INNOVATOR IN ELECTRONICS



vodafone

ASI A-SUNG
International CO.,LTD.

CodeZoo