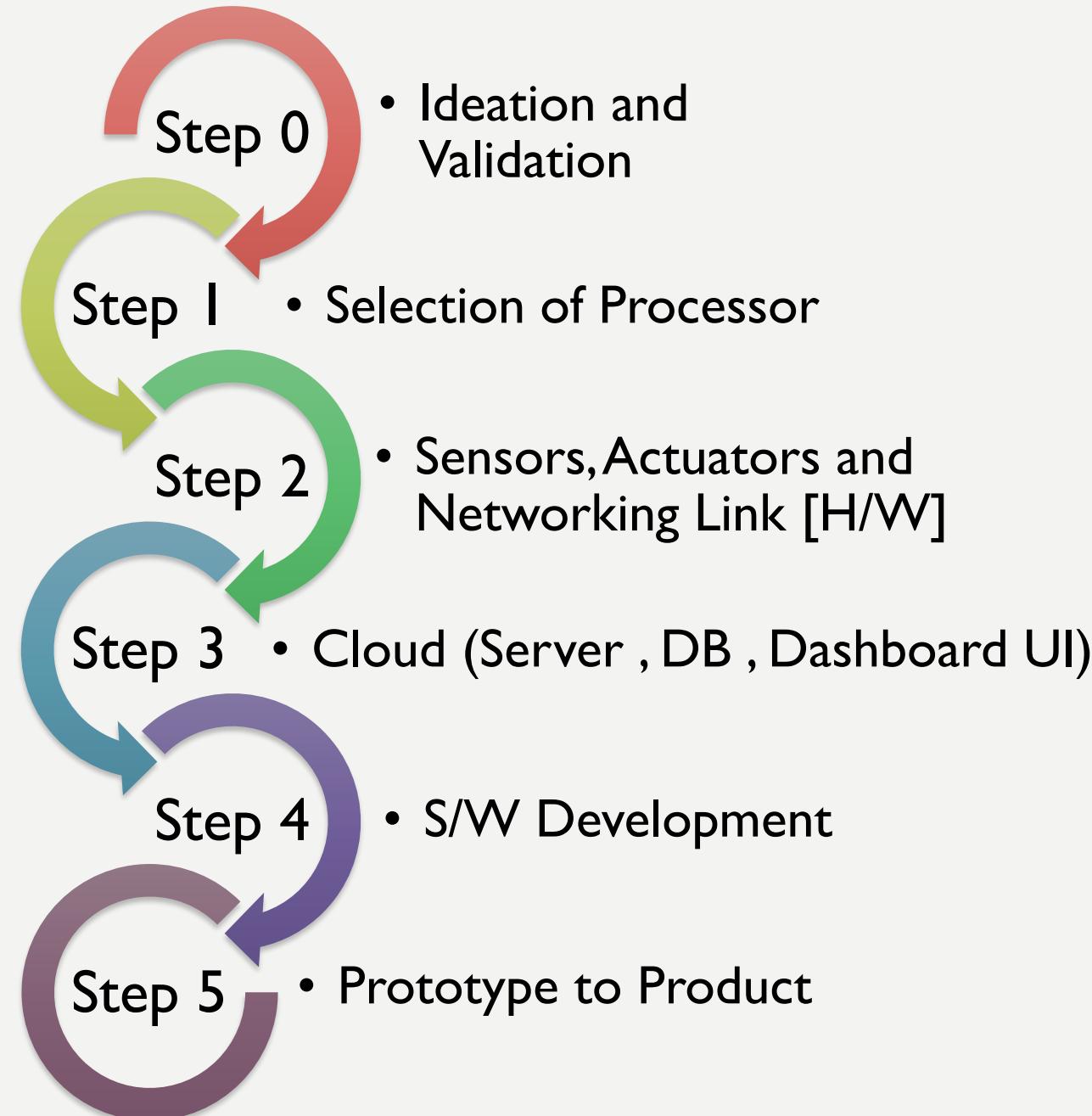


IOT PROTOTYPE TO PRODUCT

SMART GARBAGE BIN



IPP MODEL



Step 0

Ideation and Validation

- Problem
- Idea
- Validation

REASONS WHY WE NEED SMART BINS

- A reduction in the number of waste collections needed by up to 80%, resulting in less manpower, emissions, fuel use and traffic congestion
- A reduction in the number of waste bins needed
- Analytics data to manage collection routes and the placement of bins more effectively
- Improved environment (i.e. no overflowing bins and less unpleasant odours)

IDEA : INDEPENDENT MODULE

What it does :

Level and temperature monitoring in real time : A device to be fit into the dustbin which sends the level of bin filled and temperature inside the bin to the Municipal board. The municipal board will be provided with a dashboard that shows the level and temperature of the bins situated across the city. Periodic monitoring (Level and Temperature) and location of the bin is collected on the cloud.

VALIDATION

- According to a report published in Nature journal, the problem of garbage or solid waste is assuming terrible proportions today.
- At present, people of India produce about 62 million tonnes of solid-waste annually. According to the report, urban India generates 109,589 tonnes of waste per day.
- Smart Bins help to create a cleaner, safer, more hygienic environment and enhanced operational efficiency while reducing management costs, resources, and road-side emissions.
- These technologies can provide visibility on solid waste management, route planning for garbage collection, resource optimization, efficient asset management, efficient maintenance, visibility of waste bins etc.
- Automated waste collection system provides long term solution and can take care the conventional methods like door-to-door, community bins collections and transportation via sloping channel system.
- The Smart Bin is ideal for busy locations such as campuses, theme parks, airports, railway stations, and shopping malls.

Step I

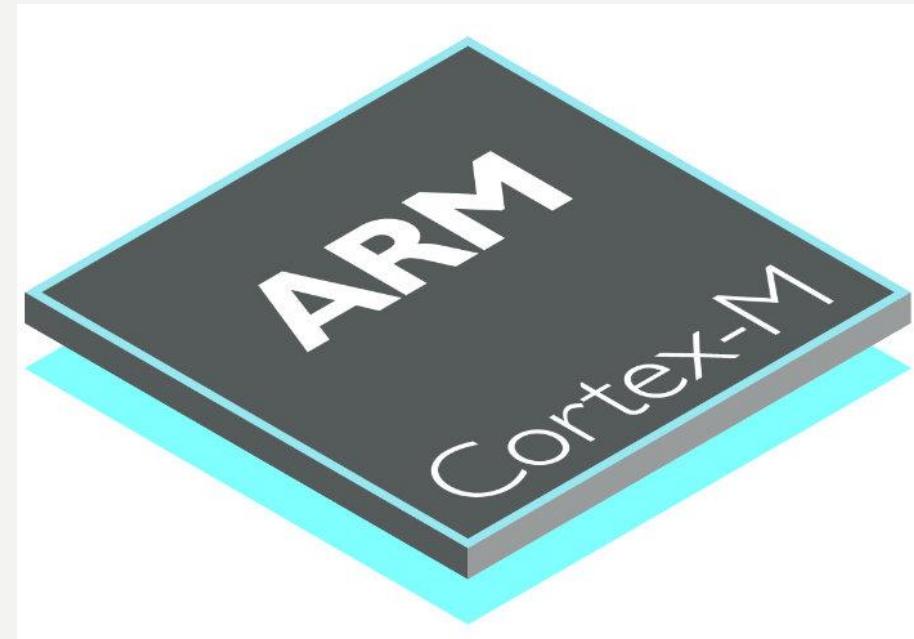
Selection of Processor

- Processor
- Development Board

Processor

ARM Cortex M0+/M3/M4

- ARMv7-M architecture
- 3-stage pipeline with branch speculation.
- Instruction sets:
 - Thumb-1 (entire).
 - Thumb-2 (entire).
 - 32-bit hardware integer multiply with 32-bit or 64-bit result, signed or unsigned, add or subtract after the multiply. 32-bit multiply is 1 cycle, but 64-bit multiply and MAC instructions require extra cycles.
 - 32-bit hardware integer divide (2–12 cycles).
 - saturation arithmetic support.
- 1 to 240 interrupts, plus NMI.
- 12 cycle interrupt latency.
- Integrated sleep modes.



Processor

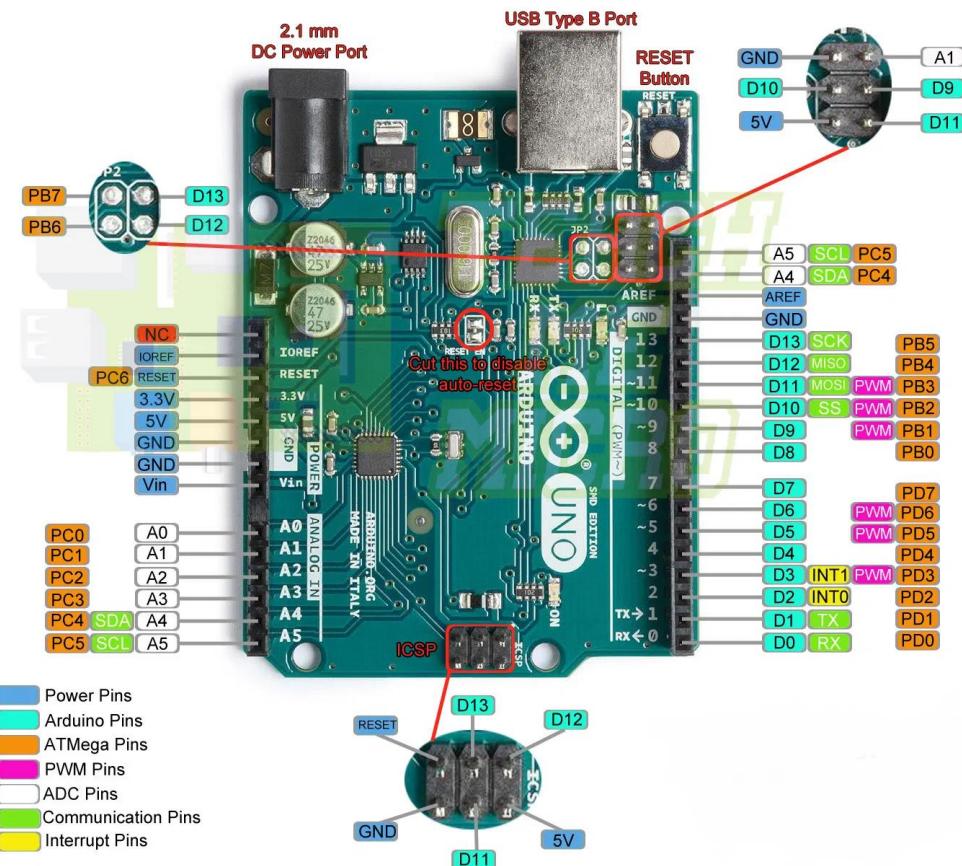
ARM7TDMI

- 32/16-bit RISC architecture (ARM v4T)
- 32-bit ARM instruction set for maximum performance and flexibility
- 16-bit Thumb instruction set for increased code density
- Unified bus interface, 32-bit data bus carries both instructions and data
- Three-stage pipeline
- 32-bit ALU
- Very small die size and low power consumption
- Fully static operation
- Coprocessor interface
- JTAG interface unit



Development Board

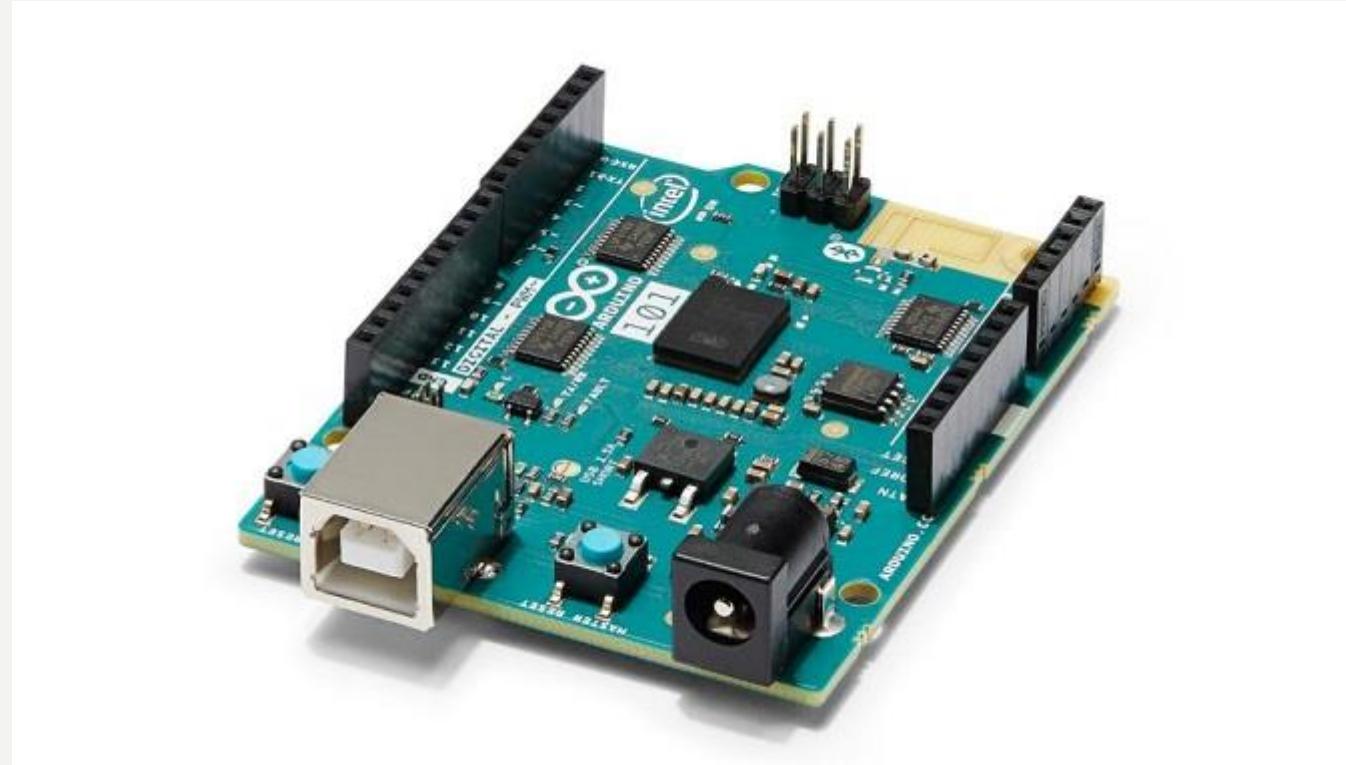
ARDUINO UNO



Arduino UNO

- AVR Atmega328, 2KB SRAM , 32 KB Flash (0.5 KB used by bootloader) , 1KB EEPROM , Most widely used , starting point for anyone interested in Electronics.
- Available in India for Rs.500-1500

Development Board

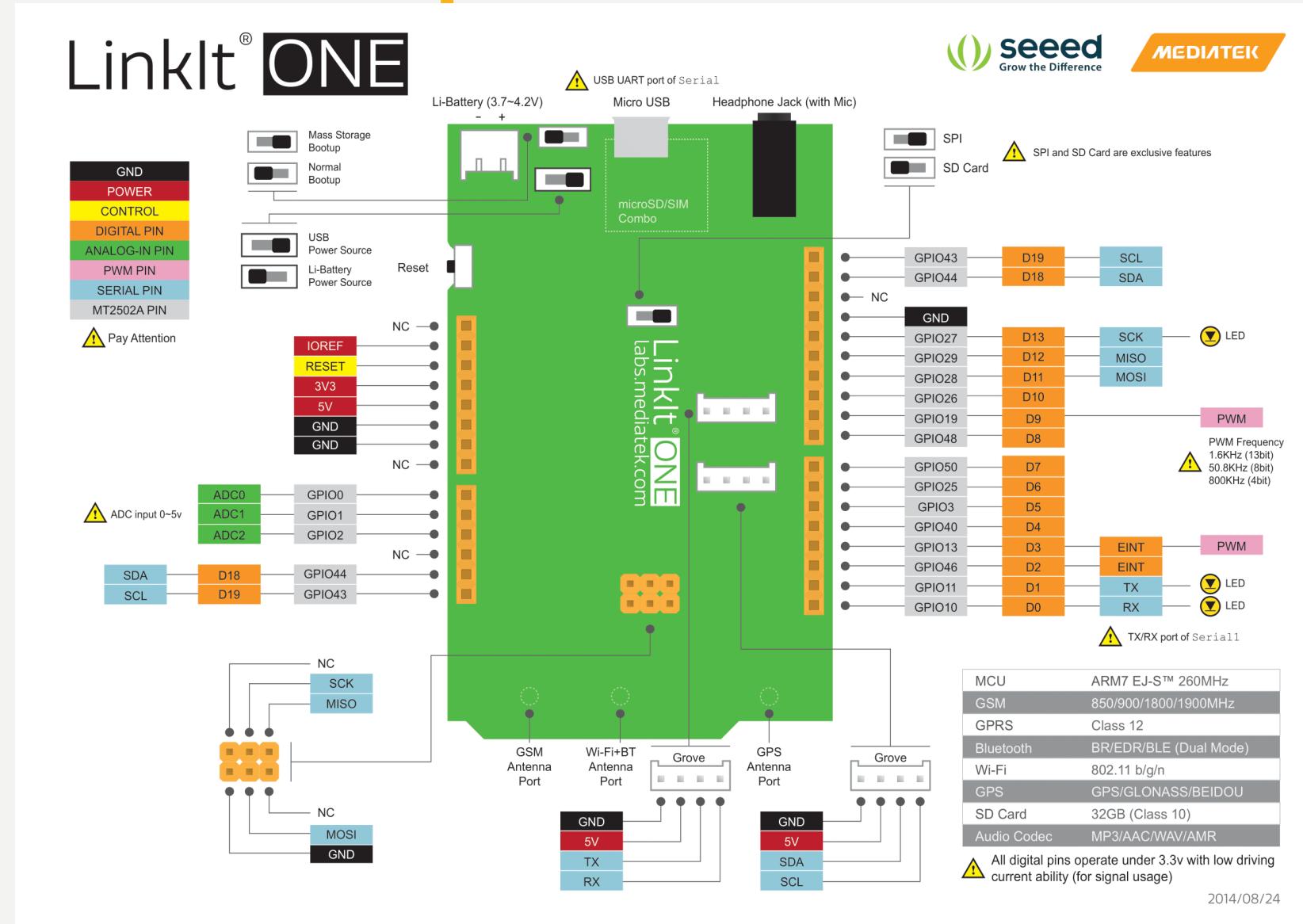


Intel Genuino 101

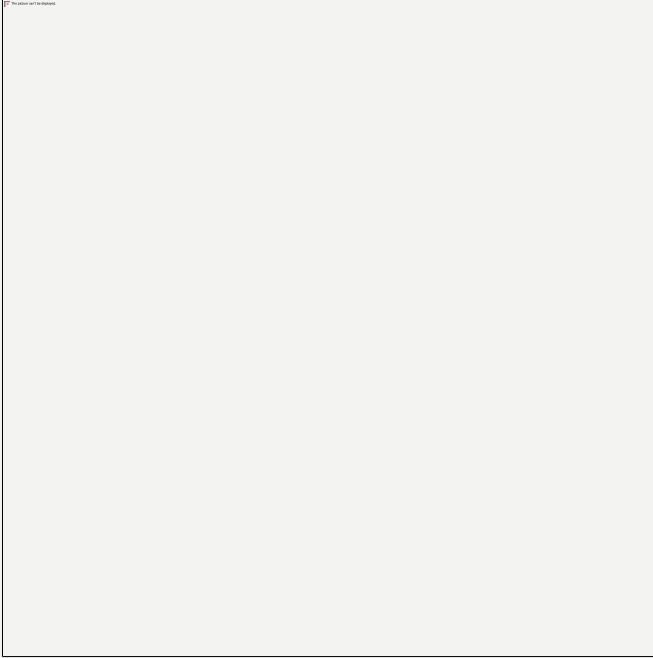
- Based on Intel Curie module , Arduino open source electronics platform for SW, Bluetooth , accelerometer and gyroscope embedded with Curie module UART , SPI
- Available in India for Rs.3500

Development Board

Mediatek Linkit One



H/W Selected – ‘MediaTek Linkit One’ because ...



Versatile Board for prototyping! (Connectivity options: Bluetooth ,Wi-Fi , GSM and Location: GPS)

Least Development time (Arduino compatible , many libraries for Arduino are present, Arduino community support for S/W libraries, ...)

Step 2

Sensors + Actuators
Networking Link
[H/W]

- Sensors & Actuators
- Networking Link



FUNCTIONALITY OF THE DEVICE

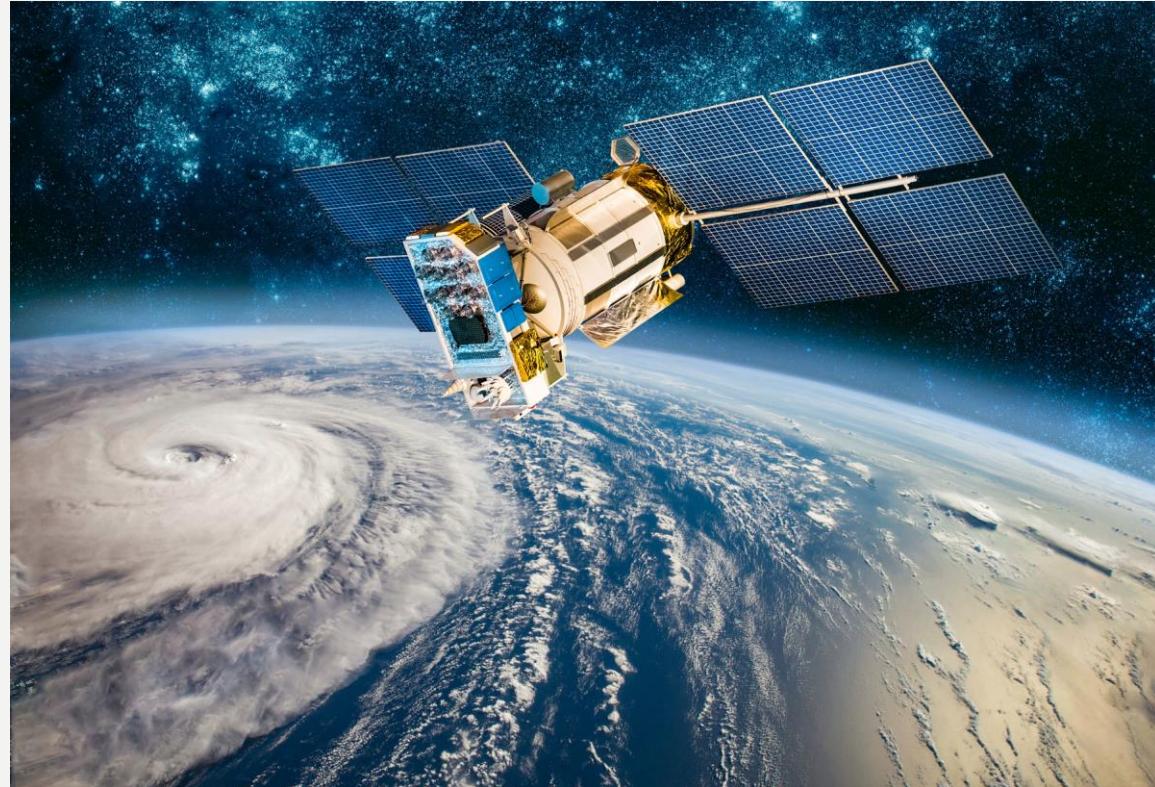
- 1. Location**
- 2. Temperature**
- 3. Bin Level**

Sensors Required

| S No. | Function | Parameter | Sensor |
|-------|-------------|-------------|-------------------|
| 1 | Tracking | Location | GNSS Module |
| 2 | Temperature | Temperature | TPH board |
| 3 | Bin Level | Distance | Ultrasonic sensor |

GNSS Module

- Global navigation satellite system (GNSS) refers to a constellation of satellites providing signals from space.
- All we need is GNSS receiver module which contains a processor and antenna that receives the signals sent by the satellites and computes the position and time.
- If the receiver's antenna can see at least 4 satellites, it can accurately calculate its position and time. This is called a lock or fix.
- Line of sight with the sky is needed for this. But , we cannot have that always (especially for indoor applications).
- The position accuracy depends on a number of variables such as signal to noise ratio, weather and obstructions such as buildings and mountains.



- The receiver must be able to get a lock on 4 satellites to be able to solve for a position.
- All these conditions make it difficult to use GNSS, but there are ways to handle these circumstances (Assisted GPS , Differential GPS).
- For the GNSS we are using the Mediatek module present on board with Linkit one.
- The chipset is Mediatek MT3332 which is present on the Linkit one board.
- MT3332 supports various location and navigation applications, including autonomous GPS (USA) , GLONASS (Russia) , GALILEO (EU) , BEIDOU (China)
- We have an antenna also , that comes with the board. So , the hardware is ready. To access the Hardware, we have to use the functions provided by the Software development kit of Linkit one board.

Global Navigation Satellite Systems



GPS



GLONASS



Galileo

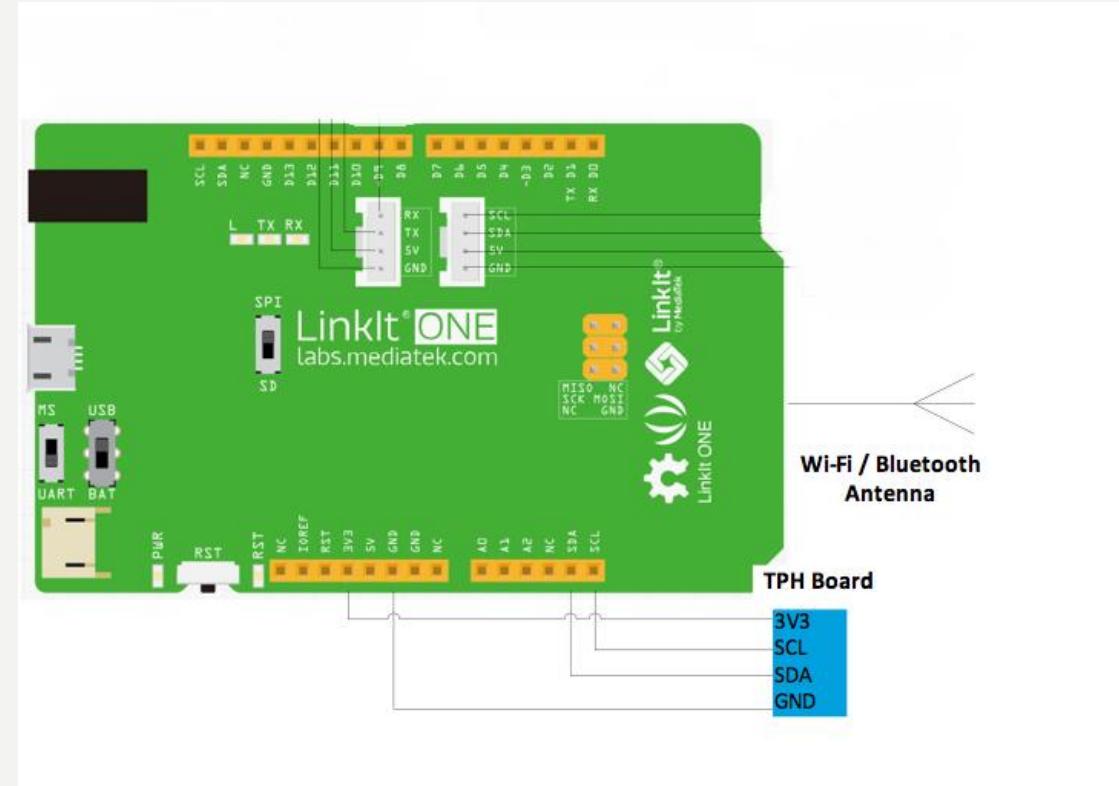
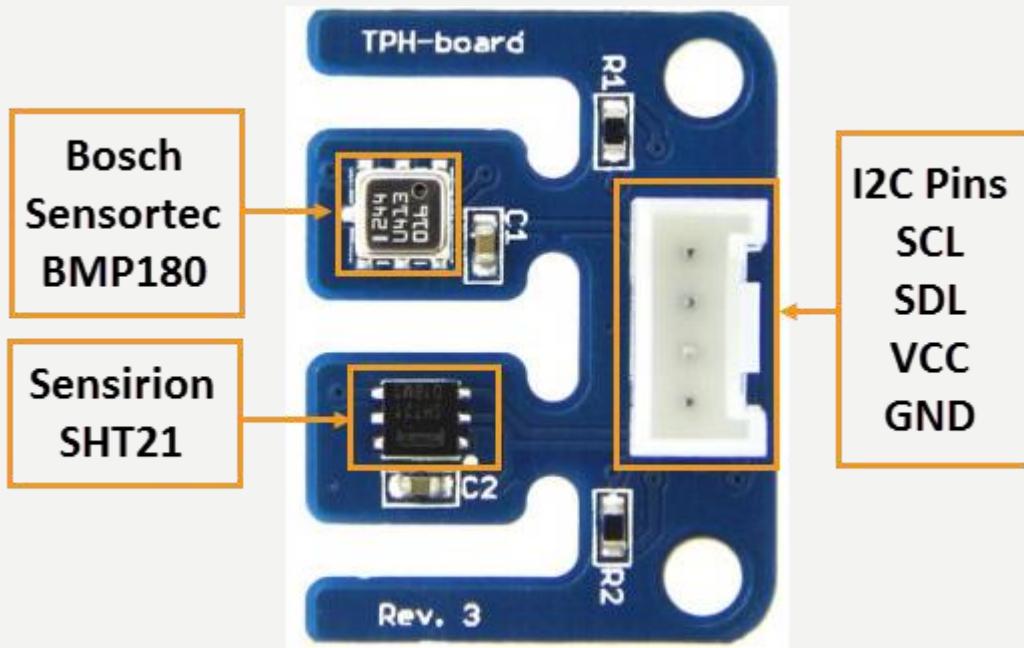


BeiDou-2

GNSS

(Global Navigation Satellite System)

TPH board



- This board has the Sensirion SHT21 humidity sensor and the Bosch Sensortec BMP180 pressure sensor (both capable of measuring temperature). TPH-board is 3.3 volt and 5V compatible, which makes it perfect to use with boards 5V Arduino boards.
- Both the SHT21 and the BMP180 are connected through the I2C/TWI with the easy Grove-header. Pull-up resistors are available on the TPH-board, but if undesired you can disconnect them through the cut-trace on the back.

- The Bosch Sensortec BMP180 is a new high-precision barometric pressure sensor. The pressure range is 300 to 1100 hPa and has a high relative accuracy of +/-0.12hPa (+/-1m).
- The Sensirion SHT21 is a digital humidity sensor. The relative humidity (RH) operating range is from 0 to 100% RH and has a precision of 0.04% RH.

Interface

| Controller | TPH board |
|-------------------|------------------|
| 3v3 | 3v3 |
| SCL(D19) | SCL |
| SDA(D18) | SDA |
| GND | GND |

HC-SR04 Ultrasonic Distance Sensor



Interface

| Controller | TPH board |
|------------|-----------|
| 5V | VCC |
| D12 | Trig |
| D11 | Echo |
| GND | GND |

The **HC-SR04 Ultrasonic (US) sensor** is a 4 pin module, whose pin names are VCC ,Trigger, Echo and Ground respectively. This sensor is used in many applications where measuring distance or sensing objects are required. The module has two eyes like projects in the front which forms the Ultrasonic transmitter and Receiver. The sensor works with the simple high school formula that

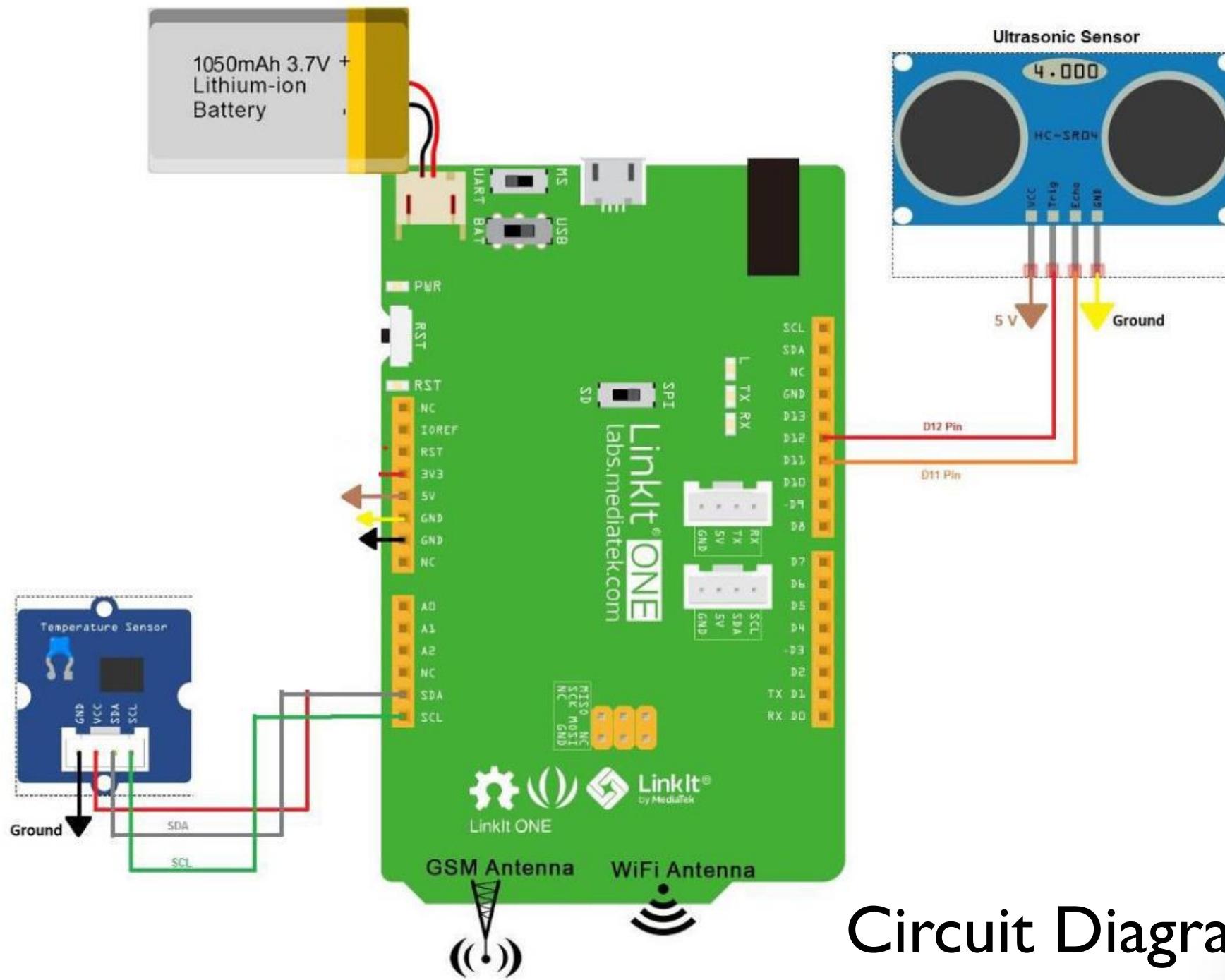
$$\text{Distance} = \text{Speed} \times \text{Time}$$

The Ultrasonic transmitter transmits an ultrasonic wave, this wave travels in air and when it gets objected by any material it gets reflected back toward the sensor this reflected wave is observed by the Ultrasonic receiver module as shown in the picture below



Power the Sensor using a regulated +5V through the VCC ad Ground pins of the sensor. The current consumed by the sensor is less than 15mA and hence can be directly powered by the on board 5V pins (If available). The Trigger and the Echo pins are both I/O pins and hence they can be connected to I/O pins of the microcontroller. To start the measurement, the trigger pin has to be made high for 10uS and then turned off. This action will trigger an ultrasonic wave at frequency of 40Hz from the transmitter and the receiver will wait for the wave to return. Once the wave is returned after it getting reflected by any object the Echo pin goes high for a particular amount of time which will be equal to the time taken for the wave to return back to the sensor.

The amount of time during which the Echo pin stays high is measured by the MCU MPU as it gives the information about the time taken for the wave to return back to the Sensor. Using this information the distance is measured as explained in the above heading.

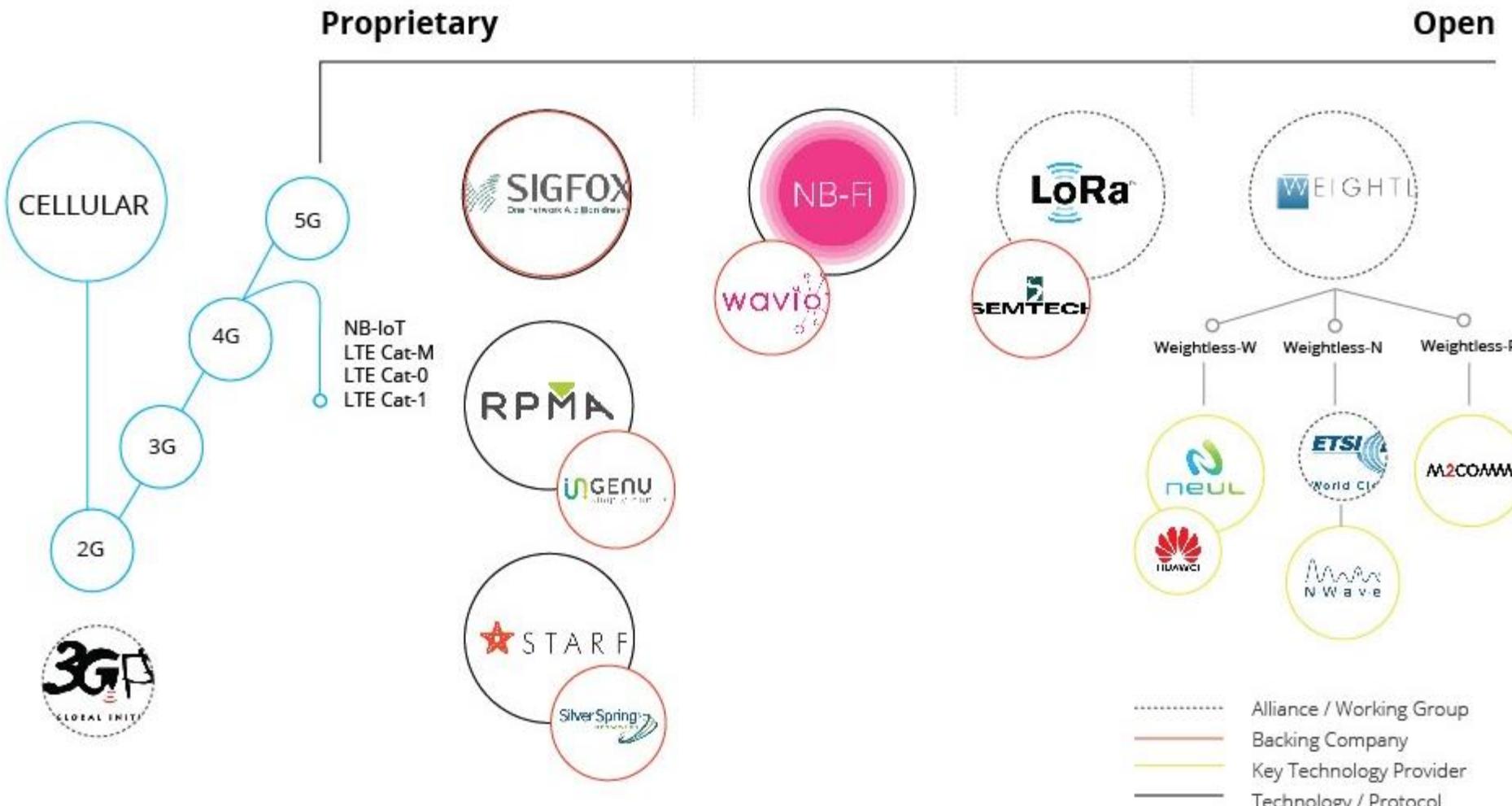


Circuit Diagram

Networking Links

LPWAN IoT Market

(Low-Power Wide Area Network)

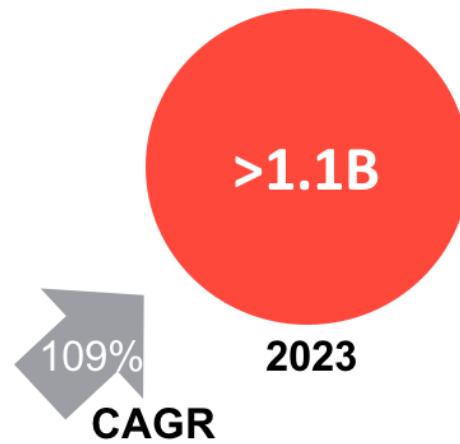


LPWAN Market 2018 – 2023: New Report Out Now



LPWAN Market Development

Global LPWAN connections



2018

Fastest growing IoT connectivity technology (2017-2023)

- Utilities the biggest segment
- Asia Pacific to become the leading adopter

7 Leading technologies



EC-GSM-IoT

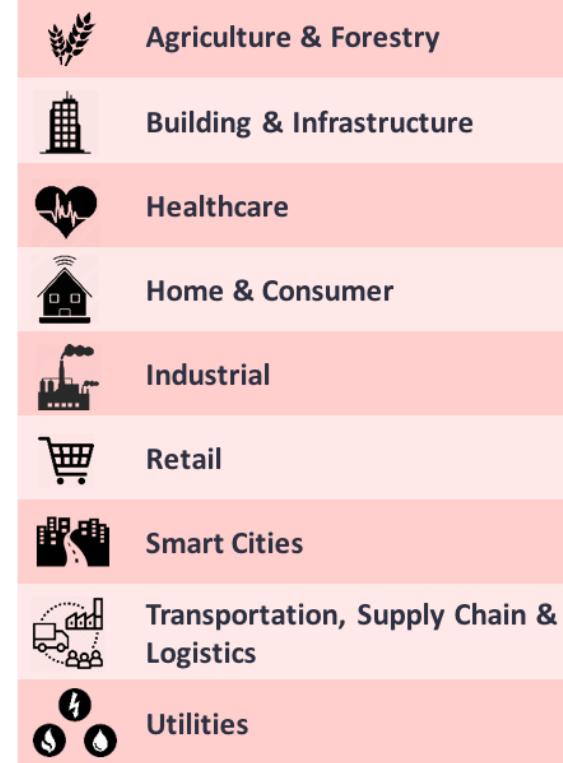
Comparison criteria:

- Technical features
- Ecosystem
- Use case suitability
- SWOT Analysis

16 other relevant technologies



Solutions in 9 market segments



37 LPWAN use cases analyzed in detail

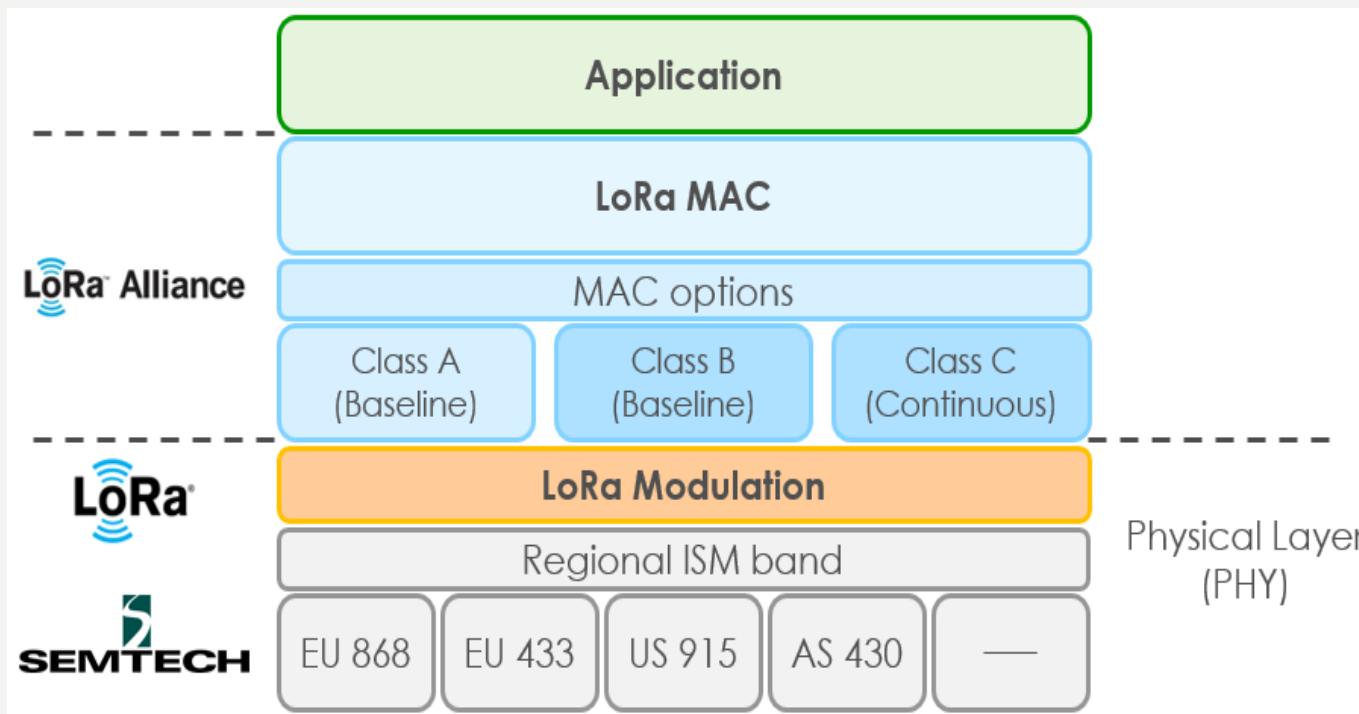
High-level overview of current LPWAN technologies

| LPWAN technologies | Adjacent / comparative technologies |
|--|---|
| Licensed spectrum | Unlicensed spectrum |
| Low-power technologies that operate in the licensed spectrum | Low-power technologies that operate in the unlicensed spectrum |
|  NB-IoT™ |  sigfox  LoRa™ |
|  LTE-M |  RPMA  WEIGHTLESS |
|  EC-GSM-IoT |  nwave  Telensa |
|  THINGSTREAM |  СТРИЖ  NB-Fi |
|  SAT4M2M |  helium  MIOTY |
|  hiber |  JupiterMesh  DASH7 |

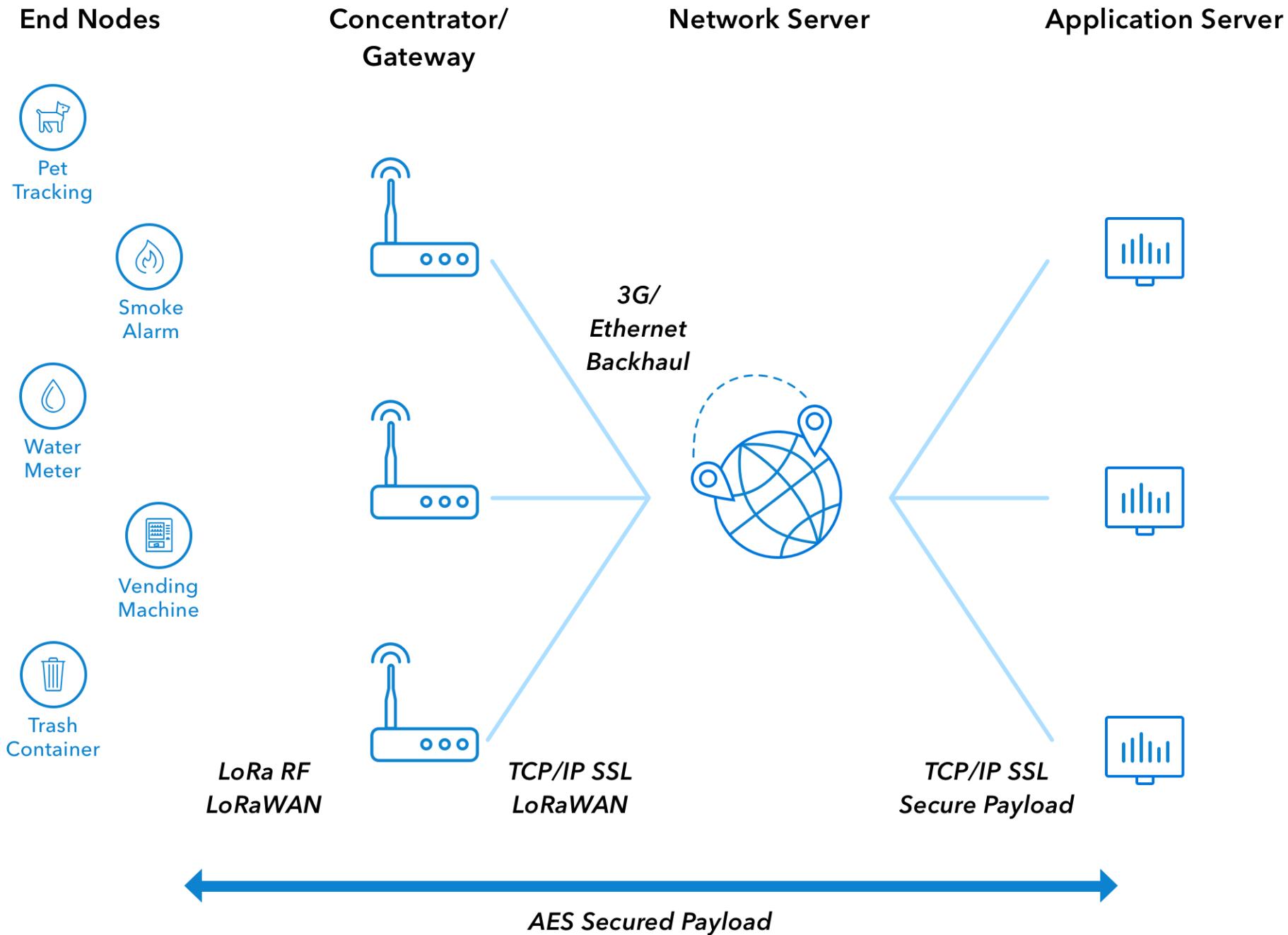
LoRaWAN

An LPWAN specification intended for wireless battery operated IoT products. It provides a secure bidirectional communication, mobility and localization services.

ARCHITECTURE



LoRaWAN Network Architecture



- It is a star of stars topology in which gateway is a transparent bridge relaying messages between end devices and a central network server in the backend.
- {Terminology to look for: End devices or nodes, base stations, uplink, downlink, bidirectional communication, Transmission and Reception windows}
- Class A – Downlink available only after sensor TX , battery powered sensors
- Class B – Energy efficient with latency controlled downlink
- Class C – No latency for downlink communication. Usually mains powered actuators.
- LoRaWAN is a media access control layer protocol. At the physical level, we have LoRa custom modulation technology called chirp spread spectrum. It uses license free ISM bands for communication.
- Frequency used : ISM bands
- The backhaul which connects the Lora base stations to INTERNET can be any one of the following :
- Ethernet / Wi-Fi / Cellular / Satellite
- The H/W needed for this is Lora end devices, base stations and gateways. LoRa development kits (1 base station and 2 end devices) are available in India.

Narrow Band IoT (NB-IoT)

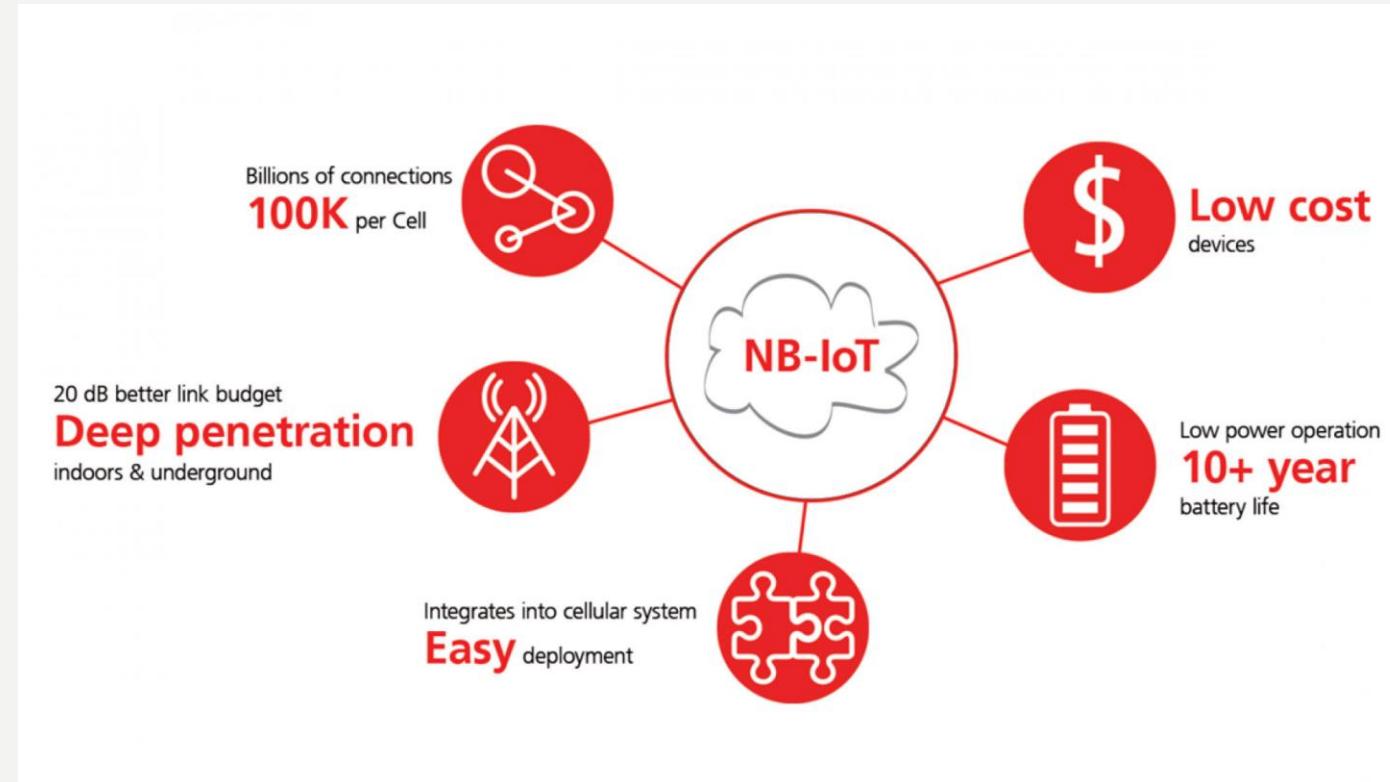
Another LPWAN radio technology standard developed to enable a wide range of devices and services to be connected using TELECOMMUNICATION bands.

Designed for the Internet of things applications and is STANDARDISED by the 3GPP.

The existing 4G cellular infrastructure is enough to deploy NB IoT. A software upgrade needs to be done to all existing 4G systems.

Jio with Samsung are plan to deploy NB IoT in India.

If we are using this mechanism, we need only NB IoT modules at the device end side (similar to GSM). Companies like mediatek (MT2625) and ublox have already developed the modules for NB IoT.



Comparison of various LPWANS

| Parameter | LoRaWAN | Sigfox , Telensa | NB-IoT |
|---|--|---|--|
| Frequency Spectrum | Unlicensed (ISM band) | Unlicensed (ISM band) | Licensed – LTE in band / Guard band / standalone |
| N/W Coverage | Least in urban environment & susceptible to interference | Medium coverage | Good coverage |
| Data rate | 10 Kbps | 100 bps | 200 Kbps |
| Battery life | Good | Good | Good |
| Base station Maintenance is part of our project. | Yes , thus requiring more time and effort to make a product. | No , third party operators or the company itself will provide. | No, Cellular N/W , similar to GSM base stations |
| Ecosystem | Semtech formed the LoRa alliance and standardizing the LoRaWAN | Deployed in more than 30 countries and trying to expand their N/W | 3GPP is standardizing this and all the telecom companies have the potential to deploy this N/W |
| Is it ready in India ? (As of today) | Yes, can be tested by purchasing base station and end device modes. Tata Communications has setup base stations in different cities. | No, these companies haven't come to India yet | Jio with Samsung are planning to setup |

GSM/GPRS communication - Networking Link available on board with Linkit One

- The main controller MT2502 has the GSM/GPRS integrated with ARM7 EJ-S core , BT and Wi-Fi.
- GPRS communication can be used in the applications via functions of LGPRS class in Mediatek Linkit one API of the SDK.
- A normal size sim card slot is given on the board.
- A patch antenna is also provided along with the board.

Step 3

Cloud(Server , DB ,
Dashboard UI)

- Platform
- Development Cycle

Platform

Platforms available : PubNub , Thingspeak , Mediatek Cloud Sandbox , Ubidots , etc.

Platform Chosen : Mediatek Cloud Sandbox (MCS) as it is developer friendly and feature rich.

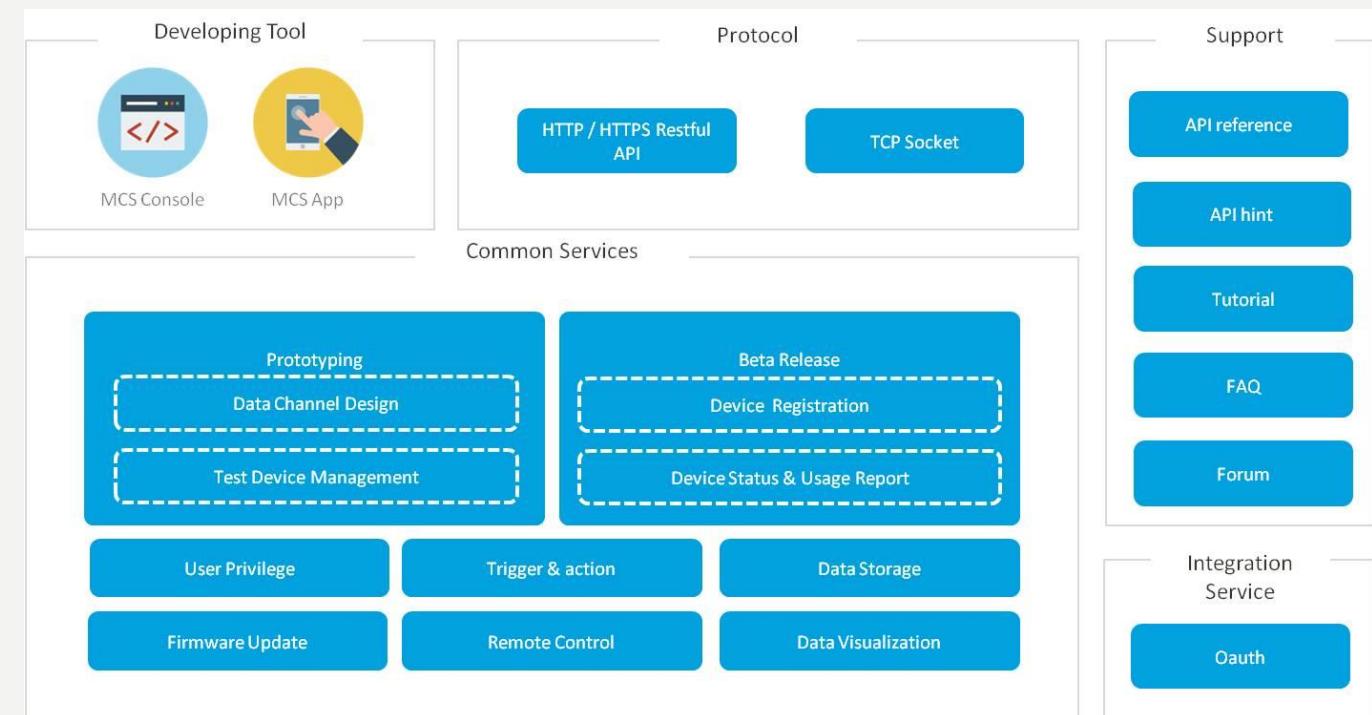
- MediaTek Cloud Sandbox (MCS) provides free cloud-based data and device management services used in the development and pre-commercial testing of Wearable and IoT devices. It frees you from having to develop your own cloud infrastructure to support such prototype development.
- Use RESTful APIs to collect data from the devices and view the data on a powerful web-based dashboard that offers a range of display and graphing options as well as the ability to issue commands to control your Wearable and IoT devices. In addition, a complementary smartphone app lets you review collected data and control your devices anytime and anywhere.



With MediaTek Cloud Sandbox you

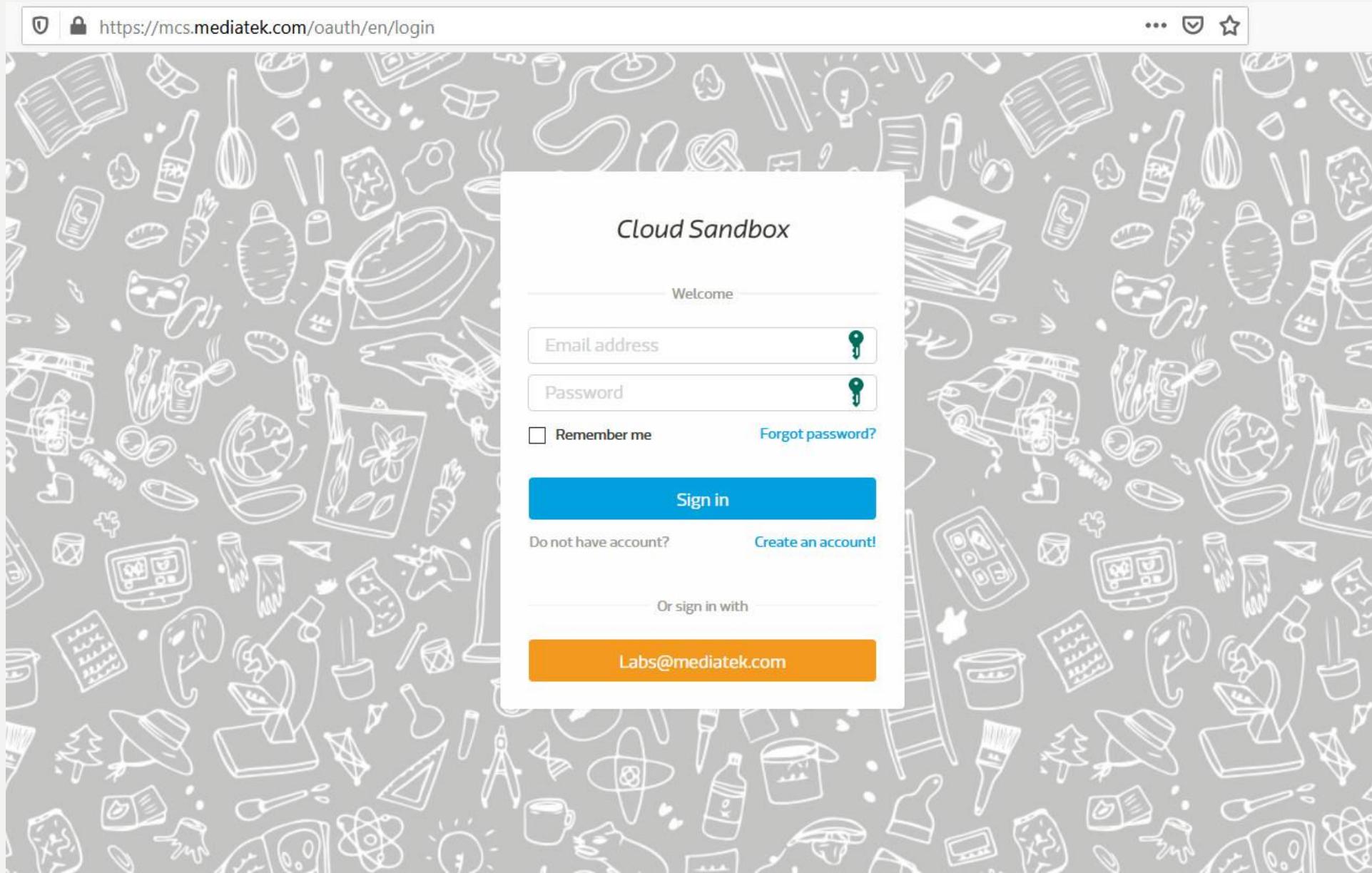
can :

- Define Wearables and IoT prototype profiles and individual devices within a profile
- Push and Pull data points between a device and the MCS such as geo-location, temperature, humidity and more
- Remotely control your devices using state data points, such as switch-state and more
- Visualize data points graphically
- Receive email or Mobile Push notifications when data points are collected or changed
- Manage device's life cycle, in the same manner as in a live implementation
- Manage and control devices remotely, using the complementary mobile app
- Create reports about the prototypes, devices and collected data
- Perform FOTA (Firmware Over the Air) updates
- Control access to data and devices with granular security control



Development Cycle

1. Login



2. Create Prototype

MEDIATEK Labs Cloud Sandbox

Development Management Scene New

Dashboard Prototype Test devices

Last updated prototype All prototype

 Prototype Name Smart Garbage Bin Hardware Platform Linkit ONE (MT2502) Last updated time 2020-06-09 22:20

▼ Test devices list

Quick resources

Develop with our hardware platform

 Develop with Linkit Smart 7688  Develop with Linkit ONE

 Develop with Linkit Connect 7681

Others

 Go to MediaTek Labs  Go to Android mobile app

 Go to forum



Development > Prototype



Prototype list

Create your prototype now!

Create your prototype now!

Create

Prototype name *

Smart Garbage Bin

Prototype version *

Bin v1.0

Hardware platform *

MediaTek development board



Hardware name *

LinkIt ONE (MT2502)



Description

Smart Garbage Bin

Industry *

Others



Industry name *

Environment

Application *

Others



Image upload



Upload

Cancel

Save



Controller

The controller data channels allow you to control the status of your devices. eg, ON/OFF for a switch

[Add](#)

Display

The display data channels allow you to get the data from your devices.

[Add](#)

Function

Function data channel process your device data and return value to other data channels.

[Add](#)[Send us a message!](#)

3. Add Data channel

Can't find your template?

Tell us what kind of template you want to add!

Identify the Variables required

| S No. | Variable (Data channel name) | Data channel ID | Data channel Type | Units/data |
|-------|------------------------------|-----------------|-------------------|-----------------|
| 1 | Location | GPS | Display | GPS Coordinates |
| 2 | Temperature | Temperature | Display | Degree Celsius |
| 3 | Ultrasonic Distance | Ultrasonic | Display | Inch |
| 4 | Garbage Level Indicator | GarbageLevel | Function | Inch |
| 5 | Garbage Bin Level | BinLevel | Display | Category(3) |
| 6 | Battery Level | Battery_Level | Display | Percentage |
| 7 | Counter | Counter | Display | No. of updates |

Development > Prototype > Smart Garbage Bin

Smart Garbage Bin (ID: Pvwoq8iMOY00)

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Create test device](#)[Beta Release](#)

More ▾

**Status:** Under Development**Industry:** Environment**Application:** Others**Description:** Smart Garbage Bin

1

Test device

Create test device or beta release the prototype to try out and collect real data!

[Data channel](#) [Trigger & Action](#) [User privileges](#) [Firmware](#) [Test device](#)

Add Data channel now! [Add](#)

[Map](#) [Satellite](#)

[Location](#)
Data channel Id: GPS
To display location of the device.

0.0
degree Celsius

Temperature
Data channel Id: Temperature
To sense temperature of the bin.

0.0
inch

Ultrasonic Distance
Data channel Id: Ultrasonic
To get the bin level in inches from ultrasonic sensor.

Empty Half Full

Garbage Bin Level
Data channel Id: BinLevel
To indicate the garbage bin level.

Last data point status: N/A

Garbage Level Indicator
Data channel Id: GarbageLevel
To indicate the garbage level.

0
percent

Battery Level
Data channel Id: Battery_Level
Indicates the battery level

0
Others

Counter
Data channel Id: Counter
Indicates the number of data points (data packets) reached

Final Prototype

Development > Prototype > Smart Garbage Bin

Smart Garbage Bin (ID: Pvwoq8iMOYOO)

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Create test device](#)[Beta Release](#)[More ▾](#)**Status:** Under Development**Industry:** Environment**Application:** Others**Description:** Smart Garbage Bin

1

Test device

Create test device or beta release the prototype to try out and collect real data!

[Data channel](#)[Trigger & Action](#)[User privileges](#)[Firmware](#)[Test device](#)

Trigger & Action (2)

| | Name | Trigger criteria | Trigger action | |
|---|------------------|-----------------------|----------------|--|
| 1 | Empty the Bin | Garbage Bin Level = 2 | Console Alert | |
| 2 | High Temperature | Temperature > 50 | Console Alert | |

[+ Add trigger & action](#)

Alert Severity (3)

| Severity level | Severity name | Level color | |
|----------------|---------------|-------------|--|
| S1 | High | | |
| S2 | Medium | | |
| S3 | Low | | |

[+ Add alert severity](#)

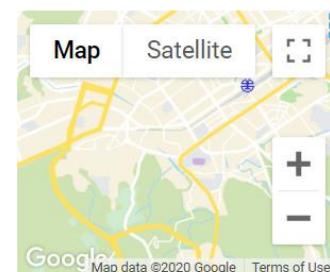
● Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status: Public PrivatePublic URL: <https://mcs.mediatek.com/public/devices/D11zWh8e> [Copy](#)

Description: Smart Garbage Bin

You will need the deviceId and deviceKey when calling our API to access this device

DeviceId: [D11zWh8e](#) [Copy](#)DeviceKey: [XXXXXXXXXX](#) [Copy](#)[Data channel](#)[Trigger & Action](#)[User privileges](#)[API hint](#)**Location**

Data channel Id: GPS

To display location of the device.

0.0

degree Celsius

Temperature

Data channel Id: Temperature

To sense temperature of the bin.

0.0

inch

Ultrasonic Distance

Data channel Id: Ultrasonic

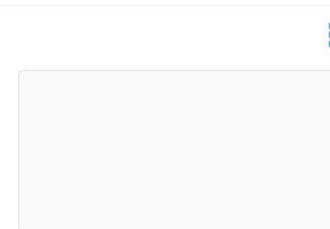
To get the bin level in inches from ultrasonic sensor.

Empty Half Full

**Garbage Bin Level**

Data channel Id: BinLevel

To indicate the garbage bin level.



Last data point status: N/A

Garbage Level Indicator

Data channel Id: GarbageLevel

To indicate the garbage level.

0

percent

Battery Level

Data channel Id: Battery_Level

Indicates the battery level

0

Others

Counter

Data channel Id: Counter

Indicates the number of data points (data packets) reached

4. Create test device

5. Connect test device

After writing the code to interact with the cloud , start the device. Now your device is sending the data to the cloud and receiving the data from the cloud.

| Switch No. | Functionality | Position 1 - Functionality | Position 2 - Functionality |
|------------|---------------|--|--|
| 1 | Program Mode | MS : In this position, when connected to PC, Linkit One board will be shown as 10MB USB drive. The program will not execute in this mode. Any file that is copied to this drive can be read via the code. | UART :This position is used to set the board to program mode. Firmware can be uploaded in this mode. |
| 2 | Power | BAT : Board powered by Li-ion Battery. To charge battery, set the switch to this position and connect the board to PC. | USB : Board powered by USB port. Set the switch to this position when there is no battery connected to program the board. |
| 3 | SD/SPI | SPI : This position allows access of external SPI pins (D10 - D13) | SD : This position allows the code to access SD card.This mode also disables access of SPI pins (D10-D13). |

6. Manage and control the test device

7. Beta release prototype

8. Create device

9. Manage released devices

Step 4

S/W Development (Application Program)

- Setup up the development environment
- Application Development

Set up the development environment

We have used the Linkit one board in Windows environment. The process of setting up the board in windows is as follows:

- Installing Arduino IDE
- Installing Linkit ONE SDK (Just a plug-in to Arduino IDE)
- Configure Arduino IDE to use a Linkit ONE development board
- Creating project

<https://docs.labs.mediatek.com/resource/linkit-one/en/getting-started/get-started-on-windows/install-the-arduino-ide-and-linkit-one-sdk>

S/W development on Linkit one board

Arduino Constructs :

Two default functions are there for every project in Arduino IDE

Setup function -> Executed only once after reset. Sensor initialization is done here.

Loop function -> Executed repeatedly like a while(1) loop in micro controllers.

Accessing components on board:

The hardware on the board can be accessed only through the software interface given by Mediatek. All the feature of board are exposed as classes in this interface.

<http://labs MEDIATEK.com/api/linkit-one/frames.html?frmname=topic&frmfile=index.html>

Http GET and POST from the board

The remote module has to interact with the cloud to update any sensor value or get any configuration change.

Refer to the Mediatek cloud APIs to **UPLOAD DATA POINTS (POST)** and **RETRIEVE DATA POINTS (GET)**. **CSV** format is used in the app.

Go to **Resources → API references** (in your mediatek cloud sandbox account) to find out how to interact with the Mediatek cloud.

Example of Http POST request :

```
include <HttpClient.h>
include <EthernetClient.h>

EthernetClient content;
HttpClient http(content);
content.println("POST /mcs/v2/devices/D1IzWn8e/datapoints.csv HTTP/1.1");
#hint! Please do not add excessive spaces
String data = "GPS,,12,13,14"
```

#timestamp is in unix-time format the milliseconds and is optional. If not provided,
#system will generate timestamp at the time of receiving this API

```
int dataLength = data.length();
content.println("Host: api.mediatek.com");
content.println("deviceKey: EscXXXXXXXXXXXXXX");
content.print("Content-Length: ");
content.println(dataLength);
content.println("Content-Type: text/csv");
content.println("Connection: close");
content.println();
content.println(data);
```

Application development

Algorithm

SETUP FUNCTION

Initialize the N/W Interface (service provider)

Setup up the Temperature sensor

Setup up the Ultrasonic sensor

Initialize the GNSS module

Initialize the serial communication (Used for debugging)

LOOP FUNCTION

Get the values of Latitude , Longitude and altitude from the GNSS module

Get the value of battery level

Get the values of temperature , ultrasonic distance from the respective sensors

Read the values of Counter

Also send the ultrasonic distance value for the GarbageLevel function in the cloud

Arrange the values in a csv format

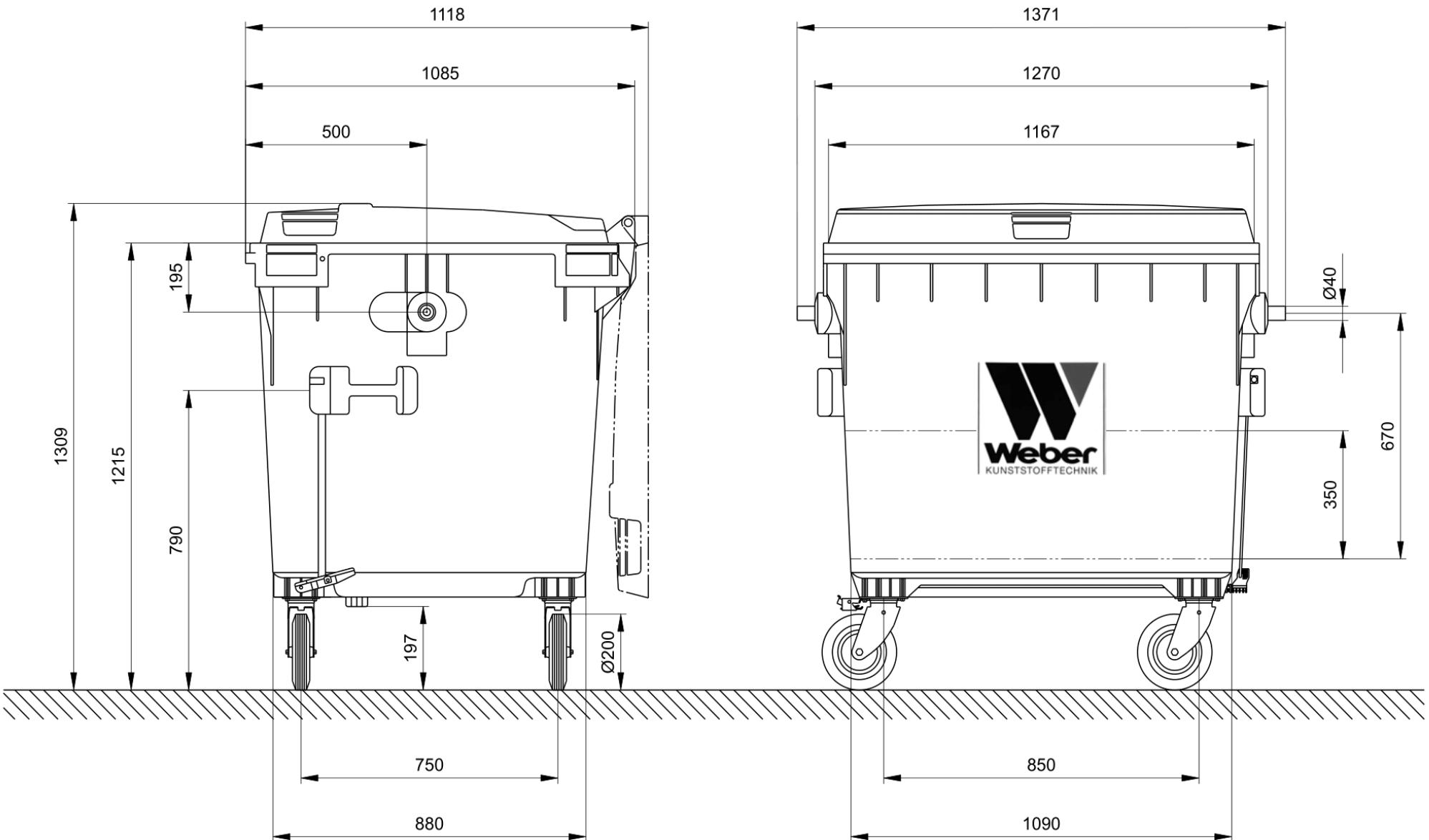
Send all these values (7) to the cloud in a Http POST request

Wait for 30 minutes.



TEST CASES

Dimensions of dustbin considered for Test Cases



Mobile Waste Containers MGB 1100 Litre Flat Lid CLASSIC

Sizes, Measures, Dimensions: Height 1309 mm; Width 1371 mm; Depth 1085 mm

Edit data channel

| | |
|---|---|
| Data channel name * | <input type="text" value="Garbage Level Indicator"/> |
| Description | <input type="text" value="To indicate the garbage level."/> |
| Language * | <input style="width: 150px; border: 1px solid #ccc; padding: 2px; margin-right: 10px;" type="text" value="JavaScript"/> ▼ |
| <p>You can use <code>{dataChnl1: value1, dataChnl2: value2, ...}</code> to return value to other data channels within the device. Besides, please be mindful of the constrains while completing your code. ?</p> <div style="border: 1px solid #ccc; padding: 10px; min-height: 150px;"><pre>1 // Use context.value to get uploaded data point. 2 var bin = context.value; 3 var level = 0; 4 if(bin < 4.0) { 5 level = 2; 6 } 7 else if(bin < 19.0 && bin > 13.0) { 8 level = 1; 9 } 10 else { 11 level = 0; 12 } 13 return { 14 BinLevel: level 15 };</pre></div> | |

Clear

Cancel

Save

**Data channel type : Function
ID : GarbageLevel
Responsible for showing
Empty / Half / Full – Bin Level**

Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status : [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/D1tzWn8e> [Copy](#)

Description : Smart Garbage Bin

You will need the deviceId and deviceKey when calling our API to access this device

DeviceId: [D1tzWn8e](#)[Copy](#)

DeviceKey:

[Copy](#)[Data channel](#)[Trigger & Action](#)[User privileges](#)[API hint](#)

Map Satellite

Google Map data ©2020 Terms of Use

Location
Last data point time: 2020-06-09 22:44
To display location of the device.

31.3 degree Celsius

Temperature
Last data point time: 2020-06-09 22:44
To sense temperature of the bin.

36.3 inch

Ultrasonic Distance
Last data point time: 2020-06-09 22:44
To get the bin level in inches from ultrasonic sensor.

Empty Half Full

Garbage Bin Level
Last data point time: 2020-06-09 22:44
To indicate the garbage bin level.

36.3

Last data point status: OK

Garbage Level Indicator
Last data point time: 2020-06-09 22:44
To indicate the garbage level.

100 percent

Battery Level
Last data point time: 2020-06-09 22:44
Indicates the battery level

1 Others

Counter
Last data point time: 2020-06-09 22:44
Indicates the number of data points (data packets) reached

Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status : [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/D1tzWn8e> [Copy](#)

Description : Smart Garbage Bin

You will need the deviceld and deviceKey when calling our API to access this device

Deviceld: [D1tzWn8e](#)DeviceKey: [XXXXXXXXXX](#)[Copy](#)[Copy](#)[Data channel](#)[Trigger & Action](#)[User privileges](#)[API hint](#)

[Map](#) [Satellite](#) [\[\]](#)

Google Map data ©2020 Terms of Use

Location
Last data point time: 2020-06-09 22:47
To display location of the device.

34.3

degree Celsius

Temperature
Last data point time: 2020-06-09 22:47
To sense temperature of the bin.

18.1

inch

Ultrasonic Distance
Last data point time: 2020-06-09 22:47
To get the bin level in inches from ultrasonic sensor.

Empty Half Full

Garbage Bin Level
Last data point time: 2020-06-09 22:47
To indicate the garbage bin level.

18.1

Last data point status: OK

Garbage Level Indicator
Last data point time: 2020-06-09 22:47
To indicate the garbage level.

100

percent

Battery Level
Last data point time: 2020-06-09 22:47
Indicates the battery level

2

Others

Counter
Last data point time: 2020-06-09 22:47
Indicates the number of data points (data packets) reached

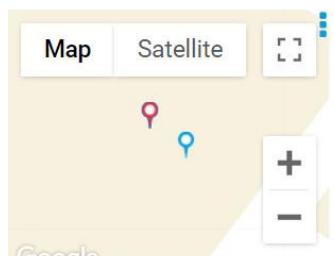
Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status: [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/D1LzWn8e> [Copy](#)

Description: Smart Garbage Bin

You will need the deviceID and deviceKey when calling our API to access this device

DeviceID: [D1LzWn8e](#) [Copy](#)DeviceKey: [XXXXXXXXXX](#) [Copy](#)[Data channel](#)[Trigger & Action](#)[User privileges](#)[API hint](#)**Location**

Last data point time: 2020-06-09 22:48

To display location of the device.

38.3

degree Celsius

Temperature

Last data point time: 2020-06-09 22:48

To sense temperature of the bin.

3.7

inch

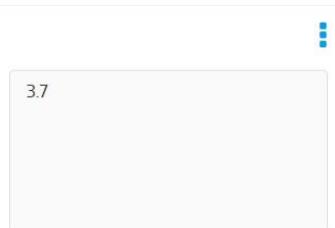
High

Empty Half Full

**Garbage Bin Level**

Last data point time: 2020-06-09 22:48

To indicate the garbage bin level.



Last data point status: OK

Garbage Level Indicator

Last data point time: 2020-06-09 22:48

To indicate the garbage level.

100

percent

Battery Level

Last data point time: 2020-06-09 22:48

Indicates the battery level

3

Others

Counter

Last data point time: 2020-06-09 22:48

Indicates the number of data points (data packets) reached

Development > Test devices > Local Bin

Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status : [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/D1tzWn8e> [Copy](#)

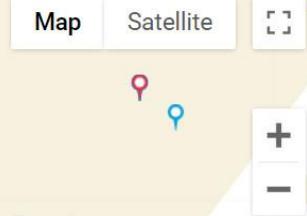
Description : Smart Garbage Bin

You will need the deviceId and deviceKey when calling our API to access this device

DeviceId: [D1tzWn8e](#) [Copy](#)DeviceKey: [XXXXXXXXXX](#) [Copy](#)

[Data channel](#) [Trigger & Action](#) [User privileges](#) [API hint](#)

[Map](#) [Satellite](#)


Map data ©2020 Google Terms of Use

Location
Last data point time: 2020-06-09 22:48
To display location of the device.

38.3
degree Celsius

Temperature
Last data point time: 2020-06-09 22:48
To sense temperature of the bin.

3.7
inch

Ultrasonic Distance
Last data point time: 2020-06-09 22:48
To get the bin level in inches from ultrasonic sensor.

High
Empty the Bin
Alert time: 2020-06-09 22:48
[Dismiss](#)

100
percent

Battery Level
Last data point time: 2020-06-09 22:48
Indicates the battery level

3
Others

Counter
Last data point time: 2020-06-09 22:48
Indicates the number of data points (data packets) reached

3.7
Garbage Level Indicator
Last data point status: OK

Garbage Level Indicator
Last data point time: 2020-06-09 22:48
To indicate the garbage level.

Development > Test devices > Local Bin

Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status : [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/Dl1zWn8e> [Copy](#)

Description : Smart Garbage Bin

You will need the deviceID and deviceKey when calling our API to access this device

DeviceID: [Dl1zWn8e](#) [Copy](#)DeviceKey: [XXXXXXXXXX](#) [Copy](#)

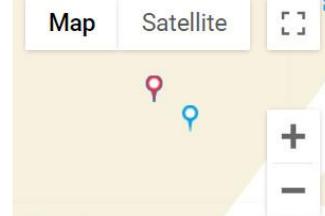
Data channel

Trigger & Action

User privileges

API hint

[Map](#) [Satellite](#) [\[+\]](#)



Google Map data ©2020 Terms of Use

Location
Last data point time: 2020-06-09 22:52
To display location of the device.

 High

Temperature
Last data point time: 2020-06-09 22:52
To sense temperature of the bin.

50.3 degree Celsius

Ultrasonic Distance
Last data point time: 2020-06-09 22:52
To get the bin level in inches from ultrasonic sensor.

16.7 inch

Garbage Bin Level
Last data point time: 2020-06-09 22:52
To indicate the garbage bin level.

Empty Half Full

16.7

Last data point status: OK

Garbage Level Indicator
Last data point time: 2020-06-09 22:52
To indicate the garbage level.

100 percent

Battery Level
Last data point time: 2020-06-09 22:52
Indicates the battery level

4 Others

Counter
Last data point time: 2020-06-09 22:52
Indicates the number of data points (data packets) reached

Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: Linkit ONE (MT2502)

[Delete](#)[Back to prototype](#)Status : [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/D1lzWn8e> [Copy](#)

Description : Smart Garbage Bin

You will need the deviceld and deviceKey when calling our API to access this device

Deviceld: [D1lzWn8e](#) [Copy](#)DeviceKey: [XXXXXXXXXX](#) [Copy](#)

[Data channel](#) [Trigger & Action](#) [User privileges](#) [API hint](#)

[Map](#) [Satellite](#)

High Temparature
Alert time: 2020-06-09 22:52
[Dismiss](#)

Temperature
Last data point time: 2020-06-09 22:52
To sense temperature of the bin.

16.7
inch

Ultrasonic Distance
Last data point time: 2020-06-09 22:52
To get the bin level in inches from ultrasonic sensor.

Empty Half Full

Garbage Bin Level
Last data point time: 2020-06-09 22:52
To indicate the garbage bin level.

16.7

100 percent

4 Others

Counter
Last data point time: 2020-06-09 22:52
Indicates the number of data points (data packets) reached

Garbage Level Indicator
Last data point time: 2020-06-09 22:52
To indicate the garbage level.

Battery Level
Last data point time: 2020-06-09 22:52
Indicates the battery level

Development > Test devices > Local Bin

Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status : [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/Dl1zWn8e> [Copy](#)

Description : Smart Garbage Bin

You will need the deviceld and deviceKey when calling our API to access this device

Deviceld: [Dl1zWn8e](#) [Copy](#)DeviceKey: [XXXXXXXXXXXXXX](#) [Copy](#)

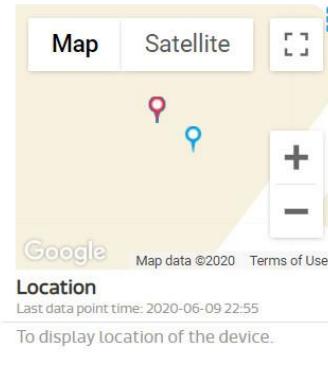
Data channel

Trigger & Action

User privileges

API hint

[Map](#) [Satellite](#)



Map data ©2020 Google Terms of Use

Location
Last data point time: 2020-06-09 22:55
To display location of the device.



Garbage Level Indicator  **2.7**
Last data point status: OK
Last data point time: 2020-06-09 22:55
To indicate the garbage level.

Battery Level  **100** percent
Last data point time: 2020-06-09 22:55
Indicates the battery level

Counter  **5** Others
Last data point time: 2020-06-09 22:55
Indicates the number of data points (data packets) reached

Local Bin

Creator: Manoj Version: Bin v1.0 Hardware platform: LinkIt ONE (MT2502)

[Delete](#)[Back to prototype](#)Status : [Public](#) [Private](#)Public URL: <https://mcs.mediatek.com/public/devices/D1tzWn8e> [Copy](#)

Description : Smart Garbage Bin

You will need the deviceld and deviceKey when calling our API to access this device

Deviceld: [D1tzWn8e](#) [Copy](#)DeviceKey: [XXXXXXXXXXXXXX](#) [Copy](#)

Data channel

Trigger & Action

User privileges

API hint

[Map](#) [Satellite](#) [...](#)


Google Map data ©2020 Terms of Use

Location
Last data point time: 2020-06-09 22:55
To display location of the device.

High

High Temperature
Alert time: 2020-06-09 22:55 [Dismiss](#)

Temperature
Last data point time: 2020-06-09 22:55
To sense temperature of the bin.

2.7
inch

Ultrasonic Distance
Last data point time: 2020-06-09 22:55
To get the bin level in inches from ultrasonic sensor.

High

Empty the Bin
Alert time: 2020-06-09 22:55 [Dismiss](#)

Garbage Bin Level
Last data point time: 2020-06-09 22:55
To indicate the garbage bin level.

2.7

Last data point status: OK

Garbage Level Indicator
Last data point time: 2020-06-09 22:55
To indicate the garbage level.

100
percent

Battery Level
Last data point time: 2020-06-09 22:55
Indicates the battery level

5
Others

Counter
Last data point time: 2020-06-09 22:55
Indicates the number of data points (data packets) reached



SMART GARBAGE BIN

Public Device Link

<https://mcs.mediatek.com/public/devices/D1lzWn8e>

Step 5

Prototype to Product

- Challenges
- Future Updates

Challenges

Features Proposed : Temperature , Bin Level , Location

Features Delivered : Temperature , Bin Level , Location

Environment wear and tear issue : IP Resistance 66

Battery backup

Ultrasonic Sensor : Wide beam sensor to Narrow beam sensor

Future upgrades

Foul smell sensor : (NH₃/H₂S/CH₃SH)

Battery backup : Solar power

Wireless Connectivity : LoRa (868 Mhz)