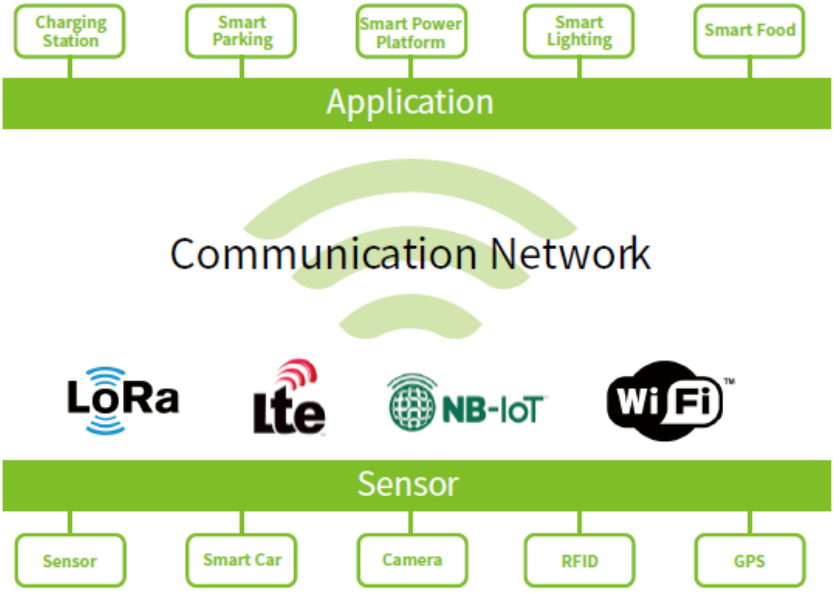
Being Communication Inc. TM

Acer Industrial Automation Data Acquisition Module (IDAM) Specification

1. Introduction

The Internet of Things can be divided into three layers:

- **Sensors**
- **Communication Networks**
- **Applications**



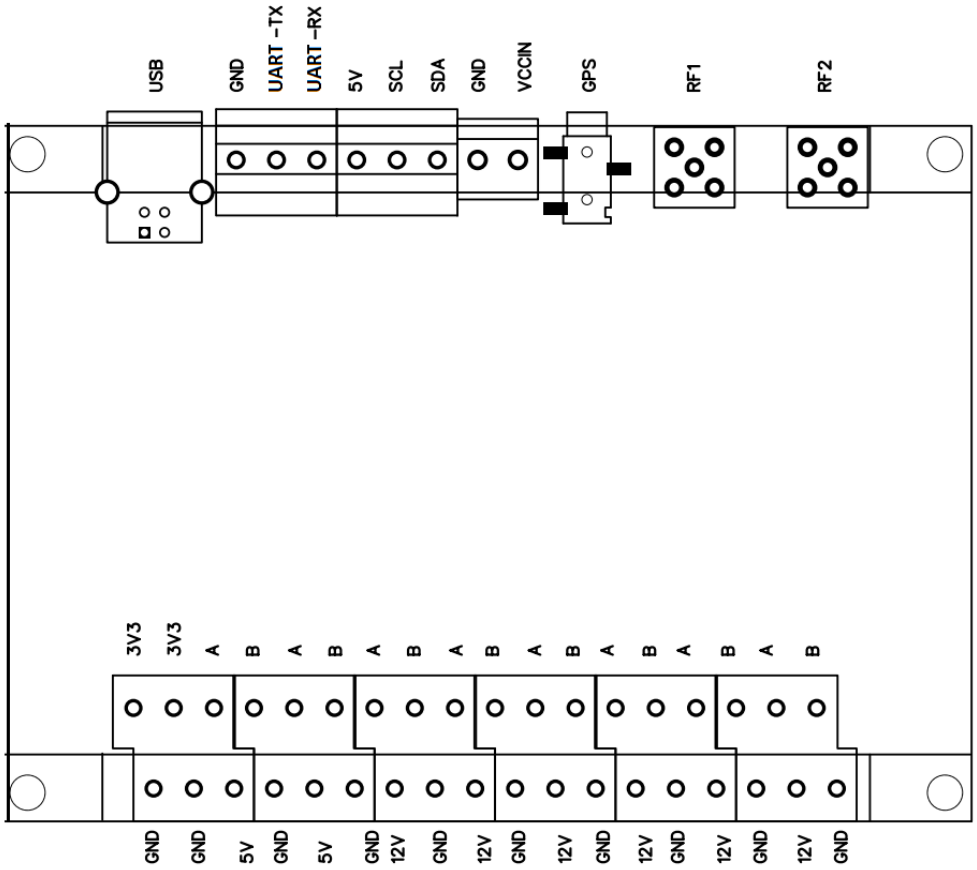
The first layer comprises of sensors and similar devices. For each application, sensors or other devices collect data. Developers pick the right sensors to support the application, then design hardware that can control the sensors and read and transmit that data.

The second layer consists of communication networks. There are many ways for sensors to communicate with the cloud or backend servers. Developers must consider communication distance, signal coverage, data plan, battery life, etc. Different locations and different environments need different solutions, so flexibility is important to the design.

The third layer is made up of applications. After data is sent to the cloud or backend server, UIs show results or carry out more data analysis. There are many APIs between the cloud/backend server and applications. Developers can follow defined APIs to access or control data.

Typically, developing one IoT project may take between six months and a year. Acer Being Communication hopes to shorten the development cycle and reduce complexity while remaining flexible and ensuring easy communication between each platform and interface. To achieve this, Acer Being Communication is basing its designs on the most popular sensor interfaces, communication protocols, and APIs to design programmable data acquisition modules. This concept is named **Smart Connection**.

2. General Feature



2.1 Supply Voltage and Current

a) DC voltage input rating：12V；
b) DC current input rating：200mA。
c) DC voltage output rating: 3.3V, 5V, 12V

2.2 Module Spec

a. Dimension ： L145mm*W91mm*T41mm
b. Weight：≤200g
c. Operation temperature and humidity: -30℃～+80℃， Humidity <95%

2.3 Interface

a) 1 USB port (Type B) to connect PC and do the configuration setting.
b) 8 channel RS485 to connect different kinds of industrial sensors
c) 1 GPS port to connect GPS module
d) 1 channel I2C interface to connect I2C device
e) 1 channel UART interface to connect UART device
f) RF 1 is antenna input for Lora module

g) RF2 is antenna input for Wi-Fi/NB-IoT (Optional)/4G module (Optional)
h) Embedded motion detection sensor

3. Product Specification

3.1 Lora Module Spec

- Standard: IEEE 802.15.4g
- Transmit Output Power: 19dBm
- Data Rate: 0.018-37.5Kbps
- Modulation Techniques: Multilevel (G)FSK and MSK
- Frequency bands: 470-510MHz or 862-932MHz
- Temperature range: -40℃ to +85℃
- Operation voltage: 2.0V to 3.6V

3.2 Wi-Fi Module Spec

- Standard: IEEE 802.11b/g/n
- Frequency range: 2.412GHz – 2.484GHz
- Transmit Output Power:

  802.11b: +19dBm (Max. @11Mbps),

  802.11g: +18dBm (Max. @54Mbps),

  802.11n: +17dBm (Max. @HT20, MCS7), +17dBm (Max. @HT40, MCS7)
- Sensitivity:

  802.11b: -89dBm (@11Mbps)

  802.11g: -81dBm (@54Mbps)

  802.11n: -73dBm (@HT20, MCS7), -71dBm(@HT40, MCS7)
- Temperature range: -40℃ to +85℃
- Operation voltage: 3.2.V to 3.6V

3.3 NB-IOT Module Spec (Optional)

- Support 3GPP Rel14 NB-IoT air interfaces and protocols
- Support Band: B1, B3, B5, B8, B20, B28*
- Output power: 23 dBm±2dB@ Class 3
- Sensitivity: -129 dBm±1dB
- Temperature range: -40℃ to +85℃

- Supply voltage: 3.1V to 4.2V, Typ.:3.6V
- Power consumption: 3.0uA@PSM /1.7mA @ Idle Mode, DRX=1.28s
- Support DRX/eDRX/PSM in the different 3GPP modes of operation

3.4 LTE Module Spec (Optional)

- LTE Cat 4 module
- 3GPP Rel. 11 LTE technology
- Frequency bands:

  LTE FDD: B1/B3/B5/B7/B8/B20

  LTE TDD: B28/B40/B41

  WCDMA: B1/B5.B8

  GSM: B3/B8
- Output Power:

  Class 4 (33dBm+/-2dB) for GSM850

  Class 4 (33dBM+/-2dB) for GGSM900

  Class 1 (30dBm+/-2dB) for DCS1800

  Class 1 (30dBm+/-2dB) for PCS1900

  Class E2 (27dBm+/-3dB) for GSM850 8-PSK

  Class E2 (27dBm+/-3dB) for EGSM900 8-PSK

  Class E2 (26dBm+/-3dB) for DCS1800 80PSK

  Class E2 (26dBm+/-3dB) for PCS1900 8-PSK

  Class 3 (24dBm+1/-3dB) for WCDMA bands

  Class 3 (23dBm+/-2dB) for LTE-FDD bands

  Class 3 (23dBm+/-2dB) for LTE-TDD bands

  Class 4 (33dBm+/-2dB) for GSM850

  Class 4 (33dBm+/-2dB) for EGSM900

  Class 1 (30dBm+/-2dB) for DCS1800

  Class 1 (30dBm+/-2dB) for PCS1900

  Class E2 (27dBm+/-3dB) for GSM850 8-PSK

  Class E2 (27dBm+/-3dB) for EGSM900 8-PSK

  Class E2 (26dBm+/-3dB) for DCS1800 8-PSK

  Class E2 (26dBm+/-3dB) for PCS1900 8-PSK

  Class 3 (24dBm+1/-3dB) for WCDMA bands

Class 3 (23dBm+/-2dB) for LTE-FDD bands

Class 3 (23dBm+/-2dB) for LTE-TDD bands

- Sensitivity:

  LTE B1: -101.5dBm (10M)

  LTE B2: -101dBm (10M)

  LTE B3: -101.5dBm (10M)

  LTE B4: -101dBm (10M)

  LTE B5: -101dBm (10M)

  LTE B7: -99.5dBm (10M)

  LTE B8: -101dBm (10M)

  LTE B12: -101dBm (10M)

  LTE B13: -100dBm (10M)

  LTE B14: -99dBm (10M)

  LTE B18: -101.7dBm (10M)

  LTE B19: -101.4dBm (10M)

  LTE B20: -102.5dBm (10M)

  LTE B26: -101.5dBm (10M)

  LTE B28: -102dBm (10M)

  LTE B38: -100dBm (10M)

  LTE B40: -100dBm (10M)

  LTE B41: -99dBm (10M)

  LTE B66: -99dBm (10M)

  LTE B71: -100dBm (10M)

  WCDMA B1: -110dBm

  WCDMA B2: -110dBm

  WCDMA B4: -110dBm

  WCDMA B6: -110.5dBm

  WCDMA B8: -110.5dBm

  WCDMA B19: -110.5dBm

  GSM850: -109dBm

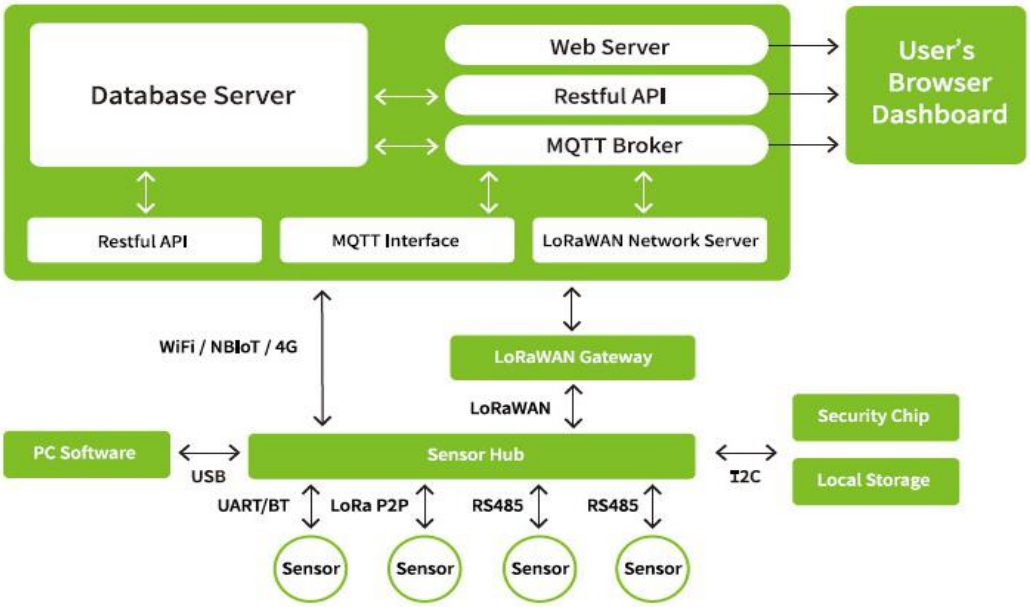
  EGSM900: -109dBm

  DCS1800: -109dBm

  PCS1900: -109dBm

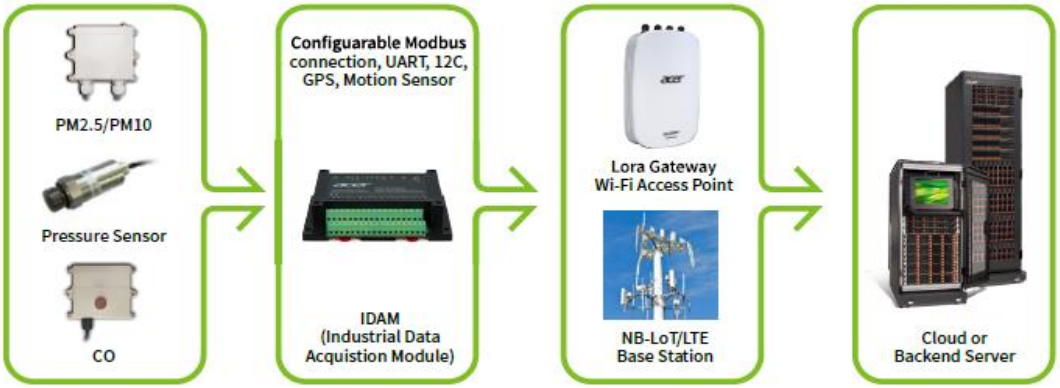
4. Software Specification

4.1 Software Architecture



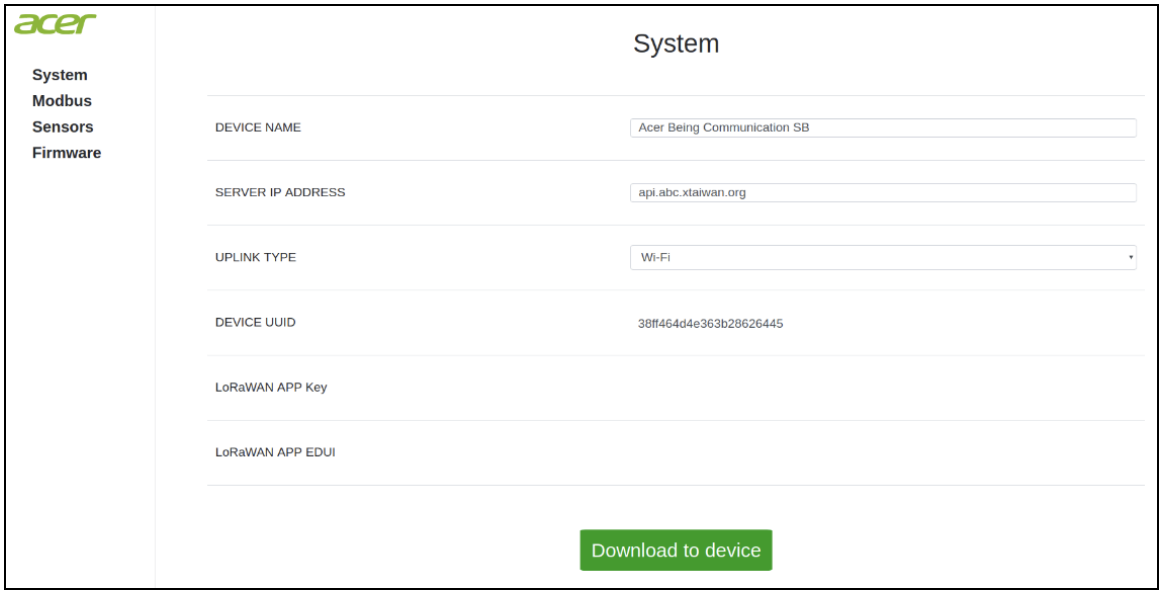
By connecting the sensors with RS485 / ModBus, we could setup the SCADA like system in few minutes by using specific PC software to finish the IDMA firmware configuration. IDAM supports WiFi / NBIoT / LTE 4G / LoRaWAN methods for uplloading data. If customers are using Wi-Fi, NB-IoT, or 4G, IDAM can provide data through Restful API or MQTT interface. If customers are using LoraWAN, IDAM can send the payload to LoraWAN gateway then have gateway to pass through the data to LoraWAN network server.

If customers want to support GPS, motion detection, and use I2C or UART to connect more sensors, Acer does have customized firmware to support the demand. Acer also can support customized API to upload the data to dedicated platform. IDAM also can use I2C interface to connect security chip and local storage to enhance the data security function and data backup.



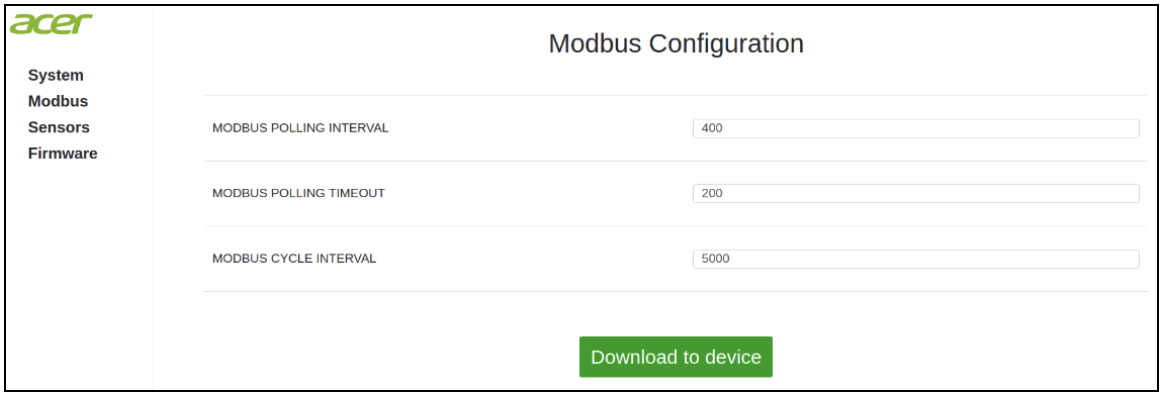
4.2 PC Software (For Modbus sensors)

After the software installation on PC, the software will automatically pop up if users connect IDAM to PC through USB port.



In system configuration page, we need to choose the upload method we want.

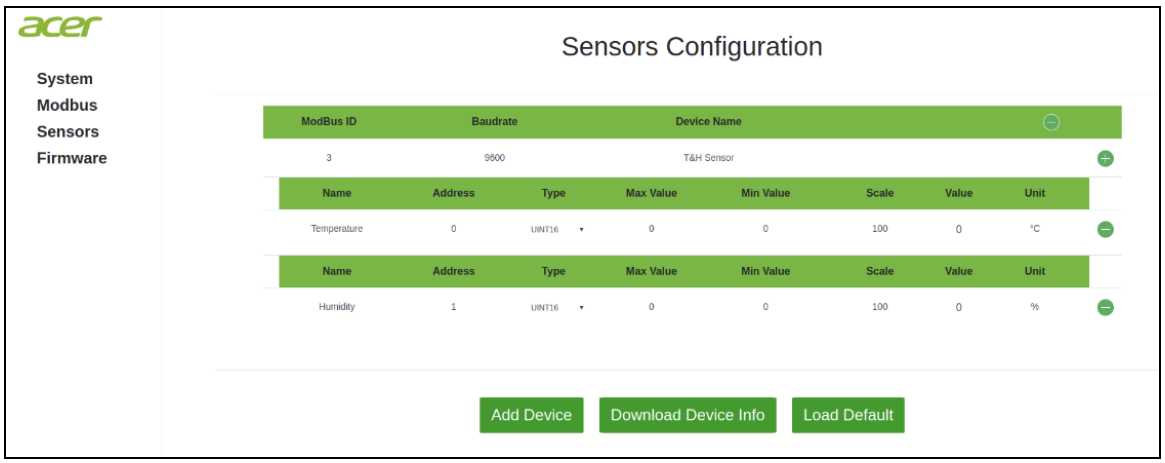
DEVICE NAME : The value will be upload to server for dashboard display.
SERVER IP ADDRESS: The IP address of your private server
UPLINK TYPE: LoRaWAN / WiFi / LET 4G / NBIoT
DEVICE UUID: The UUID for IDAM
LoRaWAN APP EUI
LoRaWAN APP Key
LoRaWAN Device EDUI : The information for LoRaWAN network server



In Modbus configuration page:

MODBUS POLLING INTERVAL: the polling interval for each device. (Unit: ms)
MODBUS POLLING TIMEOUT: the timeout value (Unit: ms)
MODBUS CYCLE INTERVAL: the period for reading all devices. (Unit: ms)

Note: the timeout value is different for each device, please pick the maximum for all.



In sensors configuration page:

1. Please press “Add Device” for adding new device.
2. Please modify the Modbus ID / Baudrate / Device Name by the sensor specification.
3. Please press “+” for adding new variable for this device.
4. Press more times if you need more variables for this device .
5. Modify the Name / ModBus Address / Variable Type / Max Value / Min Value / Scale / Unit for this variable.
   Note: If the value we get from modbus is 523 and scale is 10, the value will become “52.3”.
6. Press “Download Device Info” button. The configuration will be downloaded to IDAM & uploaded data to dedicated platform.

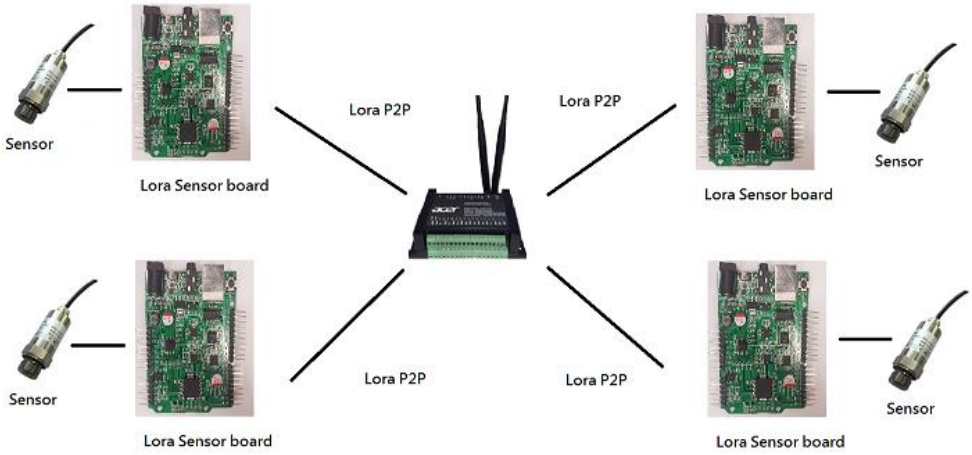
5. Accessory for Smart Connection

5.1 LoRa Gateway

The LoRa Gateway collects data from each LoRa device then sends it to the cloud or backend server. It is a good solution for developers who want to build up a private cloud. The LoRa coverage range can be from 1km to 10km, depending on the landscape and the height at which the LoRa Gateway is located.

5.2 LoRa Sensor Board

Not all sensors support radio frequency, so developers can leverage IDAMs to connect to the cloud or backend servers. However, in some environments, it is not possible to use cables to connect sensors directly to the IDAM. Acer Being Communication will provide LoRa sensor boards, which can convert signals from UART, I2C, or RS485 (Modbus) to LoRa. The sensor board can then communicate with IDAMs via LoRa P2P (point to point). IDAMs can send the data via Wi-Fi, 4G-LTE, or NB-IoT. This gives developers flexibility when installing sensors.



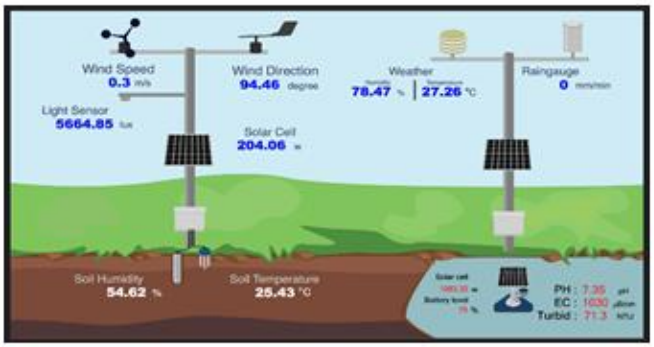
5.3 Solar Power Converter:

Areas without access to a power source can use solar panels to generate energy. Acer Being Communication has developed a solution that converts solar power to 12V or 24V, and also stores energy in the battery. It connects to the IDAM via a RS485 (Modbus) interface. Developers can display the power status on the dashboard after getting data from the IDAM.

6. Application

6.1 Smart Agriculture Weather Station

Real-time weather monitoring systems are an important tool for monitoring the climatic conditions of a farm. Farmers can save time and money by implementing a Smart Agriculture Weather Station, and receive warnings of extreme weather conditions.



Sensor List include :

- Ambient Light Sensor
- Wind Speed Sensor
- Wind Direction Sensor
- Air Humidity & Tempature
- Rainfall Sensor
- Soil Humidity Sensor
- "NH3 Sensor Version (Ammoniac)"
- PH Sensor For Soil
- PM2.5, PM10
- Co2 Sensor
- O3 Sensor
- O2 Sensor
- Atmospheric pressure sensor

6.2 Smart Water Quality Monitoring Station

Monitoring water standards is a complex, time-consuming process. Acer Being Communication proposes using IoT for real-time water quality monitoring.

Sensor List include :

- PH Sensor
- DO Sensor
- EC Sensor + Temp
- Turbity Sensor
- Dissolved Oxygen Sensor
- ORP Sensor
- Sainlity Sensor
- Chlorophyll Sensor
- COD sensor
- BOD sensor
- TSS sensor
- Cyanobacteria sensor
- NH3 & NH4 Sensor

The water station can implement water pumps, filters, and flow channels. The monitoring station can also implement motion detection and GPS functions. If the station is moved without authorization, it will send an alarm to the system, and administrators can use GPS to determine the station's location.

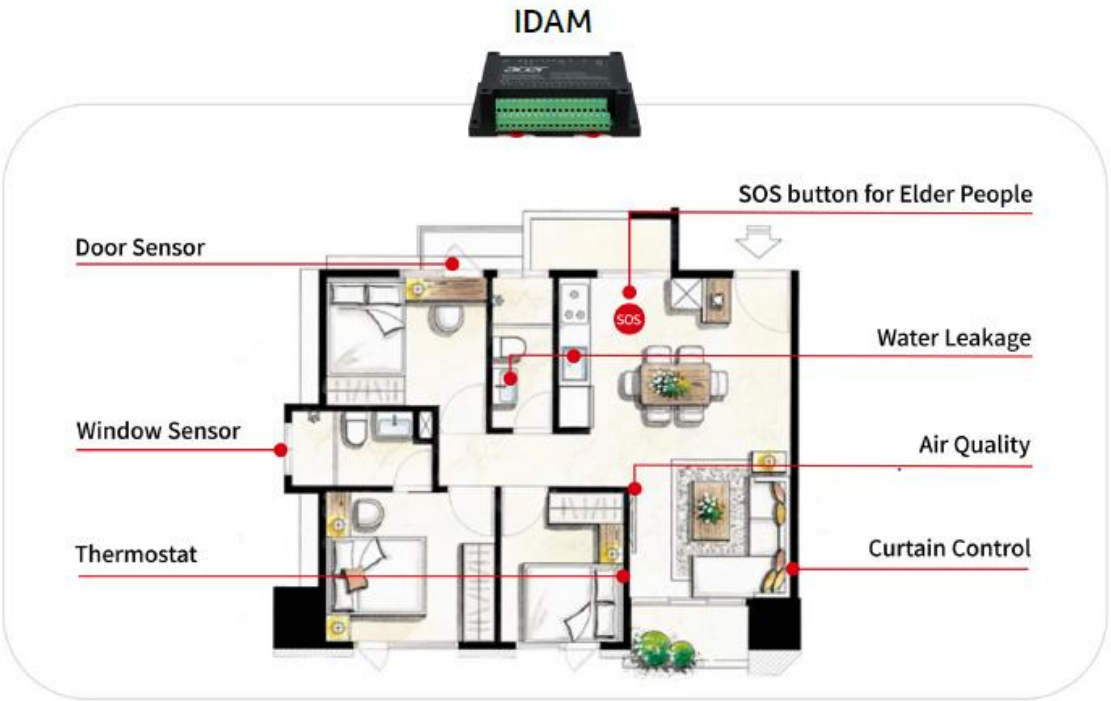
6.3 Smart Building

LoRa (Long-Range wireless) is a communication technology with a strong signal strength, long data transfer distance, and lower power consumption. As LoRa doesn't require a license, users can develop their own high-security private networks without paying for data transactions. Many people use LoRa to develop wireless ecosystems for houses, warehouses, and factories.

Not all sensors used in Smart Building environments support LoRa, and some sensors still have battery life concerns. To solve these issues, developers can use IDAMs. Sensors are connected to IDAMs, through which they receive power and send data. Below are two cases. One is implemented in each home of a smart community; the other is implemented in each room of a smart factory.

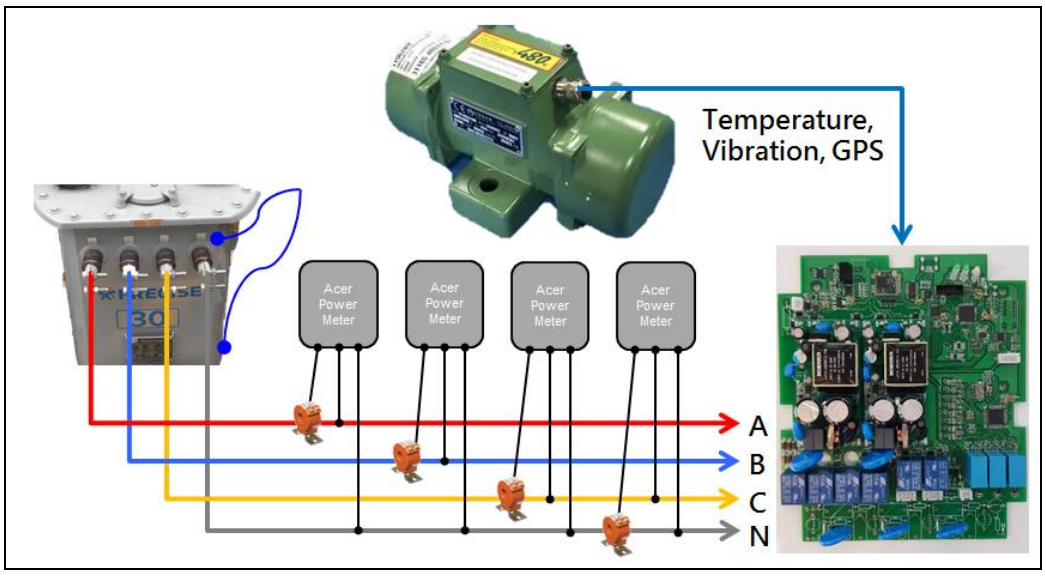
Smart Home

Numerous sensors can be installed in each home. In addition, an SOS button can be installed for elderly residents. They just press the button if they need help. With these sensors, insurance companies, safety institutions, and community committees can manage security for each resident. They also can provide services for residents, allowing them to control curtains, thermostats, and power plugs remotely. Once the IDAM collects the data from each home, it can use LoRa technology to send data to the LoRa gateway, which is located in the center of the community or on the roof of a building.

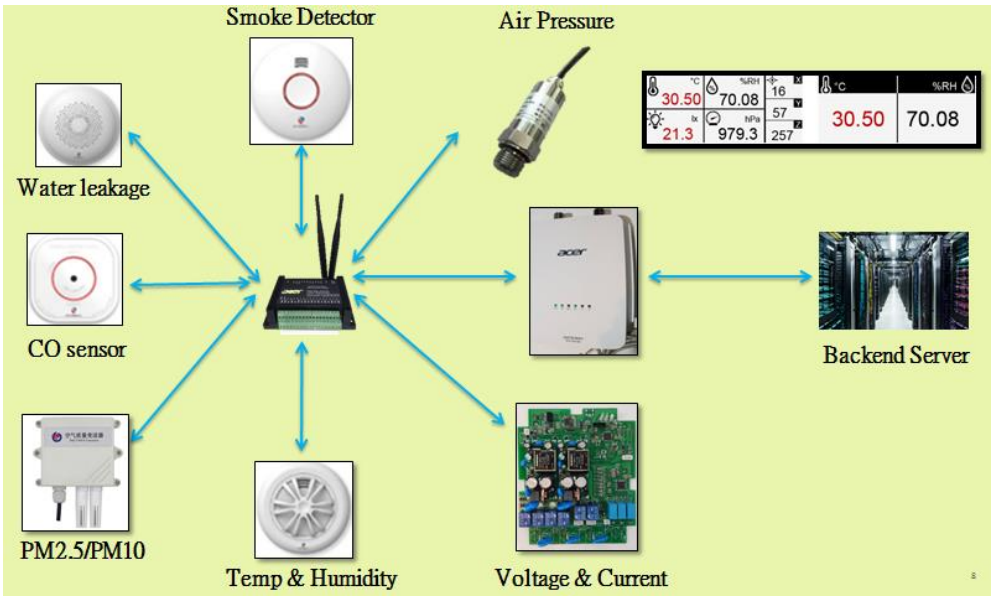


Smart Factory

The same concept can also work in factories. Here, manangers want to modify existing PLCs (Programmable Logic Controllers) to support Industy 4.0. Acer Being Communication proposes to use Smart Connection to implement Industry 4.0. By monitoring electricity currents, it is easy to identify if a machine is operating inefficiently. In addition, the health of each machine can be measured by analyzing its temperature and vibration status. A smart power monitoring system can also monitor power consumption and power supply in each area of the factory, ensuring there is always a stable supply.

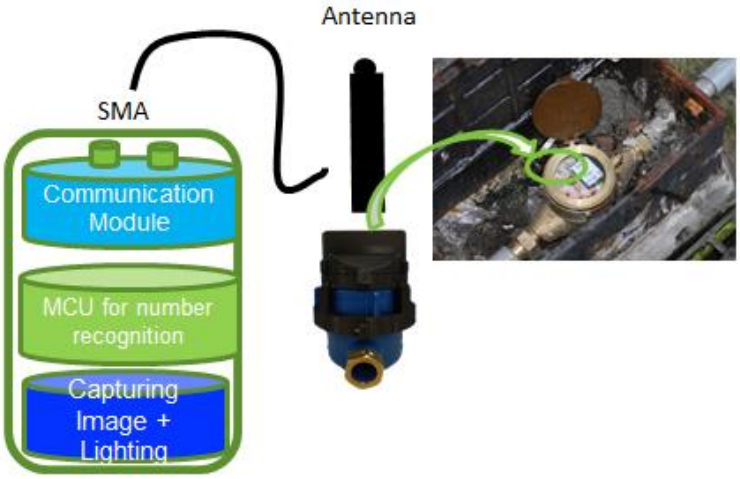


In addition, factories can also implement sensors to help with safety or environmental control.



6.4 Smart Water Meter

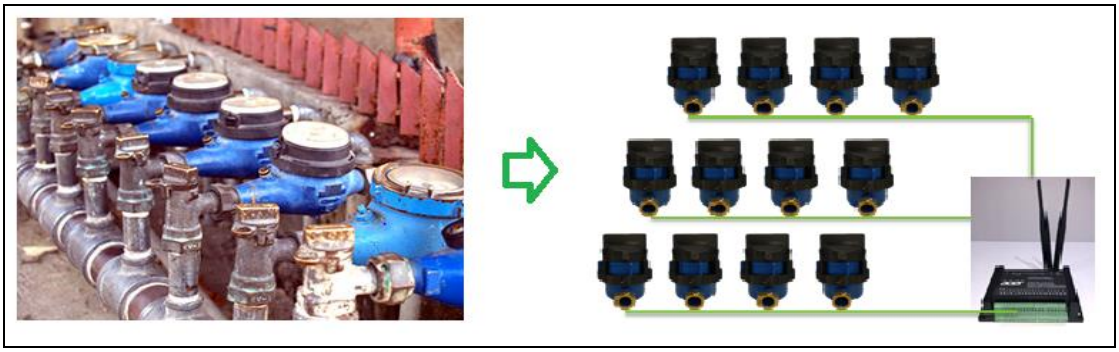
Acer Being Communication realizes the biggest challenge for governments hoping to phase in smart water meters is the budget. In addition to purchasing new meters, there are installation and operating costs. To solve this problem, Acer Being Communication proposes upgrading existing meters to smart meters via the "Add-on" concept. "Add-on" means adding a device to water meters directly, capturing the reading, carrying out local OCR (Optical Character Recognition), and then sending the results to the cloud or backend system. In this way, governments don't need to purchase new meters, or pay to install them.



Another benefit of the "Add-on" concept is on the supplier side. There are different meters for different sizes of pipes, so it will be a big investment for water companies to support them all, especially as each new meter needs validation and certification. The "Add-on" device works with any kind of meter.

Add-on Meters + IDAM

There are many water meters on roofs of buildings. Acer Being Communication suggests using the Smart Connection concept. Each meter uses Bluetooth technology to connect to an IDAM. The IDAM gathers all the data and sends it to the cloud or backend server. This reduces the total cost as each communication module (LoRA, NB-IoT, 4G-LTE) inside the "Add-on" can be removed.



6.5 Smart Lighting