



IoTini BSS-1000 Water Tank Monitor Case Study 18-11-15

IoTini developed a system for monitoring urban rooftop water tanks. The first version of the system, in the field today, monitors water temperature and outside temperature. The plug and play system includes the remote hardware, a web Dashboard for managing sensors, and Android/Apple mobile apps. All hardware and software is developed in-house.

The hardware was created with broader applications anticipated. The next product variant for water tank applications will add tank level (submersible pressure sensor) and flow measurement capability. The full array of options is listed here:

Options				Dash Code
Non-Rechargeable Battery				BATPRI
Rechargeable Battery				BATSEC
Ext Power Input (+5V to +12V)				EXTPWR
Ext 10K Thermistor (Temp Sensor)				THERM
Ext 1 Wire Digital Thermometer				DS18B20
Ext Leak Sensor				LEAK
Ext Level Sensor				LEV
Ext Flow Meter				FLOW
Ext Switch #1 (NO/NC)				SW1
Ext Switch #2 (NO/NC)				SW2
Accelerometer				AC
Environmental Sensor (Temp/Humid/Air Pressure/IAQ))				ES
GNSS				GNSS
Wireless - CAT M Cell				CATM
Wireless - LoRa				LORA
Wireless - 900 MHz				900M
Wireless - BLE 2.4 GHz				BLE
USB UART Active				USB

The urban tank monitor system uses LTE CAT-M cellular connectivity running on the AT&T network. This protocol is optimized for low power, greater range, and improved indoor penetration compared to previous generation cell options.

The hardware can also be configured to use LoRa for wireless communications. LoRa, an acronym for Long Range, is another newer wireless protocol that has gained significant traction as an industry standard for sensor applications. LoRa can be implemented as a private network, or where available, can be run on a public network (e.g. Senet). LoRa is well matched to sensor and control applications with low data rates and where transmissions are no more frequent than a couple minutes apart.

LoRa systems are set up as a star network with a multitude of remote sensors connected to each LoRa WAN gateway. For a private network, IoTini can provide LoRa WAN gateways configured with a LoRa WAN network server. Each LoRa WAN gateway requires an internet connection (Ethernet) for backhaul to the cloud but one gateway can cover a several mile radius.

If a public LoRa network is used then the LoRa WAN gateway is not needed. Sensors are deployed and pointed to the network provider's system.



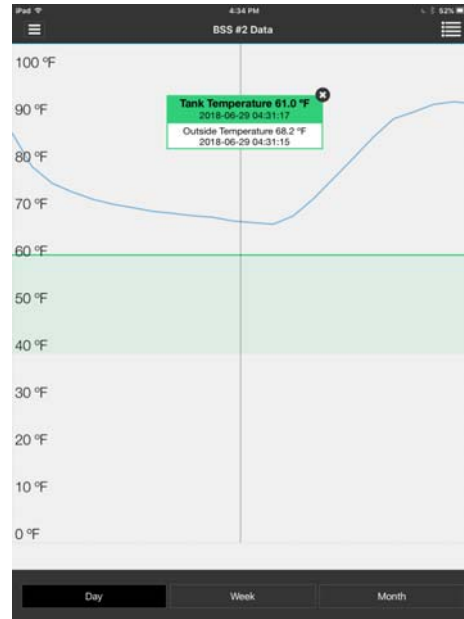
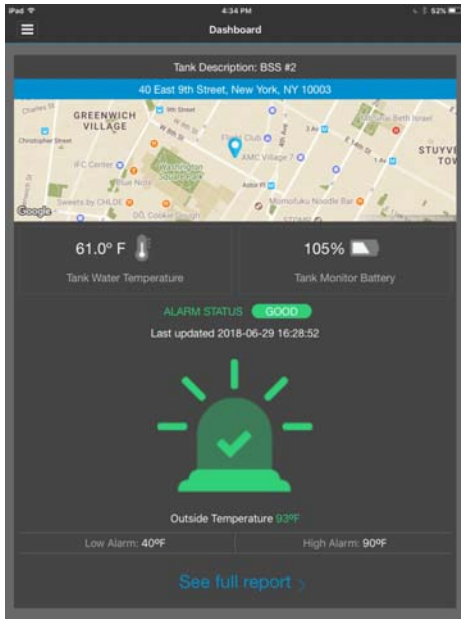
Basic Water Tank Monitor Hardware

The urban water tank monitoring system was designed to take measurements every hour and reports every four hours. Great effort went into optimizing the sleep current so the battery can last about five years. For other applications, an important first step is to create a power budget that is based on the sensors used and the measurement and reporting frequency. Then the power source can be specified. Most applications would include an internal rechargeable battery that can be connected to a solar panel or directly to a power source in the +5VDC to +12VDC range.

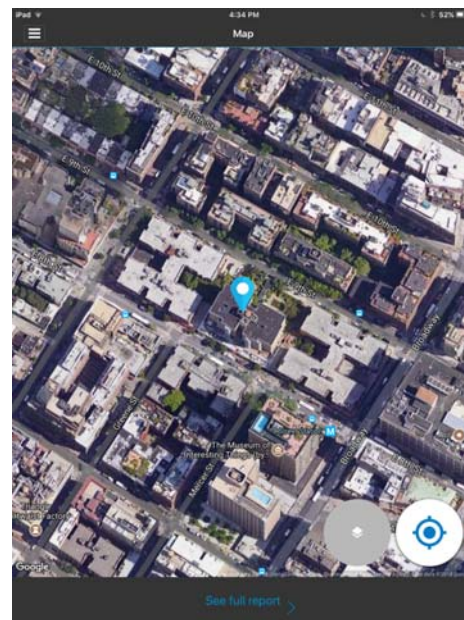
The hardware is important but even more important is the data and alerting the user about problems. Here, if the system wakes to make a measurement and the water temperature is below 40 deg. F or above 90 deg. F it will immediately report an alarm condition. The user will get a text message and an email with an alert and the alarm will be noted on the web Dashboard and on the mobile app. The system will automatically send subsequent alarms using a backoff approach until the alarm condition is corrected. In other words the first alarm is immediate, and then a next alarm is one hour later, then one day, then one week.

The system is also bidirectional and can be customized for specific applications. The foundation for manual control is built into the Dashboard today. Here the user can, for example, remotely control a switch (e.g. a pump) using a RIB relay tied into the BSS-1000.

All data is recorded. Here are examples of data display on the mobile app. And data can be downloaded in a format that can be brought into a spreadsheet for analysis. The urban water tank monitoring system logs a year's worth of data that is required by building Inspectors.



Tank Temperature	Outside Temperature
61.0°F	93.1°F
2018-06-29 16:28:52	2018-06-29 16:28:50
61.0°F	93.5°F
2018-06-29 15:29:06	2018-06-29 15:29:03
61.0°F	93.0°F
2018-06-29 14:29:18	2018-06-29 14:29:16
61.0°F	91.3°F
2018-06-29 13:29:31	2018-06-29 13:29:29
61.0°F	89.9°F
2018-06-29 12:29:43	2018-06-29 12:29:41
61.0°F	86.0°F
2018-06-29 11:29:56	2018-06-29 11:29:54
61.0°F	81.6°F
2018-06-29 10:30:08	2018-06-29 10:30:06
61.0°F	77.2°F
2018-06-29 09:30:20	2018-06-29 09:30:18
61.0°F	72.9°F
2018-06-29 08:30:31	2018-06-29 08:30:30
61.0°F	69.3°F
2018-06-29 07:30:43	2018-06-29 07:30:41
61.0°F	67.5°F
2018-06-29 06:30:54	2018-06-29 06:30:52
61.0°F	67.9°F
2018-06-29 05:31:06	2018-06-29 05:31:04
61.0°F	68.2°F
2018-06-29 04:31:17	2018-06-29 04:31:15
61.0°F	69.0°F
2018-06-29 03:31:28	2018-06-29 03:31:26
61.0°F	69.3°F
2018-06-29 02:31:39	2018-06-29 02:31:37
61.0°F	69.8°F
2018-06-29 01:31:50	2018-06-29 01:31:49
61.0°F	70.3°F
2018-06-29 00:32:02	2018-06-29 00:32:00
61.0°F	71.1°F
2018-06-28 23:32:13	2018-06-28 23:32:12
61.0°F	71.9°F
2018-06-28 22:32:24	2018-06-28 22:32:23



Mobile App Screen Shots

Dashboard

Units Location

Map Satellite

United States

Last 10 Alarms

Alarm	Unit	Type	Created At
Alarm 508	10000072	Thermistor not connected	2018-11-15 19:24:05 UTC
Alarm 902	10000079	Sensor not connected	2018-11-08 17:45:06 UTC
Alarm 502	10000031	Sensor not connected	2018-11-06 17:45:06 UTC
Alarm 501	10000068	Sensor not connected	2018-10-22 22:52:05 UTC
Alarm 500	10000065	Sensor not connected	2018-10-22 22:29:04 UTC
Alarm 498	10000057	Sensor not connected	2018-10-18 01:29:09 UTC
Alarm 408	10000057	Tank temperature high	2018-10-15 00:29:16 UTC
Alarm 687	10000057	Thermistor not connected	2018-10-19 00:29:14 UTC

Units

Tank Description	Tank Temperature	External Temperature	Battery Level	Hardware ID	Company	Status	Last Data Update	
A10000041	73.15	71.82	104	10000041		Live	2018-11-15T17:10:26.408Z	View Edit Delete
866 Third Ave SOUTH	60.21	48.6	101	10000043		Live	2018-11-15T14:04:54.956Z	View Edit Delete
440 West 57th Street	55.42	46	97	10000044		Live	2018-11-15T16:35:48.370Z	View Edit Delete
32 Gramercy Park South	57.31	47.61	103	10000040		Live	2018-11-15T15:02:41.764Z	View Edit Delete
307 Seventh Ave SPRINKLER S	53.87	43.29	98	10000042		Live	2018-11-15T15:30:57.832Z	View Edit Delete
307 Seventh Ave SPRINKLER N	60.44	47.79	102	10000064		Live	2018-11-15T17:00:33.490Z	View Edit Delete
10000071	71.28	66.81	101	10000071	IoTmTest	Live	2018-11-15T05:32:40.079Z	View Edit Delete
10000070	65.34	51.24	97	10000070	IoTmTest	Live	2018-11-15T17:19:11.535Z	View Edit Delete
10000066	70.3	70.93	105	10000066	IoTmTest	Live	2018-10-21T22:52:06.211Z	View Edit Delete
10000065	70.18	70.07	99	10000065	IoTmTest	Live	2018-10-21T22:22:30.853Z	View Edit Delete

Previous 1 2 3 4 Next

Create new unit

10000070

IMEI: 352753090922103

Hardware ID: 10000070

Temperature: 66.11°F

External Temperature: 53.64°F

Address: 930 Rincon Circle

City: San Jose

State: CA

Zip Code: 95131

GPS: 37.3964843, -121.9096668

Battery: 96%

Last Update: 2018-11-15 18:39:32 UTC

Firmware Version: 83

Installer: SS

Installation Date: 2018-11-15

Status: Live

[Back to All Units](#)
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Remote Control (e.g. pump on/off)

Download Report

Over the Air Firmware Update

New Command

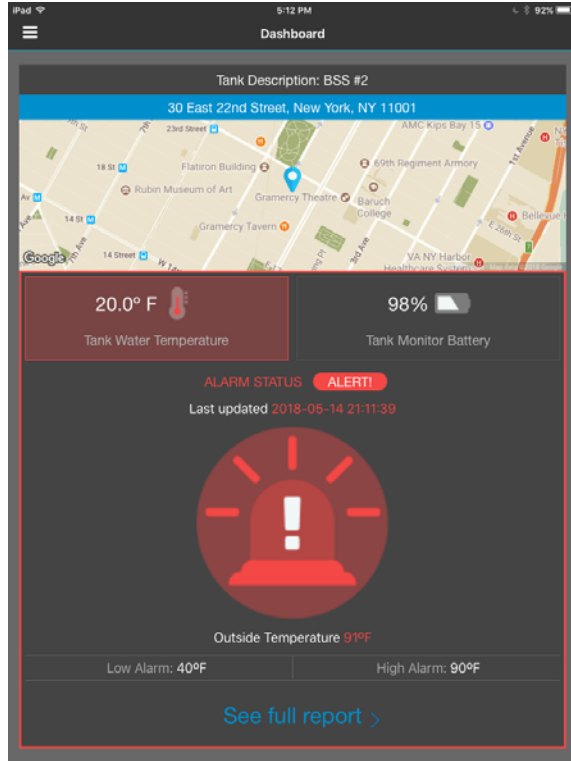
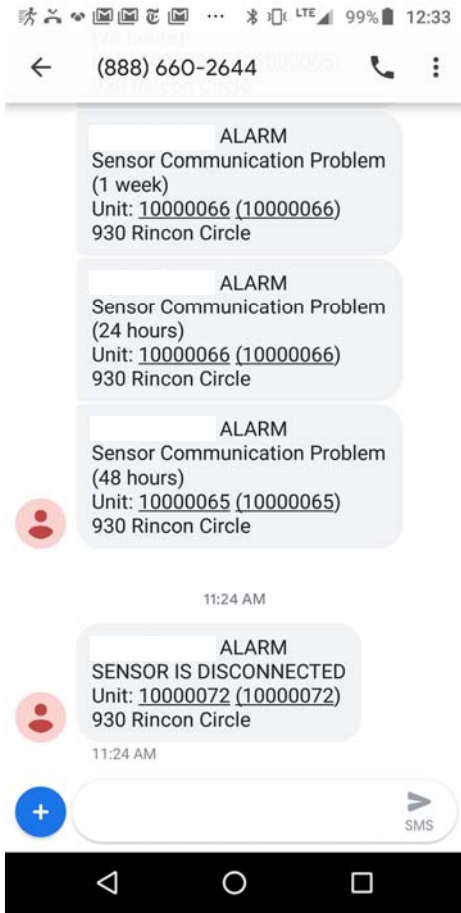
Unit: 10000070

Command: Switch Off

[Queue Command](#)

Command	Created at

Web Dashboard Screen Shots



Alarm Conditions

BSS-1000 – MONITORING SYSTEM

Ruggedized, Long Battery Life, Wireless

The new BSS-1000 is a multifunctional sensor/detector/controller gateway with optimized long battery life and low-power wireless options.

The BSS-1000 is easy to install. No external cords or wires. No dependencies on facilities infrastructure.

- Simplified single mount
- Long battery life
- Long range wireless options
- Remote sensor and control options
- External analog I/O options
- External BLE/ZigBee satellite options

IAQ/TVOC
Air Pressure
CO2
Temperature
Humidity
Location



Analog x3
4-20; 0-10 x3

Analog Inputs
(optional)



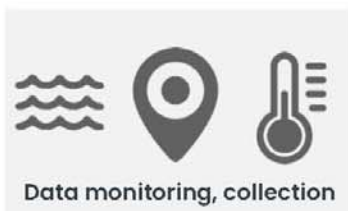
Remote BLE
Sensors (optional)

Why IoTini?

- End-to-End System including dashboard and smartphone App.
- Battery Optimized for continuous remote operation.
- Text and email alarm notification to ensure actions.
- Configurable Modules to meet customer specific requirements.
- Easily customized to unique requirements.

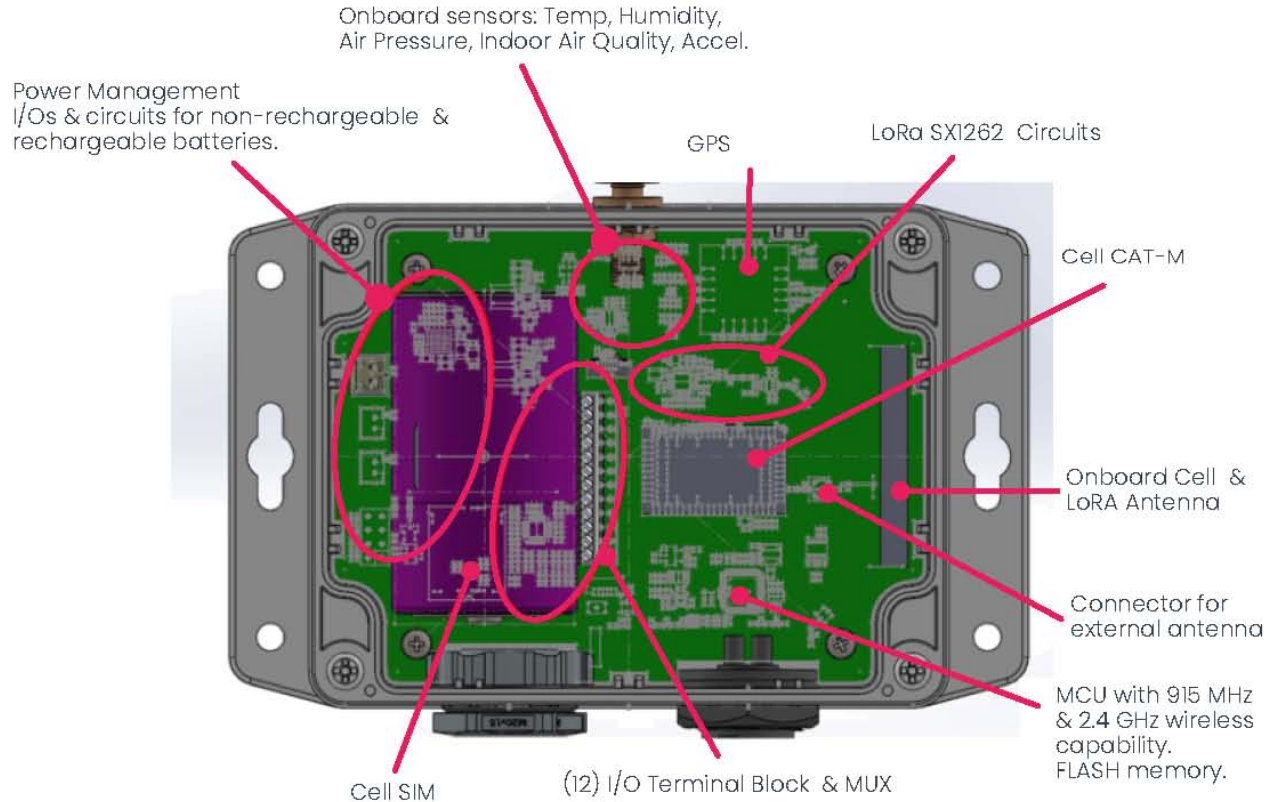


The IoTini remote monitoring system



www.iotini.com • +1 408 373 6624 • info@iotini.com

BSS-1000 – MONITORING SYSTEM



On-board Monitoring

- Power management.
- Humidity
- Air Pressure
- TVOC (ISO 16000-29 compliant)
- IAQ* measure from 1-500
- GPS**

Analog Inputs (optional)

- 6 2 wire Analog inputs to measure external elements.
- 0-10 VDC, 4-20 mA
- Optional digital inputs.

Remote Controls (optional)

- LV Relays
- Swithes

* The BSS-1000 uses the Bosch BME680 Sensor.

Wireless

- LTE-M (Cat-M)
- AT&T, Verizon
- LoRA (private, public)
- Integrated onboard antenna.
- External SMA antenna optional.

Power

- Lithium 19Ah max battery. Estimated battery life: 2-3 yrs, (depends on duty cycle).
- Optional battery sizes.
- Optional USB power (+5, +12v inputs)

Enclosure

- 3.5 x 4.5 x 2.2 in
- 13 oz.
- Heavy duty, polycarbonate.
- Durable, impact resistant.
- Silicone rubber gasket.

Mounting Options

- 4 corner mounting screws, or 2 slotted wings installations.
- Weatherized for indoor, outdoor locations.



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Coming Soon
Flow + Temperature + Level