blues wireless

# IoT in Water Management with Smart Water Quality Monitors

"With sufficient data, public and private organizations will be empowered with the information needed for the preservation and conservation of our natural waterways."

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**Instructions on** Hackster

As the global population increases, increased consumption and industrial activity affect the world's water resources. Widespread degradation of water quality across the world is the most serious water problem. Water scarcity due to water quality degradation presents major challenges in providing enough resources to meet social, environmental, and economic needs. Technology-driven solutions for water management can help protect and detect polluted water resources, improve water quality, and make water usage more efficient. Short-term resource allocation and long-term planning can be directly impacted by leveraging IoT data derived from advanced water sensor devices that measure changes in water quality.

When building IoT device PoCs or prototypes it's best to use a Blues Wireless Notecard System on a Module because it is the quickest and most affordable way to add connectivity. With Blues Wireless you can go from unboxing the hardware, to sending arbitrary data over the global cellular network in less than 30 minutes.

## Population Growth and Water Pollution


Water pollution is becoming one of the greatest threats to freshwater availability and re-use. Contaminants from industrialization and population growth can increase concentrations of metals and chemicals, suspended sediment, and temperature, and decrease dissolved oxygen in water. Each of these have a negative impact on the aquatic ecosystem and makes water unsuitable for our needs.

Our local waterways can be polluted by a number of human activities including:



- Waste treatment facilities
- Rainwater runoff in urban areas
- Nitrates from fertilizers used in agriculture

Poor water quality not only negatively affects human health and ecosystems, but it makes water unfit for different uses and purposes, thereby reducing resource availability. By 2050, 52% of the world's population will live in water-stressed regions. UN-Water coordinates the efforts of United Nations entities and international organizations working to protect water resources from pollution, enhance and restore water quality, conserve water, and use water efficiently. More than 30 UN organizations have water and sanitation programs, reinforcing the fact that water issues are a global concern that require urgent attention.

## Water Quality Management with the IoT

If managed sustainably and effectively, the planet's freshwater resources can meet our increasing demands. Testing water quality has traditionally required chemicals, testing strips and equipment. This method requires technically trained personnel to go into the field, gather samples and process them through a lab. It is time consuming, costly, and can yield inaccurate results when testing for certain elements like fluoride. Portable field testing has become more popular but isn't always available. For elements like arsenic, commercial testing kits are complex and require several steps.

IoT sensors can measure the most relevant levels related to water quality control such as:

- dissolved oxygen
- oxidation-reduction potential
- pH
- turbidity
- total dissolved solids

IoT devices present us with the bigger picture by aggregating data and presenting it in an actionable format. IoT can be applied to tank filling levels, controlling the quality of water used in manufacturing processes, and detecting leaks. Researchers, municipalities, farmers, and manufacturers can use IoT technology to improve water management processes:

- **Maintain Water Quality** - City pools, lakes, ponds, and streams can all be monitored to better understand the impact of usage and potential contaminants.
- **Improve Sustainability** - Promote sustainable use of resources by reporting on water and utility usage, identify trends, and compare data over time.

# Building a Smart Water Quality Monitor

Monitoring water quality with an IoT device requires an array of smart sensors capable of measuring everything from pH to turbidity. With multiple sensors recording and reporting data, efficient power management and clean data visualization become critical considerations.

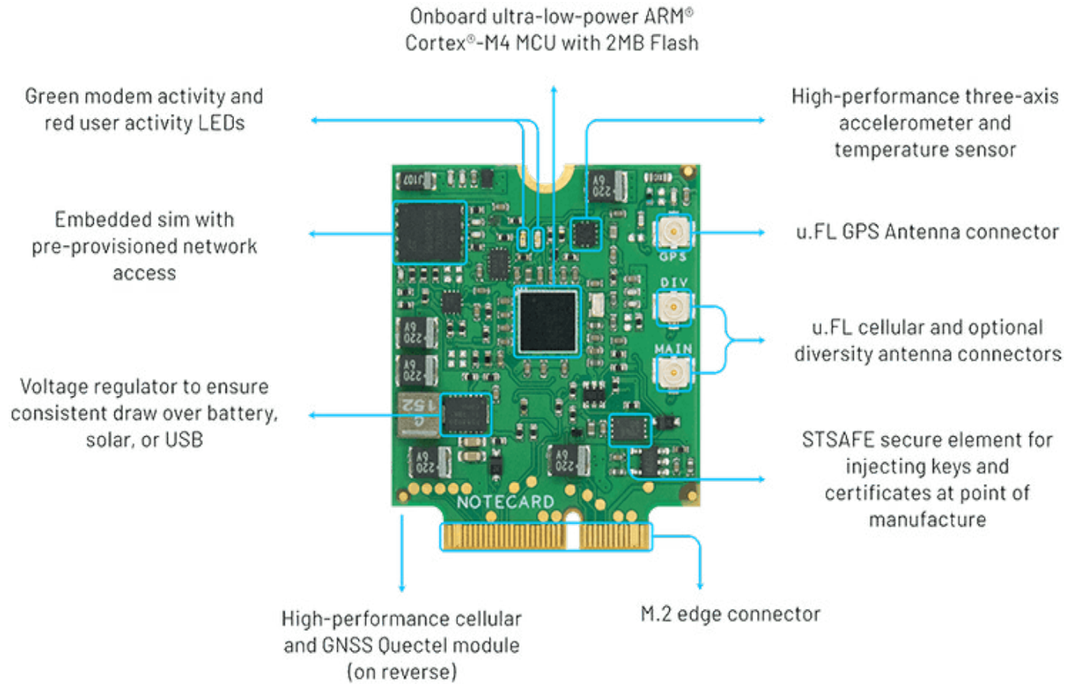
By using Blues Wireless, your data can be pumped to any cloud app with lightweight, intermittent connectivity that makes battery usage extremely efficient. Blues Wireless provides edge-to-cloud IoT infrastructure, with hardware, firmware, and cloud communication components to route to an external service for creating robust reporting and data visualization dashboards:

- **Notecard:** A tiny 30mm x 35mm System on a Module (SoM), the LTE Cat-M Notecard, North America is a cellular and GPS-enabled device-to-cloud secure data-pump that comes with 500 MB of data and 10 years of cellular for only $49. Other options are available to suit your project needs.
- **Notecarrier:** To make integration in an existing project easier, Blues Wireless provides host boards called Notecarriers. For this project, use the Notecarrier-A (or Notecarrier-F, coming soon).
- **Notehub.io:** On the cloud side, the Notecard ships preconfigured to communicate with Notehub, a thin cloud layer that enables secure bidirectional data flow. Notecards are assigned to a project in Notehub, which can route data from these projects to your cloud of choice or integrate into a data visualization platform like Ubidots.

Sometimes you have devices that need to be retrofitted with connectivity hardware. The Blues Wireless Notecard and Notecarrier can be embedded into existing hardware and microprocessors like the EnviroDIY Mayfly Data Logger. Simply connect the Notecard to your devices existing UART or I2C bus, and it will connect your device to the cellular network automatically, ready to transmit and receive data from its associated Notehub account.

You can find the complete project assembly instructions on Hackster and the full source code on GitHub.






**Hackster:** https://www.hackster.io/zachary_fields/earth-day-2021-stream-research-55a49b

**GitHub:** https://github.com/zfields/StreamResearch

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| Cost: $500<br>Lines Of Code: 250<br>Project Time: 12 Hours | Languages:<br>• C++ |

## Hardware

- Adafruit HUZZAH32 – ESP32 Feather Board
- Blues Wireless Notecarrier-A
- Blues Wireless Notecard (Cellular)
- Atlas Scientific Gravity™ Analog pH Sensor Kit
- Atlas Scientific Gravity™ Analog ORP Sensor Kit

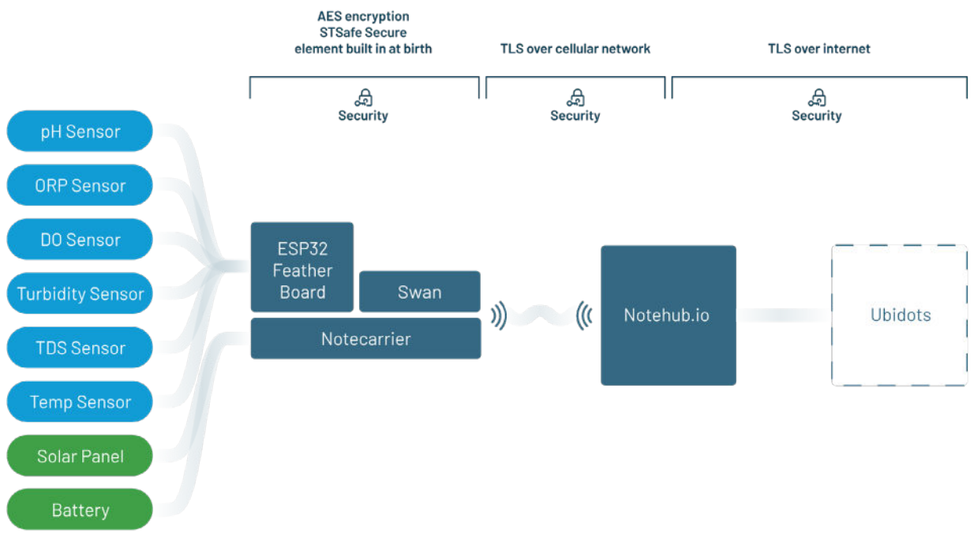
- Atlas Scientific Gravity™ Analog DO Sensor Kit
- DFRobot Analog Turbidity Sensor (SEN0189)
- DFRobot Analog TDS Sensor (SEN0244)
- DFRobot Waterproof DS18B20 Sensor Kit
- DFRobot Semi Flexible Monocrystalline Solar Panel (5V 1A)
- Adafruit FeatherWing Proto
- Rechargeable Battery, 3.7 V
- TRRS Male Plug
- Panel Mount TRRS Jack
- Grommet Kit, 100 Pcs

## Software apps and online services

- Blues Wireless Notehub.io
- Ubidots
- Arduino IDE

## The main parts of the project are:

1. Assemble the hardware.
2. Secure hardware in waterproof container.
3. Build data visualization dashboard.



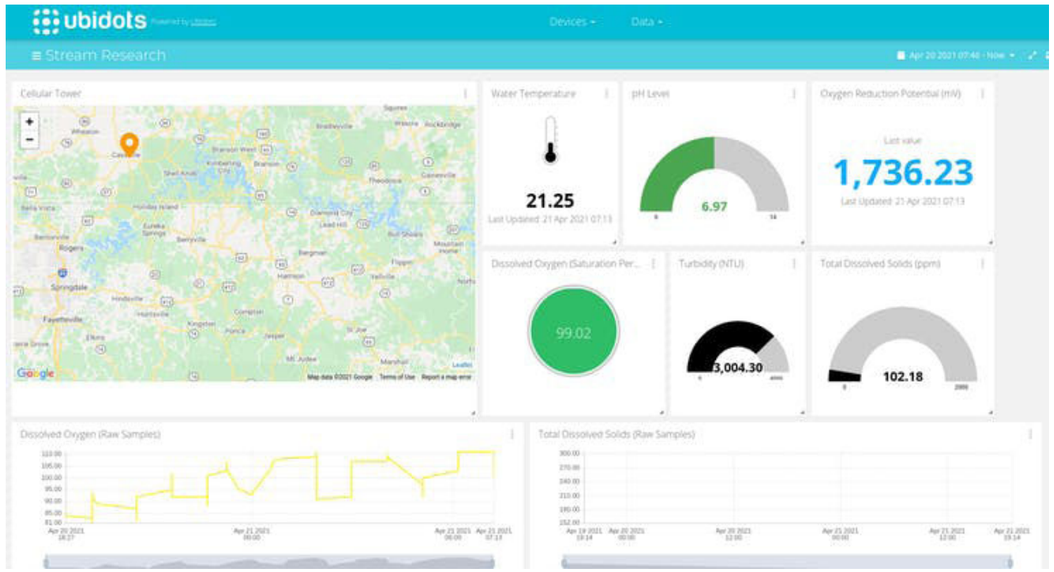



# Data Visualization for IoT Water Quality Monitors

As more organizations implement the Internet of Things in water management processes, key data points derived from device sensors will provide insights to improve water quality and efficient systems. It's hard to lead science-driven conversations without being able to represent data in a relatable and meaningful way. Dashboards are incredibly effective at sharing several related data points and giving a holistic view of the data. For this project you will use Ubidots, and it will take approximately 30-40 minutes to complete the setup.

The initial steps will be to complete the Sensor Tutorial to capture sensor data, save it in a Notefile and send data through the Notecard to Notehub; or, create your own app with sensor data. After that is ready the highest-level steps to creating the Ubidots dashboard are:

- Create a route in Notehub.io.
- Use JSONata to transform JSON.
- Route to Ubidots (this could be exchanged for another external service).
- Build data visualizations in Ubidots.
- Graphical user interface, application
- Description automatically generated




By simply declaring an Ubidots "device" (end-point), you can target Ubidots from your Notehub.io project's route, and direct the sensor readings to flow into Ubidots. Once sensor readings are in your Ubidots device, it becomes trivial to arrange them into a dashboard. Follow the Blues Wireless

Ubidots Guide for the complete steps on connecting to Ubidots from your Notehub.io route. In order to complete this guide, you'll need the following:

- A Notehub project with at least one Notecard sending sensor-reading Notes at regular intervals.
- An account with the external service you plan to use to complete this tutorial.

## Applications of This Project

Water sustainability is becoming a global priority as the world's population increases. Edge computing will improve accuracy and efficiency in the measurement of pollutants, usage, and waste. Through increased data visibility, organizations will be better equipped to protect the world's freshwater resources and reduce impacts on human well-being and the natural environment.

When working to incorporate sophisticated systems in natural waterways, urban infrastructure and utilities, or agricultural settings, one must consider how this collected data is reliably and securely delivered to the cloud. It only makes sense to use a cellular IoT solution using the Blues Wireless Notecard.

In addition to monitoring water quality, potential applications of smart systems in water management includes solutions for:

- Fish farming
- Smart farming irrigation
- Prevention of chemical wastewater pollution
- Aquarium management
- Chemical leak prevention
- Flood prevention
- Drought management
- Water control after natural disasters and emergencies
- Tank and storage monitoring

## Ready to Discuss Your Project with Us?

Blues Wireless makes it easy to make connected devices. In the article above, you've seen how little effort it takes to build an initial proof-of-concept device that reports sensor data over the cellular network. In some cases, it's best to start with one of our proof-of-concept applications, then swap out sensors or cloud apps until you get what you want. In others, it would be best to take a different tact entirely.

We can help. Schedule a consultation with a Blues Wireless Project Expert to discuss your project idea with you and help you find the shortest path to a proof-of-concept device to get your product or device connected to your cloud.