GatorByte – A Low-Cost, Real-time Water Resource Monitoring Buoy

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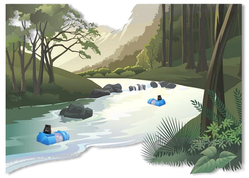
Introduction

Commercially available water-quality monitoring systems are often cost-prohibitive for water resource professionals. The goal of this open-source project is to develop a low-cost, compact, robust, and mobile water-quality datalogging platform for short or long-term deployments in water bodies.



What is GatorByte?

GatorByte is a **low-cost mobile** water-quality monitoring and assessment platform with capability to **geo-tag** measurements and report in **real-time** actionable & accessible information in a time-effective manner.

Primary Goal

Develop **a low-cost, real-time, high-resolution** water resource monitoring and assessment tool to capture **temporal and spatial variations** in parameters using widely available, off-the-shelf or fabricated components.

Objectives

Specific research objectives are:

- Develop a **prototype** buoy
- Design 3D enclosure **CAD model** and **circuit board layout**
- Develop real-time web-based **visualization tools.**
- Develop **early detection algorithms** for water-quality issues/anomalies.
- Develop algorithms to locate source of pollution using the geo-temporal data.
- Add H/W and S/W compatibility for **more sensors and electronics modules.**
- **Open-source** project

Salient Features

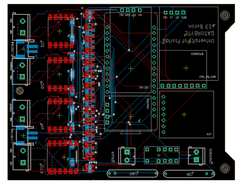
Commercially available alternatives are few to choose from, **expensive**, **large**, and have **proprietary hardware and software.**

In contrast, the proposed platform is/has:

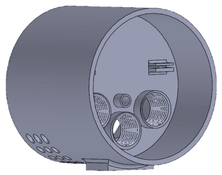
- **Open-source** hardware and software
- Built using **inexpensive** components
- **Compact** design (8 in. X 3 in. ø)
- **Customizable** 3D printed housing
- **Modular** design and **expandable** sensors support
- **Transferable** to other monitoring or investigation applications

Hardware Components and Housing

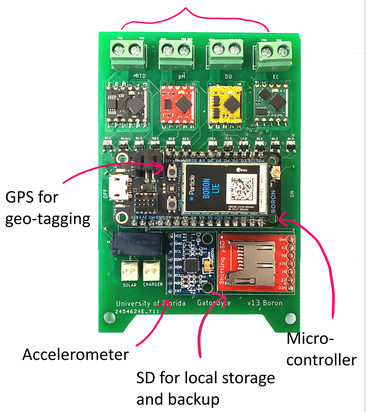
- Buoy and station configurations
- Cellular communication
- pH, Dissolved Oxygen, Temp., Conductivity
- On-board data logger
- Web server
- GPS for location tracking



a. Open-source PCB design



b. Open-source CAD design



c. GatorByte PCB

d. Assembled housing

Figure 1 GatorByte's **small form-factor**, **open-source** and **inexpensive** 3D CAD and circuit designs, and on-board electronic components.

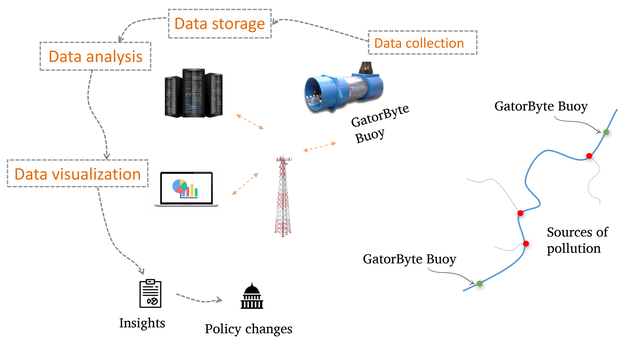
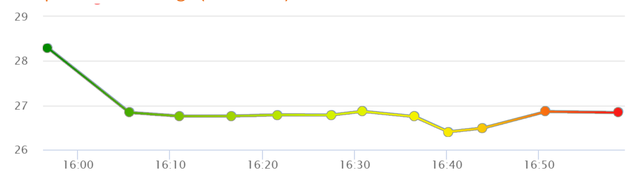


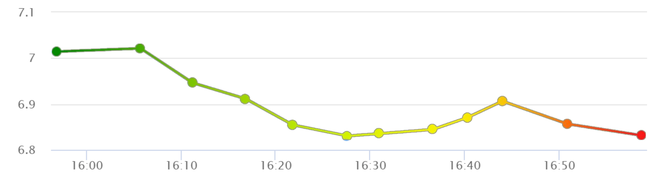
Figure 2 GatorByte platform designed to enable quick short-term mitigative actions and help with long-term policymaking.

Results

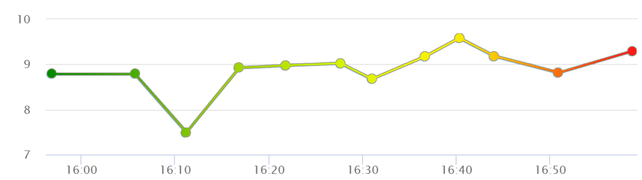
Temperature readings (in Celsius)



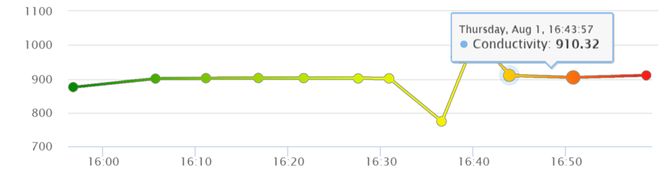
pH readings



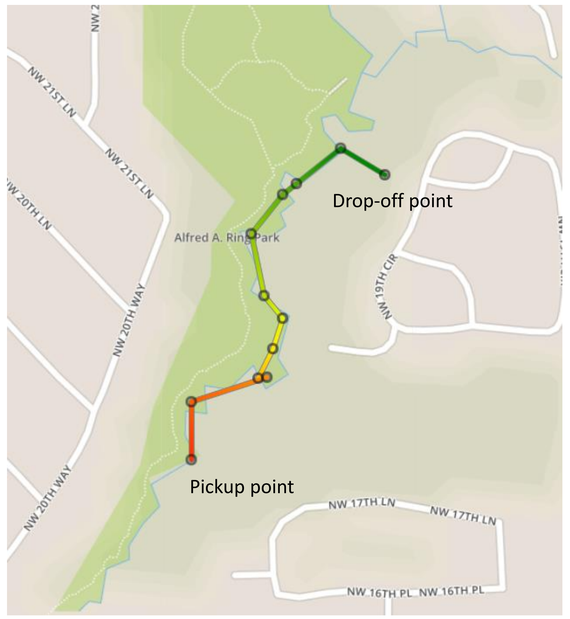
Dissolved oxygen readings (mg/l)



Electro-conductivity readings (uS/cm)



Spatial map



Figures 3 A prototype **web-application** that visualizes **the temporal and spatial** dimensions of the **water-quality data** collected during **a float survey.** The tools allow visualizing the geo-temporal water-quality data side-by-side to help users **better understand the relationship between a location and the variation of water-quality data.**

Future Work

Early 2020

- Survey urban storm water systems.
- Make the hardware and software design modular.
- Make a swarm of GatorByte buoys and stations
- Survey more urban storm water systems.

Mid 2020

- Data processing and analysis.
- Add support for various brands of components and sensors.

Early 2021

- Develop map-based visualization applications
- Make software and hardware designs open-source

Expected results

Early 2020

- Data collection and system testing
- New sensors and modules can be added very easily.
- Improve temporal and spatial resolution of data

Mid 2020

- Parameter selection and optimization
- Hardware and software design modifications to allow adding more components easily

Early 2021

- Show data variation & allow users to derive insights
- Enable other researchers to collaborate on the project, improve the system, or tailor the system for other monitoring applications.

Acknowledgments

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References

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[2] Patricia A. Beddows, and Edward K. Mallon (2018), Cave Pearl Data Logger: A Flexible Arduino-Based Logging Platform for Long-Term Monitoring in Harsh Environments

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