AUTONOMOUS AQUATIC SENSOR PLATFORM

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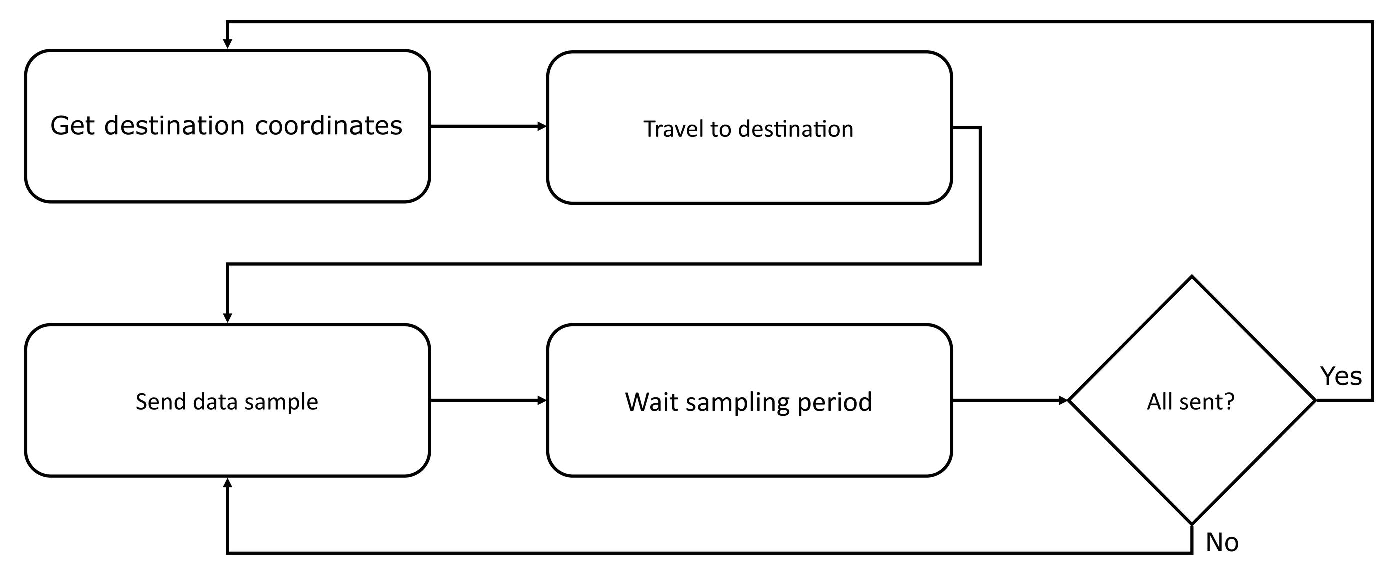
Objective

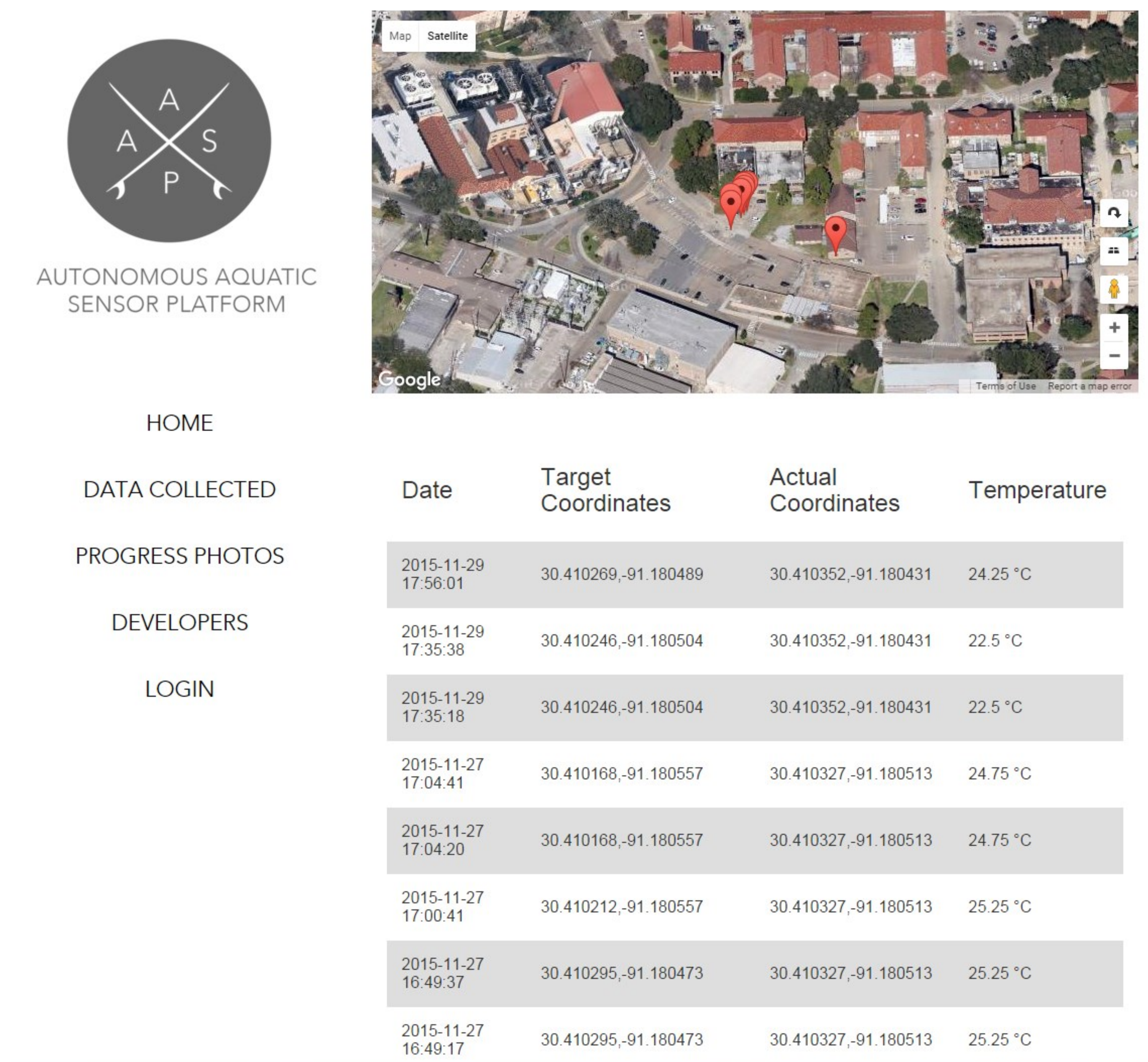
The sensor platform is a surfboard equipped with a battery powered motor, 3G transmission system, and a temperature sensor. It is integrated with a website that allows for user input that can change the destination of the device, causing it to move. After it gets within 20m of its destination it collects the temperature data and sends it to the website to be stored in an SQL database.

For practical use in autonomous data collection from still bodies of water. Allowing multiple readings from different locations for an extended period of time. In this way the prototype would function as an easy-to-use sensor platform. While the prototype only has a temperature sensor it can be modified to include other sensors to monitor nutrient levels in still bodies of water, such as a methane sensor to measure fertilizer run off.

Behavioral Diagram

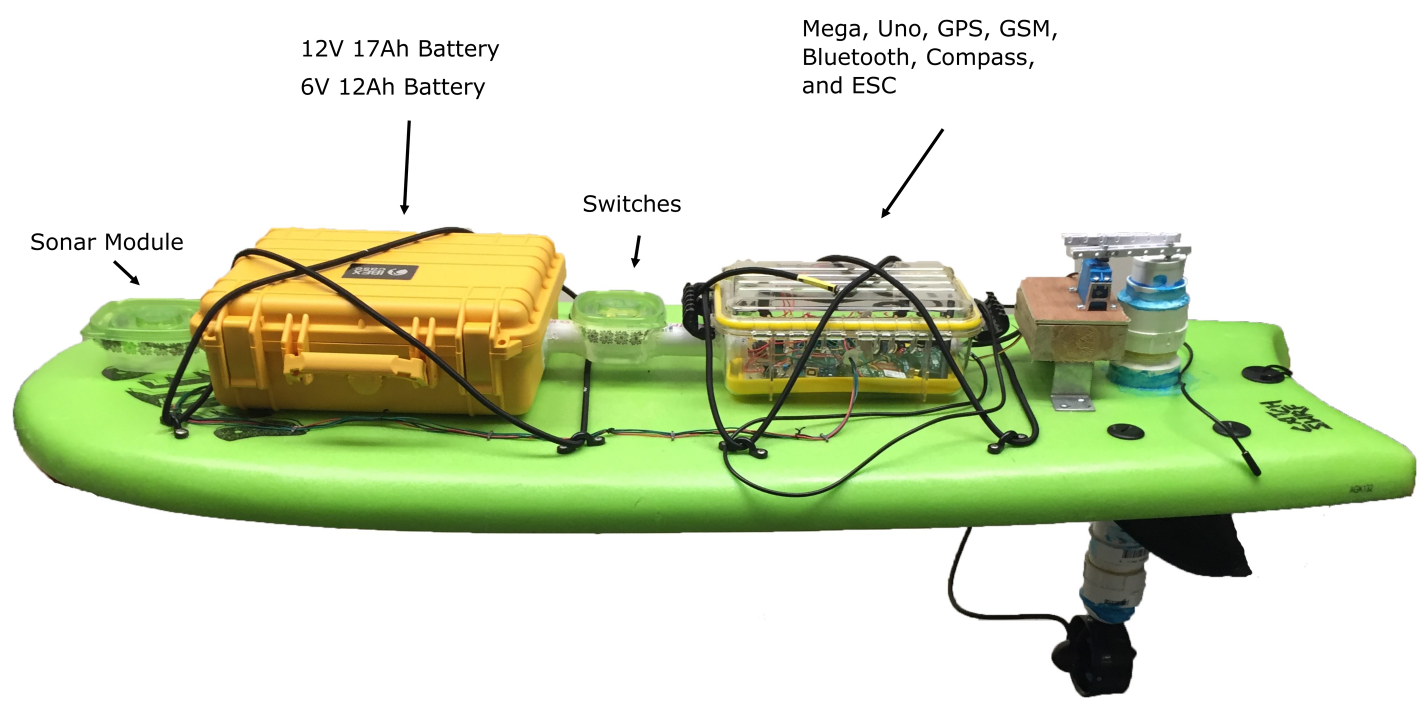


Website Interface



Requirements

Ideal Specifications	Actual Specifications
< \$500	≤ \$800
Temperature should be accurately recorded	± 0.5 °C
Deployable for a month	Requires regular maintenance.
Support an hourly sampling period	Supports any sampling period.
Operable in a rainstorm	Device is waterproof, not weatherproof.
Battery should be chargeable in one day	Has no on board charger.
Device can move at a constant speed for	Over ten hours at low speeds, at least
Device should be able to navigate to within 20 feet.	Device navigates at most within 20m.



Results

- Tested the device by moving it on land in the appropriate direction based on the servo's angle and it showed that all parts of the design were working: the angles were able to direct the device to the destination and the device communicated with the website. The sonar module has been integrated since our test and was able to detect an object in front of our device, sending the notice to the Bluetooth app.
- The tolerance for arriving at the destination was set to 20m and the device arrived within that range in all cases, with an average distance away of 13.32 ± 4.460695 meters and a maximum of 18.2 meters.

Trial	Ideal Lat.	Ideal Long.	Actual Lat.	Actual Long.	Difference (m)
1	30.410269	-91.180489	30.410352	-91.180431	10.77578455
2	30.410246	-91.180504	30.410352	-91.180431	13.70905063
3	30.410246	-91.180504	30.410352	-91.180431	13.70905063
4	30.410168	-91.180557	30.410327	-91.180513	18.17681148
5	30.410168	-91.180557	30.410327	-91.180513	18.17681148
6	30.410212	-91.180557	30.410327	-91.180513	13.46579541
7	30.410295	-91.180473	30.410327	-91.180513	5.232197914

- In **conclusion**, the project was a moderate success. Greater destination accuracy could be achieved with the current setup by lowering the distance tolerance, though this has not been tested. The sonar module could be incorporated more into the pathing to allow for evasive maneuvers with the possible addition of additional sensors. The Bluetooth functionality could be increased to allow for the user to override the destination coordinates.

How It Moves

- The Mega gets the current heading from the magnetic compass.
- Computes an angle to move the servo to from the heading and the current and destination coordinates.
- This angle data is sent to the Uno via I2C.
- The Uno then moves the servo and powers the thruster to move the device.

Design

- Powered off of 12V 17.2 Ah and 6V 12Ah batteries.
- Arduino Mega interfaced with a magnetic compass, temperature sensor, 3G, GPS, sonar, and Bluetooth modules.
- Arduino Uno interfaced with waterproof servo, ESC, and the Mega.
- Power distributed to controllers and 3G module through buck converters.
- Servo powered directly by the 6V battery.
- Receives destination coordinates from a website.
- Sends data to website and stores it in an SQL database.
- Interacts with an iPhone app via Bluetooth and informs the user on the status of the GPS, GSM, Temperature, and Compass modules.
- Informs user of imminent collision when object comes within 200cm of the sonar module through the Bluetooth app.

How it Communicates

- The Mega communicates with the website by sending HTTP POST requests.
- It periodically sends requests to the website for new destination coordinates.
- Upon arriving at the destination, it sends the current coordinates, the destination coordinates it received, and the temperature data.
- This data is then inserted into an SQL database using PHP on the website. Each sample is supplied a date and time by the webserver.