Harmful Algal Bloom Challenge

Introduction & Requirements

Introduction

What are Harmful Algal Blooms (HABs)?

Algae are natural components of marine and fresh water flora performing many roles that are vital for the health of ecosystems. However, excessive growth of algae becomes a nuisance to users of water bodies for recreation activities and to drinking water providers. Excessively dense algal growth could alter the quantity and quality of light in the water column. Some types of algae may also cause harm through the release of toxins. When conditions like light availability, warm weather, low turbulence and high nutrient levels are favorable, algae can rapidly multiply causing "blooms." When blooms (or dense surface scums) are formed, the risk of toxin contamination of surface waters increases especially for some species of algae with the ability to produce toxins and other noxious chemicals. These are known as harmful algal blooms (HABs). They are often found in marine and fresh-water ecosystems.

To learn more: http://www2.epa.gov/nutrient-policy-data/cyanobacterial-harmful-algal-blooms-cyanohabs

What is EPA's role in monitoring HABs?

Regulation

Currently there are no U.S. federal guidelines, water quality criteria and standards, or regulations concerning the management of harmful algal blooms in drinking water under the Safe Drinking Water Act (SDWA) or in ambient waters under the Clean Water Act (CWA). There are variations in how states are implementing standards or guidelines as applied to contaminants (i.e. dinoflagellates, diatoms, and cyanobacteria) that are products of HABs in drinking water and recreational water using risk assessment. However, EPA is taking an active role in providing states with technical guidance and supporting research on HABs.

Public Notification

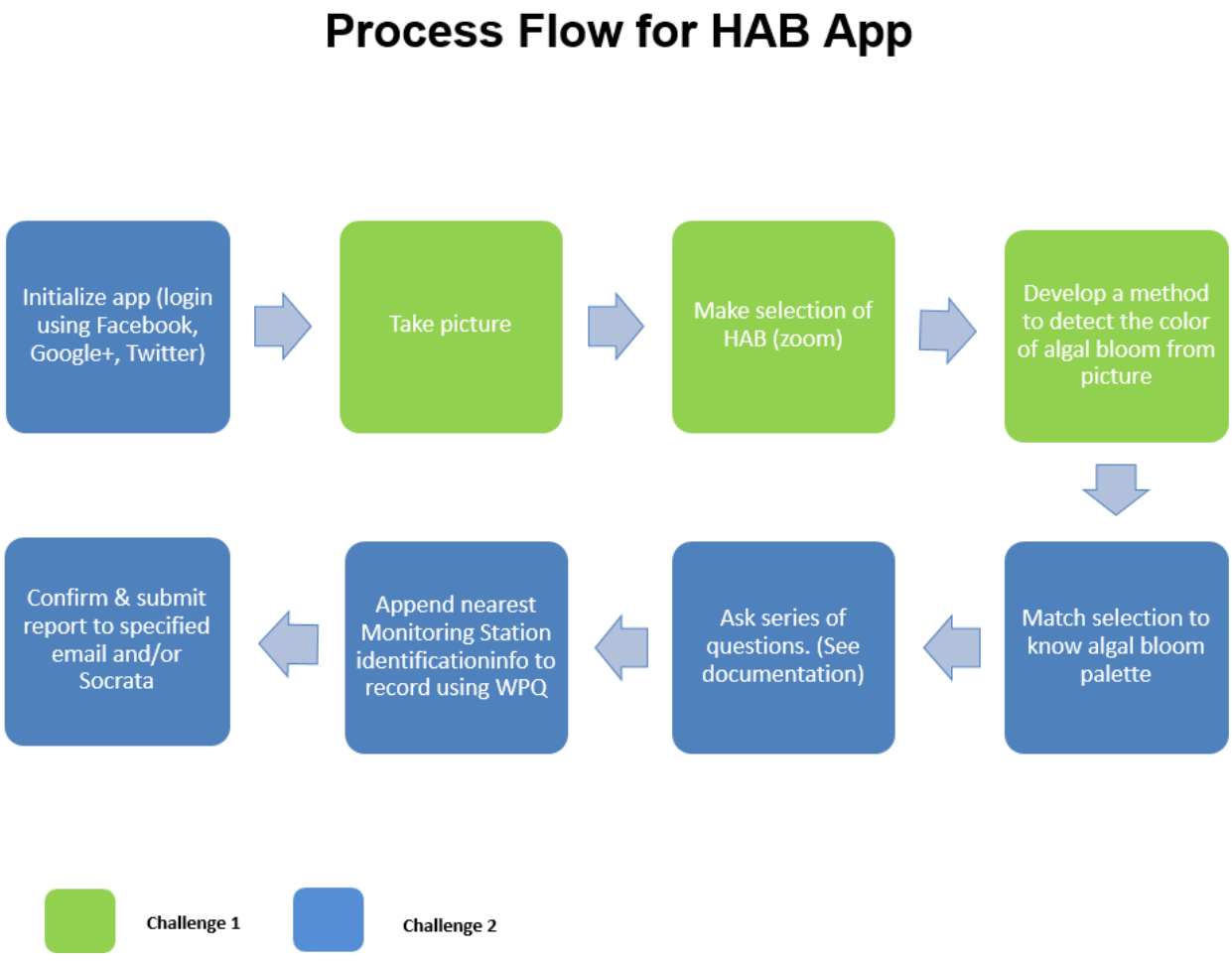
States vary on the values they use as guidelines or thresholds for HAB management actions. Some states will post advisories, alerts, and beach closures based on guidance values published by the World Health Organization (WHO) for Recreational and Drinking Water.

Challenge Requirements

Overview

The challenge is to develop a mobile application that allows users to take a picture of potential HAB observed and submit a report of the sighting. The application should aid the users in describing their observations by asking series of questions (with flexibility to accommodate state specific questions) about the potential HAB and generate information about the location where bloom was sighted (i.e. name of water body, proximity to water treatment facility, etc) using GPS features of users' smart phones.

This challenge will be divided into two (2) parts: Primary and Secondary. The Primary Challenge is designed to be completed within the 24 hours of the Hackathon. Meanwhile, the Secondary Challenge is an extension that could be accomplished over the allowable time period. The diagram below illustrates the process flow that the app should undertake.



Challenge #1

The focus of the Primary Challenge is to develop a color detecting function that could be built into the app. The following describes criteria that color detector should meet in order to satisfy the challenge:

1. Capture image of HAB
2. Automatically draw boundary around the bloom or provide option for users to manually draw boundary of bloom
3. Ask questions:
   - Do you notice any color in the water column?
   - Can you see surface scum (an accumulation at surface) or algae floating near the water surface? Algae floating at the surface and looks like grass clippings, green cottage cheese, or spilled paint.
     - If users answer Yes, they must specify: Has the surface scum impacted recreational use of the water body?
4. Utilize color recognition to match color from captured image to a color library (see below)
5. Make suggestion of bloom color based on match:
   - Ask if suggested color is correct, if not provide dropdown

Color Library: Green, Blue, Red, Rust, Brown, Milky white, Purple, Black

Challenge #2

The following describes criteria and functionalities that the app should meet in order to satisfy the Secondary Challenge:

The mobile app should….

1. Inform users of the personal information accessed or transmitted by the app and how that information is used, stored, secured, disclosed, etc.
2. Have the capability to easily support multiple states. If a state partner is added:
   a. The state partner can upload their own logo.
   b. The state partner can add/remove questions.
   c. The state partner can specify where the data gets sent to (mailbox, api) + Socrata community platform.
3. Provide users with option of logging into app using their social media accounts such as Facebook, Google+, etc. to populate personal information (name, email). Otherwise allow users to manually enter personal information (name, email, title, phone, organization)
4. Inform users that the app requires access to their location
5. Automatically generate a time and date stamp once the image is taken and the report is created

6. Present users with a map that shows the users location and allow users to correct location if GPS is unavailable or location is incorrect
7. Append the following weather condition fields to the submission in the background using the weather.gov API:

    - currrentobservation
        - temp
        - dewp
        - relh
        - winds
        - wind
        - gust
        - weather
        - windchill
        - **state (can be used to populated additional information about the location of the user)**

See Data & Service documentation for additional information

8. Automatically generate geographic information about the bloom location. Info to include:
    - Name of the water body
    - City, County, State that the water body exist in
9. Present users with series of questions about the observed HABs. Request answers for the following questions with flexibility to accommodate state specific questions :
    - What is the location of the bloom in the water body?
    - Is the bloom near drinking water source?
    - Is the bloom near publicly owned lake?
    - Is the bloom near a public beach? If yes, what is the name of the beach?
    - What is the estimate size (sq.feet) or the extent of the bloom?
        - Integrate a square footage calculator. (e.g. http://www.squarefootage.org/square-footage-calculator.php)
    - To your knowledge, is the bloom near a drinking water intake?
        - Provide Yes, No, and Unknown as dropdown options
        - If users answer Yes, they must specify the known water system
    - Were samples taken?
        - Provide Yes or No as dropdown options
        - If users answer Yes, they must specify: What type of samples? Where were the samples sent for analysis?

10. Allow users to Save report and continue at a later time before submission. (View draft submission area)

11. Allow the users to review the report before submitting their observations
12. Allow the users to see their past submissions. (View past submission area).
13. Submit data as PDF to a specify email address and/ or to the Socrata Community Data Platform.
14. Append the following Water Quality Portal fields to the submission in the background:

    - Coordinates (LAT/LONG)
    - ProviderName
    - MonitoringLocationIdentifier
    - ResolvedMonitoringLocationTypeName

    See Data & Service documentation for additional information

15. Incorporate help text and pictures that contain educational background material about HABs.
16. Tutorial for first time users who launch the application.
17. Be open source. Code should be made available on Github.

Future Requirements

- Leverage an algorithm similar to the Hydrocolor water quality app to determine the reflectance of natural water bodies.
    - http://misclab.umeoce.maine.edu/research/HydroColor.php
- The ability for the state to send a notification back to the user indicating whether or not action has been taken in response to their submitted report.

Harmful Algal Bloom Challenge

Data & Services

What data service should I consider?

- Weather.gov
- Water Quality Portal

How do I utilize the Weather.gov API for obtaining current weather conditions based off of a given latitude/longitude?

Example URL: http://forecast.weather.gov/MapClick.php?lat=43.091975399999995&lon=-89.5343961&FcstType=json	**lat**	Latitude for radial search, expressed in decimal degrees,WGS84	
	lon	Longitude for radial search, expressed in decimal degrees, WGS84	
	FcstType	**json**	**JSON (JavaScript Object Notation) is a lightweight data-interchange format.**
		xml	Output format is XML compatible with WQX-Outbound schema. This is the default format, and if a mimeType is not specified, the data will be in XML format

What is Water Quality Portal?

The Water Quality Portal (WQP) is a cooperative service sponsored by the United States Geological Survey (USGS), the Environmental Protection Agency (EPA), and the National Water Quality Monitoring Council (NWQMC). It serves data collected by over 400 state, federal, tribal, and local agencies.

How do I familiarize myself with information provided by WQP?

1. Review the About page: http://www.waterqualitydata.us/wqp_description.jsp
2. Look at the available water quality data for various states within WPQ: http://www.waterqualitydata.us/coverage.jsp

How do I utilize the Web service to submit request for monitoring station locations?

1. See table below to take a closer look at submitting a Web Service request for returning Monitoring Stations
2. For more example, refer to WQP Web Service Guide: http://www.waterqualitydata.us/webservices_documentation.jsp

Example URL: http://www.waterqualitydata.us/simplestation/search?within=1&lat=43.0919753999999995&long=-89.5343961&mimeType=json	**within**	Distance for radial search, expressed in decimal miles	These three arguments are used together to form a circle on the Earth's surface for locating data-collection stations. Many stations outside the continental US do not have latitude and longitude referenced to WGS84 and therefore cannot be found using these parameters.
	lat	Latitude for radial search, expressed in decimal degrees,WGS84	
	long	Longitude for radial search, expressed in decimal degrees, WGS84	
	mimeType	**json**	**JSON (JavaScript Object Notation) is a lightweight data-interchange format.**
		xml	Output format is XML compatible with WQX-Outbound schema. This is the default format, and if a mimeType is not specified, the data will be in XML format
		xlsx	Output format is xlsx compatible with MS-Excel 2007 and greater
		csv	Output format is comma-separated columns
		tsc|tab	Output format is tab-separated columns
		kml	Output format is KML compatible with Google Earth. This option is not available for the results service.
		kmz	Output format is kmz, a compressed form of kml compatible with Google Earth. This option is not available for the results service.

Other resources:

USGS-R allows you to see results from a given station (i.e Chlorophyll) so that users can compare the data from the past with the data they're collecting in the present.

https://github.com/USGS-R/dataRetrieval

ENDATT is an application that pulls in information such as WQP Data, using USGS-R.

http://cida.usgs.gov/enddat/dataDiscovery.jsp

The following link demonstrates how to use a Web Mapping Service Call.

http://jsfiddle.net/tgGdp/2/

Socrata Community Data Platform

https://communities.socrata.com/