About:

**1. Coupling Spatio-temporal Remote Sensing and automated *in-situ* IoTsensors to monitor and predict HABs and cyanotoxins.**

Case Study-Lake Victoria

**2. Rationale & Intro**

Algae, in limited concentration, are ecologically friendly however when an unanticipated bloom comes to pass, can have severe impacts on human health, aquatic ecosystems, form unsightly views and nuisance in points of impact and with cyanotoxins, initiated by the cyanobacteria being particularly problematic as they can be toxic and scum-forming, posing a risk to the ecosystem and to public health and as well detrimental to the economy.

The geoscientific preparedness to monitor and predict algal and cyanobacteria blooms of great material value to provide pre-warning to society and enable management processes to be activated in advance to limit the disastrous and catastrophic impact.

Previous work

Satellite data from the Sentinel 2 platform can be successfully used for estimating algal concentrations in lakes.

The advent and uptake of high resolution in-lake automated water quality sensing technology together with new satellite platforms now enables a step-change in data availability that could be used for monitoring and forecasting of cyanobacteria (and algal) blooms in lake Victoria.

Here I intend to utilize Earth Observation data, including from new satellite platforms, new in-situ sensor technology, available meteorological data, combined with machine learning techniques to provide a near real-time, intelligent capacity for assessing current state and providing short-term forecasts of likelihood of algal and cyanobacteria blooms in Lake Victoria.

**3. Problem Statement**

**4. Objectives**

In order to attempt to address United Nations SDGs 3(good health & wellbeing) & 14( Life Below Water), the research project aims to address the following objectives:

1. To monitor Harmful Algal Blooms and Cyanotoxins from Satellite RS Images data in L. Victoria.
2. To Predict occurrence of cyanobacterial and Harmful algal blooms in the Selected Lake.
3. To associate Automated Internet of Things (IoT) *in situ* sensors, machine learning Applicable in near real-time to enhance the accuracy and speed for *in situ* data analysis.
4. To develop a reporting system to alert on a short-term foreseen bloom.

**5. Study area**

**6. Methodology**

The comprehensive aim of this project is to come up with a mid-level geo-intelligent system for monitoring and short-term forecasting of cyanobacteria and algal blooms in the area of study. By employing automated Internet of Things (IoT) sensors and Earth Observation (EO) data, the Harmful Algal Blooms (HABs) monitoring and prediction can be achieved in near real-time.

The project idea intends to aggregate Earth Observation Remote Sensing data from Google Earth Engine cloud platform to extract and analyze the presence of Chlorophyll-a pigment.

Parameters to be collected from dataset for Lake Victoria:

1. Ecological water quality parameters including:

●  Chlorophyll-a surface concentration

●  Suspended Particulate Matter (SPM)

●  Lake Surface Temperature (LST)

2. Sustainability indexes (evolution of land cover - land use (1990 - 2020), evolution of pollution release into the lake due to demographic pressure

3. Time series (Long Short Term Memory) of meteorological observations.

Besides that, meteorological data (for the last few years together with water quality data supplied by the Lake Victoria Basin Health Monitoring. These data will be used to identify historic occurrences of algal and cyanobacterial blooms in that specified Lake.

 The result will be analyzed on the fly and a short Early Warning System in the form of a text SMS will be relayed to the authorities concerned.

**7.Expected Results**

The algorithms will then be usable in near real-time through the IoT utilizing incoming *in-situ* data to provide a short-term probabilistic forecast of the likelihood of a bloom, dependent on the weather conditions on previous and current trends.

* **Maps**
* **Graphic**
* **Messaging components in the User Interface,**