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Abstract

IA-GES-BLOOM-CM: Towards a Comprehensive Warning and Management System for Cyanobacterial Blooms †

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Abstract: Cyanobacterial Blooms (CBs) are an ecological and public health problem since they may be followed by the production of secondary metabolites, which are toxic for humans and other animals. This threatens the life of multiple species and prevents the use of water resources for recreational and consumption purposes. Therefore, their proper management is essential to minimize the exposure of the population and ecosystems to the harmful effects of CBs. The ability to predict the formation of CBs in a specific water body is limited by the difficulty of acquiring enough data to determine their state with the appropriate temporal and spatial granularity. Moreover, as CBs are complex phenomena that are influenced by many factors, the conclusions derived for a certain water body are hard to extrapolate to others. IA-GES-BLOOM-CM is a synergy project funded by the Community of Madrid, Spain, for boosting the collaboration of researchers from different fields (including biology, automation, and information and communication technologies) to develop disruptive solutions for CB prediction and management. Its aim is to develop a comprehensive and reliable system to automatically and efficiently characterize continental water bodies, predict where and when the CBs are expected to occur, determine their potential risks, and provide the authorities with early warnings of CB breakouts. To this end, we are conceiving a system, supported by Autonomous Surface Vehicles (ASVs, a kind of robotized boats), Modeling and Simulation (M&S) tools, and the Internet of Things (IoT). More specifically, on one hand, the ASVs, which are equipped with probes, will be (1) responsible for capturing information related to the CBs from any point of the water column and surface and will be (2) intelligently guided to the points of interest to make relevant observations in order to optimize the monitoring efforts. On the other hand, M&S tools, including dynamical models and machine learning, will be in charge of predicting the CB temporal and spatial evolution in order to guide the ASVs (whose data, in turn, will be used to fine-tune the models) and warn the authorities about relevant CBs. Finally, an IoT infrastructure will support the communications and deployment of the system, closing the gap between the authorities in charge of the water bodies and the information provided by the different elements of the system. In this paper, we will provide an overview of the main ideas of the project and of its initial developments.

Keywords: autonomous surface vehicles; modeling and simulation; optimization; artificial intelligence; Internet of Things

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