DEVELOPMENT OF A REAL-TIME, CONTINUOUS, OPTICAL TURBIDITY AND COLORIMETRIC SENSING DEVICE FOR THE MARINE ENVIRONMENT

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Our aquatic heritage is a vital resource. Anthropogenic activities and industrialisation, however, have led to increased pressures on our natural waters, and consequently, careful management is required to ensure their sustainability and health for future generations. It is important to acknowledge that one can only manage what one can measure, and therefore, environmental sensing of riverine, estuarine and marine waters is becoming increasingly important to ensure that European directives such as the Water Framework Directive [1], the Bathing Water Directive [2] and the Marine Strategy Framework Directive [3] can be met. Traditional approaches have typically involved the intermittent collection of samples at the relevant monitoring location (grab sampling), the transportation of the samples to the laboratory, the analysis of samples using various lab-based analytical techniques and the evaluation of results. In relation to aquatic environmental monitoring, this approach is not always ideal due a number of factors, for example, (1) the possibility of missing events due to insufficient sampling frequencies, (2) the potential for sample contamination from the point of collection to the laboratory, and (3) the inherent lead time from sample collection to analytical results can be problematic with regards to delayed reaction protocols and cause traceability. This research seeks to resolve some of these outstanding issues through the development of a prototype, real-time, continuous turbidity and colorimetric sensing device for the marine environment. The new device seeks to improve upon our existing Multi-Channel Optical Device (MOD) [4], see **Figure 1**, in terms of robustness and data transmittance capabilities. Potential applications are the detection of harmful algal bloom (HABs), for example cyanobacteria, which are toxic to both humans and animal species. The sensing device uses an array of coloured LEDs to not only detect and quantify changes in turbidity but also to signal changes in colour intensity. Significant challenges exist to ensure the robustness of sensing systems in the aforementioned aquatic environments, and these issues vary in significance depending on the classification and remoteness of the monitoring location. Of these challenges, biofouling is one of the key limiting factors. One important aspect of this research is that it also incorporates the testing and assessment of recently developed biofouling mitigation techniques. This device is based on a generic platform, which will potentially result in a plug and play approach for various other sensor elements.

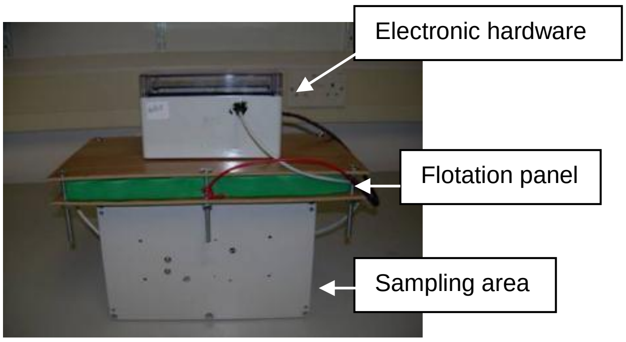

Figure 1: Multi-Channel Optical device (MOD).

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[1] EU website, Water Framework Directive, [on-line], http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2000:327:0001:0072:EN:PDF, Accessed **2012**(November).
[2] EU Website, Bathing Water Directive, [on-line], http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2006:064:0037:0051:EN:PDF, Accessed 2012(November).
[3] EU Website, Marine Strategy Framework Directive, [on-line], http://eur-lex.europa.eu/LexUriServ/LexUriServ.do?uri=OJ:L:2008:164:0019:0040:EN:PDF, Accessed 2012(November).
[4] Lau, K. T., Kim, J., O'Sullivan, T. et al, "Sensing technologies for monitoring the marine environment", MARTECH Conference, Cadiz, Spain, (2011).