

SENSOR NETWORKS FOR AQUACULTURE MONITORING SYSTEMS

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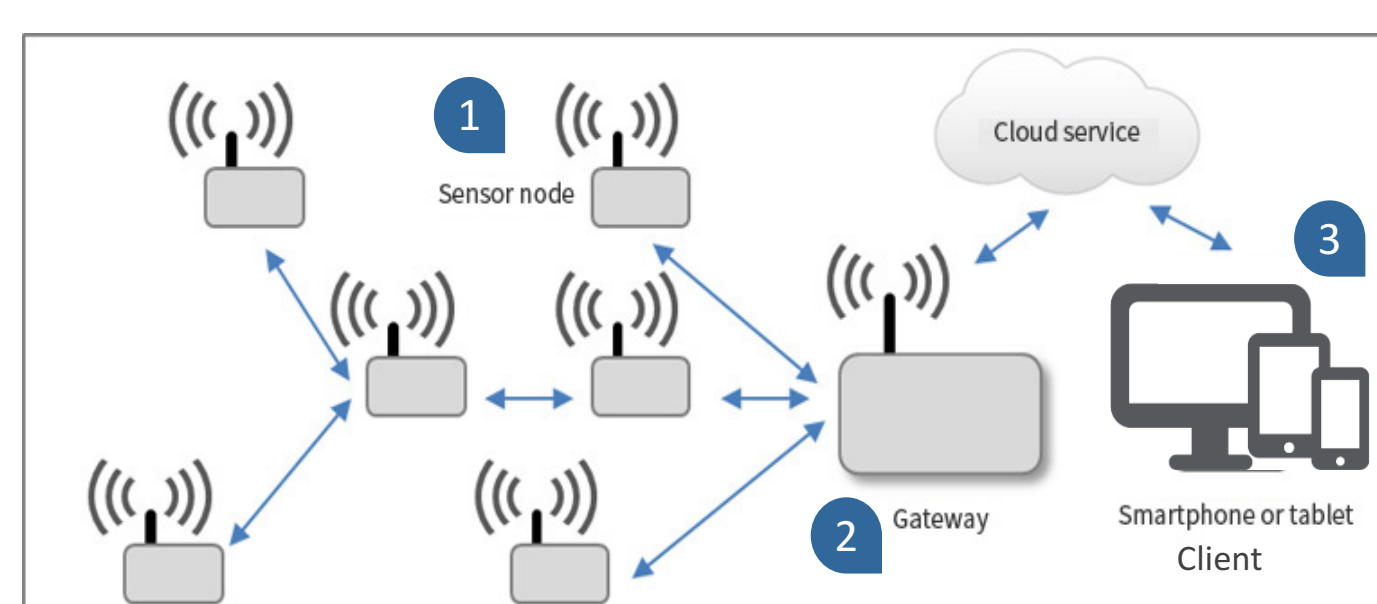
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1 OVERVIEW

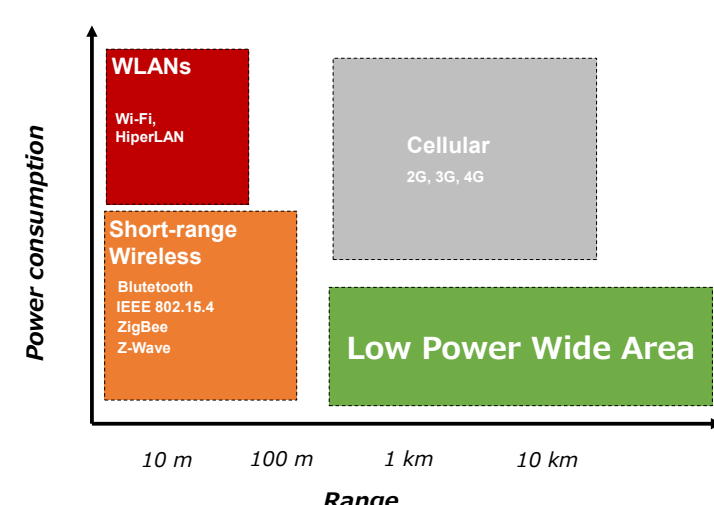
Aquaculture is one of the fastest growing food producing sectors in the world, and its economic importance is increasing. Due to the increased demand for food, market pressure and growing concern about environmental and food quality issues, special techniques have been developed and applied to increase food production and improve product quality.

A Wireless Sensor Networks - WSN

Wireless Sensor Network (WSN) is an emerging technology that promises unprecedented functionality to monitor and control the physical world. Expensive instruments and dataloggers, are replaced by lowcost wireless sensor networks providing real-time measurement with high resolution.



LP Wide Area technologies
LPWA complement and sometimes supersede the conventional cellular and short range wireless technologies in performance for various emerging smart city and machine-to-machine (M2M) applications.

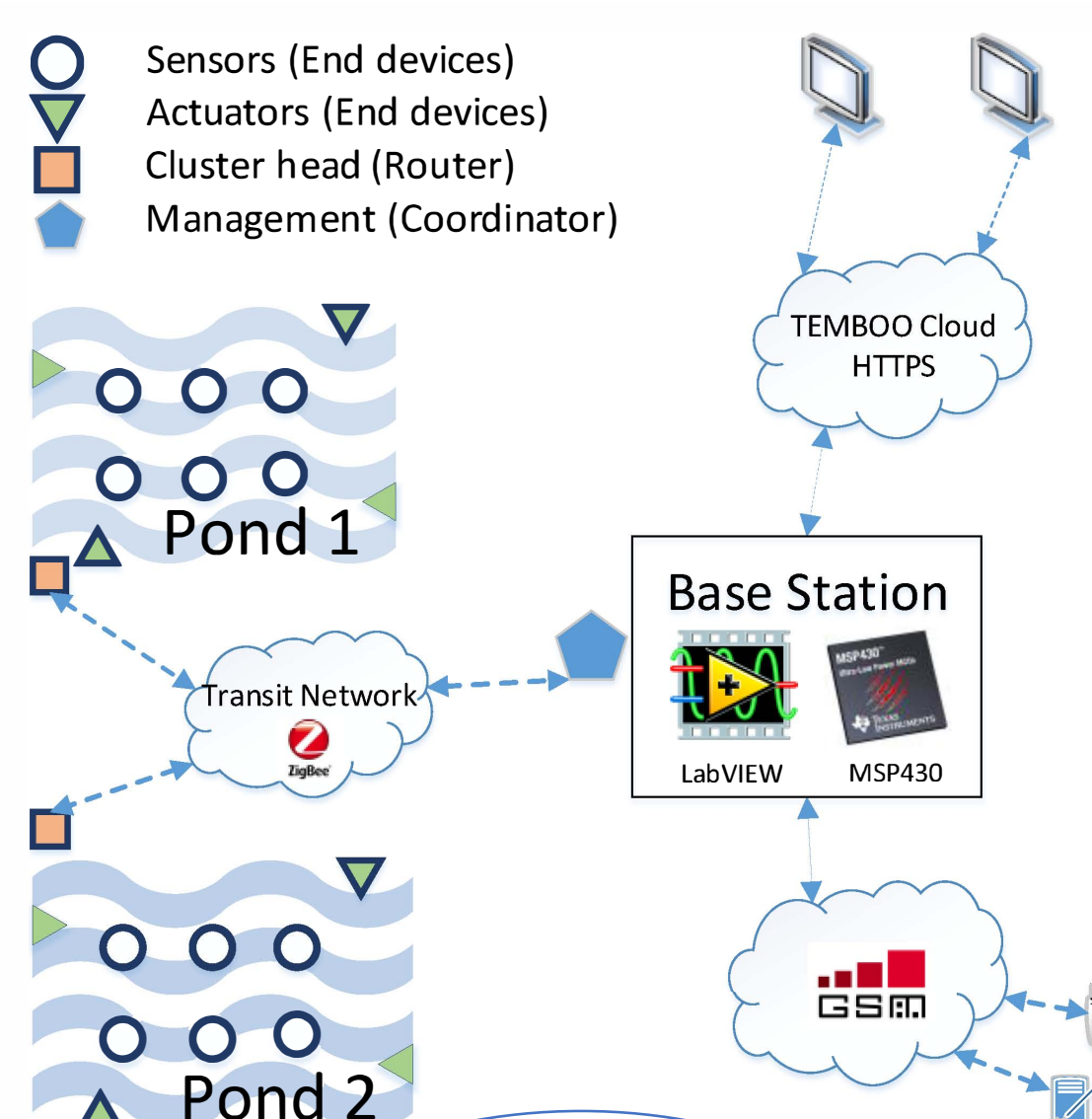


2 MOTIVATION

Scientific advances in recent years in this sector have been facilitated largely by the application of science and the introduction of new technologies [1]. Emerging technologies in areas of sensor network, network computing and ubiquitous computing are enabling the development of practical and innovative solutions, improving monitoring and decision-making capabilities.

B Automated Water Quality Monitoring

This system contributes with two important features, continuous monitoring, and automatic control that is being tested in a real application. The control activates or deactivates the oxygen pump system according to the management module and DO level [5].



3

OBJECTIVES

The objective of the present work is to **review and analyze the currently scientific advances in technology applied in aquaculture systems**, exploring the processes, architectures, the automation level and the role of sensors and new information technologies in this sector.

Innovations in water quality monitoring, fish feeding, biomass estimation, fish behaviour monitoring, disease diagnosis and food waste management can not only improve the degree of automation of aquaculture and the level of scientific management, but also reduce the cost of production, improve environmental control and increase product quality [3]. Despite the great progress of science and technology, the optimization and management of production processes of aquaculture systems is facing great challenges [4].

C IoT Technologies & Cloud Platforms

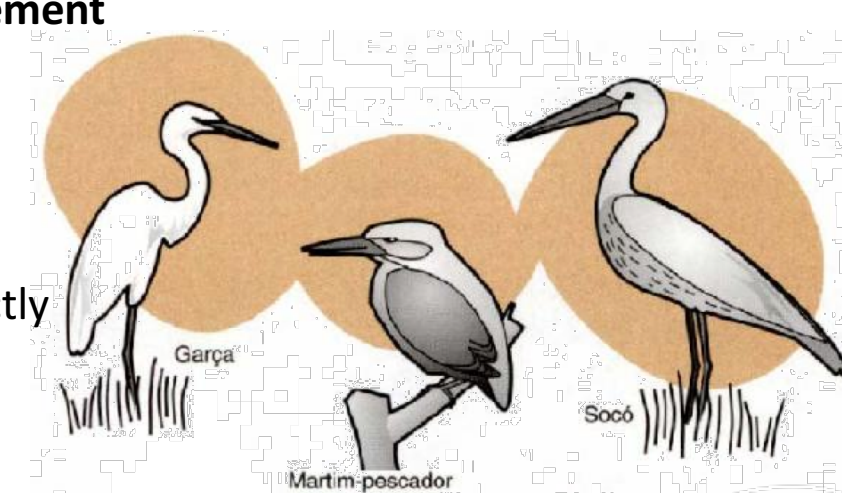
Cloud based aquaculture management solutions. Real time monitoring of DO, pH, etc., helps farmers to analyze the pond dynamics and take preventive actions with high efficiency.



IoT cloud platform allows us to collect, store, visualize and alert on time series data. It allows customizable graphs and dashboards and visual map overlays.

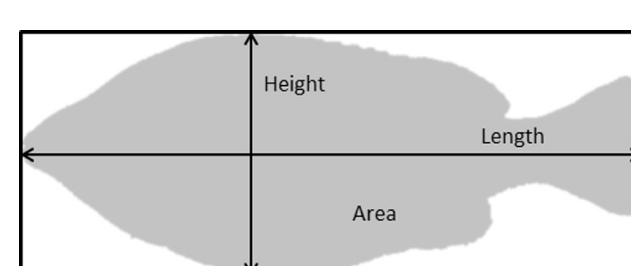
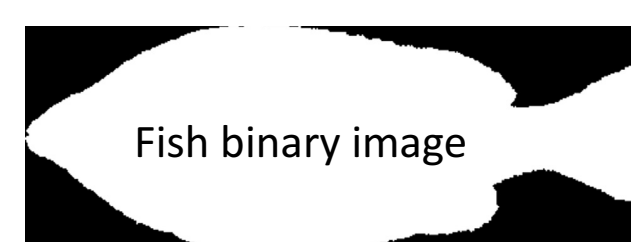
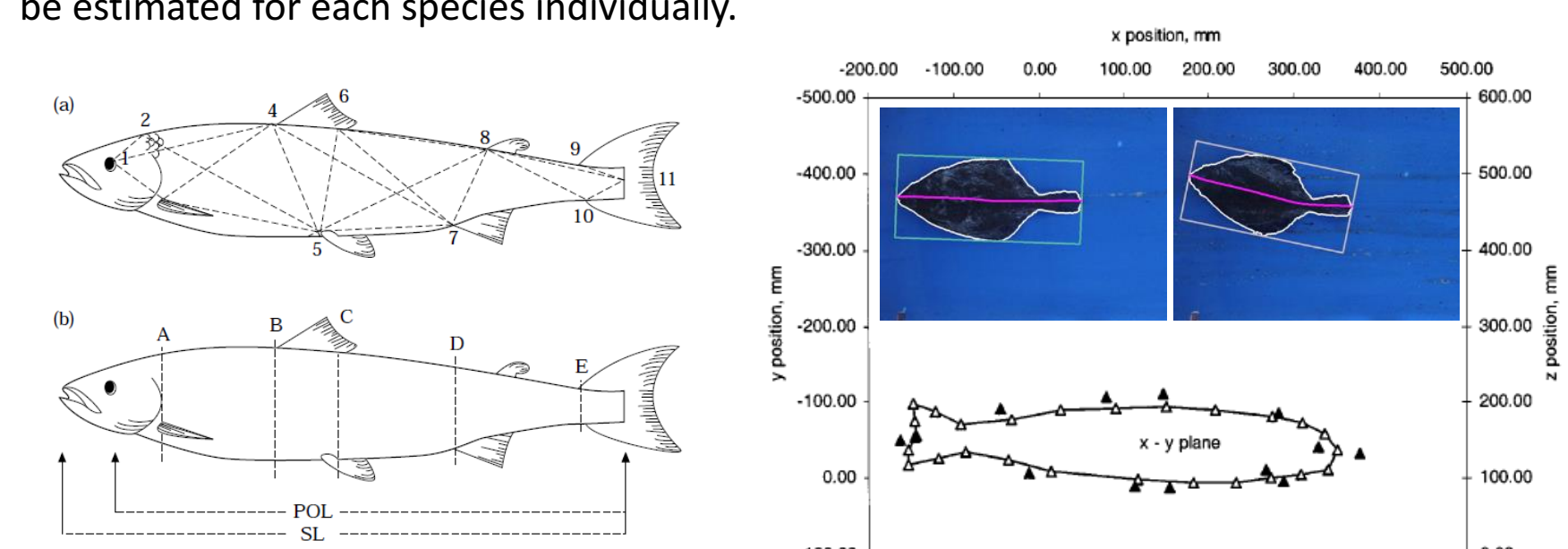
D Predation Management

To understand potential damage and to implement proper predator control methods, you need to correctly identify the species.

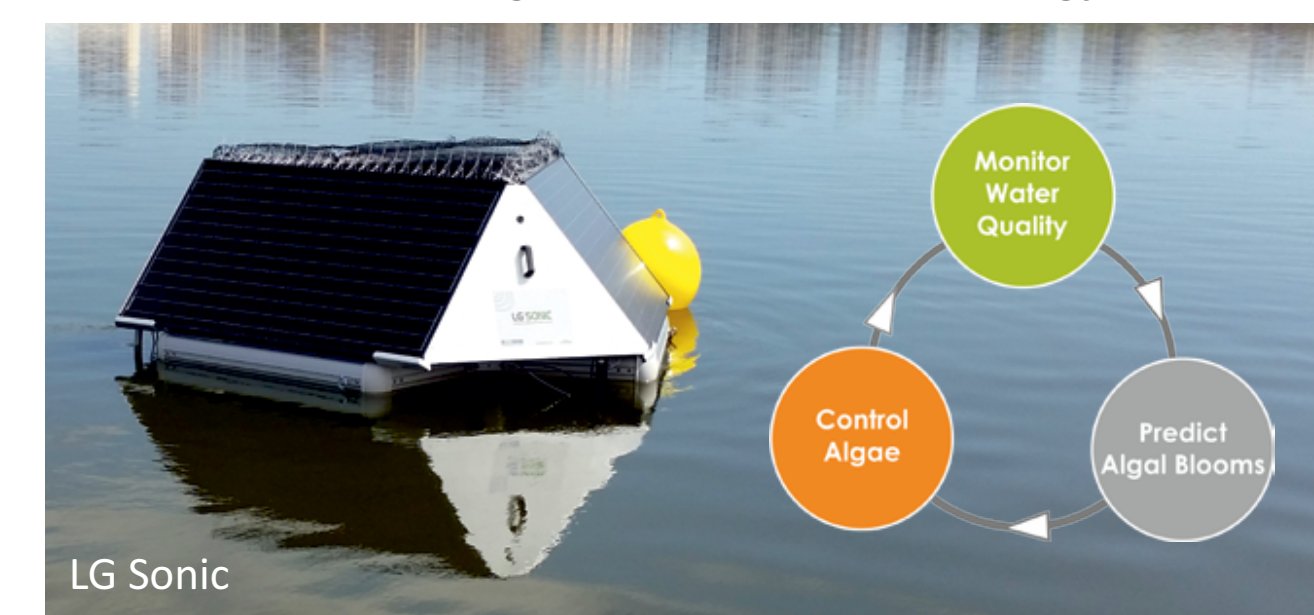


E Biomass estimation

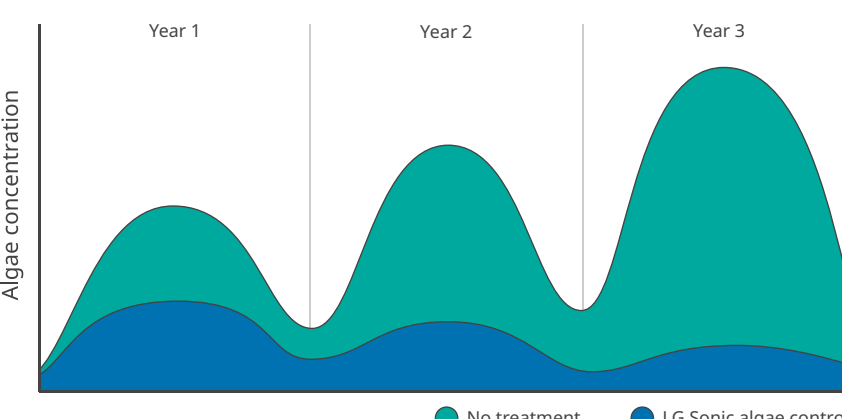
Monitoring the mass of the fish is essential for effective management in aquaculture farms. Information about fish mass enables the farmer to calculate the daily feed ratio and the fish stocking density. **Computer vision** is a non-destructive and powerful method to capture and estimate the mass of fish objectively and in real-time. However, there is no a general method to estimate the mass of every species and the optimal relation needs to be estimated for each species individually.



F Monitor and Control Algae with ultrasonic technology



Ultrasonic treatment can reduce algal blooms by 70 – 90% in concentration.



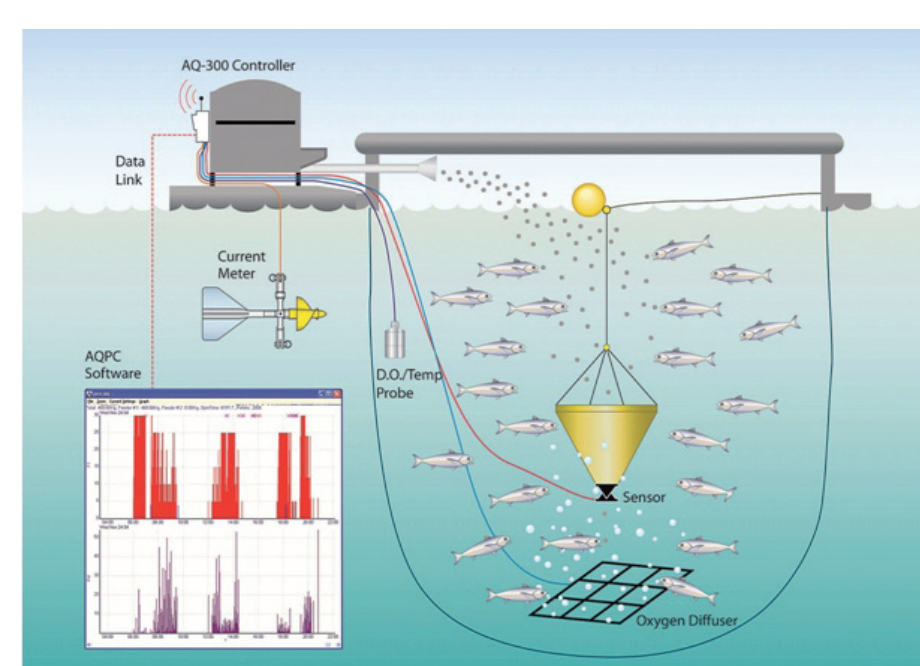
H Aquaculture Management – Automatic Aerators control



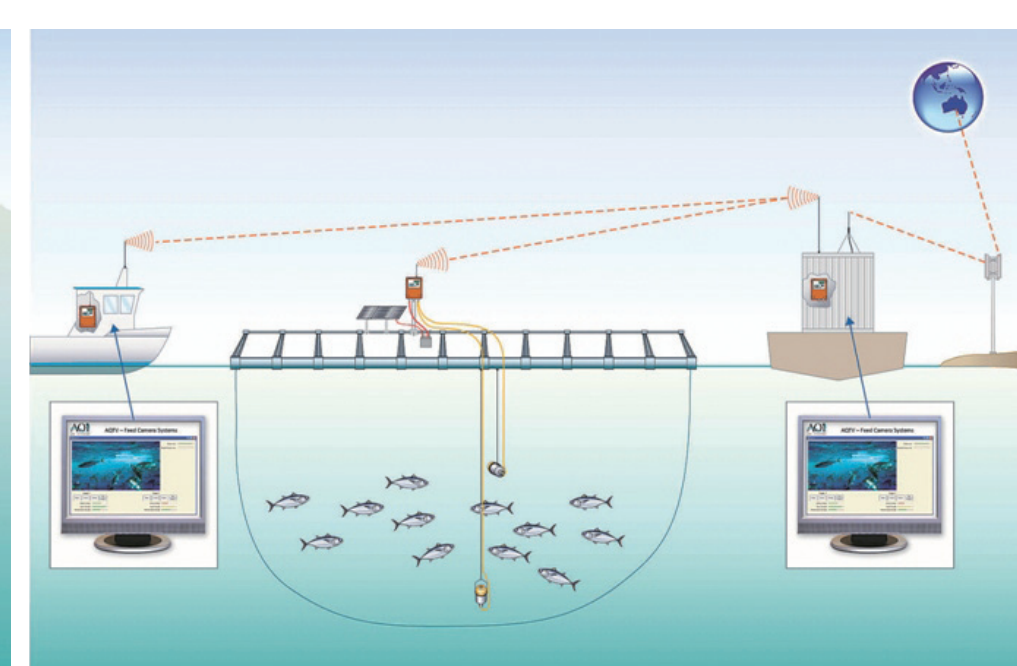
G Smart feeding methods

Aquaculture companies require precise measurements of the number and size of fish they contain in their farms, so that the tasks of feeding and crop protection can be properly managed. Research efforts have also been directed towards the improvement of on-farm feed management practices, like:

- Demand Feeding
- Computer-controlled automatic feeding systems



Infrared sensor-based feeding control system



Digital feed camera systems

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Aquatropolis

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