SMART AQUAPONICS: DEVELOPMENT OF A TOOL FOR EDUCATION, DECISION SUPPORT & MONITORING FOR AQUAPONICS

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Introduction

Aquaponics is a technology combining both aquaculture and hydroponics. The first aquaponic systems has been developed in the late seventies. Then after, aquaponics has been rapidly adopted by education sector and urban communities. During the last decade, thanks the apparition of different aquaponic farms, aquaponics became a professional activity. Nevertheless, aquaponics is facing the drawback of innovative technologies. Firstly, the lack of advanced education dedicated to aquaponics limits the availability of technicians and engineers trained to aquaponics. Secondly, the absence of references and tools specifically dedicated to aquaponics makes the conception and monitoring of aquaponic system quite complex. In order to overcome these limitations and to foster the development of aquaponics among local communities and the corporate sector, the Interreg project Smart Aquaponics is developing an online training program, a decision support tool and a monitoring tool. These tools will be accessible within an application (smartphone and PC).

The training program will be composed of a serious game and several theoretical modules. The game will allow the user to handle virtual aquaponics systems with different levels of complexity and experiment an extensive range of events occurring in real aquaponics systems. The target groups are technical secondary schools, colleges, universities and local communities.

The decision support tool will allow users to compose virtual aquaponics systems and perform simulations. These simulations will estimate the yield, efficiency and stability of the systems and, finally allow fine-tune the design

The monitoring tool will monitor the status of the different component of an aquaponics system and propose some prediction of the future status of the aquaponic system in order to (i) anticipate potential problems (ii) maintain the parameters in an optimal range. The monitoring is based on connected sensors (pH, t°, nitrogen, …) and will be compatible with small and semi-professional systems.

Materials & methods

The three tools will be based on a model that predicts the evolution of different parameters (oxygen, nitrogen, plant and fish growth, …) of an aquaponics system. The specific nature of this model lies in its ability to model aquaponics systems of different sizes and designs. Beside, the project is also developing a data acquisition chain able to connect the sensors present both in the aquaculture and hydroponic compartment to the application.

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The calibration of the model, the evaluation of the data acquisition chain and the beta testing of the application will be achieved in three steps. First, in 2019, seven aquaponic systems belonging to the Smart aquaponics partners will be used to test the data acquisition chain. The data collected will enable a first calibration of the model. Secondly, in 2020, a panel of beta testers including professionals and hobbyists will be invited to test the data acquisition chain and the beta version of the application. The data collected with this panel will enable a second calibration of the model. The panellists will also provide a feed back on the application for improvement. Third, after the release of the application (2021), all the data collected by the application will enable further calibration of the model. In fine, the accuracy of the model and of the prediction of the application will increase with the number of users.

Results

In 2021, the Smart Aquaponics project will release an application including a training program, a decision support toll and a monitoring tool. Smart Aquaponics will also propose a data acquisition chain able to connect the sensors present in the aquaponics system to the application. Due to two years of testing, the prediction of the model will be accurate, the data acquisition chain reliable and the application user friendly.

In fine, these tools should facilitate both the design and the monitoring of new aquaponic systems. This associated with the online training program should facilitate the emergence semi-professional and professional aquaponics system.