CALIFORNIA STATE SCIENCE FAIR
2015 PROJECT SUMMARY

Name(s)
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Project Number
S1405

Project Title
An Internet of Things Application for Aquaponics

Abstract

Objectives/Goals
The purpose of this project is to build an efficient Internet of Things (IoT) application for aquaponics in order to create an autonomous, self-regulating system that can be remotely-controlled by the user through the Internet. The IoT aquaponic platform is composed of devices that can sense and collect information from their environment, store it in a cloud database, and transmit it to an Internet web server.

Methods/Materials
The aquaponic system includes an indoor tank and grow bed with several varieties of vegetables, 5 goldfish, a 15 gallon grow bed, and a 20 gallon tank. A Raspberry Pi 2 is connected to a pH meter, camera, and an ambient light, water level, and room/water temperature sensor to provide data to the user. In the IoT network, multiple actuator devices such as a heater, grow light, feeder, and water and oxygen pumps can be programmed to activate or turn off based on conditions monitored by the sensors and/or set by the user. The aquaponic system utilizes computer programming to create an interactive web server written in JavaScript and HTML in which the user can access and control from the Internet while storing data collected from the device on a cloud web-hosting server. This web application provides a graphical representation of live data from the sensors, as well as a video feed of the tank.

Results
A functional live-streaming web application was created to monitor and control the conditions of the self-regulating aquaponic system with the ability for user access and control of various sensors and devices according to the system and user's needs.

Conclusions/Discussion
The design criteria and engineering goals were met. The aquaponic system is more efficient by integrating the Internet of Things (IoT) and maintains a self-monitoring aquaponic system as a smart and sustainable improvement to conventional techniques, which often require human manual labor. The web server accessible to the user provides live data collected by sensors to help him or her monitor and regulate the tank conditions. Such technology can be integrated into wastewater treatment, pool maintenance, and other water monitoring industries.

Summary Statement
I built an autonomous and/or remotely-controllable aquaponic system that stores data collected from lighting, pH, temperature, moisture, and water level sensors in a cloud database that can be accessed and controlled via the Internet.

Help Received
My father mentored with the computer programming, Sweet Leaf Hydro showed the different designs for the aquaponic system, and Kathy Grant, Lodi's Stormdrain Detectives coordinator, provided the dissolved oxygen meter.