

# Aqua-Wave Engineering

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## ABSTRACT

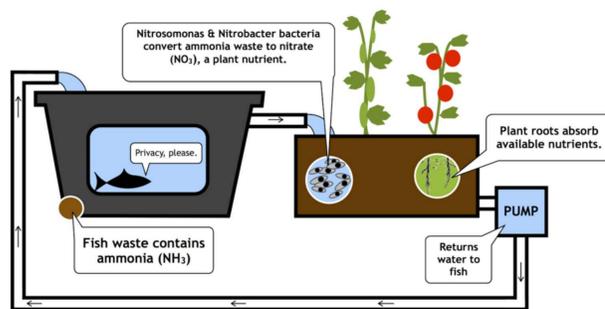
This project is collaboration between the Department of Engineering Technology and NSU E-LAB to design and build a greenhouse for educational purposes. The study focuses on combining a greenhouse with an aquaponics water system to allow users control of various sources for plant growth. The main goal in this project is to design a child proof aquaponics system so that elementary students can study plant and fish symbiosis. Temperature, nutrients, and water flow are the key variables users will be able to manipulate in this project for plant and fish development. The design for this experiment concentrates on simple but efficient systems so that elementary students may comprehend the system for educational purposes.

## INTRODUCTION

NSU ELab is a member of the Natchitoches Parish Public school. They are located on the Natchitoches Northwestern State University campus. The school offers grades K-5 which has limited enrollment for educational performance purposes. NSU Lab has dedicated staff focused on providing a superior learning environment for students. The NSU E-Lab decided fabricate an Aquaponics STEM Food Growing System which can be used to demonstrate various principles taught in technology, plant life cycles and their structure, how to make effective use of recycled materials, low-tech/high-yield gardening, ecological issues, biology, chemistry, physics and sustainable farming. To achieve this goal, the NSU department of Engineering was contacted for a collaboration.

**Mission of the project** "Improve Elementary Students Knowledge on Plant and Animal Symbiosis trough Aquaponics Greenhouse System."

### How Aquaponics Systems Work

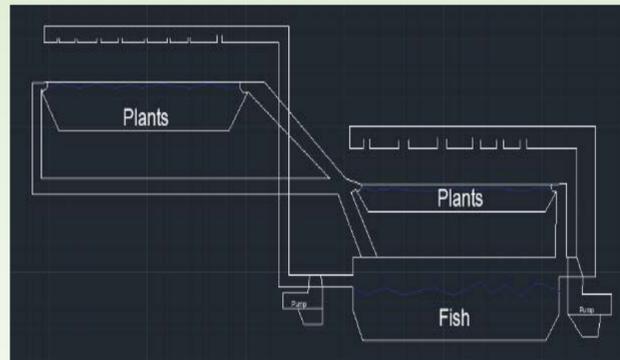


Aquaponics is a hybrid food growing technology combining the best of aquaculture (growing fish) and hydroponics (growing veggies without soil). It's completely organic because the fish produce natural fertilizer used by the plants and that means no man-made chemicals.

## Benefits of Aquaponics Greenhouse

- Environmentally friendly
- low water usage and low power usage
- Low input with simply feeding the fish
- Chemical free with no synthetic fertilizers or pesticides
- Easy to grow plants
- Low susceptibility to pests and diseases
- Timely crop turn around
- Increased crop production per square foot versus traditional farming
- Multiple crops and fish can be grown from the same system
- Fish can also be harvested as a food source

## SYSTEM DESIGN



### Aquaponics System: Design specifications

The system is designed to use natural resources and to utilize recyclable materials as much as possible

### The following elements were taking into consideration while designing the Greenhouse project:

Economical, functional, and safe structure

Structure of the Greenhouse

- Building material
- Foundation
- Shelving
- Containers

Drip system: uses gravity and pressure from fish tank

Power

Controlled environment including temperature, humidity, pH

Plants selection

Children friendly and safe design

Uses natural sunlight

Aesthetically pleasing

Versatile space

Easily modified

Portable and can be relocated if needed

## Greenhouse fabrication

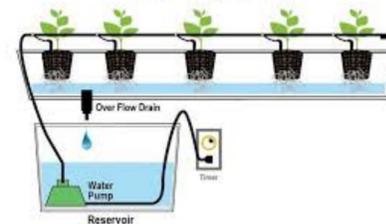


8 x 10 Greenhouse with recyclable base and wood shelves



4 x 8 Acrylic tank with recyclable base

## Drip System



### Drip Irrigation:

- Uses gravity and pressure from fish tank
- Speed can be controlled by valve on drip tube
- Pump must be speed controlled
- Continuous flow

## Conclusions

Aquaponics is a sustainable method of growing food that combines aquaculture (raising aquatic animals) and hydroponics (cultivating plants in water).

**Aquaponics system is a great STEM tool which brings live to classroom.**

Students are participating in the creation of an ecosystem that operates right before their eyes

**The system teaches students how to make effective use of recycled materials**

The Aquaponic STEM system takes Farm to school and teaches students about healthy organic vegetables, fruits, pesticide-free herbs and fish with little or no chemicals

**Educators in Science subjects can teach their students the process and necessary requirements to cultivate plants and grow fish**

Other advanced concepts of science can be developed, such as the role of bacteria in aquaponics, how the water cycle works and how much light the plants need to survive, the acceptable pH level of the water and functions of other acids such as hydroxides, carbonates, and bicarbonates, as well as the existence and importance of other chemical elements like oxygen in the process.

**Aquaponics will help motivate students, increase their curiosity and help them to learn in a fun way.**

The STEM Aquaponics system is a great teaching tool for students as well as teachers and can be customized to teach students of all ages from Elementary to Middle to High School

**Collaboration between Engineering Technology and ELAB at NSU is a win-win situation.**

This project is still in progress.....

## FUTURE WORK

1. Expand Greenhouse Inventory
2. Install Solar Panels as an Energy source
3. Look for extra resources and donors in order to complete and improve various aspects of the project. Contact: Dr. Jafar F. Al-Sharab, jafar@nsula.edu



## ACKNOWLEDGEMENTS

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