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## **Introduction – Château de Nemo**

The objective of this senior design project is to successfully design and implement an aquarium controller system that is capable of monitoring the pH of the water and changing the water level as required. The controller will also be able to control an automatic feeder and a heating system along with a day-light simulator.

The aquarium settings may be input to the system using either a keypad control mounted on the actual aquarium itself or through a personal computer (PC) connected to the internet. An associated program will be developed to allow the user to access their fish tank and control it through the internet using the Ethernet port on the chosen Rabbit Processor.

All components aside from the keypad which is mounted on the aquarium are external to the core system and hence optional. Thus, parts such as a router, a PC, and any other external devices will not be considered while discussing the packaging constraints.

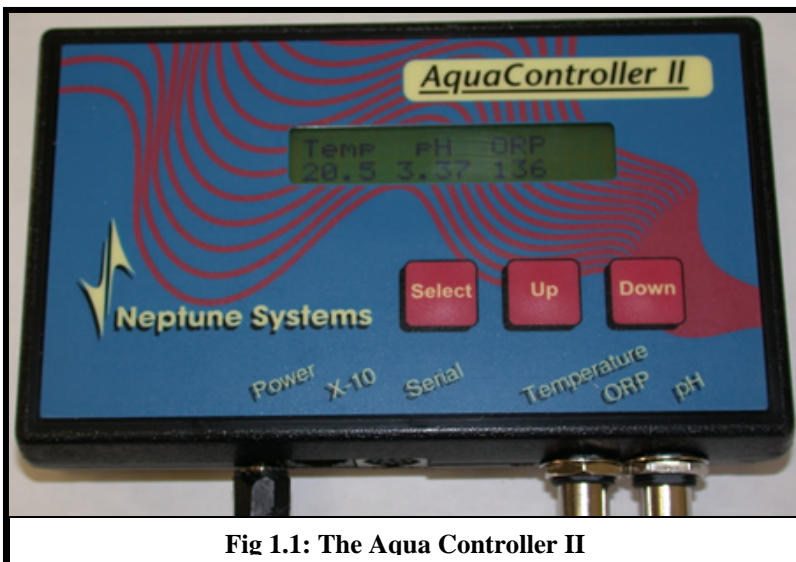
## Analysis of Similar Commercial Products & Packaging

While we aim at making our product unique and interesting, there are some products readily available in the market that provide the same services as our automatic fish tank controller. This sections aims at discussing these readily available products briefly in terms of packaging techniques.

### Neptune Systems – Aqua Controller II

The Aqua Controller II is an automatic controller manufactured and sold by Neptune Systems. The company claims the product is easy to use and allows the user to control even the most demanding aquarium while making it easy for the user to setup and run the controller.

The Aqua controller is packaged in a 3.6” x 5.75” x 1.3” plastic casing with probe input plugs for pH and Ozone sensors. Also included are an X-10 port and a serial port



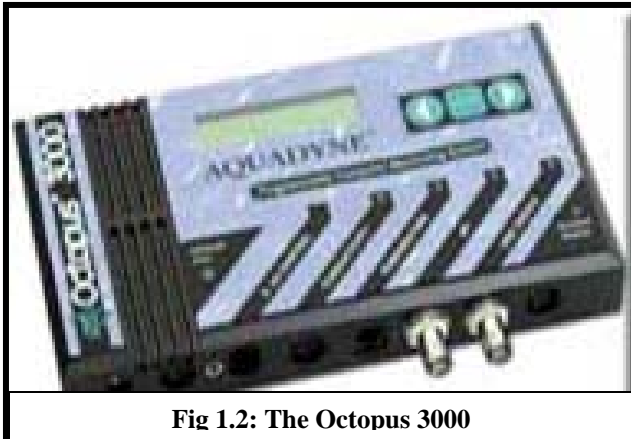
that allow easy connection to a computer. Aqua Controller II features a three button user interface. These buttons allow the user to navigate between options and modify settings accordingly. The Aqua Controller II is also

accessible through any computer, however, no external connection to a computer is necessary to set up and run the product. Lastly, the unit is pre-programmed with default settings so that the user has to make minimal changes to run the product.

## AquaDyne Computer Corporation – Octopus 3000

The Octopus 3000 controller is another automatic fish tank controller which is readily available and sold by AquaDyne Computer Corporation. AquaDyne specializes in designing water monitoring devices.

The Octopus 3000 is very similar to the Aqua Controller II in terms of packaging



**Fig 1.2: The Octopus 3000**

as it comes in a plastic casing measuring 4.2” x 6.45” x 1.75” in dimension. Again the product features three buttons through which the user may communicate with the processor and modify settings.

Aside from the buttons, the user also has information passed along through many status lights that

indicate the pH, temperature, and water levels through different LED’s (red – levels are dangerous, green – level is acceptable). Similar to the Aqua Controller II, the Octopus 3000 allows the user to connect external devices through a serial port and an X-10 port available on the device. Lastly, the Octopus 3000 packaging also includes an infrared printer port that allows the user to print aquarium data without using an external computer.

## Positive & Negative Aspects of Discussed Products

This section looks at both the above discussed commercially available products and highlights the positive and negative aspects of these products with regard to packaging techniques used.

### **Positive Aspects**

1. The user buttons on each product allow easy interaction with processor for user. Also the low number of buttons utilized it makes the product easier to understand.
2. Large LCD display’s on both products makes it easy to read for user and allows manufacturer to display a larger volume of data at a certain time.

3. Plastic casing used in both products makes the product lighter and easy to mount on any tank.
4. LED status lights on the Octopus 3000 allow user to be alarmed of tank status without having to manually read off the LCD display each time. Increases awareness level of product.
5. Pre-set settings on the Aqua Controller II ensure easy operating conditions for user.
6. Both products when interfaced to a computer allow user to use software in order to acquire data from tank in terms of graphs and charts. Also, using this feature software users can make changes to their tank using a simple programming language.

### **Negative Aspects**

1. The use of only three buttons in both cases might make it annoying for user to navigate through several options before reaching the one they would want to monitor.
2. Metal probe inputs make product heavy and hard to mount on the outside of a fish tank.
3. Also, whether or not these products are waterproof is a mystery, since this is not mentioned anywhere on the data sheets.

Overall, both the Aqua Controller II and the Octopus 3000 are two of the best products available in the market at this time. We aim at adapting the easy to use interface with minimal buttons on our product. Also the serial port on both controllers is helpful with respect to connecting the controller to a computer. Furthermore, both the Octopus 3000 and the Aqua Controller II are sold with a software package as mentioned above. This is another idea we plan to adapt in our package. Château de Nemo will support a software package that allows users to monitor data and modify tank settings through the use of a computer and an enabled Ethernet connection. It will not however support multiple day data acquisitions and graphic abilities that the commercially available products do.

Our model will be unique in the sense that it will use a dedicated Ethernet port to connect to the computer and send and receive data. This will ensure faster data rates than using the serial port as the Aqua Controller II and the Octopus 3000 use. The Ethernet port connectivity also ensures the fish tank can be accessed from anywhere in the world using the internet, thus making our product a great buy for people who have fish and travel a lot.

Also, our product is unique such that it supports an optional web-cam that allows the user to visually monitor their fish tank using a computer, which both the Aqua Controller II and the Octopus 3000 do not offer. This will make our product larger in size than the two described above, since we will have to account for an extra parallel port to allow camera interfacing, however due to the small size of the microcontroller (Rabbit 3200 – 2.73” x 1.85” x 0.86”), the overall product size will still be acceptable and easy to mount on the side of the fish tank.

## Design Specifications



Fig 1.3: Prototype fish tank which will be used for project purposes (Front view).

The components of this system are given in the following diagram. Please see attached sheets for scaled drawings.

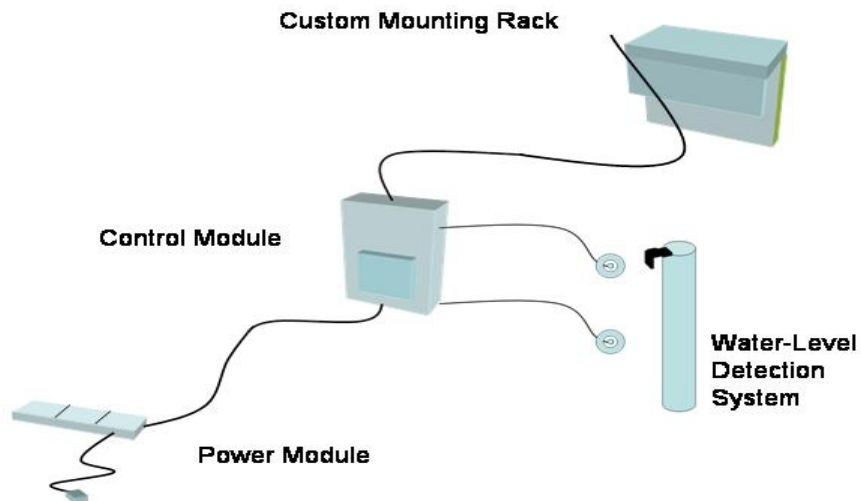


Fig 1.4 Complete System Layout

## Description of Layout

### Control Module

This module is the heart of the system. All parameters will be input to the system here from either the keypad that will be on this module or the Ethernet cable to the system.

### Power Module

This module will allow the heater and lamps to be plugged in to the system. The control module will turn on or turn off connection to the wall outlet using relays.

### Water-Level Detection System

This module contains a floating ball which will come between an LED and a detector letting the system know that the aquarium is full.

### Mounting Rack

This rack will be hooked on the aquarium and will hold the temperature and the pH probe.



## **Materials List (Major components)**

- Rabbit Core Module (3200)
- Keypad and LCD Screen (1)
- Web cam (1)
- Temperature Probe – Using a Dallas-Maxim DS18S20
- pH Probe(1)
- Auto-feeder (1)
- Light\* (Provided by member)
- Heater\* (Provided by member)
- Water Pumps (2)
- Power Strip

## **Tooling Requirements**

- Drill
- Hot Glue/Hot Glue Gun
- Exacto Knife
- Metric Ruler
- Waterproof packaging material
- Wires
- Soldering Iron

## Packaging Weight & Unit Cost

Part	Part Num	Total Weight	Unit Cost	Quantity	Final Cost
Micro	104-0520	1.4	\$89.00	1	\$89.00
Keypad/LCD	101-0541	1.9	\$79.00	1	\$79.00
Webcam	AS21	2.7	\$8.99	1	\$8.99
pH probe	214-855	2	\$15.00	1	\$15.00
Temp. Probe	DS18S20	.9	\$3.00	1	\$3.00
Water Pump	602381	6	\$16.00	2	\$32.00
Power Strip	C1959	12	\$5.00	1	\$5.00
Total Weight & Cost		26.9			\$231.99

Note: All the products above are tentative and thus the price and the weight factor are a simple estimate at this time. The lamp and the heater is not part of the system. The user provides own lamp and heater that match their aquarium. For testing purposes, Sin-Hoe Lim will donate his.



Pictures 1.0 – LCD and Keyboard Module, and pH meter

## References

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[http://www.petsmart.com/global/product\\_detail.jsp?PRODUCT%3C%3Eprd\\_id=845524441776826&ASSORTMENT%3C%3Eeast\\_id=2534374302023693&FOLDER%3C%3Efolder\\_id=2534374302026263&bmUID=1077170064706](http://www.petsmart.com/global/product_detail.jsp?PRODUCT%3C%3Eprd_id=845524441776826&ASSORTMENT%3C%3Eeast_id=2534374302023693&FOLDER%3C%3Efolder_id=2534374302026263&bmUID=1077170064706)