

Microcontroller-based Aquatic Ecosystem



TEAM #10

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PROJECT OBJECTIVES

To design and build an automated aquarium system to be a self-sustained aquatic ecosystem.

Integrate hardware and software to perform the following tasks:

- Test pH level
- Test salinity of water
- Measure and regulate temperature of water
- Measure and maintain appropriate water level
- Automatically feed the fish

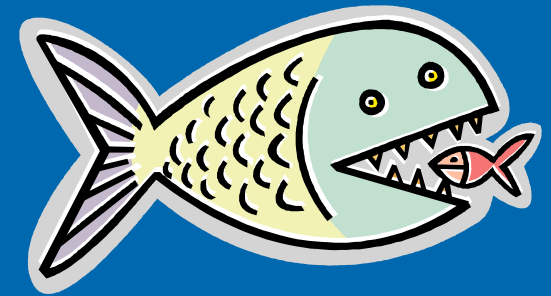
MOTIVATION

- Hobbyist pay a high price for saltwater fish
- Provide an affordable automated system
- Need a system to monitor vital elements of saltwater fish

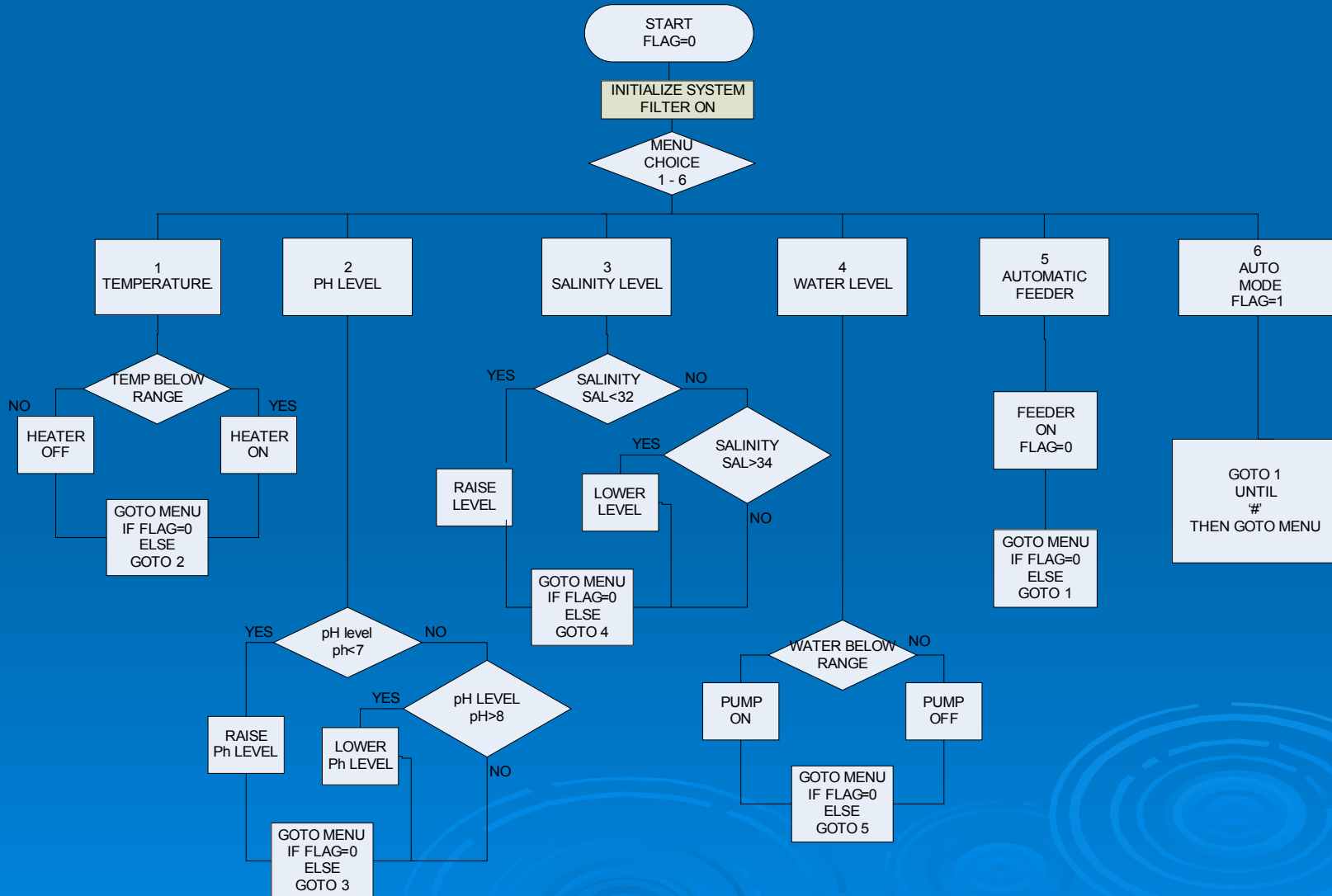


BACKGROUND

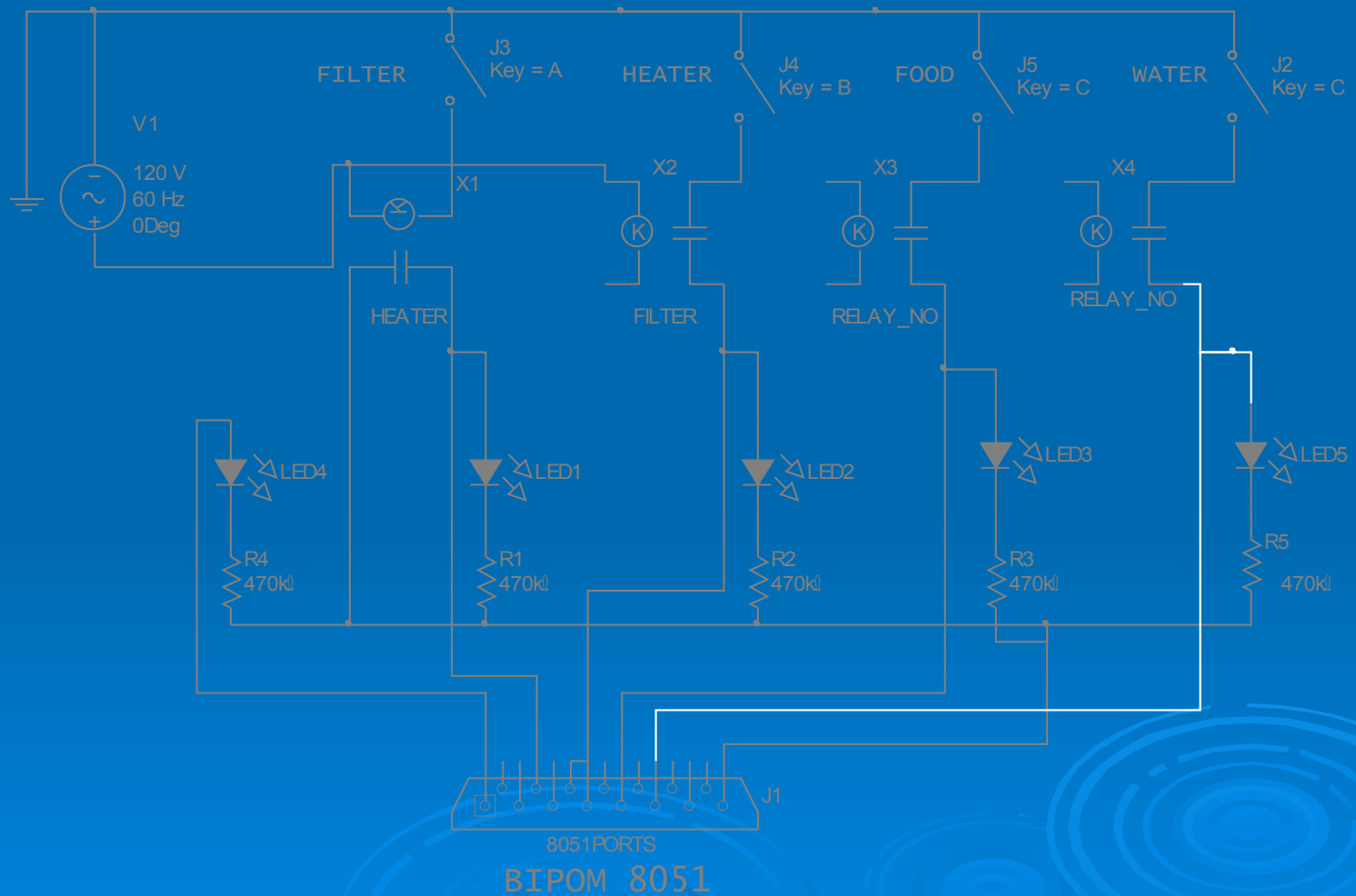
- pH Level: 7 – 8
- Temperature: 72° - 82°F
- Salinity Level: 32 – 34ppt
- Food: Once – Twice Daily (5 min amount)



SOFTWARE

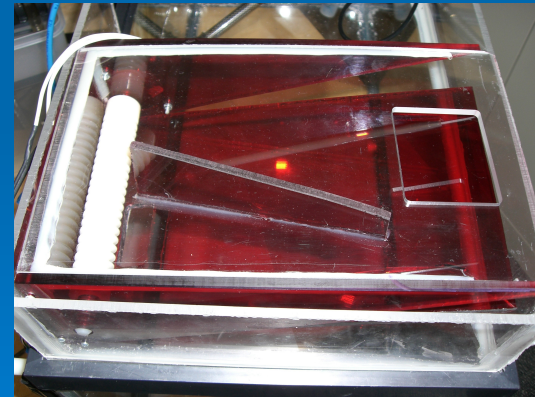
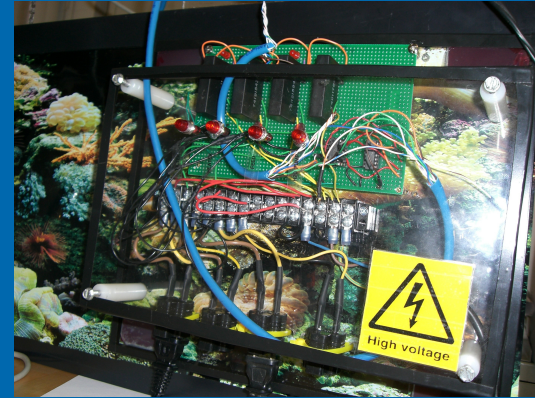


HARDWARE



HARDWARE REQUIREMENTS

- DESIGN PROTOTYPE
 - 8051 Microcontroller with Training Board
 - pH Level Sensor
 - Salinity Level Sensor
 - Temperature Sensor
 - Water Level Sensor
 - Automatic Feeder
 - Relay Circuit Board



DESIGN SPECIFICATIONS



INPUTS



OUTPUTS



VERIFICATION & TESTING

- Component Testing
 - Relay board
 - All Sensors with proper voltage output
 - Automatic motor
 - Water heater
- Integration of Microcontroller and Automated Components
- Full System Testing
 - Simulated full system test
 - Full system test

EQUIPMENT COST

| Current Financial Usage Reporting | | | | |
|-----------------------------------|----------------|-----------------|-----------------|-------------|
| Item | | Est. Cost | Actual Cost | Resource |
| Temperature Sensor | | \$30.00 | \$4.00 | EPO |
| Water Level Sensor | | \$25.00 | \$2.00 | EPO |
| Ph Sensor | | \$45.00 | \$90.00 | Vernier |
| Salinity Sensor | | \$80.00 | Donated | Team |
| Aquarium | | \$50.00 | \$30.30 | Petsmart |
| Water Pump | | \$35.00 | Donated | Team Member |
| Water Heater | | \$30.00 | Donated | Petsmart |
| Microcontroller | | \$110.00 | \$70.00 | BiPOM |
| Training Board | | \$20.00 | \$39.00 | BiPOM |
| LCD/Keypad | | \$15.00 | \$24.00 | BiPOM |
| Aquarium Filter | | \$15.00 | Donated | Classmate |
| Plexiglass, cutter, silicone | | \$30.00 | \$44.44 | Home Depot |
| 3 - Relays | | \$35.00 | \$26.85 | EPO |
| Connector Strip | | \$10.00 | \$5.25 | EPO |
| Liquid Pump | | \$20.00 | \$14.95 | EPO |
| Motor | | \$25.00 | \$6.95 | EPO |
| Circuit Board | | \$15.00 | \$6.95 | EPO |
| Light Emitting Diodes | | \$5.00 | \$1.00 | EPO |
| 14 - Lugs | | \$5.00 | \$2.10 | EPO |
| | Totals: | \$600.00 | \$367.79 | |

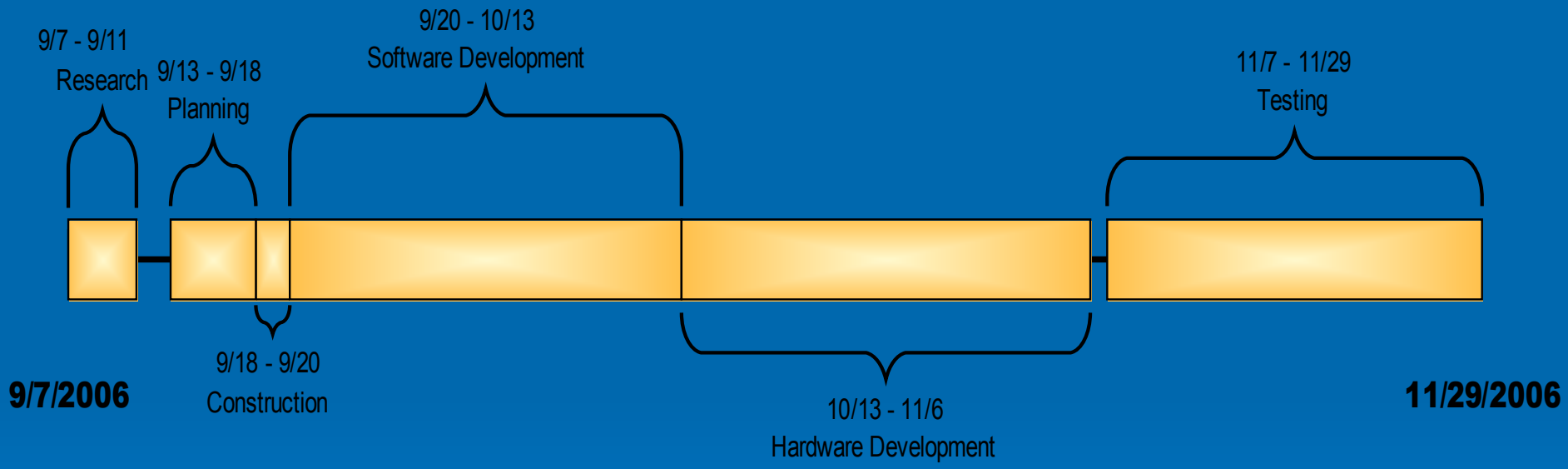
COST ANALYSIS

| LABOR | SALARY/HOUR | HOURS | TOTAL |
|----------------------|---------------|------------|--------------------|
| Research | \$25.00 | 40 | \$1,000.00 |
| Planning | \$25.00 | 24 | \$600.00 |
| Construction | \$25.00 | 32 | \$800.00 |
| Software Development | \$25.00 | 136 | \$3,400.00 |
| Hardware Development | \$25.00 | 352 | \$8,800.00 |
| Testing | \$25.00 | 328 | \$8,200.00 |
| | TOTAL: | 912 | \$22,800.00 |



Grand Total = \$23,167.79

PROJECT SCHEDULE



COMMERCIAL USAGE

- Fish hatcheries
- Restaurants with aquarium exhibits
- Zoo exhibitions
- Entertainment venues



REFERENCES

- BiPOM Electronics, Inc. “Your One Source for Microcontroller Systems and Components”, <http://www.bipom.com/> , 2004
- Vernier Software and Technology. “Measure. Analyze. Learn.”, <http://www.vernier.com/>, 2006
- Automated Aquarium Systems, Inc. “Where You Are in Control of your Aquatic Environment!”, <http://www.automatedaquariums.com/> , 1998
- Parlante, Nick. “Essential C”, <http://cslibrary.stanford.edu/101/EssentialC.pdf> , 2003

QUESTIONS

