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Cyber Aqua Culture Monitoring System Using Ardunio And Raspberry Pi

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ABSTRACT: This paper aims at detecting the problems in aquaculture so that farmers can take preventive measures before things get out of control. It is designed to operate in ponds where aquatic animals are made to develop in their natural habitat. The device is provided with sensors namely Dissolved Oxygen sensor, PH sensor, Ultra Sonic Sensor, etc. which are connected to a base device called Arduino Board. The device uses the internet connectivity to regulate the works without manpower.

In manmade ponds the Dissolved content of the oxygen, the PH level and the Water level varies with the density of the aquatic animals, so if the Dissolved oxygen content in the water decreases it will make the aquatic animals unable to survive in less oxygen atmosphere. The Dissolved oxygen sensor detects this and automatically switches on the aerators which then increase the content of oxygen. Similarly if the PH level of the water is below or above seven (7) the water becomes acidic or basic in nature which is not a good sign of natural habitat for animals. The PH level sensor detects this and we can take counter measures to make the PH again to 7. We can also regulate the temperature of the water using temperature sensor.

KEYWORDS: ardunio board, Raspberry Pi, PH leve*l*

I.INTRODUCTION

Computing the Indian aquaculture is facing a number of problems today. In 2009 Indian production is 2% of total world shrimp production contributing 1730 million dollars of exports. There are several reasons for such a low production. The farmers are not showing interest on aquaculture because of uncertainty in profits, sometimes they are losing their investments also. The major problems are electrical power needs and man power requirements. The production of electrical energy is not in our hands. The best we can do is, use the available electrical energy in an efficient way. The man power needs can be minimized by implementing automation in the process. In our papert we are implementing the following modules.

1. Feed control system.
2. Dissolved oxygen control.
3. pH control.
4. Water level control.

The feeding methods presently available methods require more man power and the feed wastage rate is very high. We are proposing a new method to feed the shrimps. The DO pumps work throughout the day irrespective of pond DO levels. We are implementing a new control system for DO pumps which will work based on DO levels of pond, because of continuous working of DO pumps the chance of failure in DO pumps is high. So we must have a monitoring system to indicate the status of DO pumps. This work will be done by the actuator failure detection module.

The acceptable range for aqua culture is usually between pH 6.5 to pH 9.0. When water is very alkaline (greater than pH 9), ammonium in water is converted to toxic ammonia, which can kill _sh. On the other hand, acidic water (less than pH 5) leeches metals from rocks and sediments. These metals have an adverse e_ect on the shrimp metabolism rates. pH, alkalinity and water hardness go hand-in-hand. Alkalinity is the sum of the carbonate and bicarbonate alkalinities, which are responsible for neutralizing acid in the water without changing the overall pH level. Water hardness is similar to alkalinity but uses di_erent measurements. It is a measure of mainly calcium, magnesium and

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other ions. The correct pH, alkalinity and hardness are essential for a successful aqua life where fertilizers containing nitrogen, prosperous and potassium are added to encourage the growth of phytoplankton. Phytoplankton breaks down waste into harmless ammonia, and is the food of zooplankton a microscopic animal which forage _sh like bluegills feed on. Phytoplankton also produces dissolved oxygen during day photosynthesis and is the most important source of dissolved oxygen in pond systems.

The dissolved oxygen (DO) is oxygen that is dissolved in water. The oxygen dissolves by di_usion from the surrounding air; aeration of water that has tumbled over falls and rapids; and as a waste product of photosynthesis Fish and aquatic animals cannot split oxygen from water (H2O) or other oxygen containing compounds. Only green plants and some bacteria can do that through photosynthesis and similar processes. Virtually all the oxygen we breath is manufacturedby green plants. A total of three-fourths of the earths oxygen supply is produced by phytoplankton in the oceans.

II.RASPBERRY PI

The Model B+ is the general revision of the original Raspberry Pi. It replaced the Model B in July 2014 and was superseded by the Raspberry Pi 2 Model B in February 2015. Compared to the Model B it has:

1.More GPIO: The GPIO header has grown to 40 pins, while retaining the same pin out for the _rst 26 pins as the Model A and B.

2.More USB:. We now have 4 USB 2.0 ports, compared to 2 on the Model B, and better hot plug and overcurrent behavior.

3.Micro SD: The old friction-_t SD card socket has been replaced with a much nicer push-push micro SD version.

4.Lower power consumption: By replacing linear regulators with switching ones weve reduced power consumption by between 0.5W and 1W.

5.Better audio: The audio circuit incorporates a dedicated low-noise power supply.

6.Neater form factor: Weve aligned the USB connectors with the board edge, moved composite video onto the 3.5mm jack, and added four squarely-placed mounting holes.

The Model B+ is perfectly suitable for use in schools: it o_ers more exibility for learners than the leaner Model A or A+, which are more useful for embedded projects and projects which require very low power, and has more USB ports than the Model B.

III.PROPOSED MODEL

A. Experimental Setup

Arduino board consist of ATmega8 processor which is connected to four sensors namely ultrasonic sensor, PH sensor, Dissolved Oxygen sensor, Thermistor. A relay circuit is used, which has four outputs namely Input pump, Outputpump, Dissolved oxygen pump, Feed pump. The Relay circuit is connected to ATmega8 Processor. The Raspberry Pi is connected to 5V, 2A power supply, It is also connected to a3GDongle / Router through LAN The Raspberry Pi is connected to ATmega8 processor through communication ports between them

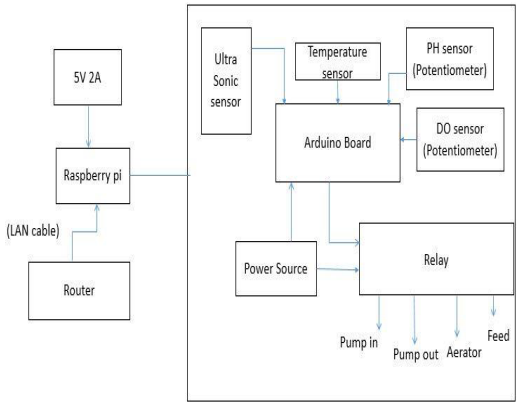

Fig.1 Block Diagram

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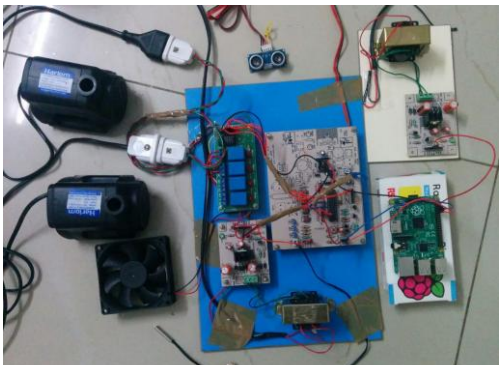

Fig.2 Experimental setup

B. Working schemes

Initially, Raspberry Pi is installed with the Raspbian operating system

• Ultra-sonic, Dissolved Oxygen, PH and Temperature sensor sends their value to Atmega8 processor which is connected to Raspberry Pi
• In the Atmega8 processor the Arduino program is burnt such that each sensor has its own cut off values
• If the sensor sends a value outside the cut off value required action takes place
• A transmitter pin in the analog pi board sends the sensor data to the Raspberry Pi
• In the Raspberry Pi a Python program is programmed such that it gets all the sensor values
• A HTML page is designed such that it gets all the values from the variables of the python program
• The HTML page is made online through tunnel mechanism provided by the NGROK service
• If the system is operated in auto mode then the reverse mechanism takes place
• The commands are directly send to the relay board which performs the necessary actions.

C. Modes of operations

There are two modes of operation, Auto mode and Manual mode

AUTO MODE:
• Each sensor is given its own high and low cut-off values
• Values from the sensors results in the automatic operation of inflow, outflow pumps, aerators

MANUAL MODE:
• Inputs are obtained from the HTML page launched from the Raspberry Pi
• The values are transferred from Raspberry Pi to the Atmega8 processor, which then sends the signal to the relay board directly

• The relay board carries the required action

IV. RESULT AND DISCUSSION

A. Auto Mode

In auto mode of operation the system works automatically without user interface. The sensors namely DO sensor, PH sensor, Ultra-sonic sensor and Temperature sensor gives their input to the ATMEGA8 processor. Then the processor sends the output operation to the respective node on the relay board. If DO values are outside the cut-off values then the aerator is switched on. If the PH values are outside cut-off values then the out pump activates. If the water level in the pond decreases then the inflow pump activates. If the temperature increases then the outflow pump activates. The figure 2 shows the output of Auto Mode operation

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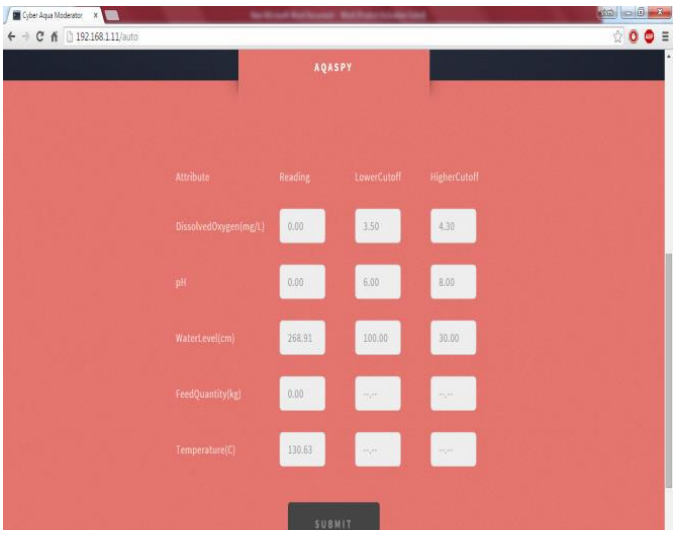

Fig 3.Output of Auto Mode Operation.

B. Manual Mode

In manual mode of operation all the inputs are given from the user. The HTML page designed to monitor the sensor values can be used to automatically switch on the inflow pump, outflow pump, aerators. The figure 3 shows the output of the Manual Mode operation

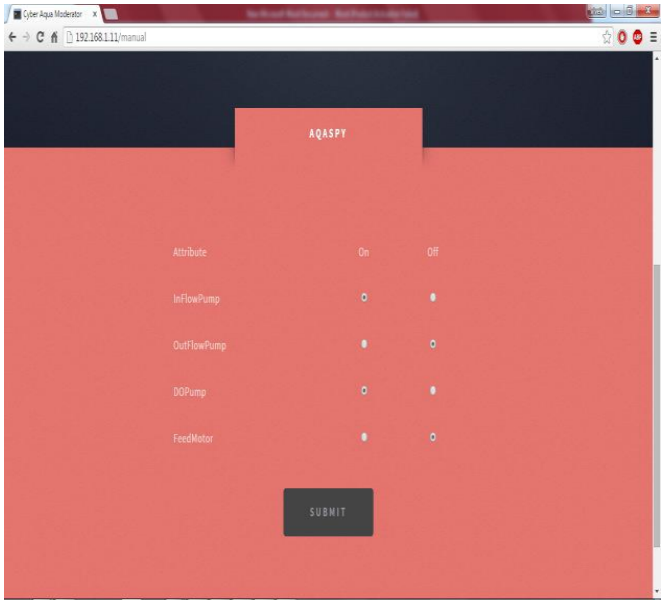

Fig 4.Output of Manual Mode Operation.

V.CONCLUSION

Automation in aquaculture can reduce manpower requirements and also increases the production rate. By using internet based Feed control system we have decreased feed conversion rate (FCR). By using dissolved oxygen (DO) sensor and relay circuit we can continuously monitor and control DO levels in the pond. Maintaining the required

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DO levels will increase growth rate of a shrimp and productivity as well. In order to provide good water quality pH levels should be monitored. pH can be controlled by replacing the water so a relay circuit is used along with pH sensor which operates water pump accordingly. Actuators like water pump and aerators are used in aquaculture. Failures in these actuators can be detected by measuring the current continuously.

This paper can be made more effective by implementing temperature monitoring and salinity monitoring systems because, DO level partially depends upon surrounding temperature and salinity of water in the pond.

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