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Aquatic Farm Monitoring System

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Abstract –It is very important to maintain water parameters such as Temperature, Water Level, pH in Fish farming in pond, lake. Manual monitoring of these parameters is time consuming and may involve human errors. The work in this paper discusses design of aquatic farm monitoring system to measure and monitor various water parameters. A prototype model of fish farming system designedand parameters of water such as a Temperature, Water Level, and pHare monitored by using Temperature, Ultrasonic, and pH sensors respectively. Further, water parameterscan be monitored from other location by using IOT. Water parameters controlling action is done by Raspberry Pi 3B+. This system maintain water parameters by using different devices such as for maintaining temperature Heater is used, for oxygen, Air pump is used. Thus the designed prototype system monitors as well as controlls the water parameters.

Key Words: Fish farming, Ultrasonic sensor, pH sensor, Thinkspeak, Air pump, Heater.

1.INTRODUCTION

Research in aquaculture is an input to increase stabilized production of aquatic animal like fishes. The main aim the project is remote monitoring of the fish farming by using the various sensors to reduce the risk related to the production of fishes. In this process we use sensor like pH value, temperature and level sensor. By using this sensors all the work is automated and it will also be easy to monitor the fish farming parameters from other location.

Fish are cold-blooded animals, regulating their body temperature directly by the water environment. Changes in water temperature affect the amount of dissolved oxygen in the water and fish oxygen consumption. Although the fish can withstand a broad water temperature range, any sudden, extreme changes in water temperature will have a considerable impact on fish physiology. A chilling injury will cause the fish to rush into, paralysis with a loss of balance, leading to death. The reason may be the respiratory center, or osmotic regulation is affected at high temperatures. As the water temperature increases the fish suffer respiratory arrest. [1] The amount of dissolved oxygen in water increases/decreases based on seasons. When the amount of dissolved oxygen in water is reduced below certain limit then fish growth will be hindered. When amount of dissolved oxygen becomes lower than the fish survival conditions the fish will die.[2]In general fish farming the acidity and alkaline of the water should be maintained between 6 to 8. Too acidic or alkaline will cause adverse effects, acid erosion of the gill tissue, tissue coagulation necrosis, increased mucus secretion, abdominal congestion and inflammation. If the PH value is less than 4.5, the fish will die.[3]

Therefore maintaining of water parameterssuch as Temperature, pH etc. is very important for fish growth.

2.SYSTEM OVERVIEW

The block diagram of Aquatic Farm Monitoring System as shown in Fig-1.In this block diagram some input block such as Temperature sensor, Water level sensor, pH sensor are present. These input blocks sense the water parameters such as Temperature, Water level,pH.This sensed parameters send to controlling block. The processor is controlling block in this system. The processor, process the input sensed signal and controlling action will be take place. The displays, Relay module, Air pump, Filter motor, Heater are present in output block. This output block drives according to processor instructions. This also providesaccess of water parametersfrom other location by using IOT.

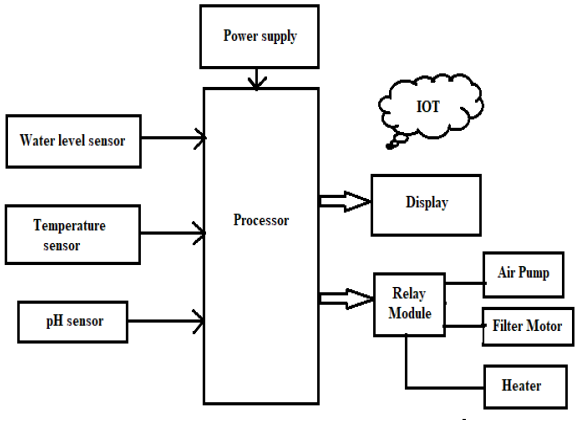


Fig-1: Block Diagram of Aquatic Farm Monitoring System

2.1SYSTEMREQUIREMENTS

2.1.1 Raspberry Pi3B+

The Raspberry Pi 3B+ is a credit-card sized computer that plugs into your TV and a keyboard. It is a capable little computer which can be used in electronics projects, and for many of the things that your desktop PC does, like spreadsheets, word-processing and games.

1. Speed: 1.4 GHz 64-bit Quad-Core Processor.
2. 1 GB RAM Dual Band 2.4GHz and 5GHz
3. IEEE 802.11.b/g/n/ac Wireless LAN
4. Enhanced Ethernet Performance
5. Voltage:5v-2.5 amp

2.1.2 PH sensor

A pH meter is a scientific instrument that measures the hydrogen-ion activity in water-based solution, indicating its acidity or basicity expressed as pH.A pH sensor is one of the most essential tool that is typically used for water measurement. This type of sensor is able to measure the amount of alkalinity and acidity in water and other solution. When a substance has a pH value of seven, this is considered to be neutral.

1. Measuring Range 0 to 14.00 pH
2. Module Power :DC 9.00V, 1A
3. Accuracy 0.1 pH,
4. Response Time:<=1min
5. Output:0.5 to 3V
6. Internal Resistance:250M0
7. Operating Temperature:0 to 60^0 C

2.1.3 Air pump

An Air pump is one key way to add oxygen to the water, allowing fish to breathing easily and grow healthy. Air pumps for lakes, ponds and tanks are typically connected to an aeration device.

1. Voltage: 220-240V
2. Frequency: 50/60Hz
3. Watt: 2.5W Max
4. Output: 3L/Min.
5. High technology
6. Excellent and reliable quality
7. High output, Safe and quiet operation

2.1.4 Heater

Heater is Electrical device, which is used to heat the water. When water Temperature below the threshold limit then Heater is ON through Relay module. Switching of Heater accordingly requirement by using Raspberry Pi.

1. Temperature range: 20°~34°C
2. Power: 100W
3. high quality quartz glass
4. double seal material

2.1.5 MCP 3204

The Microchip Technology Inc. MCP3204/3208 devices are successive approximation 12-bit Analog-to-Digital (A/D) converters with on-board sample and hold circuitry. The MCP3204 is programmable to provide two pseudo-differential input pairs or four single-ended inputs.

1. 12-bit resolution
2. Four single-ended inputs
3. SPI interface
4. 100 sampling rate
5. -40 to +85°C temperature range

2.1.6 20x4 LCD Display

20x4 means that 20 characters can be displayed in each of the 4 rows of the 20x4 LCD, thus a total of 80 characters can be displayed at any instance of time. These signals are recognized by the LCD module from status of the RS pin. Now data can be read also from the LCD display, by pulling the R/W pin high

1. Type: Character
2. Display format: 20 x 4 characters
3. Built-in controller: ST 7066 (or equivalent)
4. Duty cycle: 1/16
5. 5 x 8 dots includes cursor
6. + 5 V power supply (also available for + 3 V)
7. LED can be driven by pin 1, pin 2, pin 15, pin 16 or A and K

.

2.1.7 Four channel relay module

The four channel relay module is a convenient board which is used to control high voltage, high current load such as motor, Heater, Air pump. It is interface with microprocessor such as Raspberry pi 3B+. It also comes with a led to indicate the status of relay.

1. relay module is 5V active low
2. output maximum contact is AC250V 10A and DC30V 10A.
3. Working status indicator lights

2.1.8 Raspbian

Raspberry pi OS (formerly raspbian) is a De bian based operating system for raspberry pi. Since 2015 it has been officially provided by the raspberry pi foundation as the primary operating system for the family of raspberry pi single-board computers. The original raspbian OS was created by Mic Thompson and Peter Green as an independent project. The initial build was completed in June 2012. Previous pi OS has been 32 bit and based on raspbian core, taking the name rasp bian. Since recent 64 bit versions no longer use the raspbian core, the name has been change to raspberry pi OS for both 64 bit and 32 bit versions raspberry pi OS is highly optimized for the raspberry pi lines low performance ARM CPUs.

2.2METHODOLOGY

This system used different sensors to measure water parameters. For temperature measurement, system used temperature sensor. Water level measured by using ultrasonic sensor. For finding acidity or alkaline of water used PH sensor.Outputs of all sensors send to processor. Processor receives all the information from the sensors and processing this information and find out water parameters value. All the parametersdata send to cloud via Wifi module. So that at any place accessof this informationpossible throughthinkspeak website. In this way this system monitors all the parameter at any place. Also processor analysis all the parameters and control action take place if parameters change which not suitable for aquatic animals. For maintaining the temperature and dissolve oxygen air pump is used for providing oxygen air pump is used. Filter motor is ON or OFF by certain delay to reducesammonia and maintain pH. According to temperature sensor heater action is control. In this way controlling action will be takes place.

2.3SYSTEM DEVELOPED

The prototype model of system as shown in Fig-2 and Fig-3.This system is developed at small scale level by using fish tank. The side view and front view of system as shown in figure. In this system also include filtration system at small scale level. Statuses of system are indicated by using LCD display.

Fig-2: Front View of Developed System

Fig-3: Side View of Developed System

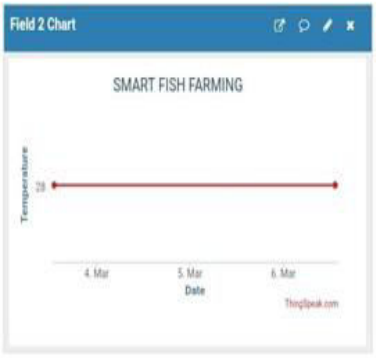
2.4RESULT

The access all water parameters such as temperature, water level, and pHis possible by usingThinkspeak.This system provides access of water parameters from other location that is apart from actual plant. Thinkspeak provide graphical representation of water parameters such as Temperature, Water Level, pH etc.There are three fields present on thinkspeak.

1. Field (1) shows that variations of water level at different date. With the help of this field monitoring of water level is possible.
2. Field (2) shows that temperature of water at different date. This field provides information about changes in water temperature.
3. Field (3) shows that pH of water level at different date.This field used in observing pH of water.

In this way this system monitor all the water parameters from other locations.

Chart-1: Field 1 Water Level Chart



Chat-2: Field 2 Temperature Chart

Chart-3: Field 3 pH Chart

3 CONCLUSIONS

To test water parameters is manual task and it is time consuming and at a time is not possible manually. If water parameter changes which is not suitable for aquatic animals according parameter controlling action take place manually

This systemmeasure pH ,water level and temperature by using sensors and Raspberry Pi 3B+.Also possible to control water parameter by using different devices such as Air pump, Heater and Filter motor.

Using IOT technology this system monitors all parameters from outside of the plant. This will reduces human efforts and save the time.

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