Abstract — monitoring the quality of water in the aquaculture is most important. When comes to monitoring, checking the water quality manually in the correct period is not possible in all time. The proposed system is to make easy of checking the quality of the water. A message will be sent to the cultivator about the change in the quality of the water. Here the smart feeding system will be helpful in feeding the fish automatically.

Keywords — smart feeding; water quality; pH; temperature;

I. INTRODUCTION

Aquaculture is the farming of fish, crustaceans, molluscs, algae and other aquatic organisms. Aquaculture is of two major types: Freshwater aquaculture and marine aquaculture. Marine aquaculture known as Mari-culture is the farming of marine aquatic organisms. Freshwater aquaculture is the farming of freshwater aquatic organisms. Though marine aquaculture has a lot of scope, freshwater aquaculture has an increased scope. Nowadays, freshwater aquaculture has become the widely followed business. Since, majority of the people have a attraction towards the aquatic organisms, and love to taste different organisms has increased the growth of aquaculture. Freshwater aquaculture requires continuous monitoring of the water quality parameters such as pH, temperature, salinity, turbidity, and dissolved oxygen and nitrogen compounds. These water quality parameters must be in a particular range, so that nothing will be harmful to the fish. If the water quality parameters do not lie in the particular range, it signifies that the water is contaminated. There are many reasons behind the contamination of water. One of the reasons is that, the excreta of the fish when reacts with the water contaminates the water. Fish cannot stay healthy in contaminated water. Other reason for alteration of water quality is the fish food. The food when gets reacted with water it produces compounds of Nitrogen. The pH of the water will rise, thus resulting as basic compound. The temperature must be monitored because climatic changes and place where the organisms are raised differs. Another major issue affecting aquaculture is that, the fish must be fed at regular intervals. If the time interval varies, it leads to the death of the organism. Therefore, some ideas were proposed to overcome the above issues in aquaculture. The existing system monitors the water quality parameters such as temperature, pH, dissolved oxygen and ammonia content and reports through ZigBee module. ZigBee has a lower operating range. Therefore, the cultivator cannot be reported, if he is out of the operating range. Therefore, we are in need of a system that alerts the cultivator wherever he is. This could be done with the help of IoT. The parameters range will be continuously updated over the internet. The drawback of IoT is that, the user must open the webpage to see the results. However, if the water quality parameters are normal no alert is needed. Therefore, we could use a GSM module that alerts the cultivator about the water quality parameter, when the threshold is exceeded and wherever he is. Food is the major requirement of every organism. No organism can live without food. Therefore, it is necessary to feed the organism at regular intervals based on its requirements. If the aquatic organism is fed based on its requirements, then the Food Conversion Ratio becomes high. Our system is specially designed in a way to increase the food conversion ratio. This system feeds the aquatic organisms at regular intervals based upon their requirements. Thus, the aquatic organisms stay healthy for a long period. This facilitates the cultivator to produce a high yield. This could also be implemented in aquariums to safeguard the life of fishes in the aquarium.

II. LITERATURE REVIEW

[1] An event-based Internet robotic system to monitor water quality and to feed crayfish in a shade house, guided by
a model-based development methodology. Their robotic system consisted of a mobile robot to transport a water multi parameter sonde and six containers for distributing food onto the pond surface, a dispatcher unit to dispense a precise amount of food from the containers and a computer running as a server to define, over the Internet, the feeding and monitoring schedule through a client application. The development methodology started by making an abstract functionality model to accomplish the tasks. Next, the functionality model is described using the unified modelling language (UML) that specifies the structure and behaviour of the system components. Later, the methodology translated the UML dynamic description depicted by state chart diagrams into Petri net (PN) formalism. PN models are merged and analysed based on their behavioural properties to validate the design as a stable event-based Internet system. Following the UML and PN designs, the robotic system is implemented. The drawback is that just an theoretical experimentation has been drafted and no explanation of the hardware was given.

[2] A network of smart sensors, based on suite of standards, for in situ and in continuous space-time monitoring of surface water bodies, in particular for seawater. Their aim is to capture possible extreme events and to collect long-term periods of data. This seawater monitoring system is a Decision Support System, which is any system that might support decision-making. Explicit set of rules or decision it should make are a matter for biologists, anyway its implementation would result in an immediate increase of the effectiveness of the analysis as it provides support to all those who need to make strategic decisions in the face of problems that cannot be solved with a conventional approach. Once implemented, new devices can be added without having to make any further changes to the network. This system was designed especially for in-situ and hardware portion lacks explanation.

[3] An automated monitoring system for the fish farm aquaculture environment. This system is network surveillance combined with mobile devices and a remote platform to collect real-time farm environmental information. It permits real-time observation and control of fish farms with dissolved oxygen sensors, temperature-sensing elements using A/D and 8051-module signal conversion. The real-time data is captured and displayed via ZigBee wireless transmission signal transmitter to remote computer terminals. Visual Basic 2010 software is used to design the interface functions and control sensing module. This system is low-cost, low power, easy operation with wireless transmission capability. This wireless monitoring system Visual Basic graphics window program design control interface displays graphs for the temperature and dissolved oxygen sensing modules. The measured value and amount of change are displayed in accordance with the settings. Drawback of this system is that for continuous monitoring solar power is required.

[4] A feeding control system based on groups of sensors that take the appropriate decisions when the fish are fed in marine fish farms. This system mixes data obtained from a group of sensor and performs an exhaustive control on the food offered to the fish, thus reducing costs. This will avoid waiting large quantities of food and an economic saving will be achieved. They used the behaviour of the movements of the fishes and some parameters from the water. These movements are monitored strategically by a group of underwater transducers placed along the length, width and depth of the cage and through data fusion, they provide the information needed in the system to continue feeding the fish or not.

[5] Artificial neural networks to predict water quality using satellite images. This shows great potential to make this process faster and at lower costs. They discussed an indirect method to estimate the concentration of pigments (chlorophyll-a), an optically active parameter in water quality. A model based on artificial neural networks, using radial basis functions architecture, was developed to predict Tucuruí’s Reservoir chlorophyll-a concentrations. As input to the neural networks, spectral information from Landsat was used, while pigment concentration were used as output information.

### III. PROPOSED SYSTEM

This system provides an efficient semi-automatic system that facilitates the healthy growing of aquatic organisms in aquaculture. This method involves the water quality monitoring system and feeding system. The water quality monitoring system continuously monitors the water quality parameters such as pH and temperature using respective sensors. Though there are many water quality parameters, pH and temperature plays a major role in water quality. The pH value of seven indicates neutral i.e. neither basic nor acidic. Fish excreta is not a controllable one. It reacts with water, thus polluting the water. This could be monitored because pH value changes when this reaction takes place. Temperature must be monitored because temperature varies with places and seasons. The GSM module is used to alert the cultivator whenever the quality parameters violates the normal range. The feeding system automatically feeds the fish based upon its requirements. A maximum of seven pellets is enough for an organism to stay healthy. More than seven or less than five may lead to the death of an organism. Therefore, it must be fed based upon its requirement.

### IV. BLOCK DIAGRAM OF THE PROPOSED SYSTEM

![Figure 1: Block Diagram](image-url)
The system mainly consists of two sensors - pH sensor and temperature sensor. The probes of these sensors are deployed in water bodies. pH probe is connected to a module which is further connected to arduino. It is a single cell battery with high resistance the voltage produced is directly proportional to the hydrogen ion concentration the probe. Potential difference given as output cannot be measured directly by arduino. This is why amplifier is needed between the two. The probe also has extremely high impedance because of which we need to connect an OP AMP to it. These are the reasons for the inclusion of pH circuit in between pH probe and arduino.

Similarly, temperature sensor is connected to the arduino for measuring temperature of water. These sensors continuously monitor water quality and send data to arduino. Arduino checks whether the received values are within the limit. If the values are out of the range, then the arduino alerts the cultivator via GSM module.

**V. HARDWARE REQUIREMENTS**

[1] Arduino Uno

- Microcontroller ATmega328
- Operating Voltage 5V
- Input Voltage (recommended) 7-12V
- Input Voltage (limits) 6-20V
- Digital I/O Pins 14 (of which 6 provide PWM output)
- Analog Input Pins 6
- DC 40 mA DC Current for 3.3V Pin 50
- mA Current per I/O Pin 40
- Flash Memory 32 KB of which 0.5 KB used by bootloader
- SRAM 2 KB
- EEPROM 1 KB
- Clock Speed 16 MHz

[2] DS18B20 Temperature Sensor

- Supply Voltage +3.0 to +5.5 V
- Sink Current 4.0 mA
- Active Current 1.5
- Write Cycle Time 2ms
- Temperature Conversion Time
- Thermometer Error $f$ For $10^\circ C$ to $+85^\circ C$ - $\pm0.5f$
  
  For $-55^\circ C$ to $+125^\circ C$ - $\pm2$

[3] pH sensor

- Range 0–14
- Response Time 95% in 1s
- Max pressure 100 PSI
- Temperature Range 1-99°C

[4] SIM900A - GSM module

- Dual-Band 900/1800 MHz
- Class 1 (1 W @ 1800/1900MHz)
- Control via AT commands (GSM 07.07, 07.05 and SIMCOM enhanced AT Commands)
- Low power consumption: 1.5mA (sleep mode)
- Operation temperature: -40°C to +85°C

**VI. DATA FLOW**

Figure 2: Flowchart

**VII. METHODOLOGY**

Figure 3 Coding process
In aquaculture, water quality management plays an important role. As water quality matters a lot, the quality is monitored on a regular basis with the help of the pH sensor and temperature sensor. The sensors will update the values to the Arduino. The updated values will be checked regularly whether the values are within limit. If any value violates the range, the warning message is sent to the cultivator through a short message using GSM module. The values found abnormal to the threshold values are harmful for healthy growing of fish. The mechanical system that is proposed will feed the fish at a regular interval of time. The time interval is already programmed in the Arduino. The food feeding will be limited according to the count of the fish in the aquafarm. As the count increases the food feeding will also be increased, if the count decreases the food feeding will be decreased. This will facilitate the healthy growing of fish. The food conversion ratio becomes high thereby decreasing the wastage of food.

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