BIO-INSPIRED WATER MONITORING SYSTEM

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Introduction:
Environmental and water quality monitoring are key to measuring and understanding the chemical and biological quality of water and for taking reactive remedial action. Monitoring water is a significant financial burden when using conventional sampling and laboratory-based techniques, but sensors offer the potential to considerably reduce these costs, as well as providing more useful, continuous monitoring capabilities. Traditional environmental and water quality monitoring is a means of providing information on the status of the natural environment and of detecting long-term changes resulting from anthropogenic activities, but does not normally allow for the detection of occasional events. While the measurement and detection of environmental pollutants can be successful under laboratory conditions, continuous monitoring remains the most challenging aspect of environmental sensing. The area of wireless sensing, particularly the concept of wireless networked sensors is fast becoming one of the most dynamic and important areas of multidisciplinary research. The ideal monitoring system of the near future might consist of a network of sensors deployed at key locations capable of autonomous operation in the field. Water quality monitoring refers to the measure of the condition of water relative to the requirements of biotic species and to human needs. It holds great importance and have uses in several areas ranging from keeping track of pollution levels using pH sensor, fish breeding depending on the temperature of the water bodies. Organic matter is a key source of many water quality challenges. Unwanted microbial growth and consumption of coagulant chemicals, attributed to excess organic matter accumulation, are two side effects well-known to the water-treatment industry. Keeping a close eye on the industries in the vicinity of the waterbody so that if there is a case of dumping or leakage then it can be controlled and regulative action could be taken. As the water quality profoundly impacts the human and ecological well-being so it is vital to screen the contamination levels, as the more we screen our water bodies the better we will have the capacity to perceive and anticipate defilement issues.

Objectives:
The objective of this project is to design a wireless water monitoring system in which a microcontroller is interfaced with sensors and servo motors. It will be controlled using the Mobile application and transmit sensed data wirelessly to the mobile application through which it will also be controlled.
1. Analog data from temperature sensor fetched and transmitted to the digital pin of the NodeMCU Microcontroller.
2. Analog data from the pH sensor and the turbidity sensor is fetched and transmitted to the multiplexer IC 4051 which will alternatively fetch the data and transmit to the analog pin of the NodeMCU.
3. The servo motors are programmed to perform an undulatory movement. They are connected and controlled by the digital pins of the Node MCU.

**Methodology:**

Hardware requirements: Sensors (pH sensor, Temperature sensor, Turbidity sensor), Servo motors, nodeMCU

Software requirements: Arduino 1.8.5(IDE), BlynkApp, Blynks, Windows OS

The wireless water monitoring system is an automated version of manually measuring temperature, pH and turbidity value and sending the information to a distant database wirelessly via mobile application. The system has got almost all things automated so that we get an advantage of this concept i.e. the real time measurement of the parameters. Maintaining backup of sent data is easy and can be done within a few seconds. This model uses a NodeMCU which is an open source IoT platform and runs on ESP8266 Wi-Fi SoC. The NodeMCU module is connected to other components and acts as the main control unit of the entire system. The system model is shown in Figure below which says about the connectivity of all mentioned devices. The real time data is sent wirelessly through the Wi-Fi module connected to the internet to the Blynk server.

The Temperature sensor is connected to the NodeMCU at digital pin D0 and the turbidity and the pH sensor are connected to the IC 4051 which is a multiplexer IC as the NodeMCU has only one analog pin and both the sensors require analog pin in order transmit the data into the server. The received real-time data is fetched by the microcontroller which has an inbuilt Wi-Fi module connected to the internet transmits the data into the server which can be viewed by the authorities in order to monitor the water pollution who have the Blynk ID. The Bio-Inspired Water Monitoring System can be controlled by the Blynk application wirelessly and made to move in the water body in different directions without harming the fishes. The authority sends the data through the application using the joystick control and this data is received by the robot controlled by NodeMCU which is connected to the Blynk server using internet. The complete circuit diagram is as shown in the Figure below.
Results and Conclusion:
The advantage of this test is that results can be immediately be observed, and the successful results contains the values of temperature, pH and turbidity in the Blynk app verifies the method of sending the data to the Blynk server and the Blynk app interface is as shown in the Figure below. The motion of the Robotic fish in forward, right and left directions verifies the method of controlling the Robotic fish through Blynk mobile app.

Blynk app interface

Scope for Future work:
1. In addition to providing water data, the robotic fish is also able to modify the way they swim according to the water conditions with the purpose of, for example, to detect and highlight the areas of concentration.
2. A Bio-propelled automated fish can drench into the water and perform different undertakings that will enhance our conduits. Such undertakings include reviewing and checking water content, clearing gliding flotsam and jetsam, gathering information and not withstanding transferring video, the terrible, and the monstrous of our waters.

3. Autonomous Robotic fish, which adapts with surrounding environment and performs behaviors or tasks with a high degree of autonomy.

Conclusions:
In this project we present the research leading to the design of a biologically inspired robotic fish. The design attempts to achieve the planned and regulated movement of a Robotic fish, while also incorporating many sensors inside the body of it.

Test thinks about were directed to describe and to improve the movement of the Robotic fish. This Robot will emulate swimming fish keeping in mind the end goal to limit the fish unsettling influence and stress, can recognize in-situ constant irregularities and this is appropriate to control natural conditions in angle ranches.

Bionic sensors were utilized to screen the water quality. Since water sharpness specifically influence different markers both water quality and fish wellbeing, so we have utilized pH sensor in the model to identify the pH level of water.