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IOT Based Aquaculture Monitoring System

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Abstract: Internet of Things (IOT) is a very fast growing technology and the field of IOT is extending its wings in every one of the areas today. With the progression in computers like Raspberry pi, the innovation is achieving the ground level with its application in farming and aquaculture. In this work, we have outlined and actualized monitoring of water quality of aquaculture utilizing Raspberry Pi, various Sensors, USB Camera and OpenCV. Water quality parameters used in this work are Temperature, Turbidity, TDS, Float sensor and usb camera. Sensor acquisition is conducted by Raspberry Pi is used as data processing device as well as server. Photo acquisition is also performed by Raspberry Pi with the help of the usb camera to detect the colour of the water. Android phone is used as the terminal device. A user can monitor the water condition using an android app through Wi-Fi within Wi-Fi range and through Internet from anywhere in the world. Some analysis is performed with the four parameters value to determine the overall approximate condition of the water and required action. Every feature in this checking gadget can work legitimately and easily.

INTRODUCTION:

Aquaculture is one of the thriving areas in many countries in the world since demand for fish and the fish prepared food is expanding day by day. According to The United Nations Food and Agriculture Organization (UNFAO) "2012 State of World Fisheries and Aquaculture", Worldwide yearly production of fishery items add up to around 128 million tons. The animal protein intake per individual is about 15% and increase the human reliance on fishery resources. The average consumption of fish products is 19 to 20 kg per person per year today and will be 16.7 kg per year in 2030 according to UNFAO. Production of fisheries, advancement and future food needs are firmly related [1]. Aquaculture comprises of the set of exercises, information and techniques for the rearing of aquatic plants and a few animal groups. This activity has an awesome significance in financial improvement and food production. Commercial aquaculture is confronting numerous issues because of sudden climatic vacillation leading to changes in water quality parameters. Aqua farmers are relying upon manual testing for knowing the condition of the various parameters of the water. But this manual testing is time consuming and also give inappropriate results as parameters for measuring water quality changes continuously. It will be better if automatic monitoring can be done somehow. So modern technology should be brought to aquaculture to overcome this problem. For rural development, technologies have to support several key application areas, for example, living quality, wellbeing, environmental change etc. [20]. So we have to be more selective in choosing the appropriate technologies for this kind of advancement. An integrated on chip computer Raspberry Pi is used in our system as data processing and storing device which has an inbuilt Wi-Fi module. Using the Dataplicity service we can also access the Raspberry Pi through internet [18]. So, no additional Wi-Fi or Internet module is required. Smartphones are very obtainable and most of the smartphones have Media Transfer Protocol(MTP) today. Using these and performing some analysis on the water quality parameters make our work un

LITERATURE SURVEY:

Tittle: Knowledge-Based Real-Time Monitoring System for Aquaculture Using IOT
Year: 2017
Author: K. Raghu Sita Rama Raju, G. Harish Kumar Varma

Internet of things is one of the rapidly growing fields for delivering social and economic benefits for emerging and developing economy. The field of IOT is expanding its wings in all the domains like medical, industrial, transportation, education, mining etc. Now-a-days with the advancement in integrated on chip computers like Arduino, Raspberry pi the technology is reaching the ground level with its application in agriculture and aquaculture.

Water quality is a critical factor while culturing aquatic organisms. It mainly depends on several parameters like dissolved oxygen, ammonia, pH, temperature, salt, nitrates, carbonates etc. The quality of water is monitored continuously with the help of sensors to ensure growth and survival of aquatic life. The sensed data is transferred to the aqua farmer mobile through cloud. As a result preventive measures can be taken in time to minimize the losses and increase the productivity.

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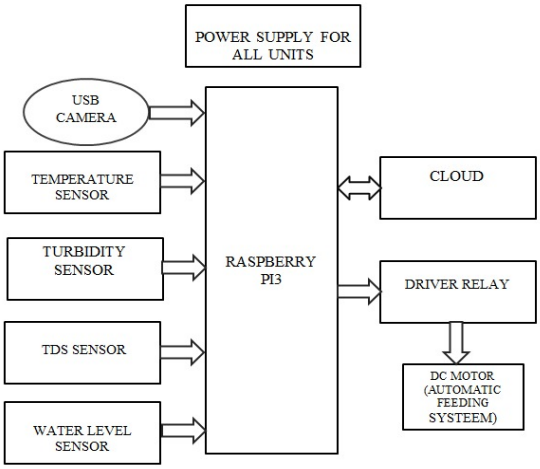
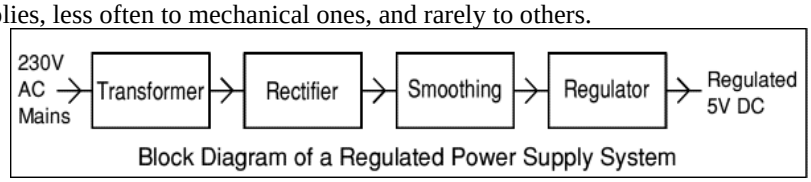
BLOCK DIAGRAM



HARDWARE DESCRIPTION

POWER SUPPLY

Power supply is a reference to a source of electrical power. A device or system that supplies electrical or other types of energy to an output load or group of loads is called a power supply unit or PSU. The term is most commonly applied to electrical energy supplies, less often to mechanical ones, and rarely to others.

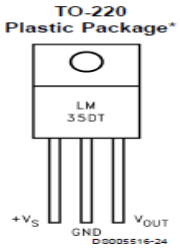


Block Diagram of a Regulated Power Supply System

TEMPERATURE SENSOR (LM35):

The LM35 is an integrated circuit sensor that can be used to measure temperature with an electrical output proportional to the temperature (in ºC). The LM35 generates a higher output voltage than thermocouples and may not require that the output voltage be amplified.

PIN DIAGRAM:



TURBIDITY SENSOR

The gravity Raspberry pi turbidity sensor detects water quality by measuring the levels of turbidity, or the opaqueness. It uses light to detect suspended particles in water by measuring the light transmittance and scattering rate, which changes with the amount of total suspended solids (TSS) in water. As the TTS increases, the liquid turbidity level increases. Turbidity sensors are used to measure water quality in rivers and streams, wastewater and effluent measurements, control instrumentation for settling ponds, sediment transport research and laboratory measurements. This liquid sensor provides analog and digital signal output modes. The threshold is adjustable when in digital signal mode. You can select the mode according to your MCU.

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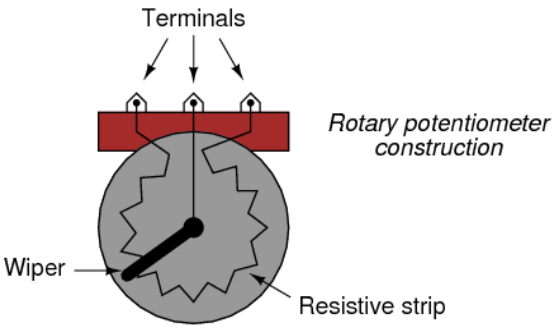
TDS SENSOR

TDS (Total Dissolved Solids) indicates how many milligrams of soluble solids are dissolved in one liter of water. In general, the higher the TDS value, the more soluble solids are dissolved in water, and the less clean the water is. Therefore, the TDS value can be used as one reference point for reflecting the cleanliness of water.

Potentiometer

A potentiometer is a manually adjustable resistor. The way this device works is relatively simple. One terminal of the potentiometer is connected to a power source. Another is hooked up to ground (a point with no voltage or resistance and which serves as a neutral reference point), while the third terminal runs across a strip of resistive material. This resistive strip generally has a low resistance at one end; its resistance gradually increases to a maximum resistance at the other end. The third terminal serves as the connection between the power source and ground, and is usually interfaced to the user by means of a knob or lever. The user can adjust the position of the third terminal along the resistive strip in order to manually increase or decrease resistance. By controlling resistance, a potentiometer can determine how much current flows through a circuit. When used to regulate current, the potentiometer is limited by the maximum resistivity of the strip.



USB CAMERA

Capture photos and videos, upload to Facebook with one-click, adjust camera settings, and more. Logitech Webcam Software lets you capture your own photos and videos (720p/1080p mode with some cameras), adjust your camera settings, activate motion detection, and use face-tracking with your preferred video-calling software.

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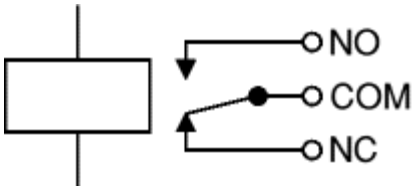
RASPBERRY Pi

The **Raspberry Pi** is a series of small single-board computers developed in the United Kingdom by the Raspberry Pi Foundation to promote the teaching of basic computer science in schools and in developing countries. The original model became far more popular than anticipated, selling outside of its target market for uses such as robotics. Peripherals (including keyboards, mice and cases) are not included with the Raspberry Pi. Some accessories however have been included in several official and unofficial bundles.

RELAYS

A relay is an **electrically operated switch**. Current flowing through the coil of the relay creates a magnetic field which attracts a lever and changes the switch contacts. The coil current can be on or off so relays have two switch positions and most have **double throw** (**changeover**) switch contacts as shown in the diagram.



SOFTWARE DESCRIPTION

PYTHON

Python is a wonderful and powerful programming language that's easy to use (easy to read and write) and with Raspberry Pi lets you connect your project to the real world. Python syntax is very clean, with an emphasis on readability and uses standard English keywords.

OPENCV

OpenCV-Python is a library of Python bindings designed to solve computer vision problems. ... OpenCV-Python makes use of Numpy, which is a highly optimized library for numerical operations with a MATLAB-style syntax. All the OpenCV array structures are converted to and from Numpy arrays.

OpenCV (Open Source Computer Vision) is a library of programming functions mainly aimed at real-time computer vision. In simple language it is library used for Image Processing. It is mainly used to do all the operation related to Images.

Human eyes provide lots of information based on what they see. Machines are facilitated with seeing everything, convert the vision into numbers and store in the memory. Here the question arises how computer convert images into numbers. So the answer is that the pixel value is used to convert images into numbers. A pixel is the smallest unit of a digital image or graphics that can be displayed and represented on a digital display device.

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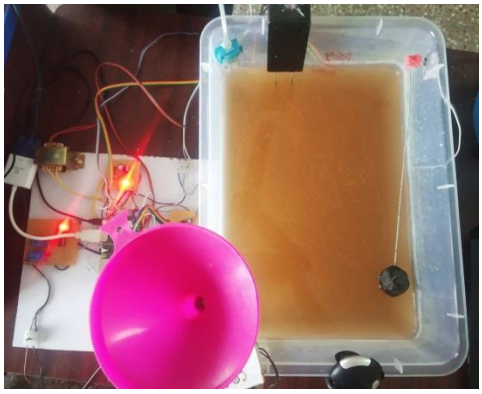
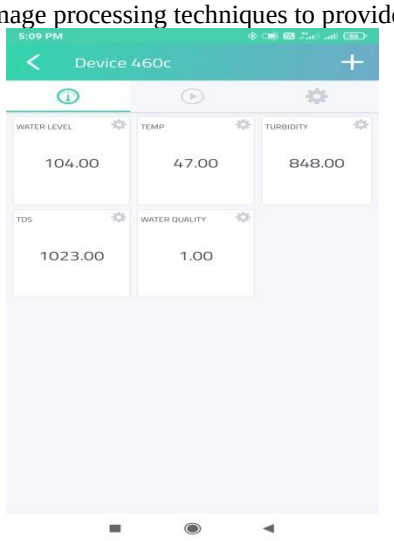
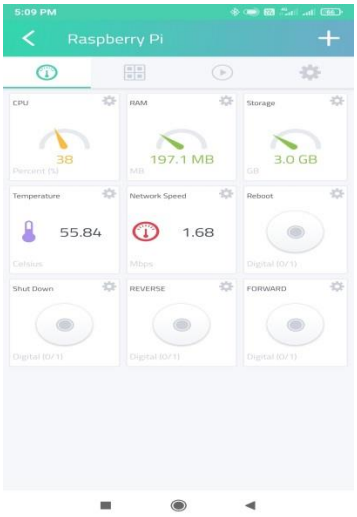
RESULT AND CONCLUSION

This work designs and implements a unique aquaculture monitoring system based on IoT. Both Wi-Fi and Internet are combined in this system for convenience. This work finds a way to give better result with low cost than other available systems. Aqua farmers can avoid time consuming manual testing now. This will help the aqua farmers to produce more number of fishes which will help to fulfil the demand for fish. Though we have created a system to control a demo aeration system, more actuators such as heating rods, fish feeder etc. will be integrated to this system. We will develop a better way to capture image and use better image processing techniques to provide better result.







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