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DESIGN AND DEVELOP WATER QUALITY MONITORING SYSTEM

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ABSTRACT

Water is very important in our daily life. The quality of water is very important aspects. Hence, we have to check the quality of water in real time to ensure safe and clean water. The system measures the physical and chemical parameters of water such as pH, level, turbidity, temperature, humidity, dissolve oxygen, conductivity, etc. In this project paper we present a system for real-time monitoring of the water quality using raspberry pi. The system consists of pH sensor, Turbidity sensor, Dissolve Oxygen sensor that are used to check the quality of water. The processor is Raspberry-pi. The measured values from the sensor can be processed by ADC and Raspberry pi. The data is instantaneously viewed on mobile/laptop/PC by using Wi-Fi in the form of Webpage.

Keywords: pH sensor, Turbidity sensor, DO sensor, Raspberry-pi3b

INTRODUCTION

Now a days, quality of water has decreased because of huge expansion of industries, growth in population, excessive use of inorganic substances. Natural quality of water due to hazards of various categories is collapsed in it. Fresh and clean water is limited on the Earth and it is essential resource for industry, industry, agriculture and all the creatures existing on earth including human being.

Traditional method of water quality control involves the manual collection of water sample at various locations. These water samples tested in laboratory using analytical technologies [5].This process is tedious thatrequires more timeand also involves human errors. Hence there is need of developing better system to monitor the water quality parameters in real-time with avoidance of the wastage of water.

The water quality parameter pH is measure of hydrogen ion concentration of solution. Pure water has 7 pH values indicate acidity and more than 7 indicate alkalinity. The normal rage of pH is 6 to 8.5. Dissolve oxygen is one of most important indicators of water quality. It is essential for the survival of fish and other aquatic organisms. Oxygen dissolves in surface water due to aerating action of winds. It makes drinking water taste better. Turbidity is measure of the cloudiness of water. Many drinking water utility strives to achieve levels as low as 0.1 NTU. The European standards for turbidity state that it must be no more than 4 NTU. World Health Organization (WHO), established that turbidity of drinking of drinking should not be more than NTU, and should ideally be below NTU.

In this project, when low level of water is detected in the overhead tank, the signal will be given to raspberry-pi that will analyze the quality of water in bottom tank. If the quality of water is good then it will be fed in the

overhead tank through pump otherwise it will drained off. And when high level is reached of overhead tank then pump will turn off.

LITERATURE REVIEW

Jayati Bhatt, JigneshPatoliya entitled *"**IOT based water quality monitoring system**"*. Published in 2016, International Journal of Industrial Electronics and Electrical Engineering.In this paper system consist of sensors which measure the water quality parameters the measured values from the sensor are processed by microcontroller and this process values are transmitted remotely to the core controller that is raspberry-pi using Zigbee protocol sensor data can be view on internet browser application using cloud computing.[3]

Vaishnavi V. Daigvane, Dr. M. A. Gaikwad entitled *"**Water Quality Monitoring System Based on IOT**"*. Published in 2017, Advances in Wireless and Mobile Communication. In this paper the system consist of several sensors is used to measuring physical and chemical parameter of water. The core controller is used in that system is Raspberry-pi. The sensor data can be viewed on Internet using Wi-Fi system.[2]

Tha.Sugapriya, S. Rakshaya et.al entitled *"**Smart Water Quality Monitoring System For Real Tome Application**"*.Published in 2018, International Journal of Pure and Applied Mathematics. This system its make use of four sensor(turbidity, temperature, pH, conductivity) and the Arduino controller connected with internet of things. The processing is done by module microcontroller and the transmission module GSM. [3]

Poornima K. Keerthana M.R. and Dr. S. Sumathi entitled *"**Borewell Water Quality and Motor Monitoring Based IoT Gateway**"*. Published in 2018, International Conference on Communication Computing And Internet Of Things. In this paper the system consist of turbidity and pH sensor to check water quality and temperature and current sensors for motor monitor, single micro-controller chip, a Wi-Fi chip is used to send data of various bore-wells to single sever. [1]

Mr. KiranPatil, Mr. SachinPatil, Mr. Sanjay Patil, Mr. VikasPatil entitled ***"Monitoring of Turbidity, pH & Temperature of Water Based on GSM"***. Published in March 2015, International Journal For Researching Science And Technology. This system consists of turbidity, pH and temperature sensor of water quality testing, single chip microcontroller data acquisition module, information transmission module, monitoring center and other activities. Monitoring is done by GSM in the form of SMS.[7]

M. B. Kalpana entitled *"Online Monitoring of Water Quality UsingRaspberry Pi3 Model B."* Published in 2016, International Journal Of Innovative Technology And Research. In this paper the system consists of conductivity,Turbidity and pH sensor of water grade testing, single board computer module/mobile module, internet and other accessories. Conductivity, Turbidity and pH of water are automatically detected under the single board computer Raspberry Pi3 model B.[6]

METHODOLOGY

Fig.1 shows the flow chart of proposed system. In this flow chart gives the systems performance in sequence. The water level of over-head tank is the first condition for system. If the tank level is high then system will remain off and when low level is detected then check the water quality in ground level tank. In ground level tank

there is 3 sensors. If all the 3 sensors output is tested okay then it is concluded that the quality of water is good. Then pump will turn on and that water will be passed in overhead tank.

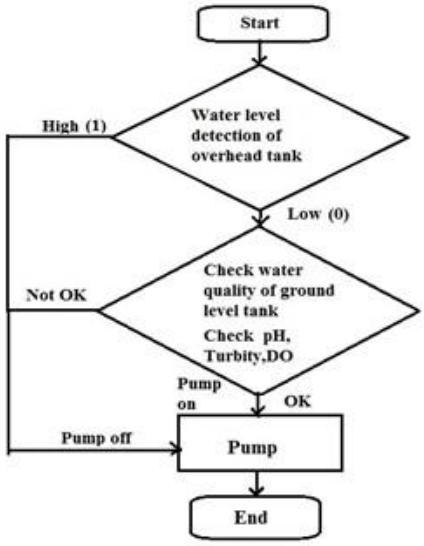

Fig 1: Flow chart

PROJECT'S BLOCK DIAGRAM

Fig 2 shows the Block diagram of system. This system consist of Turbidity sensor, pH sensor, DO sensor which are connected to processor (raspberry-pi).

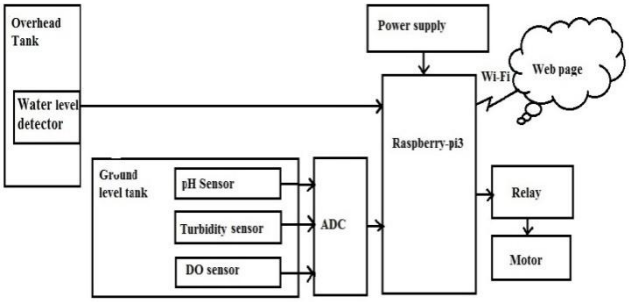

Fig 2: Block diagram

The raspberry-pi accessing the sensors output and processing them. The sensor reading can be viewed on webpage with the help of Wi-Fi.

The Turbidity sensor, Ph sensor, DO sensor check the quality of water. The water level detector is used to detect the high level of water to avoid overflow also it detect low level to start the pump. The data from all sensors is given to raspberry-pi3b. This data also will be display on webpage.

DISSOLVE OXYGEN SENSOR

The term Dissolve Oxygen refers to the amount of free oxygen dissolved in water which is readily available to respiring aquatic organisms. State water quality standards often express minimum concentration of dissolved oxygen which must be maintained in order to support life as well as be of beneficial use. Oxygen

dissolves in surface water due to aerating action of winds. Oxygen is also introduced into the water as a byproduct of aquatic plant photosynthesis. It makes drinking water taste better.

Dissolved Oxygen is measured in water using a calibrated dissolved oxygen sensor this sensor can measure the amount if dissolved oxygen directly in the water as mg/L or as a percent dissolve oxygen (%DO). Water at lower temperature should have higher mg/L of dissolve oxygen and higher % DO while warmer, polluted waters will have lower mg/L and % DO. Healthy water should generally have dissolved oxygen concentrations above 6.5-8 mg/L and between about 80-120%.

Fig 3. Turbidity sensor

PH SENSOR

The water quality parameter Ph is measure of hydrogen ion concentration of solution. Solutions with a high concentration of hydrogen ions have a low Ph and solutions with a low concentration of H^+ ions have a high pH. Pure water has 7 pH values indicate acidity and more than 7 indicate alkalinity. The normal rage of Ph is 6.5 to 8.5 .[5] In drinking water if normal range of Ph doesn't maintain it causes the irritation to the eyes, skin and mucous membranes. Also causes skin disorders.

Fig 4. Ph sensor

TURBIDITY SENSOR

Turbidity is measure of the cloudiness of water.[7] Many drinking water utility strives to achieve levels as low as 0.1 NTU (Nephelometric Turbidity Unit). Nephelometry means that the light source and the photo-detector are set at a 90-degree from each other. This is considered the angle most sensitive to light scatter regardless of particle size. The European standards for turbidity state that it must be no more than 4 NTU. World

Health Organization (WHO), established that turbidity of drinking of drinking should not be more than NTU, and should ideally be below NTU.

The goal of measuring turbidity is to get an indication for the concentration of scattering particles in water. This can be done by determination of light losses of the transmitted or the measurement of the light scattered sideways.

Fig 5. Turbidity Sensor

WATER LEVEL DETECTOR

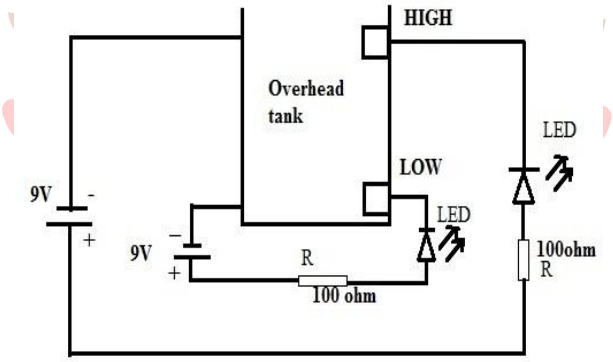

Fig 6. Circuit Diagram for level indication of overhead tank

To check level of overhead tank water detection circuit is designed. In this circuit two pairs of wires are used. In that one pair is located at high level. At high level, when water is reached the conductivity of water passes the current and we get signal indicating the water is at high level.

Water level >= High level= LED 1 ON

Otherwise = LED 1 OFF

At low level one other pair is located at low level.This connection is always present till water level is greater than low level when water level drops below low level conductivity was loss and signal will generate.

Water level <= low level = LED 2 OFF

Otherwise = LED 2 ON

RASPBERRY-pi3b

Fig 7. Raspberry-pi 3B

The Raspberry pi-3 model B is the earliest model of the third generation Raspberry Pi. It replaces the raspberry-pi 3model B in Feb 2016.

- Quad core 1.2 GHz Broadcom BCM2837 64 bit CPU
- 1 GB RAM
- BCM 3438 wireless LAN and Bluetooth Low Energy (BLE) on board
- 100 Base Ethernet
- 40-pin extended GPIO
- 4 USB 2 ports
- 4 pole stereo output and composite video port
- Full size HDMI
- CSI camera port for connecting Raspberry pi camera
- DSI display port for connecting a raspberry pi touchscreen display
- Micro SD port for loading your operating system and storing data
- Upgraded switch micro USB power source up to 2.5A

CIRCUIT DIAGRAM& WORKING

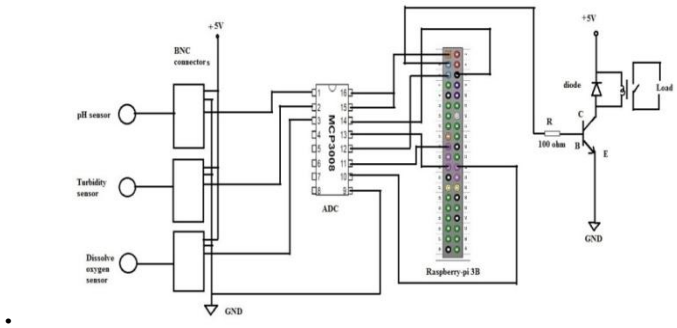

Fig 8. Circuit Diagram

Fig 8.Shows circuit diagram of our project. As per previous data we have make a circuit diagram for our project. As shown in circuit diagram we have connected a three sensors to a Raspberry-pi through the ADC 3008. Because the sensor will give output in a analog form which will convert into digital form by using the ADC. And then ADC output is given to raspberry-pi. Ph, turbidity and dissolve oxygen sensors output are connected to ADC pin no 1,2,3 sequentially as input and output of ADC is given to raspberry-pi.

There is two main condition in a circuit, if the output of the sensors is within a range then raspberry-pi will generate high output otherwise out of three sensor any one sensor is not in range that time raspberry-pi will generate low output. When output of raspberry-pi is high that time we getting low current at output pin which is not sufficient that's why we used there one power amplification circuit.

RESULT AND CONCLUSION

Fig 9.pH sensor testing

Sr.no.	Samples	pH	Voltage(v)	Nature
1	Water	7.2	3.78	Basic
2	Water + HCl	3.3	3.06	Acid
3	Water + NaCl	8.9	4.96	Basic

Table 1 : Reading of pH sensor

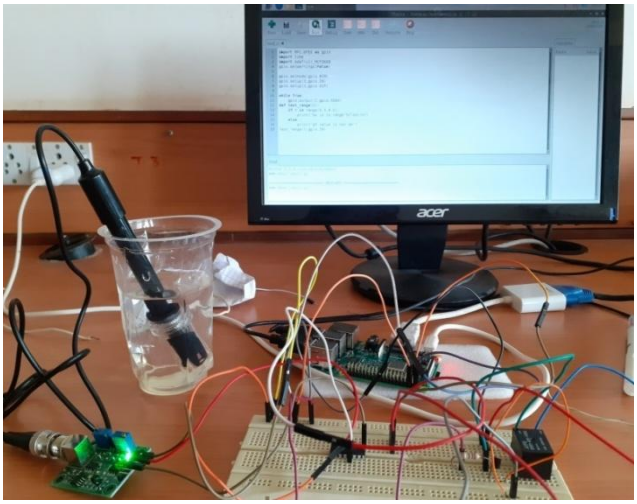

Fig 10. Interfacing of pH sensor

Table 2. Result chart of all sensors

Sr.no.	Sensor	Ideal range	Output	Status
1.	pH	6.5 - 8.5	7.2	Tested Ok
2.	Turbidity	<4 NTU	5.1	Tested Ok
3.	DO	<6.5-8 mg/L	9.2	Tested Ok

The output pin of raspberry pi will be triggered if and only if status of all the three variables is okay. Monitoring of Turbidity, pH sensor, Dissolve oxygen of water uses corresponding sensor. The system can monitor water quality automatically with low cost. So the water quality testing has to more economical convenient and fast. The system has good flexibility by replacing the corresponding sensor and changing the relevant python program. This system can be used to monitor other water quality parameter.

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