REAL TIME MONITORING AND CONTROLLING OF UNDISSOLVED PARTICLE

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ABSTRACT:

This paper present design of Real time monitoring and controlling of un-dissolved particle in water distribution system by using Turbidity sensor,LAN (LocalAreaNetwork), SMTP (Simple Mail Transfer Protocol) and motor pump to control based upon the Turbidity sensor reading in the being monitored house. Generally the monitoring of water is carried out by taking water samples to laboratory to analyze water quality parameters, this analyzing take long time and not instant. Objective of this paper is to detect un-dissolved particle inside water received in the monitored house online using LAN and display the turbidity value of monitored tank house on the webpage with turbidity values observed based on defined time. To carry out control using webpage a button is made on the webpage in order to control water motor pump at MWSS (Major Water Supply Station) by clicking after observing the turbidity sensor reading of monitored house are in danger or ok range by clicking the hyperlink in the single page the hyperlink details of water quality being reached to monitored houses from the MWSS in the single webpage.

Key Words: Turbidity Sensor, Raspberry Pi, CGI (Common Gateway Interface).

I. INTRODUCTION

With the rapid development of the economy, more and more serious problems of environment arise. Water pollution is oneof these problems. One of the most important monitored parameter of water quality is turbidity (**un-dissolved particle inside water**). The most common method to detect this parameter is to collect samples manually and then send them to laboratory for detecting and analyzing. This method wastes too much manpower and material resource, and has the limitations of the samples collecting, long-time analyzing, the aging of experiment equipment and other issues.

Turbidity is an expression of optical property that causes light to be scattered and absorbed by particles and molecules rather than transmitting in straight lines through water sample.it is caused by suspended impurities that interfaces clarity of water.

Turbidity can cause health concern because impurities provide protection for bacteria by reducing there exposure to disinfectants. Turbidity can also introduce problem to mechanical system in water causing progressive damage and final destruction

We need a system which monitors turbidity of water in real-time. Thesystemis to implement a real time monitoring and controlling system for detection of un-dissolved particle inside water at the user houses are in Danger/OK range and pass on the information to authority concerned (MWSS) to take appropriate action (such as switch OFF/ON motor) from MWSS.The Turbidity sensor values are displayed on webpage using the LAN (Local Area Network) to instantaneously transfer the turbidity sensor collected data through internet from memory card stored database using CGI (Common Gateway Interface) by help of webserver LIGHTTPD to WEBPAGE which request the IP Address assigned in web browser. The control is done from MWSS which is to control water supply by motor pump action. This allows us to remotely monitor the water quality parameter online in real-time from remote locations by internet. The system implementation leads to automation, intelligence and network of water quality monitoring as well controlling, which uses manpower, material and financial resources sparingly.

II. PROPOSED METHOD

The method proposed for real time monitoring and controlling of un-dissolved particle is basically meant to have the water distribution authority person having real time information of water quality parameter (turbidity) and controlling water distribution based upon turbidity value observed online over the webpage to them. This makes the accessing of particular area turbidity in faster way to maintain using internet. An email alert is sent to concerned person when the water quality turbidity is in danger range. The database of the area under surveillance by distribution system is updated and the values are shown respectively on webpage.

This Fig 1: shows the architecture of designed system for real time monitoring and controlling of un-dissolved particle in water distribution system.

This system includes the following modules Raspberry Pi(ARM-11), Turbiditysensor (indigenously designed), MCP 3008(ADC with SPI), RJ45 (LAN Interface), Memory card (8 GB class 4) Motor driver (transistor energized relay), Motor and a REMOTE PC (Personal computer), powersupply. The turbidity sensor is used

detect un-dissolved particle inside water, the value obtained is analog which are passed to ADC block with SPI interface.

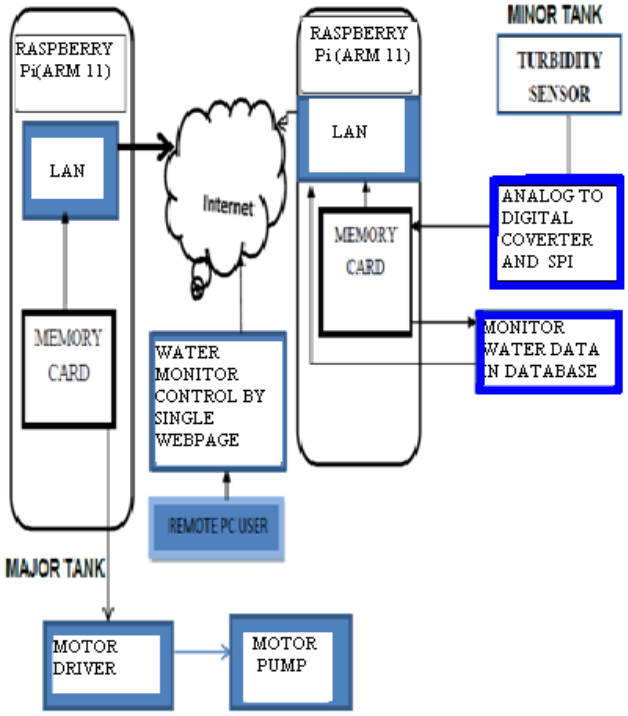

Fig.1: Block diagram of Real time monitoring and controlling of un-dissolved particle in water distribution system.

Next, step was to get the values displayed in the webpage this is achieved by saving the turbidity sensor values in the memory card by making a database which need to be updated and later these values are passed into webpage using CGI(Common Gateway Interface) were data base values are linked by python script to a webserver and passing these values to web client on his request using HTTP protocol through RJ45 (LANInterface)these step are to be carried on the minor tank side were water quality monitor turbidity sensor was placed. An assigned IP can be used later to get the details of turbidity sensor values at that location defined. We needed to control the water quality in water distribution system as it might have got water supplied dirty from the major water station to the user houses where turbidity sensor reading is continuously monitoring the values when ever the water at the location is dirty that as shown in fig 1 is minor tank were we monitor turbidity values goes below a threshold level the user sitting in the major tank station has the values in a single assigned IP were we have a webpage which has a motor control button along with a hyper link to minor tank(turbidity sensor value details) as well the user was given alert using SMTP(simple mail transfer protocol)and based on that alert along with details of the minor tank(turbidity sensor value details) being available through registered mail . The user can switch on /off the water supply from the major tank or MWSS by clicking the webpage button.

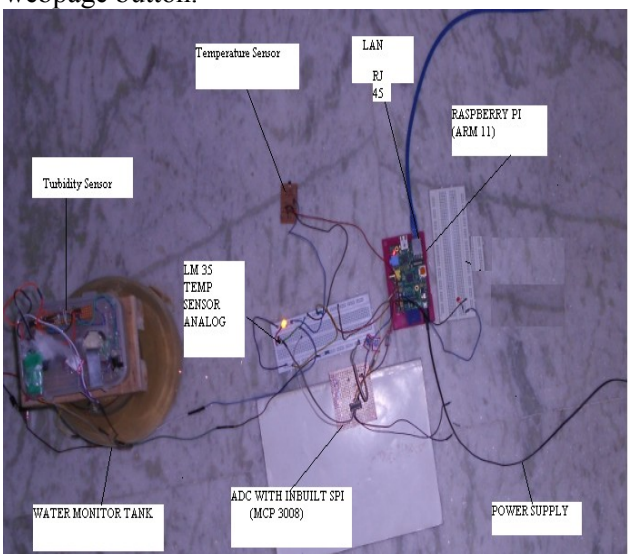

Fig.2 (a): Hardware setup for real time monitoring and controlling of un-dissolved particle at minor tank.

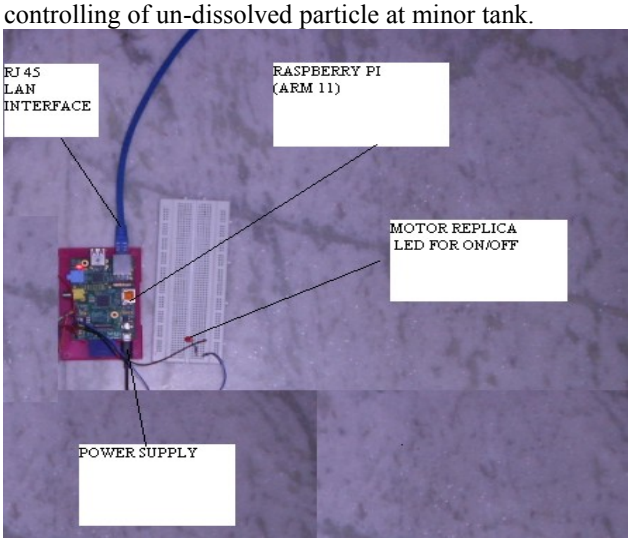

Fig.2 (b):Hardware setup for real time monitoring and controlling of un-dissolved particle at major tank.

a. Turbidity Sensor

Turbidity sensor: Turbidity is defined as amount of light that can penetrate inside the water. Turbidity sensor is used to measure the water quality inside the water tank which is un-dissolved particles present inside water as they does not allow light to penetrate much deeper inside the water from one point to another point being observed. In designing of sensor the principle of absorption of light was implemented were a light source (Laser diode) is used at an angle of 180 degree from source to the light detector LDR (Light Detecting Resistor). The figure 3 shows the side view of sensor and figure 4 shows internal circuit used for designing sensor.

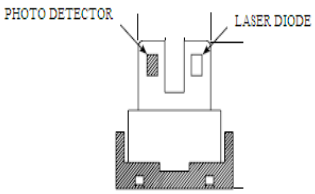

Fig .3: Side view of turbidity sensor

In figure 3 a side view of the sensor is shown which shows placement of laser diode and phodetector with gap between the protections of test tube. The fig 4 shows the circuit used for the design of turbidity sensor with symbols. The property of LDR is its resistance is less when light intensity is maximum and resistance increases when the light is less. In the circuit we are using this property for identifying un-dissolved particles. The resistor at output will have the variation in obtained voltage due to LDR property.

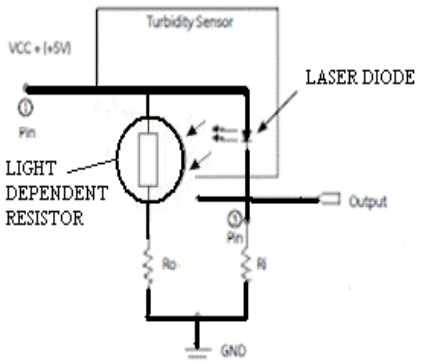

Fig .4: Internal circuit of turbidity sensor

The laser diode and photo detector (Light detecting Resistor) used are kept inside a test tube in order to protect the devices from water. The fig 5 shows the turbidity sensor were the circuit is placed inside a test tube and one test tube comprises of laser diode and another test tube comprises of LDR were there is a gap between the tubes ,which is used to analyses if any un dissolved particle is there or not inside water.

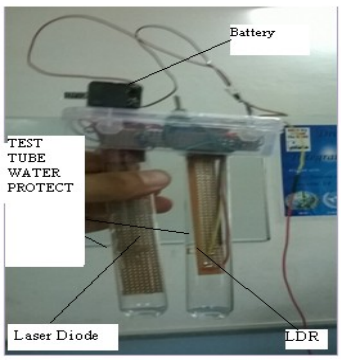

Fig.5: Prototype Turbidity Sensor

We based upon the voltage observed have analyzed whether water is having what sort of impurities by trial method and got voltage levels as shown in the Table 1 below which shows turbidity sensor voltage values and assumption..

Table 1: Turbidity Sensor Voltage Values and Assumption

S.NO	WATER TYPE	VOLTAGE (mV)	TURBIDITY (Assumption)
1	PURE WATER	1956-2566	LOW
2	MUDDYWATER	426-777	MEDIUM
3	DIRTY WATER	150-250	HIGH

These values are used to display on webpage by storing these values in memory card using database and later display the value on webpage when user click the assigned IP address.

b. Raspberry Pi (RPi) Processor:

In this proposed real time monitoring and controlling of un-dissolved particle in water distribution system used Raspberry Pi a credit card sized single board computer development in UK by the Raspberry Pi Foundation. This Raspberry Pi has a Broadcom BCM 2835 System On Chip (SOC), which includes an ARM1176JZF-S 700 MHz processor, video core IV GPU, and originally shipped with 512 megabytes (MB) of RAM (Random Access Memory).It has 26 GPIO (General Purpose Input/output Pin) out of which we have used 5 pins for SPI (Serial Peripheral Interface) and 2 for power and 1 for controlling. It uses only SD card for booting and long time storage.

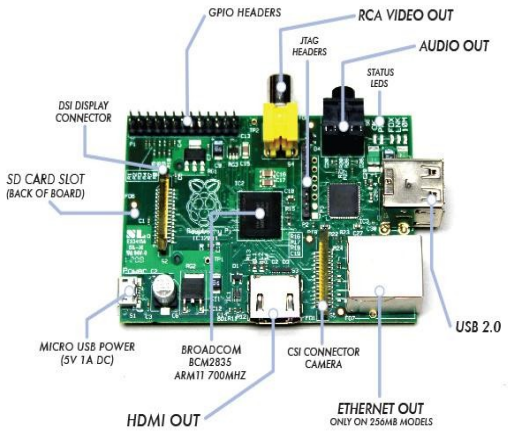

Fig.6: Raspberry Pi Processor.

c. ADC and SPI Interface (MCP 3008)

Turbidity sensor senses the water purity and according the analog data is available in its output. This analog data is to be interfaced to Raspberry Pi (RPi). RPi accepts the digital input only and does not have any inbuilt analog to digital converter so in order to convert analog data to digital format which could be

understood by the ARM 11 processor inside the Raspberry pi board. To overcome this problem, A/D (Analog to Digital) converter IC MCP 3008 is chosen which works at 2.7v and able to handle 8 analog channels and has a resolution of 10 bits. The analog sensor values can be converted to digital values and in Raspberry Pi as we are having dedicated pin for SPI protocols so by using the pins of MCP 3008, we are able to convert 8 analog channel data simultaneously to digital values. The fig 7 below shows how MCP 3008 Interfaced to RPi along with Turbidity sensor.

The turbidity sensor values is passed to MCP 3008 through channel 0 and the pins used for SPI (Serial Peripheral Interface) are 10, 11, 12 and 13 which are as CS, Din, Dout and CLK to the GPIO (General Purpose Input And Output) of RPi 24,19,21,23 which are Pin 19 - MOSI (Master In Slave Out), Pin 21 – MISO (Master Out Slave In), Pin 23 - CLK (Clock) and Pin 24 - CE0 (Select 0) respectively.

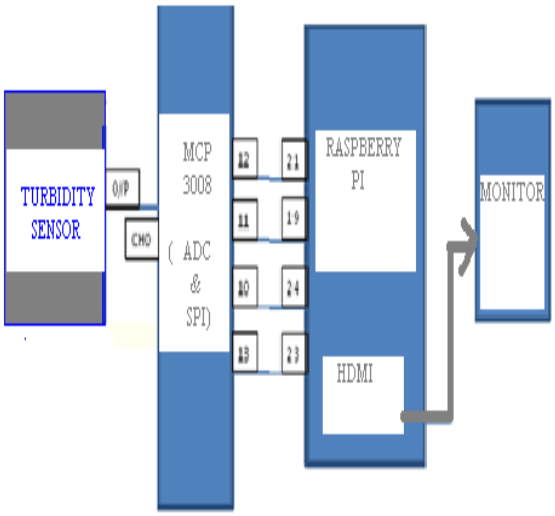

Fig.7: MCP 3008 Interfaced to RPi along with Turbidity sensor

Later this data is displayed on webpage by putting data saved in memory card to database and retrieving that data over webpage by the help of LAN (Local Area Network) connected to internet doing this we can collect the information of the minor tank connected to water distribution system with major tank. The other part is controlling the water quality we have consider in our cases water getting dirty by leakage from major tank to minor tank in water distribution system so we need to close the main water supply that is closing of motor connected for water distribution in the system. So to carry out this process, used a Raspberry Pi (RPi) in the major tank of water distribution system was the motor pump action is controlled over internet using the LAN (Local Area Network) in the RPi.

d.Local Area Network (LAN)

The LAN interface is available in raspberry pi we have used it for sending the data of sensor from the minor tank sensor location to major tank using wired Ethernet cable. A LAN is a computer network that interconnects computers within a limited area such as a home, school, computer laboratory, or office building, using network media. The defining characteristics of LANs, in contrast to wide area networks (WANs), include their smaller geographic area, and non-inclusion of leased telecommunication lines.as we connect to internet using LAN interface internet of things was used to control motor from assigned IP address from the webpage.

ALOGRITHM:

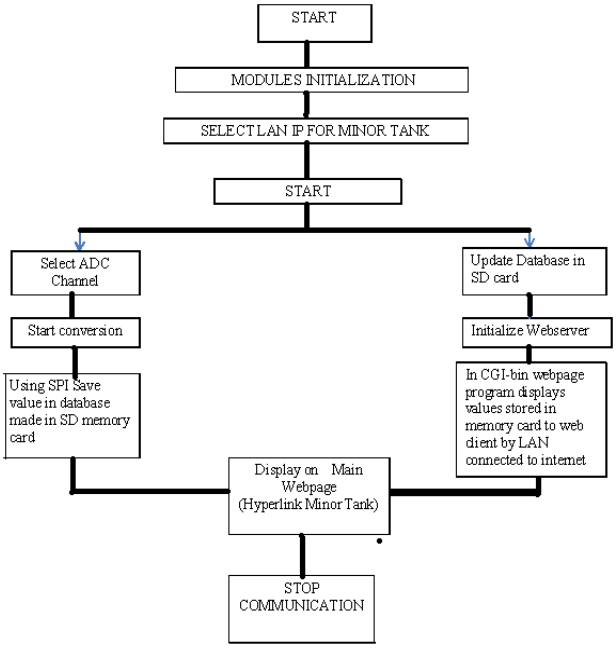

Fig .8: Flow chart to Display of Data to Webpage

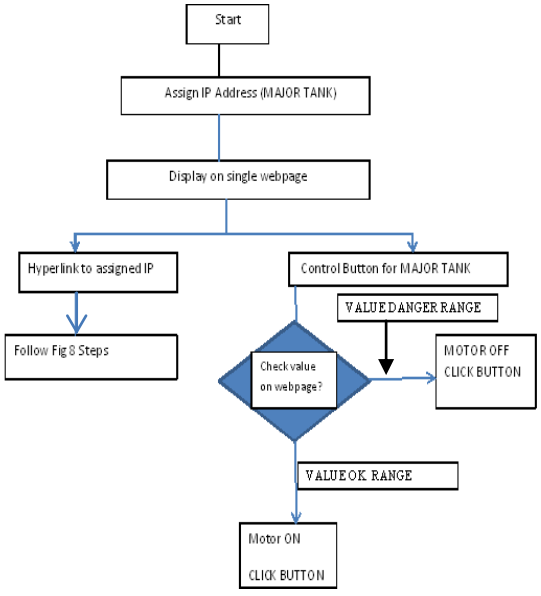

Fig .9: Flow chart to control motor by Single webpage and display data by Hyperlink

III. RESULTS

The real time monitoring and controlling system was tested with condition of sensor values first with in the monitor connected and later on to internet and later on to controlling part.

(a)The turbidity sensor reading values were first tested with the different conditions and the result are shown below with the respect to only program running and output being displayed on the monitor in the Figure 10.

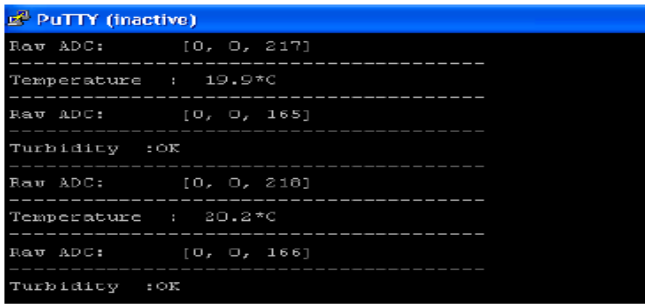

Fig.10.a: Temperature And Turbidity values on monitor Ok after SPI communication

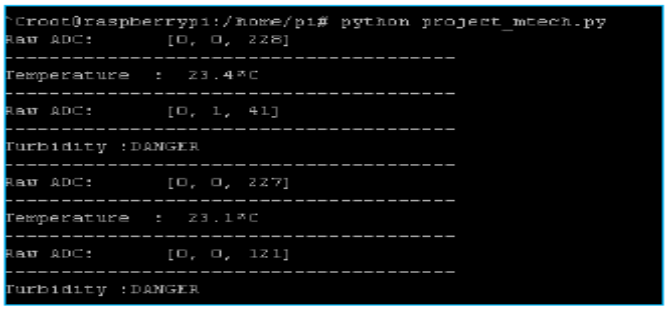

Fig.10.b: Temperature and Turbidity sensor value on monitor Dangerafter SPI Communication

(b) The result of turbidity sensor values displayed over internet using LAN in the webpage is shown in the fig11, we have made the program to run in after a minute time and collect the details of turbidity sensor .in webpage we are able to see the highest and the lowest values observed in 24 hrs.as well a record of time update as set can be seen which is one minute in are case. We also get time, date and location information as well.

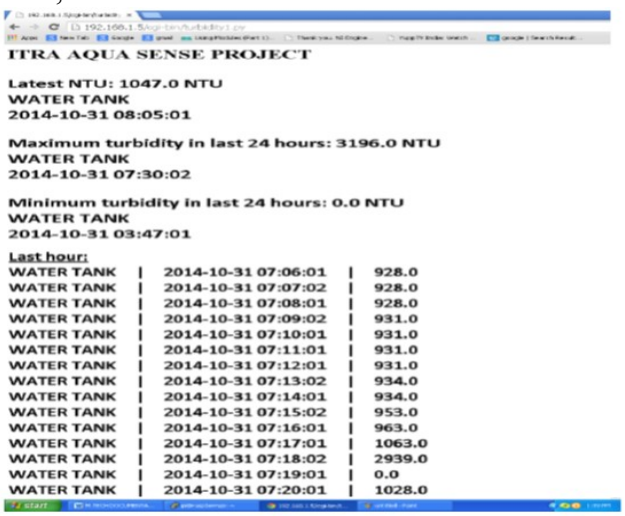

Fig 11: Webpage showing turbidity sensor data complete information over Internet

(c) In the last section we have made a webpage application on RPi which we have made a button which is used to control motor connected to major tank and stop water supply by clicking the button on and off from webpage through internet connected through LAN as shown in fig 12 and 13 at the other part ahyperlink is made of minor tank in water distribution system were person can analyze everything at a place.

Fig 12: Motor is on and Hyperlink

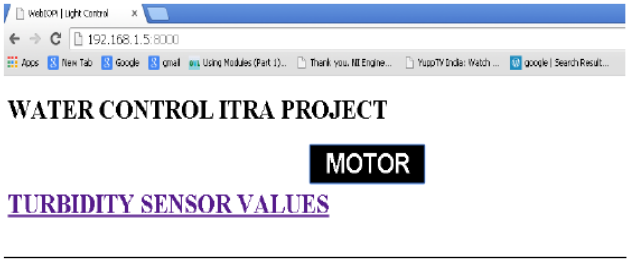

Fig 13: Motor Is Off and Hyperlink

IV. Conclusion and Future Scope

This paper present a new design of commodity hardware with cheap and consumes very less power design oriented product for getting information from the area were water quality received from water distribution system is in danger range or ok range of turbidity value. This system is designed by using Raspberry Pi (ARM 11) for fast accessing to control motor for event detection. The system allows controlling from internet the major tank distributing water supply quality received at area being monitor in minor tank of user. It provides real-time monitoring of water quality parameter online as well take action that is control the motor pump action online.

The future we can design a advanced turbidity sensor which is more accurate in detection of turbidity in water. As well make the reading values available on mail to user with other water quality parameter interfaced.

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