Global Area Industrial Water Quality Monitoring and Controlling Using IoT

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Abstract- We all know that water is one of the basic components needed for any industry, so the quality of that ingredient also matters to most to maintain a good and constant quality of output product. because of industrial automation the process cycle of the machinery is pre-determined and the machinery worked in that specific way, little amount of deviation from the require quality also cannot be tolerable by the machines so it is very important to maintain all the raw materials at most accurate proportions.

By this machine we can calculate various industrial water parameters like PH, temperature.by monitoring these factors water can be maintained at required quality. We use a data visualization toll Thing Speak for advanced data analysis and data visualization. We use an integrated system of sensors which measure the various parameters of water in pipes and can be monitored and if any variations observed it can be retained by using a value which neutralizes the changes and sets back the required levels. By integrating this device to the IOT environment we can make the device remotely accessible from every corner of campus and the data storage can also be done without any effort.

Keywords - pH, Arduino, ORP, temperature, turbidity, ESP 8266, Thing speak

I. INTRODUCTION

Late 20th century has seen a humongous jump in the industrial accidents caused by human errors which in turn lead to less production.to tackle thus problem automated system has been introduces in a limited scope of industry. these automated systems make the repetitive tasked performed by humans easier and let the humans do any productive work. When we look at industry such as chemical, semiconductor, pharmaceutical, textile and paper, we can observe that water is one of the basic materials used in any of its critical process from processing to cooling. When it was manual systems, the workers used to measure them and if any changes in the water quality was observed they would automatically do the needful and try to retain the actual level. But now due to the automated systems, it cannot allow any changes in the quality so we need to maintain the quality foe a calm process .so in this paper we develop a device which measures the parameters of water and monitor that parameters time to tie and try to raise an alarm if the threshold is dropped and retain the before levels.

II. LITERATURE SURVEY

There were similar devices built before for various purposed such as for drinking water, monitoring salinity in water bodies, for water species, etc.[1] Vaishnavi and Gaikwad entitled *"water quality monitoring system on Iot".*in this paper they discussed about a drinking water monitoring system which use pH sensor, turbidity sensor, temperature senor and flow sensor, this used Blynk cloud and blynk app to send and display data in iot devices. The proposed device is meant to monitor the drinking water and reference as its limits.

[2] A.N. Prasad, K. A. Mamun, F. R. Islam, H. Haqva's entitled "*Smart Water Quality Monitoring System".*in this paper they discuss about studying water bodies near Fiji Islands. The device which was proposed monitors the ph, ORP, conductivity and temperature of the water bodies in which industries excrete their waste water.by this they monitor the industrial wastewater and how they merge into larger bodies.

[3] Monira Mukta, Amia Islam, Surajit Das Barman, Ahmed Wasif Reza, M Saddam Hossain Khan's entitled *"IoT based Smart Water Quality Monitoring System".* The proposed SWQM device monitors the parameters such as pH, temperature, conductivity, turbidity of water and classify weather the water is drinkable or not. They used a 60 samples of train set and used fast forest classifier to train the model. The samples are from various sources such a tap water, bore water, ground water, rain water etc. This device takes the WHO standards as reference and classifies the water as drinkable or not.

[4] Sathish Pasika, Sai Teja Gandla's entitled *"Smart water quality monitoring system with cost-effective using IoT".* the proposed device is for a domestic usage, where it can be use I the household environment which monitors parameters like ph, turbidity and used a

temperature sensor to monitor the environment the water is present.it uses thing speak cloud for data visualization purpose and used Arduino mega for processing.

III. PROPOSED METHODOLOGY

The parameters which we are going to measure are ph. and temperature. We took only these parameters because there is an indirect relation between temperature and ither parameters such as conductivity and ORP etc. Besides that, our application of device is in a controlled environment and it is only used to maintain any sporadic abrupt situations, so these can be retained back within less time.

pH: It is the amount of how acidic or how alkaline the medium. This is measured by the amount of H+ ions in the liquid. this is in a scale of 0 to 14 where for 0 to 7 acidity decreases and from 7 to 10 basic nature increases and 7 is neutral.

$$pH = -\log(H^+)$$
$$pH = -\log(H_3O^-)$$

Temperature: this is one of the basic properties posed by any liquid, which also represents some other parameters such as conductivity and orp etc. Temperature is the parameter which reflect and changes in the other parameters.so by monitoring that we can say that something is not correct.

The modules and the sensors are connected as per the circuit diagram. The visual indicator consists of 3 leds which will indicate if there is any relay on or not and whether the pH is in limit or not. For this prototype we used 2 dosing tanks one with 15 c water and other with 50 c water. A 9volts submersible dc motor are placed inside the dosing tanks. A relay is used to trigger the motors.

when the temperature of the water sample is measured and, if it is below 20 c then the motor in the dosing tank (50 c) gets activated for 5 seconds and the approximately 100 ml of 50c water is been poured into the water sample tank.by this method the temperature of water is bought above 20 c.the sample process is when the water temperature crosses the upper limit. Then the motor in the dosing tank (15 c) gets activated. This is the controlling process of the project.

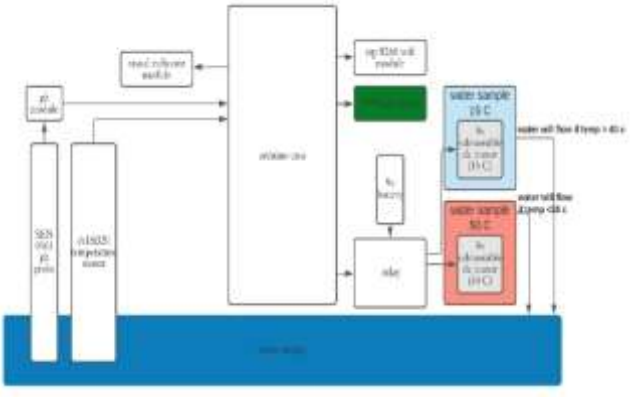

Figure 1-III-1 block diagram

We connect an ESP 8266 Wi-Fi module, which is used to transfer the data to an IOT cloud. For data visualization purpose and analysis purpose we use Thing speak cloud. for data analysis we use MATLAB software. The thing speak cloud can be also be accessed using the thing view app and the real-time data can also be viewed on the app also. The communicate using i2c protocol and tcp protocol. Here se declare the esp. as a station node and we connect it to the pre define Wi-Fi connection and the data which is acquired get transferred to the cloud.

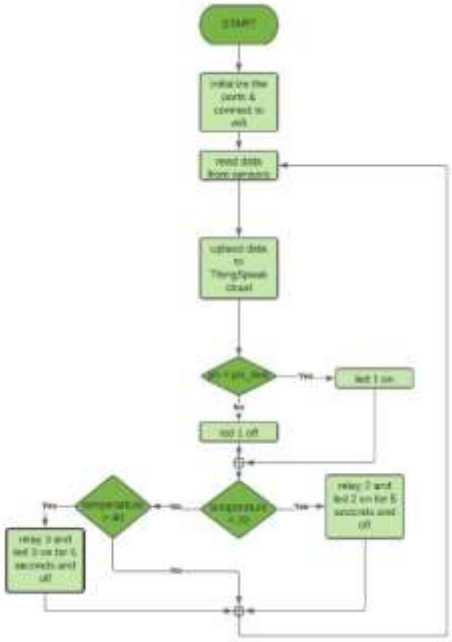

Figure 1-III-2 flow chart

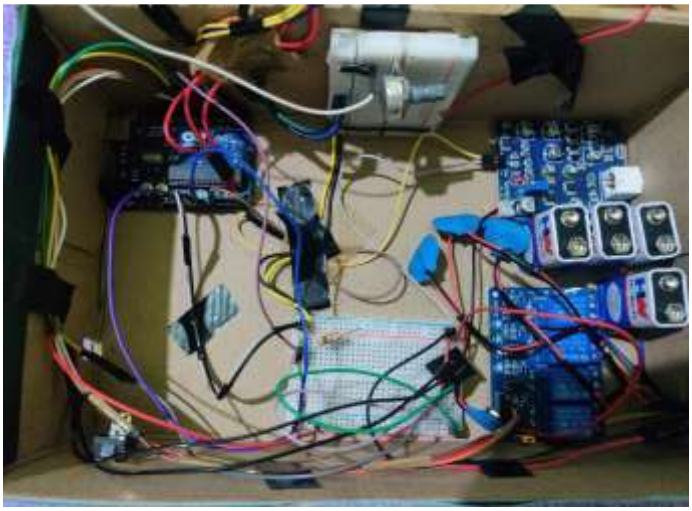

Figure III-3 circuit view

IV. RESULTS AND ANALYSIS

As we mentioned our device is supposed to monitor the pH and temperature of the water sample .and control the temperature of the water sample

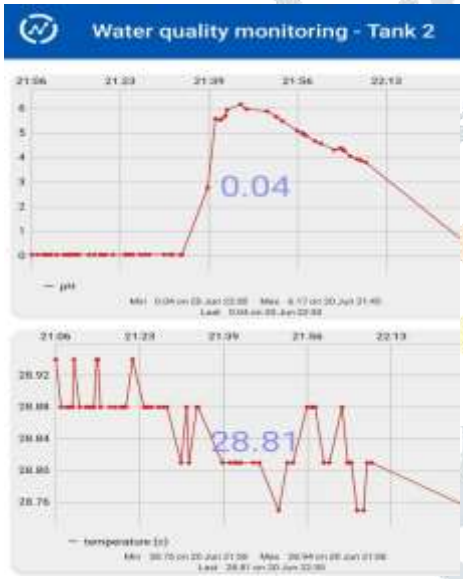

Figure IV-1 parameters of tank 2

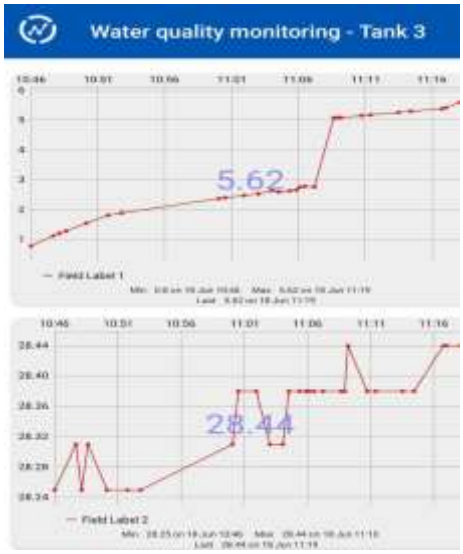

Figure IV-2 parameters of tank 3

Analysis:

We took 1 iteration equal to one cycle of relay on and off. We varied the iteration form 5 sec and 3 seconds. Observed motor throughput is equal to 20 ml/seconds.so by this we can say that for 5 sec iteration the quantity dosed is equal to 100ml and for 3 seconds iteration quantity dossed is equal to 60 ml. here are the observed temperatures for each iteration. The iteration will stop once the temperature comes in the range (20 to 40).

Table 1-1 temperature values of each iteration (iteration =100ml)

iteration	100 ml (60 c)	100ml (80 c)	200ml (80 c)	200 ml (60 c)
0	60	80	80	60
1	44	40	57.5	49.1
2	37.9	37.5	51.3	45.1
3			46.8	42.2
4			41.9	39.1
5			39.2	

Table 1-2 temperature values of each iteration (iteration = 60 ml)

iteration	100 ml (60 c)	100ml (80 c)	200ml (80 c)	200 ml (60 c)
0	60	80	80	60
1	45.8	59.2	64.7	52
2	40.1	50.5	58	46.3
3	37.8	44.3	55.2	45
4		42.9	52.2	43.9
5		41.1	47.8	41
6		38.7	46.3	39.8
7			45.2	38.6
8			44.7	
9			42	
10			41.8	
11			41	
12			40.5	
13			39.8	

For the analysis purpose we took 4 sample of 2 different quantity (100 ml,200ml) at 2 different temperatures each (60 c and 80 c). now these 4 samples are bough into the range of below 40 by dosing them with 30 C water (100 ml per iteration).and the temperature of the water sample (whose volume has been increasing) has been measured and noted down.as the temperature of the water sample increases the iterations for the relay to cycle increases, where the iteration duration are constant

$$V = w_s + N(w_i)$$

Where

V=final volume of water sample

w_s =*volume of initial water sample*

N=number of iterations

w_i =*volume of water dosed per iteration*

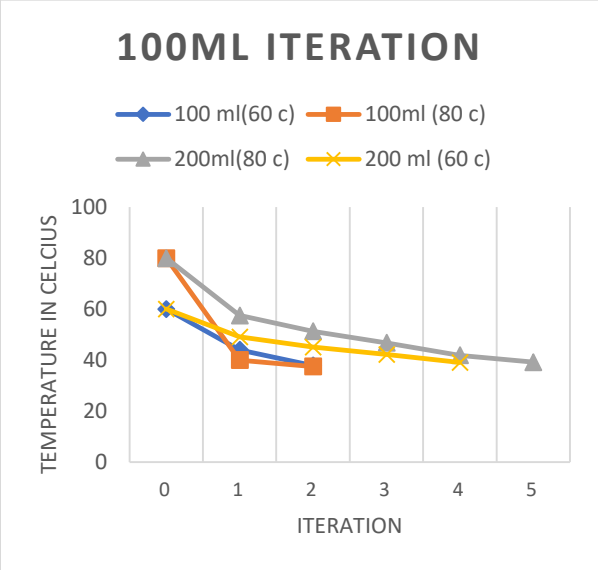

Figure IV-3 temperature vs iteration (100ml iteration)

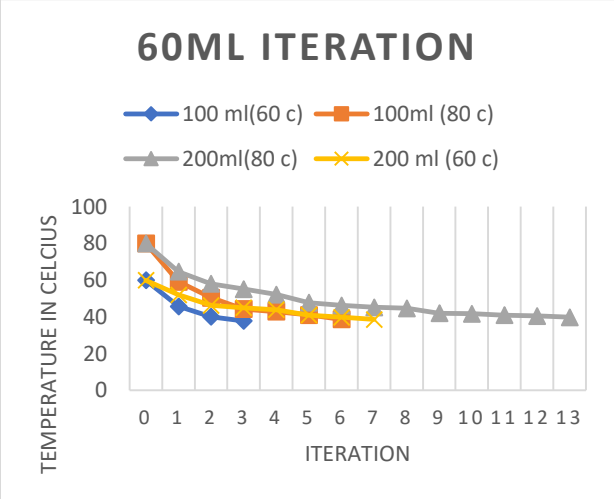

Figure IV-4 temperature vs iteration (60ml iteration)

From the graphs we can conclude that: "The rate of change of the temperature of the water sample decreases because, the volume of the water sample per iteration increases."

V. Conclusion and Future Scope

With the help of this device the repetitive and frequent task of monitoring the parameters can be automatized and the data will be transmitted to an IOT cloud. These devices can be located at various places in the plant and all the stations can be monitored simultaneous using the Thing speak cloud.so by this we can use the single IOT website to monitor the various channels in the plant. this can also be used for various parameters monitoring by introducing the particular sensor and some changes to the data acquisition process.

In future advancements we can measure the volume of the tank and store the ph adjustment chemicals such a calcium carbonate and HCl. and also adjust the ph using the peristaltic pumps. And we can add other sensors such as turbidity and ORP and monitor those parameters also. We can develop a dynamic graphical interface which will help us to set the threshold limits in the run time. Similar monitoring and controlling devices can be used to monitor other quantities also such as chemicals in air which will help us to monitor air pollution.

References:

[1] Vaishnavi V. Daigavane and Dr. M.A Gaikwad's "Water Quality Monitoring System Based on IOT".

[2] A.N. Prasad, K. A. Mamun, F. R. Islam, H. Haqva's "Smart Water Quality Monitoring System".

[3] Monira Mukta, Samia Islam, Surajit Das Barman, Ahmed Wasif Reza, M Saddam Hossain Khan's "IoT based Smart Water Quality Monitoring System"

[4] Sathish Pasika, Sai Teja Gandla's "Smart water quality monitoring system with cost-effective using IoT"