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**AN IOT BASED SMART WATER MANAGEMENT  
SYSTEM WITH QUALITY MONITORING**
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**ABSTRACT**

In order to ensure the safe supply of the drinking water the quality needs to be monitor in real time. In this paper we present a design and development of a low cost system for real time monitoring of the water quality in IOT(internet of things).The system consist of several sensors is used to measuring physical and chemical parameters of the water. The parameters such as temperature, PH, turbidity, flow sensor of the water can be measured. The measured values from the sensors can be processed by the core controller. The Arduino model can be used as a core controller. Finally, the sensor data can be viewed on internet using WI-FI system. The general objective of this project is to design the monitoring and control system of industrial parameters using IOT. This project is used to reduce the high manpower requirement in industries by monitoring the overall parameters through a single mobile by with the help of IOT communication. And also controls the parameters without any manual operation. Basically, this project is designed with microcontrollers and various sensors such as pressure sensor, temperature sensor and level sensor.

**Keywords:** *IOT, Arduino module, Flow sensor, PH sensor, Turbidity sensor, Temperature sensor, Ultrasonic sensor, WI-FI system*

**1. INTRODUCTION**

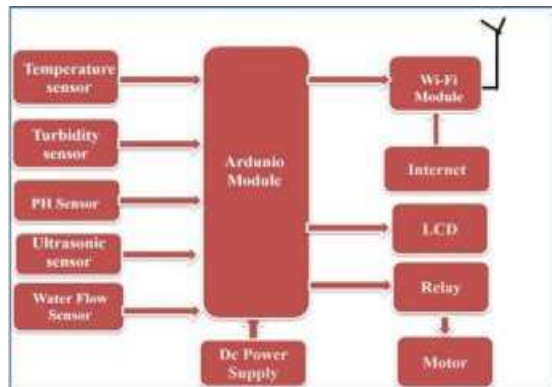
In the 21st century, there were lots of inventions, Water is an important resource for life and its existence. Nowadays, due to increase in

migration from a rural area to urban areas, the population in cities is increasing rapidly. To meet the need of water, its distribution and quality check, a novel approached is proposed which is based on

IOT (Internet of Things). The proposed system consist different sensors like water flow sensor, pH Sensor, Turbidity, Temperature sensor and water control valve and a Ardunio as a core controller. A water control valve is controlled through web interface based on water flow sensor value to ensure equal and adequate water distribution to each connection. Turbidity measures the large number of suspended particles in water that is

invisible. Higher the turbidity higher the risk of diarrhoea, collera. Lower the turbidity then the water is clean. Temperature sensor measures how the water is, hot or cold. Flow sensor measures the flow of water through flow sensor. The traditional methods of water quality monitor involves the manual collection of water samples from different locations.

## 2. BLOCK DIAGRAM



**Fig: Block diagram of smart water management system with quality monitoring**

The overall block diagram of the proposed method is explained. Each and every block of the system is explained in detail. In this block diagram consist of several sensors (temperature, pH, turbidity, flow) is connected to core controller. The core controller are accessing the sensor values and processing them to transfer the data through internet. Arduino is used as a core controller. The sensor data can be viewed on the internet Wi-Fi system.

### 2.1 pH sensor:-

The pH of a solution is the measure of the acidity or alkalinity of that solution. The pH scale is a logarithmic scale whose range is from 0-14 with a neutral point being 7. Values above 7 indicate a basic or alkaline solution and values below 7 would indicate an acidic solution. It operates on 5V power supply and it is easy to interface with arduino. The normal range of pH is 6 to 8.5.



**Fig:-PH sensor**

### 2.2 Turbidity sensor:-

Turbidity is a measure of the cloudiness of water. Turbidity has indicated the degree at which the water loses its transparency. It is considered as a good measure of the quality of water. Turbidity blocks out the light needed by submerged aquatic vegetation. It also can raise surface water temperatures above normal because suspended particles near the surface facilitate the absorption of heat from sunlight.



**Fig:-Turbidity sensor**

### 2.3 Temperature sensor:-

Water Temperature indicates how water is hot or cold. The range of DS18B20 temperature sensor is -55 to +125 °C. This temperature sensor is digital type which gives accurate reading.



**Fig:-Temperature sensor**

### 2.4 Flow sensor:-

Flow sensor is used to measure the flow of water through the flow sensor. This sensor basically consists of a plastic valve body, a rotor and a Hall Effect sensor. The pinwheel rotor rotates when water / liquid flows through the valve and its speed will be directly proportional to the flow rate. The Hall Effect sensor will provide an electrical pulse with every revolution of the pinwheel rotor.



**Fig:-Flow sensor**

### 2.5 Arduino model:-

Arduino is a microcontroller board based on the ATmega328P. It has 14 digital input/output pins (of which 6 can be used as PWM outputs), 6 analog inputs, a 16 MHz quartz crystal, a USB connection, a power jack, an ICSP header and a reset button. It contains everything needed to support the microcontroller. Arduino Software (IDE) were the reference versions of Arduino, now evolved to newer releases. The Uno board is the first in a series of USB Arduino boards, and the reference model for the Arduino platform; for an extensive list of current, past or out-dated boards see the Arduino index of boards.



**Fig:-Arduino model**

### 2.6 Wifi module:-

The ESP8266 Wi-Fi Module is a self-contained SOC with integrated TCP/IP protocol stack that can give any microcontroller access to your Wi-Fi network. The ESP8266 is capable of either hosting an application or offloading all Wi-Fi networking functions from another application processor. Each ESP8266 module comes pre-programmed with an AT command set firmware.

The ESP8266 module is an extremely cost effective board with a huge, and ever growing, community.



**Fig:-Wi-Fi module**

### 2.7 ULTRASONIC SENSOR

An ultrasonic sensor is a device that can measure the distance to an object. As the name indicates, ultrasonic sensor, measure distance by using ultrasonic waves. The sensor head emits an ultrasonic wave and receive the wave reflected back from the target. Ultrasonic sensor measure the distance to the target by measuring the time between the emission and reception.



**Fig: Ultrasonic Sensor**

### 2.8 ADAPTER POWER SUPPLY

An AC adapter, AC/DC adapter, or AC/DC converter is a type of external Power Supply, often enclosed in a case similar to an AC Plug. Other common names include plug pack, plug-in adapter, adapter block, domestic mains adapter, line power adapter, wall wart, power brick, and power adapter. Adapters for battery-powered equipment may be described as chargers or rechargers. AC adapters are used with electrical devices that require power but do not contain internal components to derive the required voltage and power from Mains Power.



**Fig: Adapter**

### 2.9 LCD Display (16 X 2)

Alphanumeric displays are used in a wide range of applications, including palmtop computers, word processors, photocopiers, point of sale terminals, medical instruments, cellular phones, etc. The 16 x 2 intelligent alphanumeric dot matrix display is capable of displaying 224 different characters and symbols. A full list of the characters and symbols is printed on pages 7/8 (note these symbols can vary between brand of LCD used).



**Fig: LCD Display**

## 2.10 RELAY

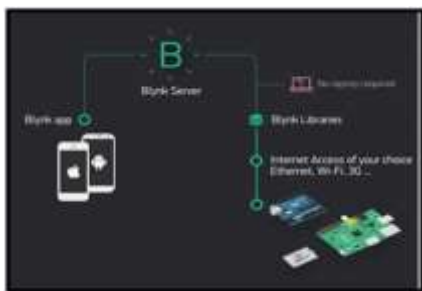
A relay is an electrically operated switch. Many relays use an electromagnet to mechanically operate a switch, but other operating principles are also used, such as solid-state relays. Relays are used where it is necessary to control a circuit by a separate low-power signal, or where several circuits must be controlled by one signal



**Fig: Relay**

## 2.11 BLYNK APP

Blynk is a Platform with iOS and Android apps to control Arduino, Raspberry Pi and the likes over the Internet. It's a digital dashboard where you can build a graphic interface for your project by simply dragging and dropping widgets. It's really simple to set everything up and you'll start tinkering in less than 5 minutes. Blynk is not tied to some specific board or shield. Instead, it's supporting hardware of your choice. Whether your Arduino or Raspberry Pi is linked to the Internet over Wi-Fi, Ethernet or this new ESP8266 chip, Blynk will get you online and ready for the Internet of Your Things.



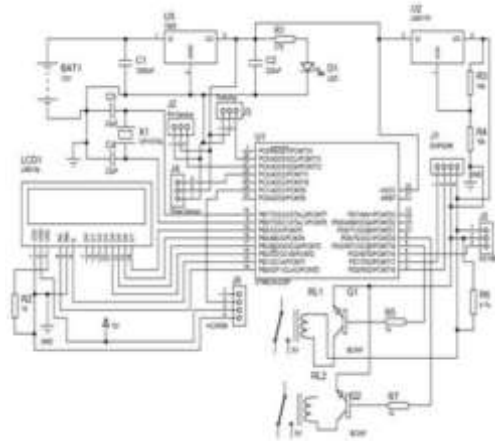
**Fig: architecture of blynk**

## 2.12 INTERNET OF THINGS

The Internet of Things (IoT) is an important topic in technology industry, policy, and engineering circles and has become headline news in both the specialty press and the popular media. This technology is embodied in a wide spectrum of networked products, systems, and sensors, which take advantage of advancements in computing power, electronics miniaturization, and network

interconnections to offer new capabilities not previously possible. An abundance of conferences, reports, and news articles discuss and debate the prospective impact of the "IoT revolution" from new market opportunities and business models to concerns about security, privacy, and technical interoperability.

## 3. CIRCUIT DIAGRAM



**Fig:circuit diagram of smart water management system**

The whole design of the system is based mainly on IOT which is newly introduced concept in the world of development. There is basically two parts included, the first one is hardware & second one is software. The hardware part has sensors which help to measure the real time values, another one is Arduino module AT MEGA328 converts the analog values to digital one, & LCD displays output from sensors, Wi-Fi module gives the connection between hardware and software.

The PCB is design at first level of construction. Then components and sensors mounted on it. BLYNK app is installed in the android version to see the output. In this we used 12V DC supply. Adapter take 230V and converted into 12V DC. There is one switch to ON and OFF the circuit. There are two IC's are used i.e. IC7805 and LM358. IC7805 is used to convert 12V to 5V, there is heat sink used to protect an IC from excessive heat. IC LM317 convert 5V to 3.3V for Wi-Fi module because Wi-Fi module required 3.3V to operate. There are two SPDT(single pole double throw) relay for two separate motor. Capacitor is used to remove the ripples and fluctuation. Potentiometer is used for controlling the brightness of LCD. When the system get started dc current

given to the kit and arduino module and WI-FI gets on. Now by using sensors we can test the quality of water like temperature of water, ph of water turbidity in the water and we can observe all the values of parameter on LCD as well as on the mobile by using android Blynk app.

#### 4. RESULT

We have identified a suitable implementation model that consists of different sensor devices and other modules, their functionalities are shown in figure. In this implementation model we used ATMEGA 328 with Wi-Fi module is as embedded device for sensing and storing the data in cloud. In built ADC and Wi-Fi module connects the embedded device to internet. Sensors are connected to Arduino UNO board for monitoring, ADC will convert the corresponding sensor reading to its digital value and from that value the corresponding environmental parameter will be evaluated.

After sensing the data from different sensor devices, which are placed in particular area of interest. The sensed data will be automatically sent to the web server, when a proper connection is established with sever device.

##### Online Monitoring on mobile App



##### Parameter Display on LCD Screen



#### 5. ADVANTAGES and APPLICATION

##### 5.1 Advantages:

- This project is more suitable to monitor water quality parameters in real time.

- To monitor data from various locations IOT environment is provided.
- No need to visit the location to monitor the water quality parameters.
- Due to real time monitoring the water quality parameters are available whenever required which can indicate any water contamination occurred.

##### 5.2 Application:

- Domestic water is intended for human consumption for drinking and cooking purposes. The Bureau of Indian Standards (Central Ground Water Board, 2017) provides details about acceptable limits of substances such as Aluminum, Ammonia, Iron, Zinc etc. Traditional water quality measurement involves manual collection of water at various locations, storing the samples in centralized location and subjecting the samples to laboratory analytical testing Such approaches are not considered efficient due to the unavailability of real time water quality information, delayed detection of contaminants and not cost effective solution. Hence, the need for continuous online water quality monitoring.
- Chemical leakage detection in revisers: Extreme pH or low DO values -signal chemical spills due to sewage treatment plant or supply pipe problem.
- The water quality monitoring is important for several applications such as environment monitoring of pond and ecosystem, drinking water distribution and measurement, contamination detection in drinking water.

#### 6. CONCLUSION & FUTURE SCOPE

##### 6.1 Conclusion

Monitoring of Turbidity, PH & Temperature of Water makes use of water detection sensor with unique advantage and existing GSM network. The system can monitor water quality automatically, and it is low in cost and does not require people on duty. So the water quality testing is likely to be more economical, convenient and fast. The system has good flexibility. Only by replacing the corresponding sensors and changing the relevant software programs, this system can be used to monitor other water quality parameters. The operation is simple. The system can be expanded to monitor hydrologic, air pollution, industrial and

agricultural production and so on. It has widespread application and extension value.

By keeping the embedded devices in the environment for monitoring enables self- protection (i.e., smart environment) to the environment. To implement this need to deploy the sensor devices in the environment for collecting the data and analysis. By deploying sensor devices in the environment, we can bring the environment into real life i.e. it can interact with other objects through the network. Then the collected data and analysis results will be available to the end user through the Wi-Fi. The smart way to monitor environment and an efficient, low cost embedded system is presented with different models

In the proposed architecture functions of different modules were discussed. The noise and air pollution monitoring system with Internet of Things (IoT) concept experimentally tested for monitoring two parameters. It also sent the sensor parameters to the cloud (Google Spread Sheets). This data will be helpful for future analysis and it can be easily shared to other end users.

### 6.2 Future Scope:

- To give information to whole users those are depends on that plant.
- Detecting the more parameters for most secure purpose.
- Increase the parameters by addition of multiple sensors.
- By interfacing relay we control the supply of water.

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