

Form 2
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 COMPLETE SPECIFICATION
 (Section 10 and Rule 13)
 NAME OF APPLICANTS & INVENTORS

DEVELOPMENT, AUTHENTICATION AND APPLICATION OF 3D-PRINTED IOT-BASED WATER QUALITY MONITORING SYSTEM-4.0 INDUSTRIAL REVOLUTION APPROACH.

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The following specification particularly describes the invention and the manner in which it is to be performed.

FIELD OF INVENTION

The present invention generally relates to water monitoring system, more particularly, this system relates to an arrangement for real time water quality monitoring system of water bodies in IoT based water quality monitoring system-4.0 Industrial revolution approach.

PRIOR ART

Maintainability of momentum and future water asset distribution is a developing worry to people in general. Tracking down a harmony between what is required by people and what is required in the climate is a significant stage in the maintainability of water assets. Furthermore, water use and water properties fundamentally affect costs caused by private buyers and organizations. Accordingly new administration procedures are needed.

The interest for cleaner water items is by and large expanding. Government organizations need to create better water items, of the sort inferred utilizing chlorine specifically, to meet progressively tough security and natural guidelines, just as to work on broad tasks. Moreover, because of the interest for cleaner regular water by its great many family clients around the world, general wellbeing specialists are by and large progressively constrained to screen the different pollutants in the water stream during the different cycles such as, desalination, to guarantee that the water fulfills the need for virtue and to have the option to go to fast restorative lengths to recognize or potentially lessen the toxins when they do start to show up. Specific

foreign substances, which might be available in the water and all the more especially, in the chlorine content, are halocarbons, including methylene chloride, chloroform. (U.S. Pat. No. 5,654,201 unveils an agent chlorine quality checking framework.) In request to screen the water pollutants and can make a restorative move, it is fundamental that a reasonable framework and technique be accessible which will precisely distinguish and gauge such impurities and which can likewise be utilized on-line at the family site, taking examples straightforwardly from its tap stream.

Water quality appraisal in the current days is a major issue. Disintegrating water quality is greatest test which people are confronting these days. The uneven locales have consistently been considered as an embodiment of radiant magnificence, yet presently these areas are dealing with the issue of helpless water quality. In slope region, there is a shortage of drinking water and wellsprings of the equivalent are restricted. Existing water sources are being dirtied step by step because of the increment in populace, illicit development, sewage water release which influencing the strength of huge space of populace. The needy individuals of India, regardless of whether living in provincial region or in metropolitan regions wear t have adequate measures just as information through which they survey the nature of water. The 80% of the number of inhabitants in India are burning-through most noticeably terrible nature of water which at last raises the issue of water-based diseases.

CN102109511A unveils a sewage checking network structure dependent on a remote sensor organization, including an observing focus, a majority of sewage boundary observing frameworks and a sewage treatment process observing framework, wherein the sewage boundary checking frameworks are associated with the checking focus by the remote sensor organization

and depends on a Zig-Bee organization; every sewage boundary observing framework and the sewage treatment process checking framework individually contain a correspondence module, a base station and sensor hubs; the correspondence module speaks with the remote sensor organization; the base station speaks with the correspondence module; the sensor hubs are associated with the base station; the base station is utilized for getting and intertwining information sent from the sensor hubs and yielding the information to the correspondence module and the sensor hubs are utilized for checking boundaries of sewage or the sewage treatment interaction, and communicating the observed information to the base station by the Zig-Bee organization; and every sensor hub involves a Zig-Bee module. In the sewage checking network structure, by using a remote sensor innovation, the ecological mishaps can be carved out in opportunity, the event and the improvement of the mishaps can be observed and assessed and afterward crisis techniques and measures can be made.

US20070090059 unveils a strategy for checking water related with somewhere around one of a water sanitization, circulation, or treatment office. The strategy incorporates working various checking units remotely situated concerning each other to at minimum to some extent play out the observing, the units each including a few distinct kinds of sensors to recognize correspondingly various attributes of the water, a handling subsystem, and a two-way correspondence subsystem. For every one of the units, the strategy incorporates handling signals relating to the various attributes with the handling subsystem. Furthermore, for one of the units, the strategy incorporates distinguishing a strange condition by executing symptomatic rationale and imparting the unusual condition to a host with the two-way correspondence subsystem for the one of the units.

WO2010051842 reveals a sensor course of action and a technique for the long-lasting remote checking of water quality in a water supply line is uncovered. The sensor game plan involves various sensors for the identification of various characteristics of water quality and for giving genuine estimation information, an imparting unit for sending the real estimation information to a focal regulator and a stream cell, which is furnished with a water delta and with a water outlet that are refined to be connectable to an inventory cylinder and separately to a conveying container of the water supply line. The sensor plan as per the creation is described in that the stream cell includes a single direction water stream way that connects the water bay to the water outlet, wherein the sensors are organized one downstream of the other regarding the water stream way so that their detecting parts, which associate with the streaming water, are situated in or possibly near a focal hub of the water stream way for each situation. Additionally unveiled is a framework for early recognition of poisons in a water dispersion organization. The framework depends on various distant sensors situated all through the water supply organization. The sensors speak with one another utilizing a self-coordinated remote organization, sharing information and control orders. The framework empowers water providers to identify defilements the exact moment they occur.

CN101339179 uncovers a water quality far off unique checking framework utilized for aquiculture; the development embraces the water quality far off powerful observing framework to acknowledge ongoing unique far off remote checking of numerous water quality boundaries which takes the water temperature, the pH esteem, the electrical conductivity, the broke up oxygen, the oxidation-decrease potential, the saltiness, the turbidity and the luminance as need, can reach out to observing more water quality boundaries all the while, and builds up an enormous scope and disseminated water quality distant unique checking network in various

districts. Contrasted and other water quality internet checking frameworks, the water quality distant unique observing framework has simple development of observing boundaries, higher estimation accuracy and great similarity, and the expense thereof is diminished by in excess of a half contrasted and the comparative item imported from abroad.

US6021664 unveils a technique for observing the nature of water at a ground water testing website without human mediation. Water at the inspecting site is cleansed until no less than one preselected cleanse measure is fulfilled. Somewhere around one water quality characteristic is naturally estimated at the inspecting site, and the nature of water at the not really set in stone dependent on the deliberate water quality trait. The technique is performed by a framework including a control unit which, as per a PC program, controls the taking of water quality characteristic estimations at the testing site. The control unit might be furnished with a port for downloading information to a professional on location and with a handset for conveying information to a base station through an interchanges network.

US20100332149 reveals a remote observing framework for checking the activity of a liquid treatment framework or potentially the characteristics, qualities, properties, and so forth, of the liquid being handled or treated by the liquid treatment framework. The framework for estimating liquid quality and additionally gear activity in a liquid treatment framework incorporates a far off PC that might be related with a data set that gets to information sent from the liquid treatment framework with the information Collected, procured, and so forth, from at least one sensors set in the liquid treatment framework. The information might be broke down or controlled by a nearby PC or potentially the distant PC, which might be utilized to create an investigation result or examination report. Such outcomes or reports, alongside some other data or Data including

verifiable or anticipated data, might be sent or conveyed to a remote review gadget for survey by a client. Techniques are additionally accommodated the activity of the remote observing arrangement of the present invention.

US20090123340 reveals a screen gadget which is joined to the water supply line of a purchaser where it more than once gauges a trademark that associates to nature of water in the water line. Every one of a progression of a water quality qualities is gotten from at least one of the estimations. The interaction proceeds at chosen stretches to persistently screen the state of water in the line. Each new worth can measure up to a reference esteem addressing a greatest satisfactory degree of toxins. In case the water quality worth surpasses the reference esteem, an exaggerate signal is delivered, showing an unsatisfactory degree of pollutants in the water. Also, the qualities can be communicated to a focal assortment office where they are corresponded with values sent by comparable gadgets on the stock lines of different shoppers to follow the nature of water of a stockpile framework over time.

.CN202615202U uncovers a water quality telemetry checking framework. Each checking terminal is furnished with a focal processor, which is associated with a clock module and a remote module, a temperature sensor is associated with a focal processor, a pH anode, a conductivity locator, a turbidity identifier, and a disintegration. The oxygen terminals are each associated with the focal processor by means of multi-way switches and sign molding modules. The observing focus PC has a remote transmission module that is associated with the checking terminal through a remote organization and gets the water quality information of every terminal. The remote organization is GSM. The checking focus PC is additionally associated with the directors cell phone by means of GSM, and an alert module is associated. At the point when the

information is unusual, the administration staff and the alert are consequently told. The checking point is set in the sewage treatment plant, and the focal processor is associated with a control module. As per the checked water quality information, the air circulation siphon and the fluid siphon are opened and shut. The framework understands the decentralized control of water quality in numerous observing stations or water checking destinations, brought together administration, programmed observing and control, saving labor and material assets, and continuous and exact reaction to the water quality data of each checking site.

However, previously mentioned references and numerous other comparative references has at least one of the accompanying deficiencies: (a) Highly costly; (b) Consumption of high measure of force; (c) low quality checking;(d) Large in size; (e) utilization of non-inexhaustible wellspring of energy and (f) slow in checking the nature of the water.

The present applications address the previously mentioned concerns and inadequacies as to furnishing further developed water observing framework with progress in the speed, diminishing expense with low power use.

NON-PATENT LITERATURE STUDY

1. B. Tjahjono, C. Esplugues, E. Ares, and G. Pelaez, "What does Industry 4.0 mean to Supply Chain?," *Procedia Manuf.*, vol. 13, no. January, pp. 1175–1182, 2017, doi: 10.1016/j.promfg.2017.09.191.
2. AlMetwally, S.A.H., Hassan, M.K. and Mourad, M.H., 2020. Real Time Internet of Things (IoT) Based Water Quality Management System. *Procedia CIRP*, 91, pp.478-485.
3. Chowdury, Mohammad Salah Uddin, Talha Bin Emran, Subhasish Ghosh, Abhijit Pathak, Mohd Manjur Alam, Nurul Absar, Karl Andersson, and Mohammad Shahadat Hossain. "IoT based real-time river water quality monitoring system." *Procedia Computer Science* 155 (2019): 161-168.

RESEARCH STATEMENT

There are a great deal of uses and regions that have applied the standards and models of the Industry 4.0. The models can be took on to commonly any framework that has the Internet of Things (IoT) capacities. The Internet of Things (IoT) calls for the utilization of a cloud climate to impart, store information and connect various gadgets [1]. The gadgets could be in various places associated through networks utilizing the created capabilities of remote correspondence. The Integration of the various kinds of gadgets and sensors enable the information assortment [2]. The information is then handled empowering the framework to settle on choices dependent on the as of now loaded decision rules. This permits the investigation of new opportunities, for instance working on the maintainability of environmental assets, like water for our situation. Overall, the present investigation framework ought to furnish an easy to use interface with infographics and meters to illustrate the quality elements as Lower-Upper cutoff points and the satisfactory worth. The present invention discusses the modern unrest and afterward the advancement of the brilliant frameworks to screen the water quality [3]. Moreover, this present investigation presents the plan of a minimal expense sensor framework for checking physio-chemical factors present in a water body. The generalist, IoT based water quality monitoring system was displayed (**Figure. 1**).

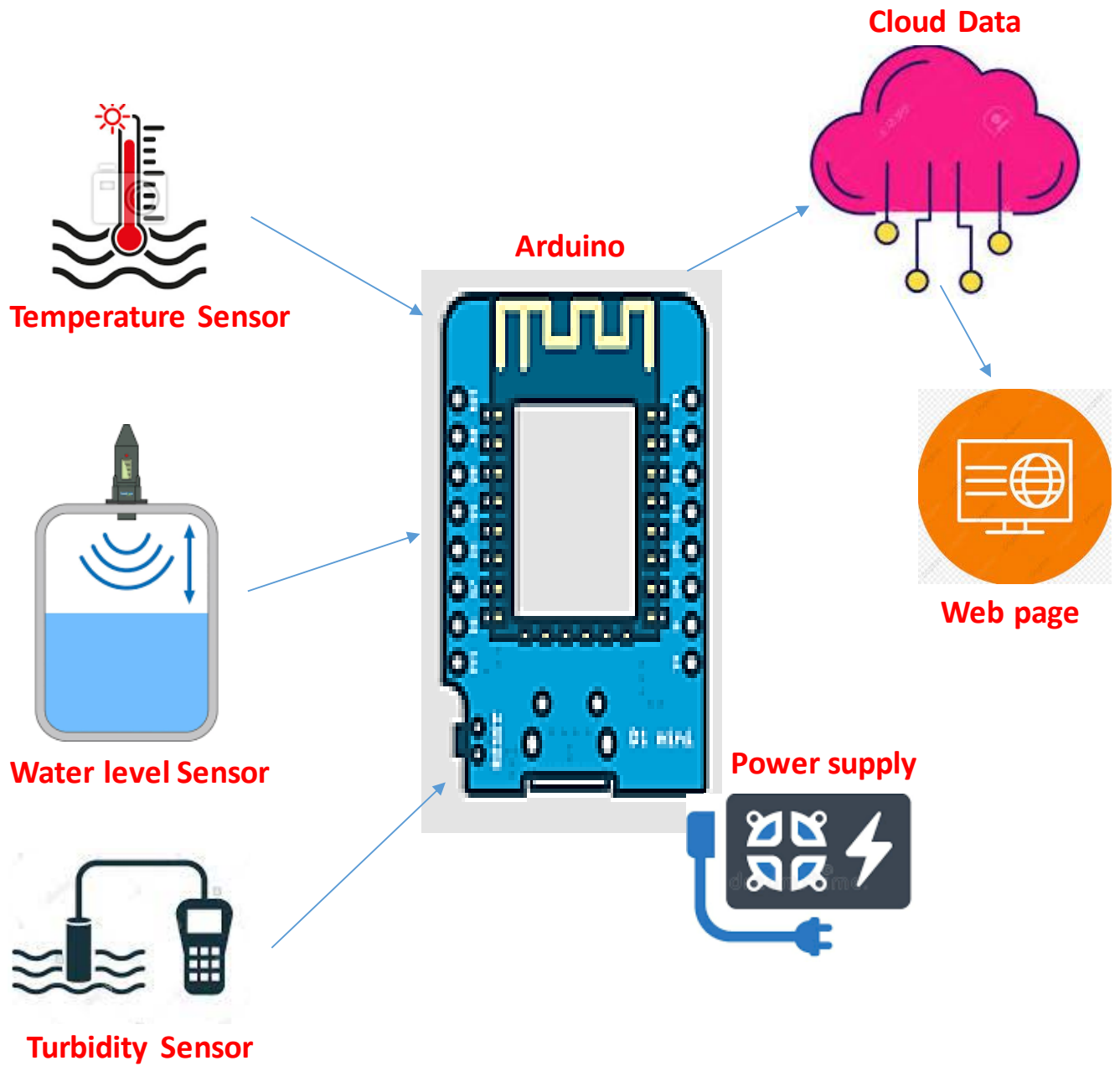


Figure. 1. Schematic view of generalist, IoT based water quality monitoring system.

METHODOLOGY

Sensors

Temperature Sensors

The temperature sensor is utilized to screen the frigidity or hotness of the water, estimated in degree Celsius, with precision of 0.1 advances, which is more exact than the mercury thermistor (Figure. 2). The activity temperature range differs between - 50 to 150, in this case the water degree is kept up with between 20 to 30 degree Celsius.



Figure. 2. Water proof temperature sensor.

pH Sensor

The pH sensor is utilized to screen the acidity and alkalinity in water, it is intended to give a worth from 0 to 14 concurring to the hydrogen particles fixation with the negative logarithmic, for this situation the water pH is kept up with between 6 to 8.5 (**figure. 3**).



Figure. 3. Schematic view of pH sensor.

Ultrasonic Water level measurement Sensor

The ultrasonic water level sensor is utilized to send beats of sound waves to the water surface on the tank and get them back to ascertain the water level in the tank, to keep away from the over stream from the water channel and to decide the water volume in the tank (**figure. 4**).



Figure. 4. Schematic view of Ultrasonic water level sensor.

The Internet of Things (IoT) parts will have the option to take the choice upon the ongoing qualities and record the patterns dependent on the verifiable information recorded according to the turbidity esteems to decide whether the water should stream in the channel or not. The evolution and impact of 4.0 industrial revolutionary approach was displayed (**figure. 5**).

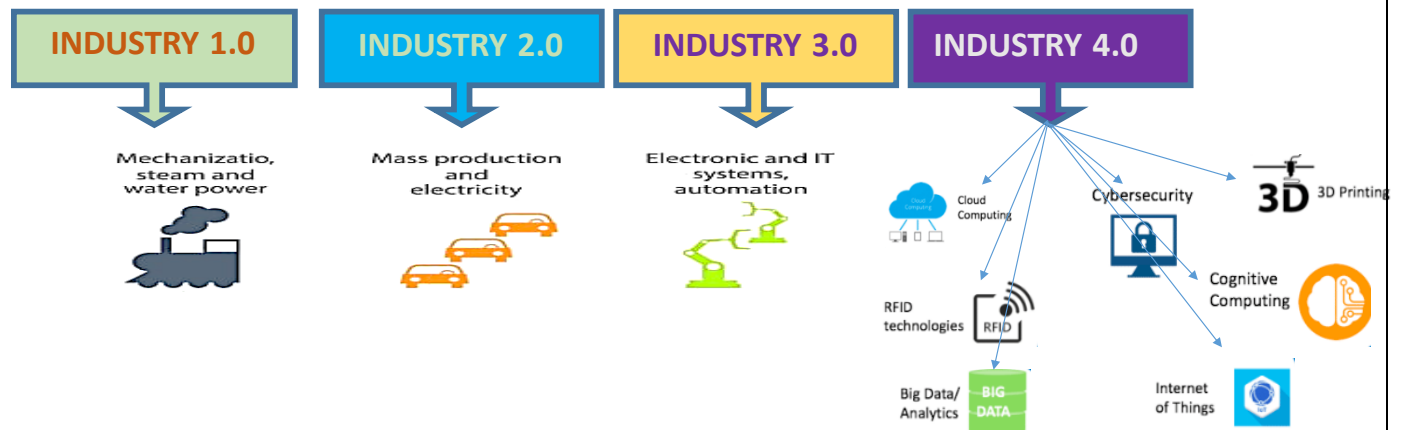


Figure. 5. Schematic view of evolution and impact of 4.0 industrial revolutionary approach.

RESULTS

The monitoring framework cloud server was developed utilizing climate Node.js. The server uses MongoDB data set framework to save the qualities got. It utilizes information structures similar to the JSON design. The information was put away in the server for translation and execution on a cloud-hosted stage created with the Angular framework. In this stage, the user can imagine the flow water conditions and can take the respective measures. Moreover, This model expected to build the effectiveness of water management frameworks. Likewise, the constant checking and operational enacts limit the human mistake, trailed by a prototype to approve the thought by gathering information and analyze it. The proposed framework block diagram is displayed (**Figure. 6**).

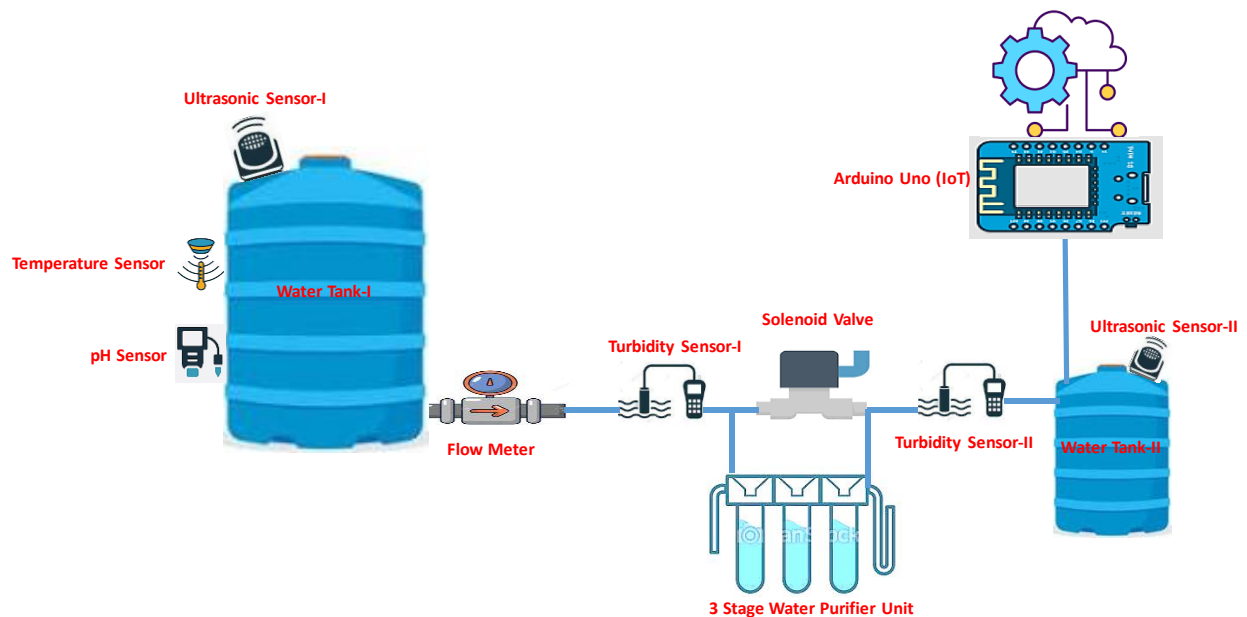


Figure. 6. Schematic view of proposed framework block diagram.

Overall, the present investigation deliver a proficient shrewd water quality-monitoring framework, means to kill the expense of the water samples investigation at disconnected lab. In expansion, giving an obvious sign of the water quality factors to stay away from any sicknesses impacts general wellbeing and the expense of controlling the nature of the burned-through water. This framework support the idea of a perceptive city that does not require human collaborations and decrease the work and activity costs. Likewise uses the various channels used to improve the water quality effectively. As the channels might be utilized once needed and not constantly.

CLAIM (S)

1. A water quality monitoring system comprising an easy to use interface with infographics and meters to illustrate the quality elements as Lower-Upper cutoff points and the satisfactory worth. The present invention discusses the modern unrest and afterward the advancement of the brilliant frameworks to screen the water quality.
2. According to claim 1 ,wherein the temperature sensor is utilized to screen the frigidity or hotness of the water, estimated in degree Celsius, with precision of 0.1 advances, which is more exact than the mercury thermistor. The activity temperature range differs between - 50 to 150, in this case the water degree is kept up with between 20 to 30 degree Celsius.
3. According to claim 1 ,wherein the pH sensor is utilized to screen the acidity and alkalinity in water, it is intended to give a worth from 0 to 14 concurring to the hydrogen particles fixation with the negative logarithmic, for this situation the water pH is kept up with between 6 to 8.5.
4. According to claim 1 ,wherein the ultrasonic water level sensor is utilized to send beats of sound waves to the water surface on the tank and get them back to ascertain the water level in the tank, to keep away from the over stream from the water channel and to decide the water volume in the tank.
5. According to claim 1 ,wherein the Internet of Things (IoT) parts will have the option to take the choice upon the ongoing qualities and record the patterns dependent on the verifiable information recorded according to the turbidity esteems to decide whether the water should stream in the channel or not.
6. According to claim 1 ,wherein the monitoring framework cloud server was developed utilizing climate Node.js. The server uses MongoDB data set framework to save the qualities got. It utilizes information structures similar to the JSON design.
7. According to claim 1 ,wherein the framework support the idea of a perceptive city that does not require human collaborations and decrease the work and activity costs. Likewise uses the various channels used to improve the water quality effectively. As the channels might be utilized once needed and not constantly.

ABSTRACT

DEVELOPMENT, AUTHENTICATION AND APPLICATION OF 3D-PRINTED IOT-BASED WATER QUALITY MONITORING SYSTEM-4.0 INDUSTRIAL REVOLUTION APPROACH.

Advancements are quickly creating which prompts a tremendous changes and consequences for the day-to-day routine of humankind. People are compelled to change the way they think and to foster new method for getting things done, which is leading to the fourth modern insurgency, alluded to as Industry 4.0. This present invention shows the plan of an observing framework for physicochemical variables on water. The factors are broken down oxygen, turbidity, temperature, and pH present in water bodies. The framework utilizes sensors and a microcontroller with internet association competent to get the information and afterward send it to a server facilitated on the web where they are handled and put away in a dataset. There is additionally a software item through which the qualities recorded and display and examined by individuals dealing with the observing system. This undertaking was created using the product life cycle philosophy; examination, plan, improvement, implementation, and testing. The principle aftereffect of this task is a framework model utilizing open-source equipment and programming to lessen framework costs, and furthermore the plan and design of the framework. The execution of the framework gives the possibility to further develop the yield productivity through the observing of various physicochemical factors in the water, carrying out instruments to ensure the effectiveness, accuracy, and minimal expense. The objective is to offer a simple way to obtaining and execution observing framework.