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A Water Pollution Monitoring System Based on IoT

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Abstract: In the 21st century, there were lots of inventions, but at the same time were pollutions, global warming and so on are being formed, because of this there is no safe drinking water for the world's pollution. Nowadays, water quality monitoring in real time faces challenges because of global warming limited water resources, growing population, etc. Water pollution is one of the biggest fears for the green globalization. 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.
Keywords: pH sensor, Turbidity sensor, Temperature sensor, Flow sensor, Ardurino model, WI-FI module.

I. INTRODUCTION

The Internet of things (IoT) brings an exciting new dimension to the world of field research, where researchers are able to access their data and insights in real time, wherever they are. This means that physical and chemical measurements can be made on-site or in the lab with a fraction of the effort that it would take if one were to rely on manual data collection [1,2,3].It also means that one can deploy a network of sensors across a region of interest and have them all communicate with each other to provide a comprehensive picture of what is happening in that area. This is particularly valuable for water quality monitoring, where changes in conditions can have serious consequences downstream [3,4,5].In recent years, the Internet of Things (IoT) has become increasingly popular for a wide range of applications, including monitoring the quality of water. By using IoT devices such as Raspberry Pi and sensors that measure various parameters such as temperature, oxygen, and pH, it is possible to continuously monitor the quality of water in real-time. This information can be collected and analyzed using programming languages such as Python and Julia to gain insights and make informed decisions about water management [1,3,4,5].For example, a system that includes temperature sensors and oxygen sensors could be used to monitor the health of a lake or river. By detecting changes in temperature and oxygen levels, it is possible to identify potential issues such as algal blooms or changes in the ecosystem. Similarly, pH sensors and BOD sensors (biochemical oxygen demand) can be used to measure the acidity and pollution levels of water bodies [6,7,8,9].

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The benefits of IoT in water quality monitoring are clear, but there are also some challenges that need to be considered. One of the biggest challenges is data management, as the volume of data generated by a large network of sensors can be enormous. It is also important to ensure that the data is of high quality, as this is essential for making accurate predictions about future conditions [10,11,12,13].Another challenge is security, as it is vital to ensure that the data collected by the sensors is not accessed by unauthorized individuals. This is particularly important given the sensitive nature of water quality data. The Internet of things (IoT) brings an exciting new dimension to the world of field research, where researchers are able to access their data and insights in real time, wherever they are. This means that physical and chemical measurements can be made on-site or in the lab with a fraction of the effort that it would take if you were to rely on manual data collection [5,9,14].

It also means that you can deploy a network of sensors across a region of interest and have them all communicate with each other to provide a comprehensive picture of what is happening in that area. This is particularly valuable for water quality monitoring, where changes in conditions can have serious consequences downstream [5,9,14].Despite these challenges, IoT in water quality monitoring is already starting to make a difference. In many cases, it is providing insights that would not have been possible without it. As the technology continues to develop, it is likely that its impact will only grow.The purpose of this work is to introduce the concepts of the Internet of Things (IoT) in determining the quality of water and what factors it can be associated with.

II. RELATED WORK

The development of a real-time IoT water quality monitor for industrial wastewater is a big deal in the fight against environmental yuckiness. Here's the lowdown on what's going on in this area:

Industrialization and city growth have messed up the environment big time, especially our waterways. Take Bangladesh, for example – their rivers and canals are getting dumped on by factories, like in the garment industry, and it's not a pretty sight. We really need some cool gadgets to keep an eye on the water situation and stop it from getting worse.Now, when the water's dirty, it can make us sick with stuff like food poisoning and the runs, not to mention breathing troubles and gross skin problems. So, having real-time info on what's in the water is a game-changer for keeping everyone healthy.The old ways of checking water quality? Not so hot. They don't always give us the full picture or keep us updated enough. But with IoT, we can keep tabs on important stuff like water temperature, cloudiness, and whether there's too much junk dissolved in it (that's TDS) and how acidic or basic it is (pH levels) all the time.And get this: water quality varies like crazy from one factory to another. Some have TDS levels that are off the charts, way above what's safe. This just shows how much we need a super-flexible system that can handle all sorts of conditions and give us the latest scoop on the water's state.But it's not just about collecting data; we've got to use that info wisely. By mixing in some specific metrics into the system, we get a clearer picture of what's happening with industrial wastewater. This helps us come up with better plans to tackle the problem of water pollution, tailored to each situation. So, integrating all this data is key for making sure our water doesn't turn into a health hazard [15].

III. IMPORTANCE OF WATER POLLUTION MONITORING:

Staying on top of water monitoring is a big deal because it lets us spot bad stuff, like germs, before it hits our drinking water. It's like a water bouncer that keeps out the riff-raff like cholera, typhoid, and hepatitis, so we don't get all sick and stuff.

- Risk Check: It's like having a water superhero squad that keeps an eye on things and jumps into action when there's trouble. They figure out how risky it is to hang around certain pollutants.
- Looking Out for Nature: Water Quality Watchdogs: These guys are like the neighborhood watch for water critters and their homes. If the water's dirty, they're on it, making sure we don't lose any cool species or mess up their pads.
- Heads Up for Water Troubles: Real-time water monitoring is like having a water spy. It tells us if there's a party in the water with algae that hog all the oxygen, which can lead to dead fish and other yucky things. It's super important for keeping our water clean and fun.
- Making Sure Everyone Follows the Rules: Water Quality Standards and Polluter Police: Monitoring keeps everyone honest, like having a hall monitor for water. It makes sure the water's safe for everyone to chill in.
- Making Smart Choices with Water Data: It's like having a crystal ball for water bosses. They can see how clean the water is and make decisions to keep our waterways healthy and figure out where to focus on fighting pollution.
- Using Water Wisely: Knowing What's What: In places where water's scarce, monitoring is like a water report card. It helps us figure out where to clean up and how to use water without wasting it like a bunch of overzealous sprinkler-running teenagers.
- Farmer's Best Friend: Water Quality Data for Smarter Farming: Farmers get a cheat sheet from this to know how much fertilizer and pesticide to use without messing up the local water. It's like giving them the 411 to keep their crops happy and the water clean.

So, water monitoring isn't just some science-y thing. It's about keeping us, the animals, and the plants all healthy and happy. It's like having a buddy that's always got your back, making sure the water you drink and the world around you stays as fresh as a daisy [16].

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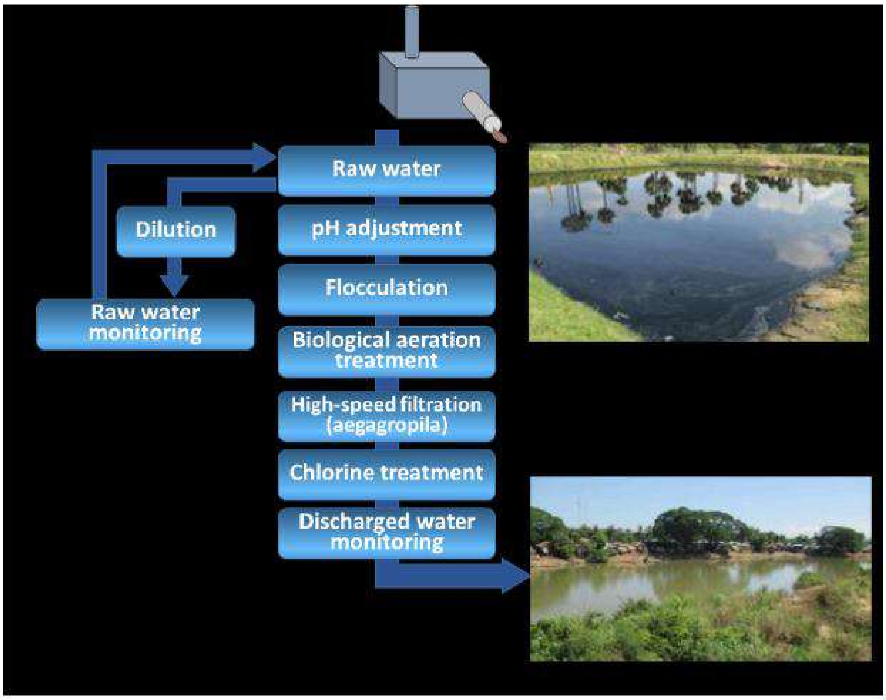

Fig.1: Flowchart on water pollution based on IOT monitoring

IV. CHALLENGES IN MONITORING WATER QUALITY

However, research on water quality monitoring does not consider systematically the context of human development in which such monitoring activities take place. By considering both financial and educational aspects, for instance, the concept of human development and related indices hint to the capacity of states to provide public services. By consequence, human development is also likely to influence the lack or availability of capacity and thus also the effectiveness of monitoring processes. Human development considers, for instance, economic growth, which is likely to influence the financial resources available for monitoring freshwater resources. Human development also indicates (implicitly) the knowledge base of societies that may influence the availability of skilled personnel for monitoring. Thus, while it has been largely neglected in monitoring discussions so far, human development is an important contributory factor to monitoring challenges even for 'easy-to-measure' parameters and deserve some systematic analysis [17].Against this background, the goal of this study was to add to the planning of successful water quality monitoring, by analysing systematically the impact of human development on the capacity for water quality monitoring within the monitoring cycle—from defining an enabling environment (existence of obligatory rules, monitoring strategies, responsible authorities and institutional capacity), to the selection of relevant water quality parameters and then to actual measurement of five representative water quality parameters: dissolved oxygen (DO), electrical conductivity (EC), pH, total phosphorus (TP) and total nitrogen (TN). To understand capacity challenges along the monitoring cycle, we conducted a survey amongst international water quality experts from science and practice in the final phase of the first SDG 6.3.2 data drive in 2017. We then further analysed the role of human development in such water monitoring capacity challenges by using the corresponding data of the human development index (HDI) [18]. The HDI admittedly characterizes human development, aggregating not only information on the standard of living (based on gross national income per capita), but also on health and knowledge (including here expected and mean years of schooling and life expectancy). This turns the HDI into a particularly comprehensive and relevant influencing factor for capacity challenges in water quality monitoring (UNDP 2016).The next section clarifies the concepts of 'human development' and 'capacity challenges in water quality monitoring' and develops the relationship between the two. We then describe the methods for gathering and analysing the data, focussing on the methodology applied in the international survey amongst water quality experts [19]. The following section then presents the results of the analysis, starting with descriptive data related to the HDI and capacity challenges, and then dealing with the correlation between the HDI and capacity challenges along the application process. The final section discusses and concludes on the results, putting emphasis on targeted strategies to overcome identified capacity challenges in water quality monitoring [20].

V. RESULT ANALYSIS

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. Inbuilt 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 [21]. The sensed data will be automatically sent to the web server, when a proper connection is established with sever device.

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VI. CONCLUSION

Our 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.

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