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IoT Based Water Quality Analyzer for Chandrabhaga River at ghat Locations in Pandharpur

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ARTICLE INFO

ABSTRACT

The problem of water contamination affects the entire world. It heralds the health and happiness of people, animals, and plants. On Wari Days, lakhs of pilgrims arrive in Pandharpur. Additionally, there are 10,000 pilgrims that visit daily. The belief of pilgrims is that if they have "Snaan" in Chandrabhaga, they will be blessed by God. The name "Dakshin Kashi" is another name for the city. On the other hand, dishonestly, waste water from local industries and Pandharpur city's drainage is dumped into the river. Of course, the water in Chandrabhaga is poisoned as a result of all of these issues. As a result of all these pilgrims' constant desire for Snaan in Chandrabhaga, the concept for a Water Quality Control Project is born. They have such a strong belief in this "Karya" that they don't give much thought to water quality of the water. They frequently have an adverse effect on their health indirectly.

To warn pilgrims about the water quality, we can install the Devices at various ghat locations. These Devices will continuously monitor the water quality and communicate their findings to the pollution control office as well as being displayed at the ghat locations.

Keywords: IoT, Water Quality, Pilgrims, ghat

1. INTRODUCTION

Regardless of whether it is utilized for drinking, home use, food production, or leisure activities, safe, easily accessible water is crucial for maintaining public health. Better water supply, sanitation, and resource management can boost a country's economic growth and make a substantial impact on reducing poverty. Everyone has the right to enough water for personal and domestic use that is available continuously, is safe, acceptable, physically accessible, and is inexpensive.

Depending on the amount of germs present, bathing water quality refers to how clean the water is at authorized beaches. These germs originate from animal or human faeces, which may signal levels of contamination that could make you ill. The Bathing Water Command oversees bathing site quality and establishes minimum requirements for bathing water quality in the EU. So how do you define acceptable water quality? What actions can the harbor master take to guarantee quality? The harbor master may not have the authority to guarantee the quality of the harbor basin when it borders estuarial or ocean waters except from ensuring that activities in his harbor do not contribute to pollution.

To regularly evaluate the quality of the water coming from the various supply sources, both qualitative and quantitative measurements are occasionally required.

Interdisciplinary relevance:

A water quality monitoring program's goal is to gather data and information on the state of water resources so that the relevant authority may make the best choice possible. The goal of an Interdisciplinary research is:

- To ensure an accurate assessment of the water quality and to have faith in the findings based on standardized practices for all aspects of water quality monitoring.
- If the researchers have backgrounds in E&TC and civil engineering, this goal will be accomplished.

2. LITERATURE REVIEW

International status:

Alex Anvari et. al.[1], Certain design choices were suggested in this project interpretation based on analysis with both objective and subjective understanding of the system being upgraded.

Natasa Markovic et. al.[2], This paper presents a description of the Sensor Web architecture for crisis management, active monitoring of measuring parameters, and quick responses in the event of environmental calamities. This design enables access to, control of, and management of river water contamination through the River Water Management and Alert System.

Jiping Xu et. al.[3], This study proposes a type of lake water information remote monitoring equipment based on embedded technology and GPRS/ 3G technology, taking into account the issues that traditional river pollution monitoring techniques is considerably more complex. The 3G transmission of the YSI data and photos was made possible by the appropriate structure design of the inferior controller. With the benefits of wide coverage and low cost, this system can automatically access the GPRS/ 3G network without network wire. It can monitor up to five water quality measures in accordance with various sources of pollution, which is practical, adaptable, and highly precise. The foundation for environmental protection management to operate at maximum capacity can be created by installing the equipment on the bank.

Shraddha V et.al.[4], Real-time quality monitoring is required to guarantee the supply of drinking water is secure. In this research, the authors design and create a low-cost system for internet of things (IoT) real-time water quality monitoring. The system, which consists of numerous sensors, is used to measure the water's physical and chemical characteristics. You may measure the water's characteristics, including its temperature, pH, turbidity, conductivity, and dissolved oxygen. The core controller is capable of processing the measured values from the sensors. You can use the raspberry PI B+ model as a core controller. The findings show that our low-cost technology can identify these high effect pollutants at relatively low quantities. The findings show that this system meets the requirements of a perfect early warning system, including being online, in-pipe, having a low deployment-operation cost, and having good detection accuracy.

Swapnil Katole et. al.[5] , In this essay, we argue that the health of our aquatic ecosystems depends on good water quality. Although continuous water quality monitoring at high temporal and spatial resolution is still prohibitively expensive, it is a crucial tool for catchment management authorities since it provides real-time data for environmental protection and locating the sources of pollution. In this system, we demonstrate the design and creation of a low-cost IOT-based system for real-time water quality monitoring.The system, which consists of numerous sensors, is used to measure the water's physical and chemical characteristics. It is possible to measure variables including temperature, turbidity, PH, and water flow. The core controller is capable of processing the measured values from the sensors. You can utilize the Raspberry Pi as a core controller. Finally, cloud computing can be used to view the sensor data online.

National Status:

S. Geetha et. al,[6], This document provides a thorough overview of the instruments and methods used by current smart water quality monitoring systems. Additionally, a simple, low-cost system for monitoring water quality is suggested. Consumers can now get data from sensors online thanks to the deployment.

Manoharan. S et. al,[7], This study measures and tests various aspects of water quality in real time, including pH, turbidity, temperature, and electric conductivity. Rapid action can be made to control extreme pollution levels based on the measured data. The main benefit of their work is that it is easy to install and may be positioned quite close to the intended location. Additionally, less experienced people can operate the proposed equipment.

Anuradha T et. al,[8], centered on performing a high-performance, precise, real-time analysis of the water quality. With the aid of a Raspberry Pi and many sensors, they have measured the TDS, temperature, turbidity, and pH levels of the water in this system. For a variety of uses, including drinking water and daily needs, these values are used to assess the water's purity.

AKILA. U et. al.[9], This paper presents a wireless sensor network-based system for monitoring water quality. A base station and multiple sensor nodes made up the system. Data on water quality was gathered on the node side using several sensors, including pH and temperature. If the water is contaminated, the information was communicated by GSM to the relevant authority.

Pradeepkumar M et. al.[10], Water detection sensors with a special benefit and an established GSM network are used for the monitoring of turbidity, PH, and temperature of water. They have created a system that can automatically check the quality of the water, thus it is anticipated that the testing will be less expensive, more practical, and quicker.

K. A. Unnikrishna Menon et. al.[11], They outline the system architecture for a wireless sensor network that helps with river water quality monitoring in this research. The pH amplifier circuit, level shifting circuit, Sallen key topology filter design, processing unit built using PIC microcontroller, and wireless communication module made up of Zigbee radio make up the sensor node's architecture.

Ms. T. Deepiga et. al.[12], In this research, they have addressed the need for the creation of effective wireless sensor networks (WSNs). In order to reduce water waste, they have successfully created a water monitoring system for smart homes and offices.

3. Significance of the study:

Water is the Jeevan. Water quality must be very high in order to be used for activities such as drinking, bathing, cooking, and other tasks. The proposed work is significant since it addresses several health issues that affect not only pilgrims but also everyone who relied on Chandrabhaga River water.

4. Objective:

In order to accomplish the healthiness of the water body under investigation, water quality suggests physical and chemical characteristics that affirm, support, and tolerate the biological system. Therefore, water quality monitoring entails regular, systematic observations that allow for an evaluation of its physical, chemical, and biological properties.

Water Quality Monitoring Network (WQMN) is therefore, a program consisting of three key components

- ❖ Where to observe(Sampling stations)
- ❖ How frequent to observe (Frequency of samplings)
- ❖ What to observe (Parameters)

The objective of the proposed research proposal are:

1. To conduct extensive literature survey to identify both scientific and technical gap in the current scenario.
2. Design and development of the real- time monitoring of the water quality parameters.
3. Design cost effective, more efficient and capable of processing, analyzing, sending the data through controller to mobile device system.
4. With this single instrument one can detect all the possible water parameters such as pH, Turbidity and Conductivity.
5. To analyze the data obtain from the study using core controller system.

5. Methodology:

Uninterruptedly the sensors will take readings for various parameter measurements. Measurement of parameters like turbidity, pH value, dissolved oxygen etc. will be monitored at river location itself. If the values are above threshold level then the message will be send to Pollution Control Office through GSM and at the same time the water quality will be displayed on the LCD displays at ghat locations.

5.1 Block Diagram:

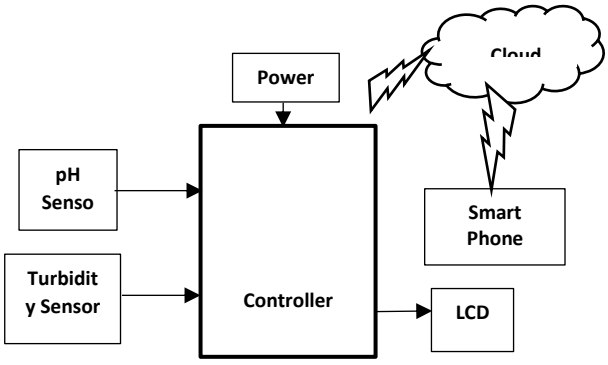


Fig. 1 Block Diagram of proposed work

The work is carried out in following steps:

- ✓ The samples are collected from Chandrabhaga River at different ghat locations & testing is carried out in laboratory.
- ✓ The threshold value will be set for conductivity sensor, pH sensor, and turbidity sensor, from lab study.
- ✓ Measure the pH, turbidity and conductivity using sensors with the designed control system.
- ✓ Parameters are displayed on LCD.
- ✓ Compare the threshold values and corresponding current readings are displayed.
- ✓ If Current reading are less than the threshold value then “Water Parameter is under Safety Level”, this message is displayed.
- ✓ If Current reading are not equal to the threshold or greater than threshold, a text message will be send to Mobile phone located at Pollution Control Office/ concern authority. And “Water Parameter is not under Safety Level”, this message is displayed.

5.2 pH of water

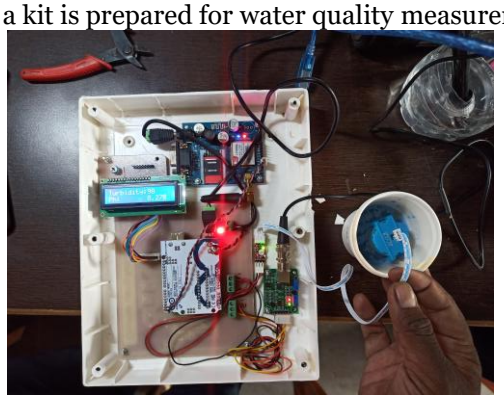
In chemistry, the pH scale is used to define the acidity or basicity of an aqueous solution. Acidic solutions are those with a pH below 7, and basic solutions are those with a pH above 7, at a temperature of 25 °C (77 °F). At this temperature, solutions with a pH of 7 are neutral. or very concentrated strong acids, the pH value can be less than 0; for very concentrated strong bases, it can be higher than 14.

5.4 Turbidity and human health

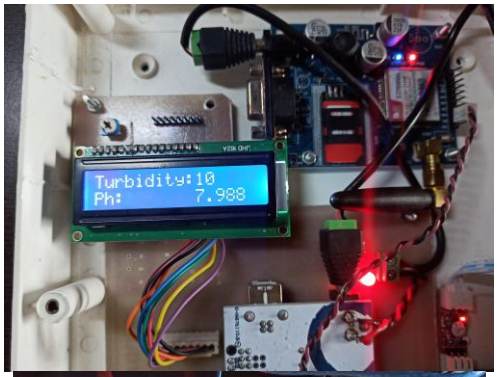
Excessive turbidity, or cloudiness, in drinking water is unsightly and could be dangerous for your health. Numerous studies demonstrate a substantial correlation between the removal of turbidity and the removal of protozoa, despite the fact that turbidity is not a direct signal of health danger. Turbidity particles give microorganisms "shelter" by minimizing their vulnerability to attack by disinfectants. It has been suggested that microbial adhesion to particulate matter promotes bacterial survival.

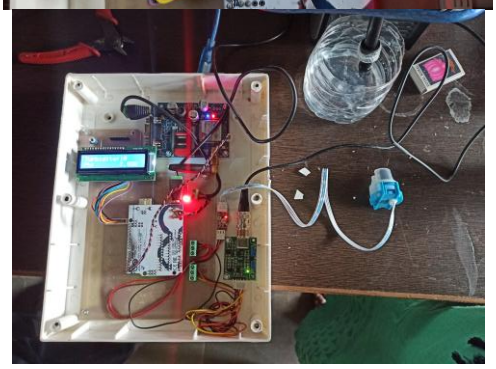
5. EXPERIMENTAL SETUP

As per the designed methodology a kit is prepared for water quality measurement.

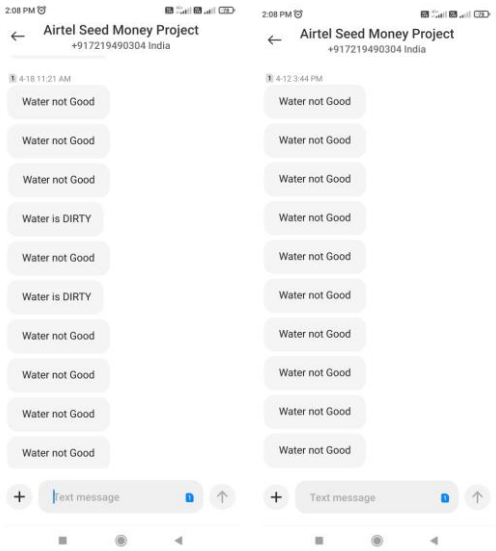


The parameters observed are Turbidity and Ph Value





As per the objective the message has been send to registered user about quality of water.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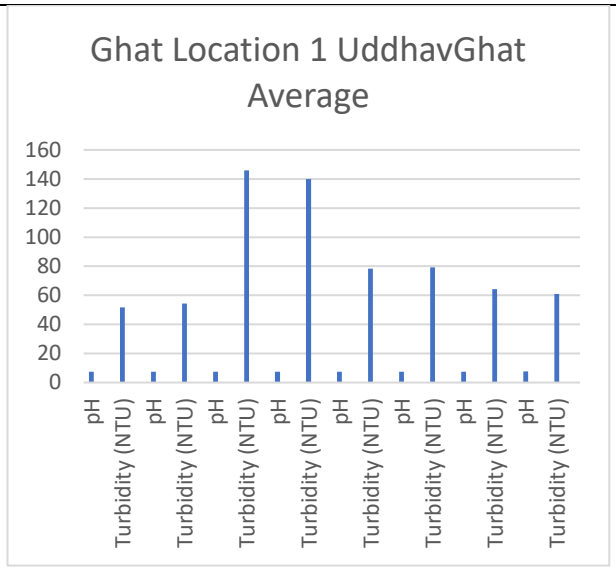
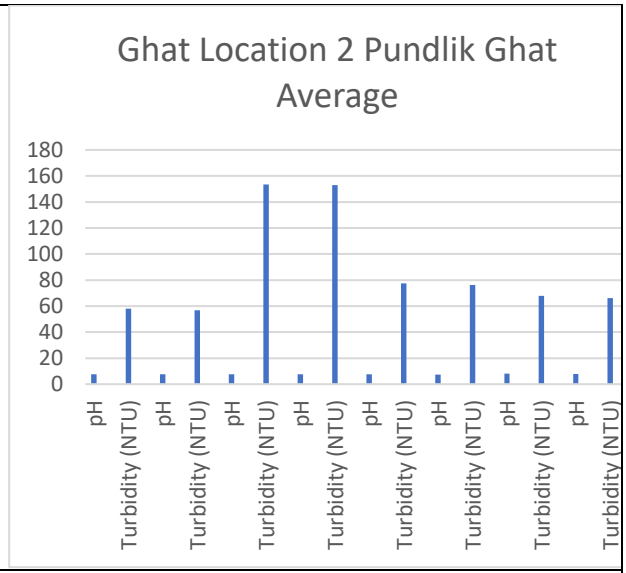
6 RESULT and DISCUSSION

The experimental observations for pH and Turbidity at different ghat locations are as follows:

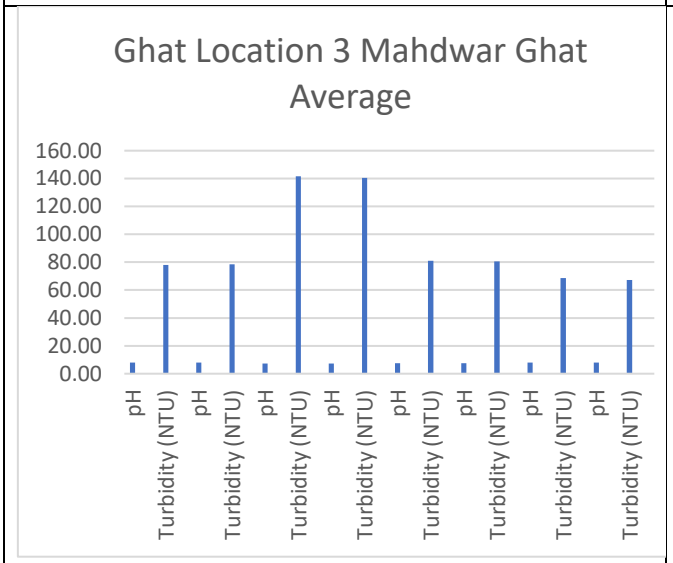
Season1	Reading	Parameters	Observation	Ghat Location 1 Uddhav Ghat		Ghat Location 2 Pundlik Ghat		Ghat Location 3 Mahdwar Ghat		Ghat Location 4 Vishnupad Ghat	
				Reading	Average	Reading	Average	Reading	Average	Reading	Average
Season1 (March, April, May)	LAB Reading	pH	Reading 1	7.43	7.44	7.48	7.515	7.9	7.91	7.81	7.835
			Reading 2	7.45		7.55		7.91		7.86	
		Turbidity (NTU)	Reading 1	52.03	51.745	59.02	57.915	77.81	77.92	67.45	68.385
			Reading 2	51.46		56.81		78.02		69.32	
	At Actual Location	pH	Reading 1	7.42	7.435	7.49	7.55	8.03	8.06	7.79	7.81
			Reading 2	7.45		7.61		8.09		7.83	
		Turbidity (NTU)	Reading 1	54.98	54.28	58.12	56.82	79.29	78.56	68.9	68.43
			Reading 2	53.58		55.52		77.82		67.96	
Season2 (June, July, August)	LAB Reading	pH	Reading 1	7.34	7.375	7.58	7.6	7.19	7.34	7.81	7.835
			Reading 2	7.41		7.62		7.49		7.86	
		Turbidity (NTU)	Reading 1	147.23	145.845	152.23	153.345	143.49	141.73	149.85	149.135
			Reading 2	144.46		154.46		139.96		148.42	
	At Actual Location	pH	Reading 1	7.38	7.405	7.59	7.64	7.23	7.38	7.83	7.82
			Reading 2	7.43		7.69		7.52		7.81	
		Turbidity (NTU)	Reading 1	137.23	139.92	151.45	152.855	141.83	140.40	148.23	149.845
			Reading 2	142.61		154.26		138.96		151.46	
Season1	**Reading**	**Parameters**	**Observation**	**Ghat Location 1 Uddhav Ghat**		**Ghat Location 2 Pundlik Ghat**		**Ghat Location 3 Mahdwar Ghat**		**Ghat Location 4 Vishnupad Ghat**	
				Reading	**Average**	**Reading**	**Average**	**Reading**	**Average**	**Reading**	**Average**
Season3 (September, October, November)	LAB Reading	pH	Reading 1	7.44	7.475	7.49	7.515	7.47	7.48	7.82	7.805
			Reading 2	7.51		7.54		7.49		7.79	
		Turbidity (NTU)	Reading 1	79.01	78.235	75.89	77.35	80.95	80.99	79.65	79.83
			Reading 2	77.46		78.81		81.02		80.01	
	At Actual Location	pH	Reading 1	7.48	7.5	7.45	7.35	7.5	7.48	7.84	7.61
			Reading 2	7.52		7.25		7.45		7.38	
		Turbidity (NTU)	Reading 1	80.01	79.245	74.87	76.23	80.14	80.48	77.56	78.77
			Reading 2	78.48		77.59		80.82		79.98	
Season4 (December, January, February)	LAB Reading	pH	Reading 1	7.48	7.505	7.94	7.975	7.9	7.92	7.92	7.95
			Reading 2	7.53		8.01		7.94		7.98	
		Turbidity (NTU)	Reading 1	63.36	64.155	69.14	67.975	69.08	68.55	68.77	69.045
			Reading 2	64.95		66.81		68.02		69.32	
	At Actual Location	pH	Reading 1	7.58	7.635	7.96	7.85	7.99	7.91	7.92	7.915
			Reading 2	7.69		7.74		7.82		7.91	
		Turbidity (NTU)	Reading 1	62.35	60.965	66.66	66.09	67.82	67.32	66.02	66.99
			Reading 2	59.58		65.52		66.82		67.96	



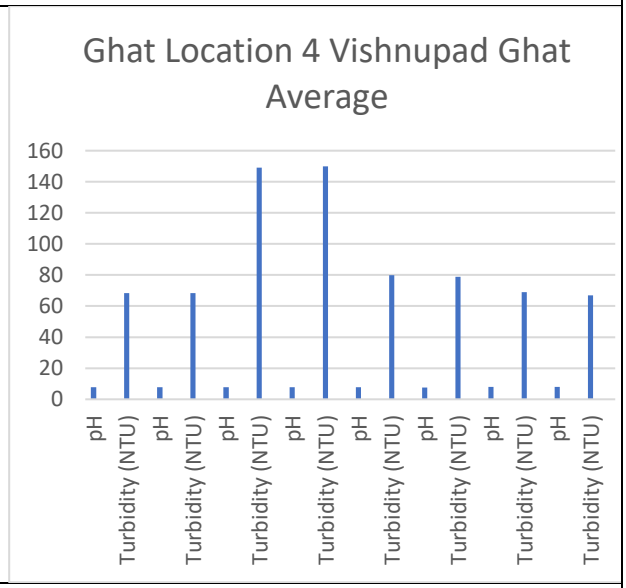
Graph1: Ghat Location 1 UddhavGhat for pH and Turbidity in laboratory and at ghat location



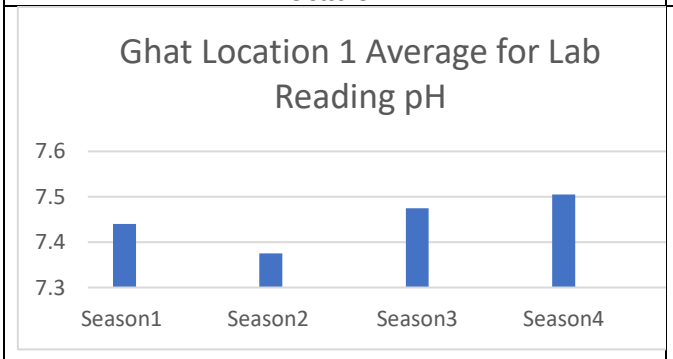
Graph2: Ghat Location 2 Pundlik Ghat for pH and Turbidity in laboratory and at ghat location



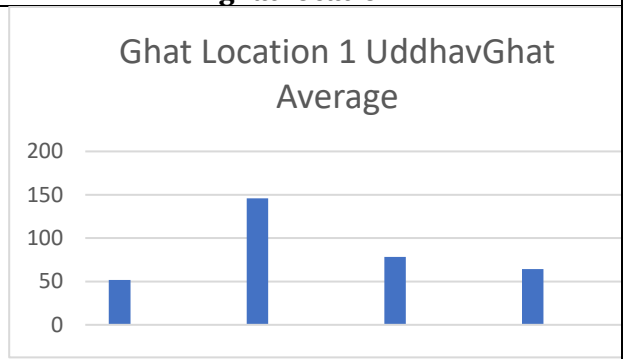
Graph3: Ghat Location 2 Mahadwar Ghat for pH and Turbidity in laboratory and at ghat location



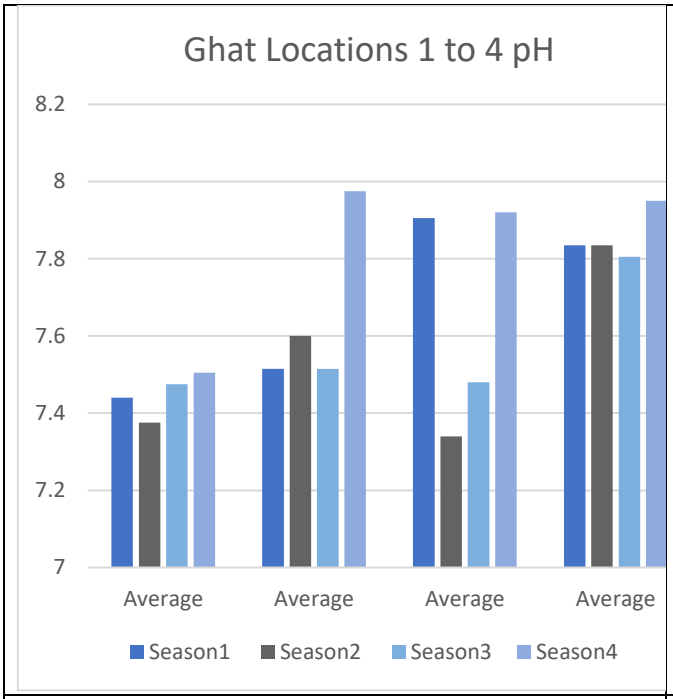
Graph4: Ghat Location 2 Vishnupad Ghat for pH and Turbidity in laboratory and at ghat location



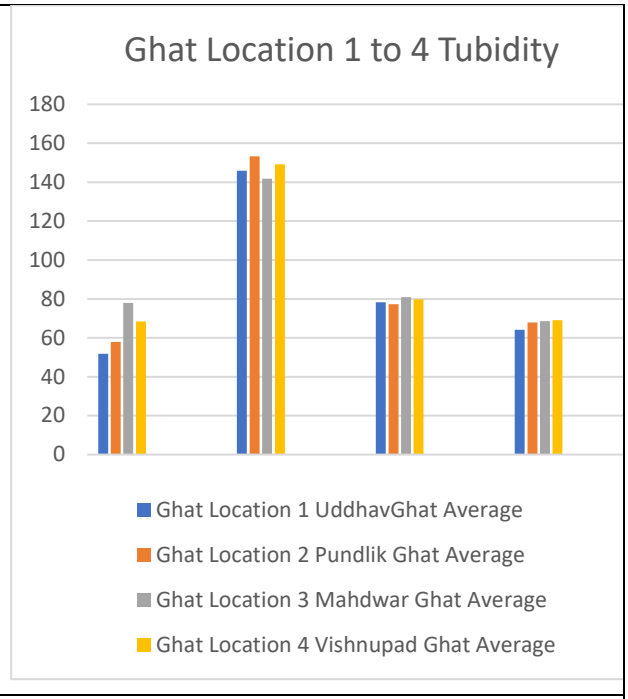
Graph5: Ghat Location 1 pH reading



Graph6: Ghat Location 1 Turbidity reading



Graph7: Ghat Location 1 to 4 pH reading



Graph8: Ghat Location 1 to 4 Turbidity reading

Four ghat locations along the Chandrabhaga River are taken into account for the study. Ghat Location1 - Uddhav Ghat and Ghat Location2 - Pundlik Ghat, Location of the GhatVishnupad Ghat. Mahdwar Ghat and Ghat Location.

Four seasons—Season 1 (March, April, May), Season 2 (June, July, August), Season 3 (September, October, November), and Season 4 (December, January, and February)—are used for the study. Additionally, readings of the pH and turbidity are taken at both laboratory and ghat locations. The graphs depict an analysis that was done for various conditions.

Since there is little difference between the water quality evaluated at ghat locations and in the lab, it can be said that the kit created for parameter measurement provides extremely high accuracy. Additionally, it has been shown that turbidity rises during the rainy season and the Wari Period. Therefore, special precautions should be taken for the pilgrims' health during certain times. The pilgrims' health benefits greatly from the experimentation.

7 CONCLUSION

To track the water quality, the project is being done near a ghat location of Pandharpur. The message of water quality is sent to the relevant authority in accordance with the design to take further action. It has been found that society needs to monitor the water quality of river, and message was sent to concern authority and corrective action is taken. At Pandharpur ghat areas, such type of project is beneficial to society.

8 ACKNOWLEDGEMENT

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