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LIQUICURE-Water Monitoring with Disease Detection using Machine Learning

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Abstract – Water is a necessary nutrient and plays a crucial role within the physical body. Pure drinking water is the source of all body fluids including blood, lymph, saliva, digestive enzymes, urines, etc. So, the right monitoring of water is much important for safe, pure and hygienic water. Source of water in most households is their wells. Therefore, testing our well water quality on a day to day basis is vital for maintaining a secure and reliable source of drinking water. The test results allow us to properly define the issues of a water system. This helps us to make sure that the water source is being properly shielded from potential contamination, which appropriate treatment is chosen and operating properly. The purity of drinking water is important for each and every one all over the planet, and today this is often a well-known problem due to many water prone diseases like cholera, diarrhoea etc. But the diseases that causes hormonal imbalance, genital disorders and tooth decay cannot be recognized through mere symptoms. So, the paper aims for solving these problems. The water samples are monitored in order to obtain the contents. Those contents are then used for purity prediction using machine learning algorithms. The results are then analyzed and checked for all the diseases which will be caused by drinking that water. The individuality is to get the water monitoring system which may be used at any home for domestic purpose. It can focus various regions that are suffering from disasters like landslides and floods. Because in such areas the water content varies and drinking that water can cause diseases that can't be recognized through mere symptoms. Main aim is to decrease the amount of living beings suffering from the harmful effects of polluted water.

Keywords; *Machine learning; water monitoring; disease detection.*

I.INTRODUCTION

Water is the main source for transporting energy to every cell in the body and which is also the controller of all body functions. The brain contains 80% of water. Severe dehydration may lead to mental retardations and loss of ability to think clearly. Water is one of the most essential natural resources for the survival of the entire life on this planet. Based on the quality of water, it can be used for different purposes like drinking, washing or irrigation. Plants and animals also depend on water for their survival. In short, all living organisms need large quantity and good quality of water for existence. Freshwater is an essential resource to agriculture and industry for its basic existence. Water quality monitoring is a fundamental step in the management of freshwater resources. According to annual report of WHO, many people are dying due to lack of pure drinking water especially pregnant women and children. It is important to check the quality of water for its required purpose, whether it be livestock watering, chemical spraying, or drinking water. Water quality testing is a tool that can be used to find pure drinking water. Therefore, the right monitoring of water is extremely much important for safe, pure and hygienic water. Water testing plays a key role in analyzing the correct operation of water supplies, testing the safety of drinking water, recognizing disease outbreaks, and validating processes and preventative measures. Water quality is the measure of the suitability of water for a particular purpose based on specific physical, chemical, and biological characteristics.

Testing of the quality of a water body, both surface water and ground water, can help us answer questions about whether the water is acceptable for drinking, bathing, or irrigation to name a few applications. It can use the results of water quality test to compare the quality of water from one water body to another in a region, state, or across the whole country. Microbiological quality is generally the main issue because infectious diseases caused by pathogenic bacteria, viruses, helminthes, etc. are the most common and widespread health risk linked with drinking water. Excess quantity of some chemicals in drinking water leads to health risk. These chemicals include fluoride, arsenic, and nitrate. Safe drinking (potable) water should be delivered to the user for drinking, food preparation, personal hygiene and washing. The water must meet the required quality standards for making pure at the point of supply to the users.

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II. LITERATURE REVIEW

[1] As the advancement in communication technology, smart solutions for water quality monitoring are increased. Here provided a detailed survey of recent research carried out in the area of smart water quality monitoring in terms of its application, communication technology used, types of sensors employed, etc. and presented a low cost, less complex water quality monitoring system using a controller with inbuilt Wi-Fi module to analyze various parameters such as pH, turbidity and conductivity. To inform the user about the deviation of water quality parameters, the system also includes an alert facility. The implementation makes the sensor to provide online data to consumers.

[2] Water quality has been usually measured through costly and time-consuming lab and statistical analysis, which will render the contemporary notion of real-time monitoring moot. The alarming causes of poor water quality necessitate another method, which is faster and inexpensive. Here, a series of supervised machine learning algorithms are used to measure the water quality index (WQI), which is a singular index to define the quality of water, and the water quality class (WQC), which is a distinctive class defined on the basis of the WQI. A method based on supervised machine learning for efficient prediction of water quality in real- time is evaluated. The research is conducted on the dataset of Rawal watershed, situated in Pakistan, acquired by The Pakistan Council of Research in Water Resources (PCRWR). A representative set of supervised machine learning algorithms were employed on the dataset for predicting the water quality index (WQI) and water quality class (WQC).

[3] Water quality monitoring techniques can be divided into physical and chemical analysis methods and biological monitoring methods. A model named Intelligent Prediction Model (IPM)
delivers an economical and practical solution to analyze the quality of water without any human intervention. An Intelligent Prediction Model (IPM) is wherein sensors are deployed to measure the parameters of water. This system uses various technologies such as the Internet of Things (IoT) and Machine Learning (ML) to solve water quality issues.

[4]Internet of Things and Remote Sensing techniques are used in various areas of research for observing, collecting and analyzing data from remote locations. Due to the growth in global industrial output, rural to urban drift and the over-usage of land and sea resources, the quality of water available to people has decreased greatly. The over utilization of fertilizers in farms and also the chemicals in different sectors such as mining and construction have contributed immensely to the reduction of water quality globally. Water is a basic need for human survival and therefore there must be mechanisms put in place to vigorously test the quality of water that made available for drinking in town and city. The Smart Water Quality Monitoring System will estimate the water parameters for analysis such as; Potential Hydrogen (pH), Oxidation and Reduction Potential (ORP), Conductivity and Temperature using an RS technology.

[5]The system detecting the safety condition of water in pipe networks by implementing an adaptive neuro-fuzzy inference system (ANFIS) model when concentrations of water quality variables in the pipes exceed their threshold limit. The event detection is based on time-series data contained pH, turbidity, color, and bacteria count measured at the effluent of a drinking water utility and nine varying locations of sensors in the distribution network in the city. This focuses on 1) Apply Pearson's correlation analysis on the water quality time series to observe the effects of variations in the water quality checking parameters on the safety analysis of water in the distribution network. 2)

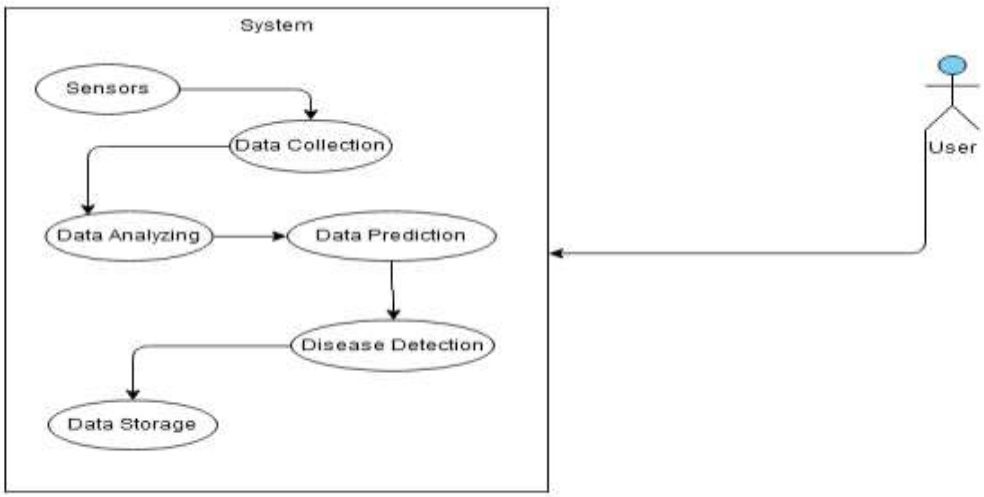
Use adaptive or varying neuro-fuzzy inference system (ANFIS) model to detect variations of water quality from baseline values established in Norwegian water safety regulations. The system offers a way of knowing the effects of each water quality variable on the overall safety condition of the water.

[6] Water quality is regulated by parameter evaluation done at the first place and evaluation of water samples is then taken into the laboratory for observation. It includes various data mining techniques for prediction of water quality. It presents an evaluation for predicting water quality by applying various data mining techniques and methods at many different locations. Many existing evaluation methods are studied and also various algorithms have been observed for analyzing the water quality and hence made a comparison. As a result of analysis, ANN is used frequently for this.

[7] The system is about implementing a Smart Water Monitoring System (SWMS) for real-time water quality and usage monitoring. It consists of two parts: Smart Water Quantity meter and Smart Water Quality meter. The importance of designing Smart Water Quantity Meter is to ensure water conservation by monitoring the amount of water consumed by a household, notify the same to the consumer and the authority. A three- slab billing system generates consumption bill according to the quantity consumed. The Smart Water Quality meter checks the purity of drinking water that the consumer receives, by observing five qualitative parameters of water viz. pH, temperature, turbidity, dissolved oxygen and conductivity. The system ensures to prevent any health hazards or any threats caused due to accidental seepage of sewage or farm release into
the portable or drinking water.

[8] Water quality assessment method not only shows spatial variations in water quality, but also conveniently to quickly monitor water quality levels. The water quality index (WQI) is used for the water quality checking of drinking water source by the Ministry of Water Resources, Monitoring and Evaluation Centre of Water Environment. The water quality index (WQI) is used to find threats to water quality and to support better water resource management. It includes a machine learning algorithm, WQI, and remote sensing spectral indices through fractional derivatives methods and in turn build a model for estimating and assessing the WQI.

III. METHODOLOGY



Project consists of three modules:
1) Water monitoring system
2) Purity testing
3) Disease prediction
Initially the sensors collect required data from water. The collected data is then used for purity test using machine learning algorithms. Before that, digital image processing is used to distinguish the water sample. The process is

performed by analyzing the different images of water. After the purity test, result is given to data mining algorithm for disease prediction that is done with the help of data mining. The processed output is sent to the user as the result.

MODULE 1-WATER MONITORING UNIT

Water monitoring unit is basically a unit that monitor various contents present in the water. It measures physical and chemical parameters of the water. The water samples collected are passed through various sensors that is embedded in the unit such as turbidity, pH, conductivity sensors etc. By passing through these sensors corresponding parameters present in the water are obtained. Those observed values from the sensors are processed by the core controller. The sensor data can also be shows on the web server.

MODULE 2-PURITY TESTING

Using the data from the web server we can check whether the water is pure or not. For that obtained data is passed to the computing system which has machine learning algorithms such as,SVM, ANN etc. By using these algorithms, we can predict whether the collected water samples are pure or not. After the analysis, the corresponding data is then given to the web server for disease prediction.

MODULE 3-DISEASE PREDICTION

Here, the water samples after the quality test is processed for disease prediction. Disease prediction is carried out using data mining techniques. The prediction is done by comparing the data with the standard contents of water. After the process, the result shows what all are the diseases that can caused by that water. It mainly focuses on the diseases that cannot be recognized through mere symptoms such as, hormonal imbalance, tooth decay etc. Final result is displayed in the device and is sent to the web application. This device can be installed in each household. Our expected outcome is to monitor the purity of water which is consumed by our society and alert them for corrective actions when the disease-causing contents are above the allowable limits. Our future plan is to expand the region of monitoring, develop more sensors for
better content evaluation and improve the algorithms for more accurate results.

V.CONCLUSION

Water is one of the most essential resources for survival and its quality is determined through water quality index. Conventionally, to test water quality, one has to go through expensive and cumbersome lab analysis. This system explores an alternative method of machine learning to predict water quality using minimal and easily available water quality parameters. A set of representative supervised machine learning algorithms were employed to estimate water quality index. In addition to this, the system is dealing with disease prediction. This was done by using data mining. If the result obtained from machine learning algorithms shows that water is impure, then we analyse which water parameter is present beyond the limit. Based on the result, the system predicts the diseases.
In future, we propose to integrate the findings of this system in a large-scale. This system can be implemented in a region basis. This will develop the system in various regions that are affected by disasters such as landslides and floods. Because in such areas the water content varies and drinking that water leads to severe diseases that may cause death.

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