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REAL -TIME GROUNDWATER LEVEL MANAGEMENT USING IOT

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ABSTRACT

This paper is concentrated on water table monitoring, long-term water table data and data visualization. The extent logger provides a cheap and convenient method to live level, temperature and conductivity beat one probe. It can provide real time data which is being recorded by the connected data logger. Water-level measurements from boreholes are the principal source of data about the groundwater .The quality of water is based on pH level measurement and data is transmitted through IOT . Arduino Uno approach is used to find the water level and broadcasting is done to get updated information. The results showed time- varying feature for the groundwater management, which was capable of updating observations, and decision variables in real time. Along with this a web-based platform was developed to facilitate the process. This study combined simulation and optimization model which could be used to support the decision-making related to sustainable management.

***Keywords**: Groundwater, level logger, data collection.*

I. INTRODUCTION

Around 3% of water on Earth is water about 69% of this is often locked up in glaciers and ice caps; 30% is found as groundwater and 1% is accounted for in lakes, rivers, reservoirs and therefore the atmosphere. We are presently faced with the grim reality of ever depleting water resources thanks to a spread of reasons like overexploitation for human use, high degree of pollution, dehydration or depletion of sources of recharge like glaciers and escape of rainwater. Depletion of water reserves goes to form life extremely difficult for future generations. For devising, implementing, monitoring and reviewing the effectiveness of plans for reduction in water consumption, conservation, preservation and improvement of water quality and regeneration of water reserves, it is essential to comprehensively map, measure and monitor the extent and quality of both subsoil aquifer and surface water reservoirs and streams, also as sources of recharge like rainfall.

II. EXISTING METHODS FOR MONITORING SYSTEM

Water isn't only essential for all sorts of life on our planet, but is additionally an important resource for agriculture, manufacturing and lots of other activities. Despite its importance, water is that the one among the foremost poorly managed resources within the world. Contamination of ground and surface water happens from several sources. In agricultural areas, fertilizers are the main source of contamination[1][35]. In urban areas, the careless disposal of commercial effluents and other wastes results in poor quality of water. Effluents affect our surroundings and health and demand constant monitoring and control. Water quality monitoring is additionally an integral a part of most conservation program to watch pollution thanks to human activities or overexploitation. Online monitoring of water quality allows the pollution level of water at remote locations to be monitored continuously in near real time from a central location and requires little or no skilled or unskilled manpower. Sometimes differing types of sensors using different principles could also be available for measuring an equivalent parameter[19].

Magnetic Reed Liquid Level Sensors

Most float switches utilize a magnetic reed switch to open or close the circuit. The reed is encased during a glass tube, which is cemented into a plastic or chrome steel stem with epoxy. The illustration to the left demonstrates how a magnet are often wont to open or close a circuit by moving it closer to or farther faraway from a reed switch.

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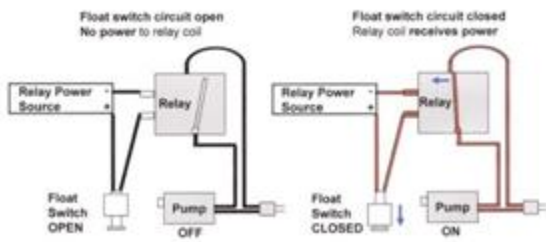

Fig 1:Float switches

Soil Moisture Sensor Module

This is a simple to use digital soil moisture sensor. Just insert the sensor within the soil and it can measure moisture or water level content in it. It gives a digital output of 5V when moisture level is high and 0V when the moisture level is low within the soil. The sensor includes a potentiometer to line the specified moisture threshold. When the sensor measures more moisture than the set threshold, the digital output goes high and an LED indicates the output. When the moisture within the soil is a smaller amount than the set threshold, the output remains low.

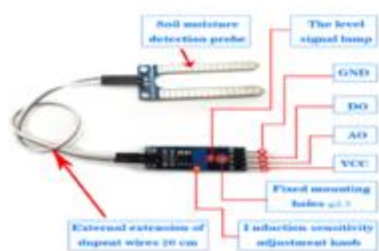

Fig 2: Soil moisture sensor module

III. TYPES OF DATA LOGGERS

The data loggers are designed to simply accept a spread of various input types. There are single-input also as multi-input data loggers. the foremost common sorts of input accepted by data loggers include pressure, temperature, humidity, voltage, and current. There are a spread of various sorts of data loggers available within the market, and each of these has unique applications[11][29].

Temperature data logger

A data logger that's found altogether sorts of manufacturing industries may be a temperature data logger. These devices hold immense significance for the upkeep of supply chains. From the handling phase to the shipping phase, temperature data logger records data in the least stages of a supply chain.

Wireless Data Loggers

One of the foremost useful and advanced sorts of data loggers that are in use today include the wireless data loggers. The simplest feature of those devices is that a user can remotely operate them from any location .A wireless data logger comes with an in-built alarm which operates on the real-time data that the device gathers through sensors. it's a versatile logging device that needs no external hardware.

Humidity Data Loggers

When there's a requirement to live some parameters during a temperature-sensitive environment, the humidity data loggers are a sensible choice. The areas where the humidity data loggers mostly are available use include calibration rooms, greenhouses, basements, and warehouses. These data loggers measure the change within the levels of environmental humidity. When the recorded-data exceeds a group limit or falls abnormally below it, these data loggers provide real-time alerts.

Pressure Data Loggers
Another common sort of data logger that comes in use when a requirement to live the pressure of a liquid or a gas arises is that the pressure data logger. The applications of those devices are a number of the foremost common applications of pressure data loggers include monitoring water levels, height, depth, speed, and fluid flow. Moreover, pressure data loggers are often wont to gauge pressure, absolute pressure, or load. These data loggers contains the accelerometer. As these devices are expected to figure with a fluid including gas and liquid, their construction favors their deployment in harsh underwater conditions.

Vibration Data Loggers
A vibration data logger is additionally commonly mentioned as a shock data logger. The aim of this device is to record shocks and vibrations over a specified period of time . The device records the info within the sort of time and acceleration because it records acceleration and time, vibration data loggers contains accelerometers alongside a storage .

RTD Data Loggers
RTD or the resistance temperature detector may be a sort of data logger that detects natural process . The essential construction of an RTD consists of a wire made from either platinum, or copper, or nickel, and a glass or ceramic core. The wire is wrapped round the core, which is what helps in recording highly accurate resistance-temperature relationships. As these devices are fragile, the simplest approach to use them is together with probes.

IV. METHODOLOGY

Automatic water level monitoring systems are often programmed to form measurements in observation wells at a specified frequency over long periods .Arduino is used to analyze the pH of groundwater. Continuous monitoring provides the very best level of resolution of water level fluctuations[12][32]. Hydrographs constructed from frequent water level measurements collected with endless monitoring system are often used to accurately identify the consequences of varied stresses on the aquifer system and surface water and to supply the foremost accurate estimates of maximum and minimum water level fluctuations. An automatic water level monitoring system basically consists of a fluid pressure sensor connected through a cable to an automatic data logger.

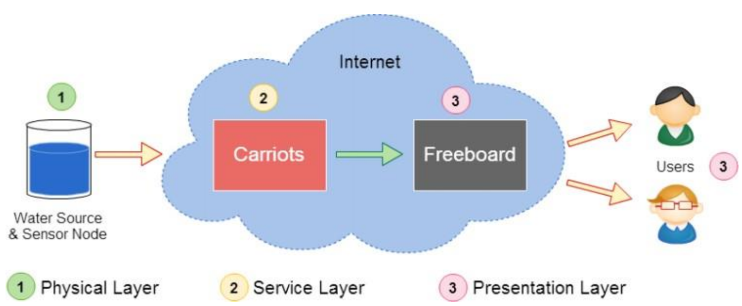

Fig 3: Interaction between the three layers of proposed water level system

Theory of operation
The VFC320 monolithic voltage-to-frequency converter has been used to get a digital pulse train output whose repetition rate is directly proportional to the analog input voltage. The circuit shown in Fig.4 is composed of an input amplifier, two comparators and a flip-flop , two switched current sinks, and an open collector output transistor stage. Essentially the input amplifier acts as an integrator that produces a two-part ramp. The first part is a function of the input voltage, and the second part is dependent on the input voltage and current sink.

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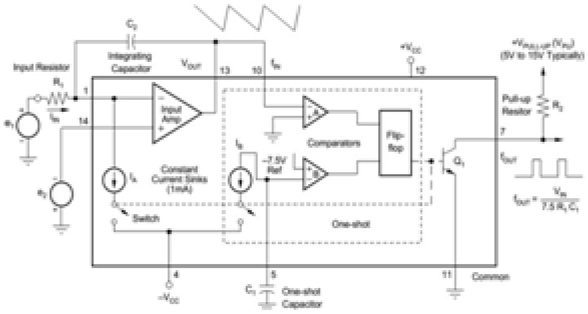

VIN

For Positive input Voltage use e1,short e2 For Negative input Voltage use e2,short e1

For Differental Input Voltage use e1and e2

Fig 4: Functional Block Diagram of VFC320

Calculation

$f_{OUT} = 1/ t_1 + t_2$

In the time $t_1 + t_2$ the integrator capacitor C_2 charges and discharges but the net voltage change is zero. Thus $\Delta Q = 0 = I_{IN} t_1 + (I_{IN} – I_A) t_2$

So that $I_{IN} (t_1 + t_2) = I_A t_2$

But since $t=t_1 + t_2$ and $I_{IN} = Vin/R_1$

$f_{OUT} = Vin/I_A R_1 R_2$

In the time t_1, I_B charges the one-shot capacitor C_1 until its voltage reaches –7.5V and trips comparator B.

Thus $t_2 = C_{IN}\ 7.5/I_B$

$Fout = (V_{IN}/7.5\ R_1 C_1).I_B/I_A$

Since $I_A = I_B$ Then

$Fout = Vin/7.5 R_1 C_1$

Calculation for the Borehole

$C_0 = 19\ \mu F$	$f_0 = 84 KHz$	$R = 1K\Omega$
$C_1 = 20\ \mu F$	$f_1 = 80 KHz$	
$C_2 = 21\ \mu F$	$f_2 = 76 KHz$	
$C_3 = 18\ \mu F$	$f_3 = 89 KHz$	

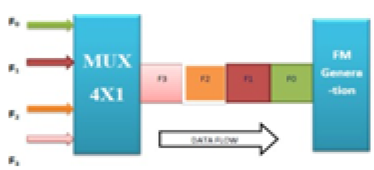

Fig 5: Data flow of frequency band f0-f3

All four frequencies are multiplexed by a multiplexer and modulated by a modulation. After this these frequencies are transmitted by FM transmitter through channel. At the control panel FM frequency are received by FM receiver and Demodulated by demodulation circuit which provides the original frequency.

Computational Analysis

This paper describe the used MATLAB programming through IoT and Arduino for analysis of frequency spectrum of different type of frequency length . To run the Sensor the Arduino software was used for generating frequency spectrum related to frequencies originated by different depth of pH based data logger.

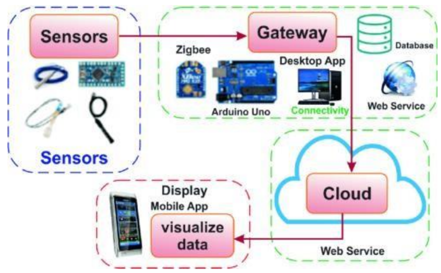

Fig 6: IOT Based Monitoring System

V. RESULT

When the water level goes up the variation on spectrum shows up and vice a versa. In 3D view we have analysed the frequency, Depth and month. On the basis of above work, we have been able to find out ground water level in different months in the same year and in the same month in the different years. Outcome of above work is to forecast the water level in coming years for water board and Municipal Corporation. This work can be extended for monitoring, planning and management of water level based existing systems in any part of India.

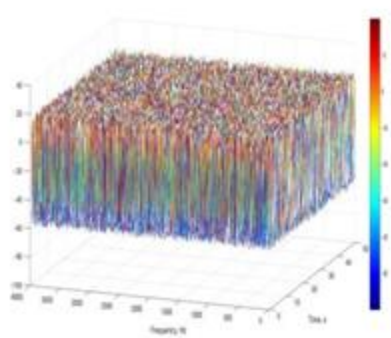

Fig 7: 3D frequency spectrum of ground water at diffenet places in Mohanlalganj

VI. CONCLUSION

In this study, a real-time management system of groundwater resource was designed and developed based on IOT techniques. This system was deployed in the Mohanlalganj to help solve the groundwater depletion problem. With the facility of IOT techniques, a real-time management system was implemented to provide accurate decision support. Reasonable results were obtained by appropriately defining the initial boundary conditions and calibrating the parameters. The optimization was proved to be effective, controlling the groundwater level from drawdown. Under normal conditions, the cultivated area for different scenarios, which could be sustained by the available water resources, was calculated. Furthermore, the real-time management system was integrated into a web-based platform to ease work. In the future, we can deploy more sensors and further expand the concept of real-time management to the entire region considering the surface water to regulate water resources

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