

Innovative Groundwater Monitoring Technology Using Frequency Based Data Logger

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ABSTRACT

The rapid development of sensor and wireless communication technologies is increasing use of automated (wireless) sensor in environmental monitoring. Availability of smart, small and cheap sensors measuring a wide range Environmental standards have enabled the continuous monitoring of the environment. And real-time applications.

I. INTRODUCTION

Ground Water level monitoring and predictions on that basis for the management of water resources are the main challenge for poor countries. Low cost solution for above problem can help our local bodies to plan their water resources effectively. Electronically DSP based system may be effective tool for monitoring and predictions of ground water level.

The Geological Survey of Alabama Groundwater Assessment Program (GSAGAP)[1]. Real-Time Groundwater Monitoring Program is currently comprised of 24 wells and 2 springs, constructed in strategic locations at varying depths in both semi-confined and confined aquifers. The wells are equipped with automatic digital recording equipment and a telemetry interface system, which transmits data by cellular signal directly to the GAP offices where it is uploaded graphically to the GAP website daily[2].

Long-term hydrographs from monitoring wells provide an indicator of water level fluctuations, which can be affected by groundwater withdrawals, land use, and climatic changes[3]. The period of record for some of the wells continuously

monitored by the GSA is longer than 60 years, providing excellent data trend analysis. The response of groundwater levels to meteorological drought is generally slower than other drought indicators, such as soil moisture and stream flow, and can provide information related to drought intensity and duration. Percentiles are included with some of the real-time hydrographs to allow comparison of recent water levels with levels collected during the period of record.

II. LITERATURE REVIEW AND EXISTING GROUND WATER LEVEL MONITORING METHODS

In literature various researchers contributed their works in field of groundwater discovery, monitoring, and management system from last decade. This field is so important for the further researchers that it may be assumed for the declaration of 3rd world war for potable ground water.

Ground water hydraulics was first studied by Henry Darcy (1856) and similar types of work were done by Slitcher (1899) King (1899). Work of Meinzer (1923,1932) and . Meinzer and Steams (1928) were based on geohydrology and study of change in ground water storage. Additional contribution to ground water flow and movement were carried by Hubbert (1940) and Jacob (1940). This work was further modified by Piper (1944); Stiff (1950); Chebotarev(1955); Hem(1959); Baok (1960); Garrels and Christ (1965). Later, application of computer numerical modelling and integrated approaches has been given advancement in ground water study.

a) WATER DOWSING TECHNIQUE

"Water dowsing" normally refers to the practice of using a forked stick, rod, pendulum, or similar device to detect underground water, minerals, or other hidden or lost substances, and Hundreds have been the subject of discussion and controversy, not thousands, not years.Prepare a set of keys used for water balls. Though the tools and methods vary widely, most of the dowzers (also called diviners or water doves) probably use traditional orchard sticks, which can come from different trees including willow, peach, and witchhazels.

b) INTEGRATED MODELING METHODS

For this study, we evaluate outputs from a high-resolution hydrologic imulation of the majority of the contiguous U.S. developed by *Maxwell et al.* The CONUS simulation was generated using the fully integrated groundwater-surface water model ParFlow. Figure 2.1 is a conceptual representation of a ParFlow model for a simple hillslope.

c) METHOD BASED ON HYDROGEOPHYSICS

Geophysical methods are now the **main methods of investigation** and detection of

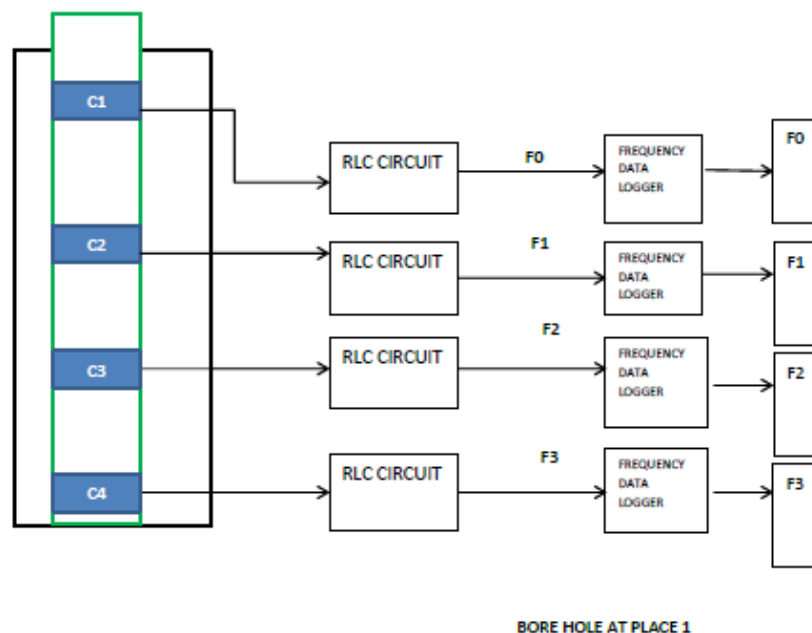
underground aquifers. The method chosen mainly depends on the geological context.

With these methods, **we strive to study the soil's physical properties and in particular its electrical properties.** The aquifers are most often trapped between rock layers. All rocks conduct a certain amount of electricity, but their conductivity and resistivity vary according to their type : compact rock, dry rock, fractured rock, wet rock, permeable structures or impermeable ones[11].

A material's electrical resistivity is its capacity to oppose the flow of electric current. From these measurements, the type, size and quality of the aquifer is deduced and specified, or perhaps only presumed, but with a high probability.

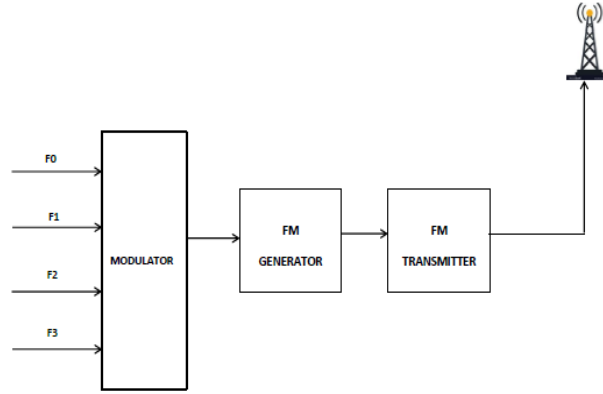
III. BLOCK DIAGRAM OF GROUND WATER LEVEL MONITORING SYSTEM

In this thesis, we monitored the level of ground water at different places of tehsil Mohanlal Ganj, District Lucknow. We monitored ground water level of four different places. We arranged a circuitry at one place and arrange same circuitry on another place.



From above figure we inserted a parallel plate capacitor of 50 feet. The dielectric constant will vary with respect to the depth of ground. As the capacitance will change the RLC circuit will produce resonance frequency this resonance frequency will process by frequency data logger. Same process will be executed for remaining borehole.

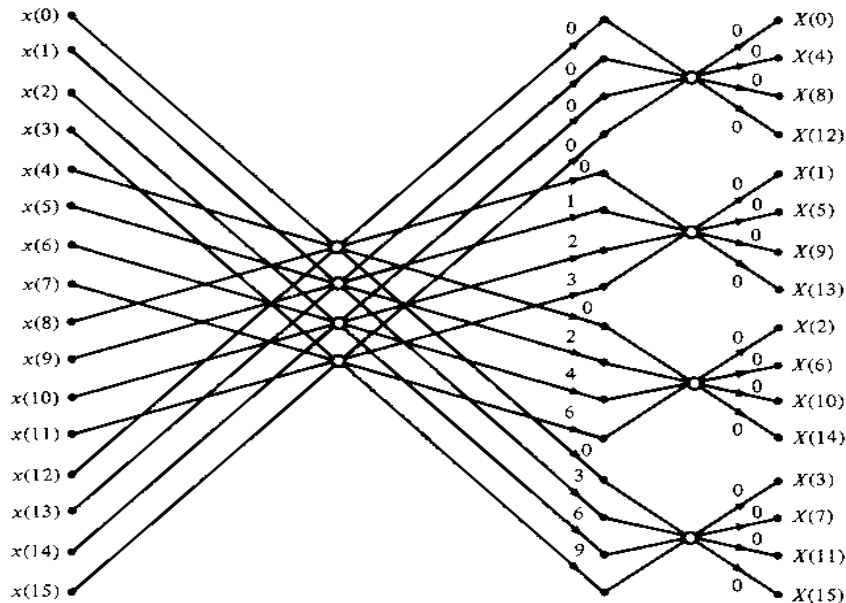
IV. FREQUENCY BASED DATA LOGGER



FREQUENCY BASED DATA LOGGER

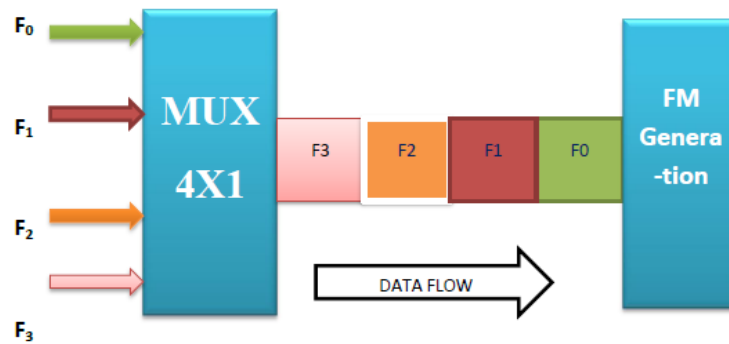
The FDM is an analog multiplexing that combines analog signals. Frequency division multiplexing is applied when the bandwidth of the link is greater than the combined bandwidth of the signals to be transmitted[4].

In this type of multiplexing, signals are generated by sending different device-modulated carrier frequencies, and these modulated signals are then combined into a single signal that can be transported by the link. To accommodate the modulated signal, the carrier frequencies are separated with enough bandwidth[7], and these bandwidth ranges are the channels through which different signals travel. These channels can be separated by unused bandwidth. Some of the examples for the time division multiplexing include radio and television signal transmission[8].



For illustrative purposes, let us re-derive the radix-4 decimation-in-frequency algorithm by breaking the N -point DFT formula into four smaller DFTs. We have

$$\begin{aligned}
 X(k) &= \sum_{n=0}^{N-1} x(n) W_N^{kn} \\
 &= \sum_{n=0}^{N/4-1} x(n) W_N^{kn} + \sum_{n=N/4}^{N/2-1} x(n) W_N^{kn} + \sum_{n=N/2}^{3N/4-1} x(n) W_N^{kn} + \sum_{n=3N/4}^{N-1} x(n) W_N^{kn} \\
 &= \sum_{n=0}^{N/4-1} x(n) W_N^{kn} + W_N^{Nk/4} \sum_{n=0}^{N/4-1} x\left(n + \frac{N}{4}\right) W_N^{kn} + \\
 &\quad W_N^{Nk/2} \sum_{n=0}^{N/4-1} x\left(n + \frac{N}{2}\right) W_N^{kn} + W_N^{3Nk/4} \sum_{n=0}^{N/4-1} x\left(n + \frac{3N}{4}\right) W_N^{kn}
 \end{aligned}$$

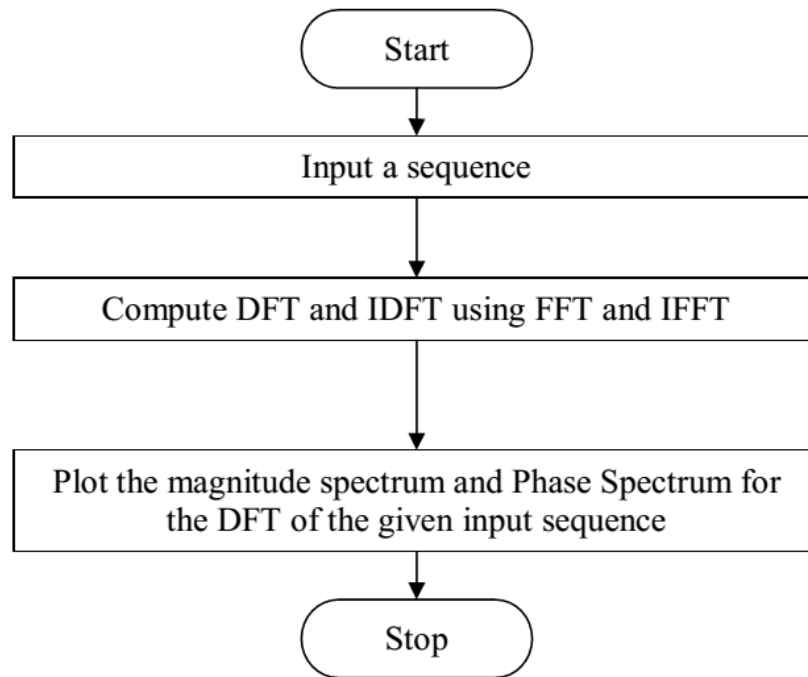


All four frequencies are multiplexed by a multiplexer and modulated by a modulation. After this these frequencies are transmitted by FM transmitter through channel.

At the control panel FM frequency are received by FM receiver and Demodulated by demodulation circuit which provides the original frequency.

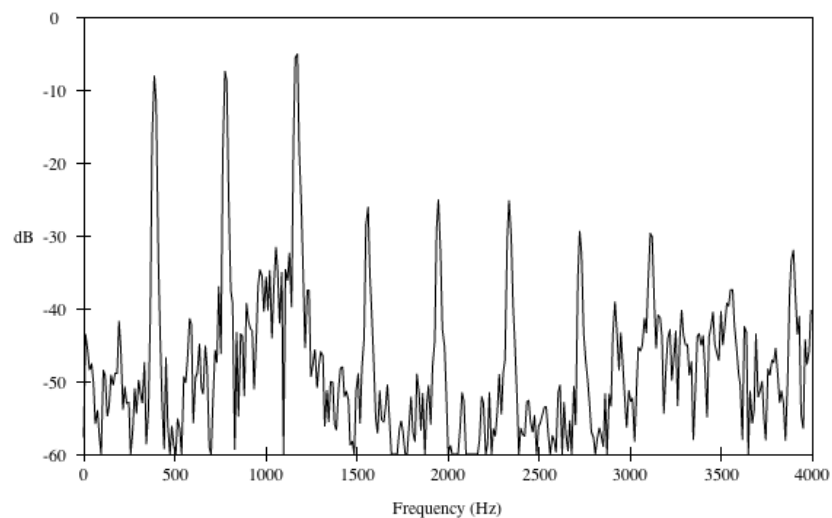
V. ALGORITHM

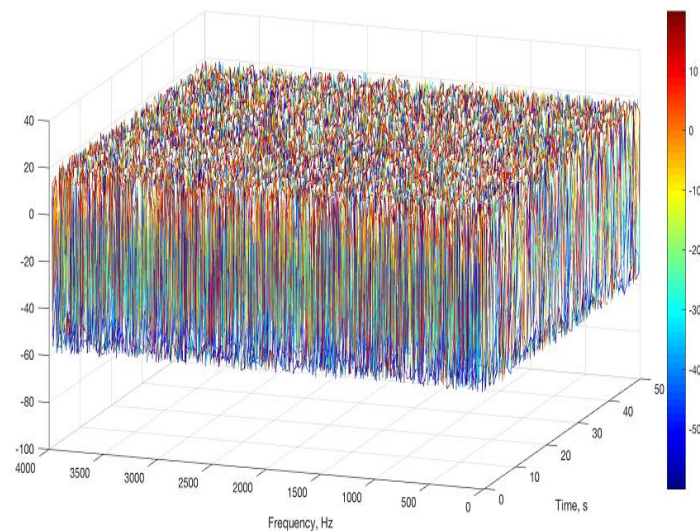
1. Get the input sequence.
2. Compute the DFT and IDFT using FFT and IFFT function.
3. Plot the input sequence, real part, imaginary part, magnitude spectrum and phase spectrum of the DFT obtained and IFFT sequence obtained.

**Flow Chart**

VI. RESULT

I can try the spectrum analyzer myself here. I shall probably get a spectrum analyzer. I can see the variation on screen and predict the water level up and down.





I figured out that the values that were imported into MATLAB were converted into string values. I stopped using the import button and used the xlsread function instead, and that allowed me to import the numerical values without them being converted into strings.

VII. REFERENCES

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