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Title of the Thesis ----- **Design and Development of ASIC for low Power Economical Water Quality Detection.**

Abstract

In Urban water supply system, various water quality determining indices such as pH, TDS, BOD, COD and Turbidity are monitored continuously. When these indices exceed the limiting value, the system will effectively handle the treatment against deterioration ensuring the safety of water. Water is vital for all known forms of life. Many research works have contributed to design water quality measuring devices. But it has always been a challenge to find a precise and accurate device for monitoring the quality of water. The concept of pH was first introduced by Danish chemist Soren Peder Lauritz Sorensen at the Carlsberg Laboratory in 1909 and revised to the modern pH in 1924 after it became apparent that electromotive force in cells depended on activity rather than concentration of hydrogen ions. The pH is a measure of the acidity or basicity of an aqueous solution. The use of micro sensors for infield monitoring of environmental parameters is gaining interest due to their advantages over conventional sensors. In the field of micro sensors for environmental applications, Ion Selective Field Effect Transistors (ISFETs) has proved to be of special application. They are particularly helpful for measuring pH and other ions in small volumes and they can be integrated in compact flow cells for continuous measurements and monitoring. ISFET was first introduced by Bergvald in 1970. ISFET is specially designed MOSFET which has the similar structure as that of the MOSFET except that the poly gate of MOSFET is removed from the silicon surface and is replaced with a reference electrode inserted inside the solution, which is directly in contact with the hydrogen ion (H+) sensitive gate electrode. The literature survey about ISFET device is as follow:

(a) Theoretical concept and operational mechanism

(b) Signal processing techniques

(c) Limitations like thermal dependency, drift, temperature compensation techniques

(d) Analog Instrumentation in ISFET for Biomedical applications.

As population is increased exponentially, monitoring quality of water resources and sewage system for water pollution is typical and necessary task in today's overdeveloped scenario. Now a day's we have Semiconductor based micro sensors which are easily available and economical and able to react with the ion concentration, in other words activity of the ions.

These sensors are economical and can react with the ion concentration, in other words activity of the ions. These micro sensors have many features like small size, high sensitivity and single chip integration also it can be implemented by CMOS technology. These features make it, first choice for VLSI electrochemistry biomedical applications. These micro sensors have been modelled and several drawbacks related to thermal dependency, long-term drift, linearity, dynamic range has been found. To improve the accuracy in the biomedical applications, it is necessary to find the compensation method to make the applications free from these effects and in order to capture the output response of these micro sensors, a readout interface is necessary. Hence to promote ISFET based application new devices using VMDs and CMDs are developed which are very important in biomedical applications and to overcome the drawbacks in the conventional devices.

Water is vital for all known forms of life. With the expansion of industrial production and increase in the population every year, wastewater produced by industry discharged into rivers and lakes due to which the quality of water is destroyed by a large extent. Hence, it is more and more urgent to take effective measure to monitor and protect the water resources. Many research works have contributed to design quality measuring devices. But it's always a challenge to select a more precise and accurate device for monitoring and detecting the quality of water. In this thesis following problems are discussed.

(a) Simulation of voltage mode devices based sensor output processing systems.
(b) Various sensor output processing systems using current mode devices (CMD) and there comparison with the conventional devices.
(c) Development of a suitable Spice Model of novel Photo Catalytic Sensor (PCS) for the measurement of dissolved oxygen.
(d) A Novel Pseudo NMOS based CC-ISFET device.