

**LIQUID LEVEL MEASUREMENT SENSOR
FOR FLOW METER AND
INDUSTRIAL STORAGE TANK CALIBRATION**

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Degree of Master of Science

Department of Electrical Engineering

University of Moratuwa
Sri Lanka

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Dissertation submitted in partial fulfillment of the requirements for the degree
Master of Science in Industrial Automation

Department of Electrical Engineering

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Sri Lanka

August 2016

DECLARATION

“I declare that this is my own work and this dissertation does not incorporate without acknowledgement any material previously submitted for a Degree or Diploma in any other University or institute of higher learning and to the best of my knowledge and belief it does not contain any material previously published or written by another person except where the acknowledgement is made in the text.

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The above candidate has carried out research for the Master's Dissertation under our supervision.

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Abstract

The aim of this research contains two parts, firstly to develop accurate, simple and inexpensive liquid level measurement sensor for underground fuel storage tank and secondly the realization of a new calibration method for liquid flow meters. The level of the liquid can be detected with various methods such as Ultrasonic, Mechanical, Doppler, Capacitive, Optical, and Laser. Even though numbers of level sensors are available in the market the Dipstick is commonly used in industries to measure the liquid height. It is a time consuming manual method. Also standing-start-and-stop method and flying-start-and-finish method are used to calibrate flow meters. But those are expensive and complicated systems.

Proposed capacitive liquid-level sensor measures the electrical capacitance between two electrodes immersed in a liquid and calculate the liquid level from the capacitance. It consists of two electrodes, inner electrode is surrounded by insulation material, and the outer electrode is aluminum pipe. The sensitivity, systematic error, random error and uncertainty of the sensor are better with tap water in the tank rather than petroleum products. The effectiveness of this proposed method is tested by a series of numerical and experimental tests. It reveals that an accuracy of the instrument is $\pm 0.5\text{cm}$ and $\pm 1\text{cm}$ with tap water and petroleum product respectively.

The instrument has been validated against the calibrated dipstick and ultrasonic distance sensometer with liquid as the tap water. And also instrument has been validated by calibrated dipstick and pressure level measurement sensor with petroleum products.



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LIST OF ABBREVIATIONS

Abbreviation	Description
ANOVA	Analysis of Variance
CDC	Capacitance to Digital Converter
NML	National Measurement Laboratory
PTB	National Measurement Laboratory of German
PTFE	Polytetrafluoroethylene (Teflon)
SCADA	Supervisory Control and DATA Acquisition System



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