CAPACITIVE SENSORS

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SENSORS AND CONDITIONING

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1 Introduction

A sensor is a device that detects or senses physical variables.[1].These are electronic sensors that are activated when an object invades its sensitive area by changing its logical state.[2].Capacitive sensors ration against different materials that exceed a certain capacity.The connection distance is greater if your dielectric constant is high[3].
Types of capacitive sensors
The affected variable will be displayed
-Level: dielectric variation
-Humidity: permittivity
-Position: fully variable capacitor[3]

1.1 Circuits for conditioning

Voltage divider

It is used to calculate the voltage of any of the resistors that have been joined in a series array, based on the voltage of the array. If there are no series resistors it is not possible to apply voltage divider.[4]

Labview
Labview is a tool that allows to characterize sensors, since it offers pwm modules, indicators of voltage changes, in addition to graphs that allow to relate variables.

1.2 Abstract

This report presents the results and design of capacitive sensors, with which it was possible to know the level of a tank by applying parallel plates and changing

the logical state of a capacitive proximity sensor. In addition, an interface was made using Labview and Arduino for the level sensor. As well as an application of the sensors and their importance in signal conditioning in sensors. The respective measurements were made for each circuit with a multimeter, without the power supply and concepts explained in the methodology section.

1.3 Objectives

1) Properly characterize the capacitive sensors to obtain a reading of each physical variable very close to the real one.

2) Analyze the electrical variation characteristics of each sensor, observing the behavior analogously and digitally.

3) Understand the operation of Labview software to get a correct visualization of the values obtained.

2 Metodology

The voltage divider conditioning was carried out for the capacitive proximity sensor due to its supply of more than 12 volts, so when entering the Arduino it must not exceed its 5 volt output.
On the other hand for the level detector another voltage divider was applied, since the copper and aluminum plates allowed to have a potential difference, thus finding a voltage and linearizing with characteristic equation.

The Labview platform by allowing communication with Arduino and the easy entry of equations allowed characterization and level representation.

2.1 Questionnaire

2.1.1 Previous questionnaire

2.2 Reasons of mistake

*Plates distance:the distance between the plates and their material affects the capacitance of the sensor by taking wrong measurements for the level *Polarization:The type of parallel plate sensor did not need any type of polarization since when implementing it it can be said that it is self-generating, its voltage varies depending on the level that the water touches the plates.

2.3 Contador

```
// Pin de entrada del sensor capacitivo (negro)
int Sensor = 7;

// Variable que registra el estado del sensor de entrada
int ValorSensor = 0;

// Variable que registra el numero de personas que pasaron por el sensor
int Contador = 0;

// Pin de la conexion de LED rojo
int LedRojo = 10;


// Configuracion Pantalla LCD
#include <LiquidCrystal.h>


void setup()
{
  Serial.begin(9600);
  pinMode(Sensor, INPUT);


}

void loop()
{
  // Establecer la variable ValorFototransistor con el estado del sensor pin 7
  ValorSensor = digitalRead(Sensor);



  if(ValorSensor!=1 )
  {
    digitalWrite(LedRojo, LOW);
    Contador=Contador+1;
    if(Contador>99){
     Contador=0;
Contador=Contador+1;
      }

//    Serial.print("Contador: ");

    while(digitalRead(Sensor)!=1){
      delay(100);
```

3

```
        }
while ( d i g i t a l R e a d ( Sensor )!=1){
        delay ( 1 0 0 ) ;

        }
        S e r i a l . p r i n t l n ( Contador ) ;
        }
         }
```

2.3.1 Results

A. What is the most accurate way to perform the signal conditioning of a ca-
pacitve sensor?

It depends on the sensor and, as you want to see its analog or digital config-
uration, voltage dividers, distance, area, permeability of the plates, with that
find the capacitance.
B. What is the most accurate way to linearize a capacitive sensor?
In the case of the proximity sensor, it is better to find its supply voltage and a
correct way to analyze its logic output. For the level sensor it is necessary to
measure the variation of voltage with respect to the water level, from this the
equation is linearized with x (independent variable) as voltage and Y (dependent
variable) as water level.
C. What are the implications of a poor precision fit on an capacitive sensor?
Obtaining incorrect data and far from the actual physicality variable, even de-
pending on the application for which the sensor is used, would ruin the results of
a complete system, for example, giving a much higher error rate by incorrectly
measuring the level.

3 Conclusions

1) The capacitive sensors were adapted in an analogous and digital way, in the
first one establishing the real value of a tank in milliliters and digitally with the
presence and absence of metals.
2)For the proximity sensor a digital behavior was established since it was
fed by a DC source, at its output a voltage divider was established to take logic
levels (1 and 0) of the Arduino digital input, while the level sensor With parallel
plates, the sensor exhibited an analog behavior due to its variation when coming
into contact with different water levels.
3)The Labview interface was created only in order to show the level of the
tank by relating the voltage collected and through its alignment.

3.1 Observations

3.2 Professional application

As biomedical engineers, in the hospital maintenance sector, the plant must be inspected for both availability and provisional, for this it is necessary that the hydraulic network indicates digitally the level of reserve tank, indicating its level, associated with the capacity of patients.

In addition, currently in Colombia, specifically in Bogota, there is an insufficiency in tanks, so the entities remitted the construction and surveillance of new tanks.[5]

4 Bibliography

[1] Pérez García, R. (2018). Análisis, diseño y caracterización de filtros activos implementados mediante el circuito integrado UAF42.

[2]https://www.weg.net/CAPACITIVESENSORS.

[3]http://libroweb.alfaomega.com.mx/TEMA06-SENSORESCAPACITIVOS2.pdf.

[4]https://analisisdecircuitos1.wordpress.com/Capitulo17:Divisoresdevoltajeycorriente

[5]https://www.eltiempo.com/archivo/documento/MAM-378809