DEVELOPMENT OF MICROCONTROLLER BASED INSTRUMENT FOR CHECKING QUALITY OF EDIBLE OILS

Sahil Bhardwaj[1], Amarjit Singh[2]

[1]AP, EEE (IET Bhaddal Technical Campus)
[2]AP, EIE (IET Bhaddal Technical Campus)

Abstract

Edible oils plays a very important role in human beings in third generation , because lots of people suffer from fat , asthama , blood pressure , etc due to consuming a lower quality of oils in their daily life , so I decided to design and develop an instrument which can easily display the quality of oil on the basis of some parameters . The one of the main reason of lowering down the quality of oil is carbon due to heating, so if we can measure the amount or percentage of carbon in the oil we can prevent so many bad things to happen. So I have designed a low cost microcontroller based instrument which measures the amount of carbon in oil by measuring capacitance of oil with the help of a capacitive sensor[1].This is not only the one application of this instrument , this instrument also plays an important role in automobile industries , as it can be used for checking the condition of mobile oils in vehicles , in today's busy life people don't have time to check engine oil , power steering oil even they don't have time to maintain their own vehicle , so I thought if I put this type of instrument as an indicator at the meter section of cars and motorbikes people can read out the condition of engine oil and before the oil goes into the worst condition they can change their oils.This instrument can also be used by various food departments etc where they can check various samples of different companies and decides the price of oils and can check the quality whether the quality of oil is in safe range or not.

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1. INTRODUCTION

The quality of oils is influenced by percentage of carbon it. Knowledge of percentage of carbon in oils is very important, because with the increase in carbon in edible oils can cause serious problems to human health, so if we have instrument which can measure percentage of carbon directly and can avoid such health related problems. In most of the Indian kitchens the food is processed using edible oil, sometime the edible oil which has been already subjected to intensive heating during frying process as a result of which oil already get burned which imparts odd smell as well as bad taste. In order to monitor the edible life of cooking oil, a low cost instrument for quantitative and qualitative is desired for so as to analyze the amount of burning free components i.e. carbon can be monitored as carbon is conductive in nature so the electrical property of the edible oil will get effected and the objective of this instrument is to monitor the variation of the electrical property of the oil. Not only this even the pollution due to oil because of the adulteration of non edible and edible oil will also influence the electrical property of the oil so design of the instrument to determine the dielectric property of oil during burning , storing etc

2. INSTRUMENTATION INVOLVED IN THE DEVELOPED SYSTEM

The Microcontroller-based instrument mentioned in this work consists of

a) A sensor
b) Hardware and
c) Software.

The capacitive sensor is a cylindrical capacitor with two cylindrical plates one outer and one inner made of copper the outer plate is a hollow cylinder and the inner plate is a solid rod cylinder both plates encapsulated from each other by a Bakelite sheet and the outer plate is encapsulated from air by Teflon coating and electric tape so that charge should not be lost[11]. The inner plate is positive and the outer plate is negative.

Fig: 1 Capacitive Sensor

2.1 Specifications

Inner radius of outer cylindrical plate = 13 mm
Radius of inner cylindrical plate = 2 mm
Height of capacitor = 50 mm

Therefore volume of outer cylinder = 26533 cu.mm

Therefore volume of inner cylinder = 628 cu.mm

Therefore volume of capacitor = volume (outer) – volume (inner) = 25905 cu.mm

Total oil handling capacity of capacitor = 25 ml (as measured)

Total carbon handling capacity of capacitor = 15 gm (as measured)

10% carbon = 1.5
20% carbon = 3 gm

C/L = 2*3.14*K*E / ln (b/a) [11]
C is capacitance

L is length of the capacitor K is the dielectric constant

b is the inner radius of outer plate a is the radius of inner plate
Hardware: The hardware used is instrumentation
Software: The software for the microcontroller is written in the C language.

3. BLOCK DIAGRAM OF DEVELOPED SYSTEM

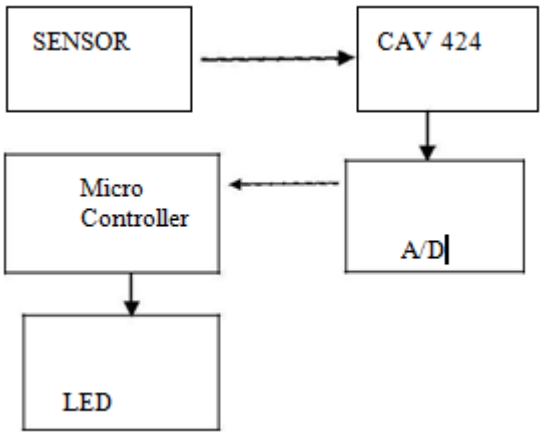

Fig: 2 Block Diagram

1. Sensor – The sensor used for measuring carbon in oil is a cylindrical shape capacitor , which has two cylindrical plates , one outer and one inner, both insulated from one another with Bakelite sheets , the outer plate is a hollow cylinder made of copper encapsulated from outer air by Teflon and electric tape and the inner plate is a solid rod also made of copper.
2. Capacitance to voltage converter – It is necessary to convert , change in capacitance of capacitor due to change in carbon has to be convert into the voltage form , for this CAV424 is used , which is a integrated circuit for capacitance to voltage converter.
3. Analog to digital converter – The output voltage from the CAV424 (capacitance to voltage converter) is in analog form , so it is necessary to convert this analog voltage into the digital form because input to microcontroller should be in digital form as microcontroller is a digital device . The analog to digital converter used is ADC0804
4. Microcontroller – The microcontroller used for programming is 89C51 . It take the input digital signal at its input port from the output of the ADC0804 and give output signal to LCD JHD 162A from its output port.
5. LCD Display – The LCD used for display is LCD JHD 162A . It has 16 pins interfaced with microcontroller P89V51RD2 . The LCD JHD I62A will display output in voltage form which is proportional to percentage of carbon.

4. SCHEMATIC DIAGRAM

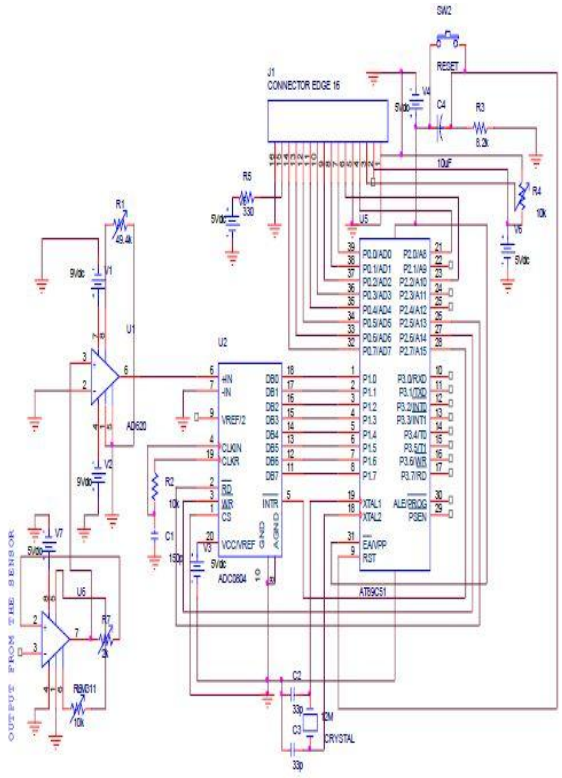

Fig: 3 Circuit Diagram

Brief Detail of above Diagram:

In the above diagram the output from the CAV424 is given to comparator LM 311 at pins 2 and 3 the output of the comparator is taken from pin 7 and given to the instrumentation amplifier AD620 at pin 3 and output is taken from pin 6 and given to ADC0804 at pin 6 and ADC will convert the analog input into 8 bit digital output at pins 11 to pin 18 and these pins are interfaced with port 1(input port) of the microcontroller 89c51. Port 2 of the microcontroller will work as control port and output is taken from port 0 (output port) and interfaced with LCD JHD 162A at pin 7 to pin 14.
AD620 will operate at +- 9v
LM311 at +5v
CAV 424 at +5v
ADC 0804 at +5v
89C51 at +5v
LCD at +5v

5. METHODOLGY

For measuring capacitance various experiments have to be performed , first of all prepare and take a sample of oil and carbon with 10% carbon ie 1.5 gm connect the wires of plates of capacitor with the capacitance measuring instrument and get the value of capacitance with 10% carbon and similarly with 20% .

The measured capacitance is then converted into the voltage signal by CAV424 and the voltage output is taken from pin 5 & 6 of the CAV 424 and output from CAV is given to pin 2 and 3 of the LM 311(the output of this is in 100 to 150 mv range) and output of this is given to AD620 where the signal is amplified upto 5 volt and this analog signal is given to the ADC 0804 to pin 6 and the digital output from the 0804 is taken from pin11 to pin18 and is given to the input port of the microcontroller ie port 1 , port 2 of the microcontroller is used as control port and port 0 is used as output port the controlled output from the output port of the microcontroller is given to the pin 7 to pin 14 of the LCD for display .

6. CALIBRATION TABLE AND CHART

Table: 1 Calibration

percentage of carbon in oil	output voltage in volts
0	4.91
5	4.93
10	4.94
15	4.97
20	4.99

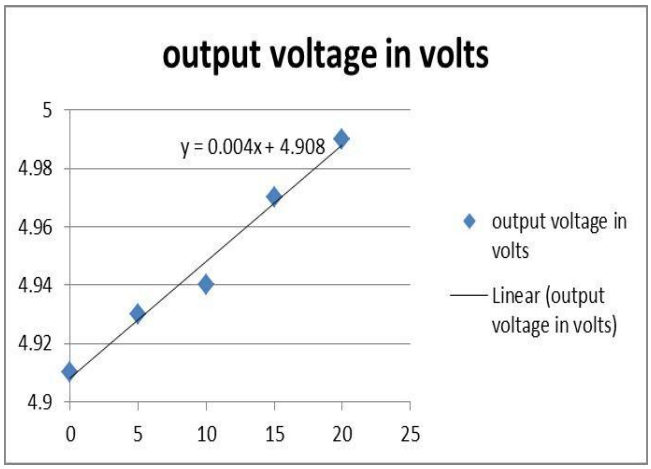

Fig 4: Output Voltage

7. RESULTS

With various different samples of carbon in oil different values of capacitances and voltages are measured and different values of dielectric constants are calculated with the help of measured capacitances, It is observed that the value of capacitance is decreasing with increasing carbon percentage, where as voltage is increasing with increasing percentage of carbon as carbon is conductive and voltage is inversely proportional to the capacitance. Also the dielectric strength decreases with the increasing carbon percentage.

Table: 2 Measured Value

S.No	Measured Value
1	4.91 V
2	4.93 V
3	4.94 V
4	4.97 V
5	4.99 V

8. CONCLUSIONS AND FUTURE SCOPE

There are so many future aspects of this microcontroller based carbon measuring instrument. It can be very useful in so many another applications, it can be used for deciding quality and price of edible oils , it can be used for mobile oils[7] , so it is a very advance instrument for automobile industries they can implement this instrument in automobile which will be very beneficial to the users they can easily read out the digital read out of the condition of the oil from this meter this also provide benefit to users as well as safety of the engine of the vehicle .

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