IJFEAT
INTERNATIONAL JOURNAL FOR ENGINEERING APPLICATIONS AND TECHNOLOGY

"DESIGN OF MILK ANALYSIS SYSTEM FOR DAIRY FARMERS USING EMBEDDED SYSTEM"

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ABSTRACT:-

The milk industry in India is a huge contributor to the income of a nation and this industry rests on the existence of cooperation that bring together dairy Farmers by combining their individual, small contributions. Most of these co-operations use a dual axis price fixing that is used to set the price of milk. But even at this age of technology, these establishments use old equipments to get convenient and in most of the cases, wrong quality readings (FAT,CLR,SNF) and thus the small dairy farmers are cheated out of their money because of this. So we plan on designing and implementing an embedded solution which would allow for fast and accurate determination of the sample parameters and which can replace the existing methods as the primary test. one of the applications of embedded system that we call the Electro-MilkTester.

Keywords:- **CLR, Corrected Lactometer Reading, Fat measurement, Liquid density measurement, Milk, Sensors, SNF, Solid not Fat.**

I. INTRODUCTION

Milk is a primary source for nutrition in many young mammals before they are able to digest other types of food. As such milk has several naturally added substances to help the baby in terms of both nutrition and immunity. Thus milk becomes a very valuable agricultural product that are extensively farmed. In figures, India is the largest producer and consumer of milk, with zero import or export. Also, this sector happens to have a considerable share of the Gross Domestic Product that is generated by the agricultural sector.

And based on the money generated, it is comparable on a global scale. However, even with such an important position, the Indian dairy sector is not technologically up to date, as is the case with all the agricultural sectors in India.

One of the main problems faced in the grass-root level of the milk industry is the quality scale (a measure of quality) and successively the methods that are used to implement such a scale for the purpose of fixing the price. The quality of the milk is the measure of its nutritive value. Since milk is mostly water, the quality is the content of the milk in the form of fats, proteins and sugar.

These contents are broadly divided into 2 categories – FAT and SNF (solid not fat). The price of the given sample of milk is set by giving the money on the basis of the amount of these two components. This is called the Dual Axis price system.

II. LITREATURE SURVEY

1)Auvray, M.; Spence, C. (2008) has reviewed the literature on the multisensory relations that connecting the taste, odor, and the trigeminal system in order to find out the coverage to which flavor can be described as a perceptual system. According to his review, flavor is not termed as a separate sensory modality but as a perceptual modality that is unified by the act of eating.

2) This Milk Producer Group Resource Book is part of a series of practical field guides for people working in small-scale dairying in developing countries. These field guides are produced by the Animal Production and Health Division of the Food and Agriculture Organization (FAO) of the United Nations.

3) Lefier. D, R. Grappin, and S. Pochet, "Determination of fat, protein and lactose in raw milk by Fourier transform infrared spectroscopy and by analysis with a conventional filter-based milk analyser," J. AOAC Int.,vol. 79, no. 3, pp. 711–717, 1996.

III. OVERALL REVIEW

So, as far as we have seen, to calculate the quality of a milk sample we need at the least two variables in the form of the specific gravity (as we have seen, also called the CLR) of the sample and its fat content. But the greatest problem that we would face would be the actual measurement of the CLR of the sample, due to the above mentioned fact of unavailability of affordable technology which can be used as a method. Rather than use a small improvement over a lactometer, like an "Auto-CLR", which does nothing in improving the accuracy of the system, we propose a completely new method of measuring liquid density.

To measure a physical quantity we must make use of one of the physical properties. All the previous methods use one of the properties.

We plan to use a fairly unused property in measuring the density that is the gauge pressure created by a column of liquid. Mathematically, we know that the pressure exerted by a column of fluid at a particular depth is dependent only on the depth of the point, the density of liquid and the acceleration due to gravity (which is a constant).

$$P = H * p * g$$

Since we already know that acceleration due to gravity is a constant, and if we can measure the pressure at a fixed depth of the liquid, we can find the density of the liquid from the above equation by one simple calculation.

Once the density of the liquid is known the CLR can be directly calculated by dividing the density by the density of water. This will give a direct specific gravity reading and will require no temperature corrections as done in lactometers andAuto-CLRs.

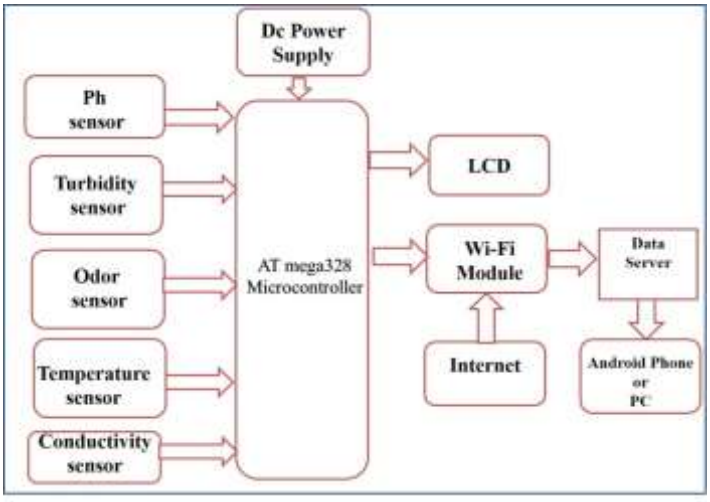

Figure 1. Proposed Block Diagram

Consider different samples of milk which includes fresh milk which is processed as per the standards and milk which is contaminated by

toxicity, which also includes milk which is preserved for long hours. Now the samples are accordingly monitored one after the other. In general, the test will be performed with reference to standard parameter values according to which any abnormalities found in the samples will be determining its quality. As specified earlier about the four modules involved, the working method of those is as follows

(a) pH sensor: Every liquid has its own pH value according to temperature and other dependent parameters. So the standard fresh milk has pH of range 6.5-6.7, above and below this range is totally considered as abnormalities in its quality. Here it monitors the pH and provides a visual alert via LCD, which displays the pH level and indicates whether the tested milk is normal or abnormal, in simple words good quality or bad quality.

(b) Temperature sensor: Milk has its own temperature criteria which should be maintained during storage, even if the milk is mixed with water or with any toxic materials the temperature of the milk will not be in the normal range.. The survey will be carried out on safe temperature zone according to which the LCD will display the quality of milk.

(c) Odor sensor: The concentration of odor will vary from fresh milk to toxic milk. When the toxicity in milk is high it tends to release toxic gases which come out as bad odor from the milk when milk is preserved for a very long time or due to external contamination. So we detect the gases releasing out from sample which are nothing but bad odor in general. After any such detection of gases the quality of milk will be displayed on LCD.

(d) Conductivity Sensor:

Conductivity (or Electrolytic Conductivity) is defined as the ability of a substance to conduct electrical current..

Working:-

Take 120 ml of milk is in cylinder. The lactometer moves in a vertical direction and attains a fixed floating position. The lactometer reading is calibrated on scale on lactometer itself .The reading on the lactometer corresponding to the level of the milk gives the lactometer reading. But in Auto CLR we measure this vertical movement electronically. The upper tip of the lactometer is attached to the float of the type is used in motorcycles to indicate fuel level. This float moves vertically along with motion of lactometer. Using a strain gauge attached to the float, the resistance change is calibrated as a measure of the lactometer reading. The Solids-Not-Fat (SNF) means proteins, lactose, minerals, acids, enzymes, vitamins contents of the milk. It is the total solid content minus the fat content. The total milk solids are the sum of Fat and SNF. The SNF can be calculated using following formula:

SNF = (CLR reading/4) + (Fat x 0.21) + 0.36

1. Method of determination.

Conductivity (or Electrolytic Conductivity) is defined as the ability of a substance to conduct electrical current. It is the reciprocal of the resistance.

In a healthy animal*, the mean value of electric conductivity is:

Milk type Conductivity values

Cow milk between 4 to 6 mS/cm (18°C);

Sheep milk between 3 to 5 mS/cm (18°C);

Buffalo between 2,5 to 5 mS/cm (18°C);

Advantages:-

- Low initial investment and maintenance cost.
- Ease of handling.
- Output will be obtained within less response time.
- The power supply unit consumes less power.

Application:-

- This device is used in small diaries for analysis of quality of milk.
- It can also be used by the normal people, where an individual should know about the quality of milk that he consumes in his daily life.
- It can be used by Milk Traders for Computerized Milk Analysis

IV. METHODOLOGY

As payment for the milk of farmer's are based on the quality of the milk which they delivered to the dairy and the quality is decided on Fat, SNF & Weight of milk. First we find the FAT content and the Specific Gravity (or the Corrected Lactometer Reading, shortened as CLR) of the milk and then find out the SNF content from a mathematical equation, called as the "Richmond's Equation".

FAT Measurement A (Electronic Milko-Tester)

Unlike the chemical test, the electronic meters are non-destructive in nature. It works on the principle of scattering of light by the heavier fat globules in the milk sample. To avoid making mistakes in readings, the samples are homogenized. In most of the cases, the homogenization is done by chemicals which are non-corrosive in nature. The fat globules are further dispersed by passing it through a nozzle or a syringe. As a fixed ratio, 0.5 ml of milk is mixed with 6.5 ml of reactant solution. The reactant solution of 10 liters is prepared from EDTA (Ethylene Diamine Tetra Acetic acid) sachet powder (1 packet =52.6gms) + Antifoam (1.0ml) + emulsifier (Triton-X-100 =0.5ml). Now when a beam of light is shone on one end, by knowing the amount of scattering, we can figure out the amount of fat present in the solution.

CLR Measurement B. (Lactometer)

Lactometers are hydrometers that are specifically built with a scale to measure the density of milk. And this reading of a sample is taken as a fixed and standard value called as the Lactometer reading. This instrument mainly contains glass tube containing mercury or lead shots at the bottom side of it. A fixed amount of sample is taken in a measuring cylinder and the lactometer is dipped in it. Based on the density of the sample, the lactometer rises or falls and the reading is taken from the scale that is on it. The most important factor affecting the lactometer reading is temperature, and there is a correction factor that must be included for a respective change in temperature. This corrected reading is the actual value of the density, and is known as the CLR (Corrected Lactometer Reading).

Some have added some features to the regular lactometer, to improve its accuracy and to make the readings easier to be read.

Auto CLR :-

Auto CLR uses a transducer to find the position of the lactometer. The lactometer moves in a vertical motion, so the motion is detected by means of a linear motion transducer. The position is encoded and the value is given to a microcontroller. The microcontroller runs a fixed function to find the density based on the position value. The microcontroller also makes it very much easier to add the correction to the readings. Thus, Auto CLR gives the correct readings in a digital format that can be understood by anyone using it.
Once the CLR and Fat content is known, by application of the Richmond's equation, we find out the SNF value of the sample as follows.

SNF% = 0.25*CLR + 0.2 * FAT + 0.5

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