Adulterant Testing of Milk using Analog Sensors and Programmable Logic Controller

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Abstract— Adulteration is a global concern and developing countries at a higher risk associated with it, due to lack of monitoring and policies. This adulteration can pose serious health hazards leading to fatal diseases and a decrease in its quality. Adulteration usually refers to mixing other matter of an inferior and sometimes harmful quality with food or drink intended to be sold. As a result of adulteration, food or drink becomes impure and unfit for human consumption. Here the monitoring of liquid adulteration particularly that of milk is done by setting a limited range of the specific gravity of milk and maintaining temperature corrections at various temperature points to obtain an accurate specific gravity reading. In this manner, one parameter of the adulteration of milk will be distinguished from pure milk.

Key words: Pressure Sensor, Temperature Sensor, Specific Gravity, Programmable Logic Controller (PLC)

I. INTRODUCTION

Milk is the nutritional food for living mammals, which is good for health. It is an emulsion or colloid of butterfat globules within a water based fluid that contains dissolved carbohydrates and protein aggregates with minerals. The quality of milk is essential for the survival of living beings on earth. In this project it is to analyse the quality of milk by determining the adulterants that are added in the fresh milk. Adulteration reduces the quality of milk and can even make it hazardous. Adulterants like soap, salt, table sugar and H_2O_2 may be added to milk. These are determined by the use of electronic methods. The country's dairy industry faces several hurdles in ensuring product quality and safety.

The aim of this project is to develop new instrumentation methods and sensor systems for milk quality analysis to enable inspection and traceability of produce.

In most cases, the diaries use a device called lactometer to detect the quality of milk based on the amount of water added to it. Even though lacto meter is generally used to measure the purity of milk it is not reliable instrument, it fails to give the correct assessment of purity if the density of skimmed milk is made equal to that of pure milk by adding water in an appropriate proportion. Hence, to overcome the disadvantage of Lactometer, an embedded unit is designed to determine the purity of milk.

The developed system is very much useful for the easy analysis of the milk sample and determines whether the given sample is adulterated or not. The project is interfaced with the PLC which processes and classifies the milk sample which is finally displayed on screen. This is an interestingly new project in the field of electronics. It helps to analyze the milk samples based on milk density, conductivity and temperature.

II. PRESENT TECHNOLOGY

Milk Adulteration Tester: As illustrated in Fig.1, It is testing device used to check any adulteration in raw milk. This device performs chemical test. A result of test is used to indication of adulteration of milk. The tester sucks the sample of milk into the device to perform a chemical test and results gets displayed on screen.

Fig. 1: Milk Adulterant Tester

This device as certain limitations as under

1) It checks only random samples.
2) Its time consuming device.
3) Varying results from sample to sample.
4) No continuous monitoring

III. PRIMARY METHODS

Different tests are used to check the adulteration of milk by using the centrifusion method as shown in Fig.2, titration method and other chemical tests. As per the study the milk from the farmers are collected at collection centers. Here they perform primary tests to check temperature of the milk using lactometer and also fat test is performed using electronic milk tester as illustrated in Fig.3. All the collection centers milk is bought to the Diary. Here they performed certain primary level tests and also different chemical test are done at the Quality Control. Quality Control Department of the company mainly provides the standardization to the product.

He system consists of two analog sensors namely pressure sensor and temperature sensor. The pressure sensor has 1% total error band, compact outline and -40°C to 125°C operating temperature range. The temperature sensor used here is the K type thermocouple. It has good linearity of EMF to the measurement temperature. Good resistance against oxidization below 1000°C. Most stable among thermocouple of inexpensive material. Both this sensors are used to satisfy the purpose of detection of specific gravity of milk.

PLC is adapted for the control and continuous monitoring of manufacturing processes. It has high reliability and ease of programming and process fault

diagnosis. In this system we used PLC having 8 digital inputs and 4 relay outputs. Two analog inputs (0-10V) in 12-24VDC.it provides 250 lines ladder programming.

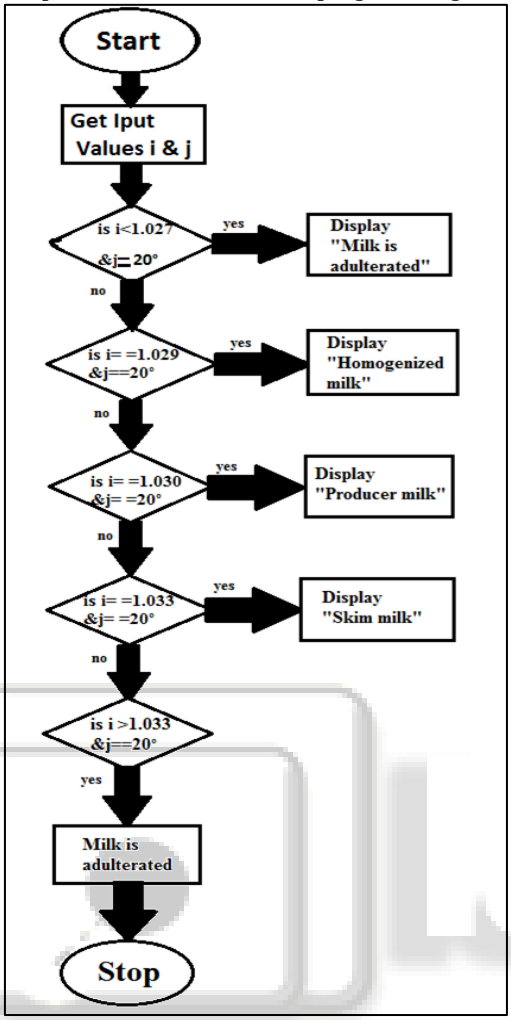

Fig. 5: Flow Chart

As illustrated in the Fig.5 input value i is the input taken from pressure sensor and j is the temperature value which is constant. Here the reference value is 20°C matched with specific gravity of milk. The i value is matched with specific gravity of milk. If the condition satisfies then result is displayed. If the condition fails, it goes to next step. For the milk specific gravity range lies between 1.027 to 1.033.If the resultant value does not lie within the mentioned range then display will show as milk is adulterated.

IV. Experimental Results

Equation to Calculate Specific Gravity of Milk: By knowing the input value of current in mA, we can calculate specific gravity of milk .As illustrated in equation (1), based upon the input value of the sample of milk the end result of the equation is the specific gravity of the sample. This is then given to the PLC for further comparison to the set value.

$$\frac{I-Im}{It} \times K \qquad (1)$$

Where

I = $input\ value\ in\ mA$

Im = minimum $value of\ the\ pressure\ sensor\ in\ mA$

It = $total\ range\ of\ current\ to\ the\ pressure\ sensor$

K = $range\ of\ the\ pressure\ sensor$

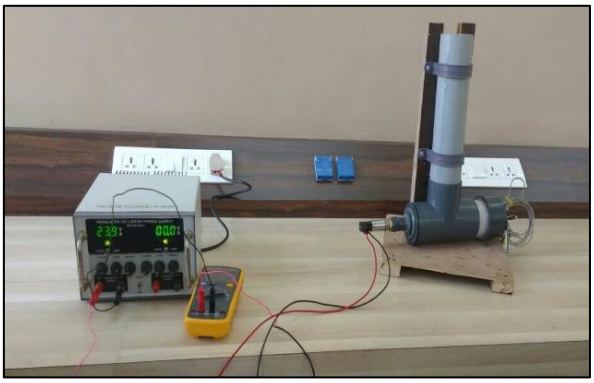

Fig. 6: Testing of Proposed Method

As illustrated in Fig.6, testing of proposed method is carried out by taking the sample of milk in the cylindrical chamber having standard measured quantity of 1 litre and using pressure sensor the input value of prssure value is recorded. By using equation (1) value of specific gravity of sample of milk is calculated.

V. Conclusion

This is a budding method which can help in avoiding any form of liquid adulteration wherein the inputs of the fast flowing samples are compared to a fixed value. Thus empowering society to know their right to good health and hence avoid degradation of the same.

VI. Future Work & Scope

The quality of milk can also be evaluated by checking the ph level by making using of the ph sensor. Milk has a standard ph range of 6.5-6.7 so any value above or below this range is considered to be spoilt and abnormalities in its quality.

Besides providing the quality assurance of milk to consumers this technology can also be used in detecting the specific gravity of any liquid such as petrol, oils etc. hence detecting any abnormalities.

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